



UNIVERSITY OF
LIVERPOOL

**A STUDY OF SUPPLY CHAIN COLLABORATIONS IN SMALL AND
MEDIUM-SIZED ENTERPRISES IN THE UK, INDIA AND CHINA**

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ABSTRACT

Collaborations in supply chains continue to be a central focus in a firm's success and businesses are regularly striving to harness the collective capabilities of the networks to which they belong through the use of effective collaborative strategies. It is therefore vital for the firms to ensure sound and effective collaborative strategies in their supply chain practices. It is researched that supply chain collaboration provides a competitive edge in terms of improving the capability and performance of supply chain networks and the organisations linked in the network.

The aim of the research is to contribute to a better understanding of the collaborative supply chain practices adopted by Small and Medium Enterprises (SMEs). This study on SMEs explored and evaluated scope of vertical and horizontal collaborations. This research also examined the relationship between different collaborative strategies adopted by SMEs. Additionally other collaborative issues such as: essential requirements of collaboration, principle reasons of collaboration, major hurdles in collaborative initiatives, and the major benefits associated with collaborations were also discussed in this research.

Empirical data has been used to determine the relationship between various collaborative initiatives and to find out any difference in these initiatives from country to country. A chi-square test, ANOVA test, a post-hoc analysis and a correlation analysis were conducted with survey data collected from 365 manufacturing SMEs from the UK, India and China. The results indicate that collaborative initiatives adopted by the SMEs differ significantly from country to country and the results also indicate positive relationship between different strategies.

Keywords: *Small and Medium-sized Enterprises, supply chain collaboration, collaborative initiatives, empirical study*

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CONTENTS

CHAPTER 1: INTRODUCTION	14
1.1 INTRODUCTION	14
1.2 THE BACKGROUND OF THE RESEARCH	15
1.3 RESEARCH NEED, SCOPE AND SAMPLE	16
1.4 OBJECTIVES OF THE RESEARCH	17
1.5 OUTLINE OF THE CHAPTERS	18
CHAPTER 2-LITERATURE REVIEW	20
2.1. INTRODUCTION	20
2.2. LITERATURE REVIEW AND BACKGROUND:	22
2.2.1.1 Supply Chain Management:	23
2.2.1.2 Overview of SMEs and their supply chains	25
2.2.1.2 a. Internal environment of SME	26
2.2.2.3. Collaboration in SMEs	28
2.2.2.1 Scope of Collaboration for SMEs	30
2.2.2.2 Framework for collaborations in SMEs	31
Internal Collaboration.....	32
External Collaboration.....	32
2.2.3. Collaborative Initiatives for SMEs	35
2.2.3.1. Co-Development	35
2.2.3.2. Co-Design	36
2.2.3.3. Aggregated Purchasing	39
2.2.3.4. Collaborative Planning, Forecasting and Replenishment (CPFR).....	41
2.2.3.5 Co-Logistics.....	43
2.2.3.6. Joint Venture	45
2.2.3.7 Shared Resources and Services.....	46
2.2.3.8. Co-manufacturing	47
2.2.3.9 Joint Problem Solving.....	48
2.3 SUMMARY	52
CHAPTER3 –RESEARCH METHODOLOGY	54
3.1 INTRODUCTION	54
3.2 RESEARCH CHOICE: QUANTITATIVE AND QUALITATIVE	56
3.2 THE SURVEY APPROACH	59
3.3 QUESTIONNAIRE DESIGN	61
3.4 THE SAMPLE	64
3.5 DATA COLLECTION	66
3.5.1 Mixed Strategy for data collection	67
3.6 RESPONDENTS	68
3.7 DATA ANALYSIS	71
3.7.1 Description of variables	72
3.7.2 Comparison of variables.....	72
3.7.3 Relationship between variables.....	72
3.8 CHAPTER SUMMARY	73
CHAPTER4 -DATA ANALYSIS.....	75
4.1. CHARACTERISTICS OF RESPONDENTS.....	75
4.1.1 Country:.....	75
4.1.2 Job Position:	75
4.1.3 Type of Industry	76
4.1.4 Supply Chain Structure:	77
4.1.5 Ownership Profile	78
4.1.6 Total Sales Volume:	79

4.1.7 Research and Developmental Expenses:	80
4.1.8 Logistics Expenses:	81
4.1.9 Production Expenses:	82
4.1.10 Years of Establishment of Organisation:	83
4.2. SUPPLY CHAIN COLLABORATION	84
4.2.1 Supply Chain Collaboration and Ownership:	84
4.2.2 Supply Chain Collaboration and Supply Chain Structure:	84
4.3 TYPES OF COLLABORATION (COLLABORATIVE INITIATIVES):	85
4.3.1. Joint Venture-	85
4.3.1.1 Joint Venture and Size of Organisation	85
4.3.1.2 Joint Venture and Ownership	88
4.3.1.3 Joint Venture and Supply Chain Structure	92
4.3.1.4 Joint Venture and Age of Organisation	95
4.3.2 Co-development-	99
4.3.2.1 Co-development and Size of Organisation	99
4.3.2.2 Co-development and Ownership	103
4.3.2.3 Co-development and Supply Chain Structure	106
4.3.2.4 Co-development and Age of Organisation	109
4.3.2.5 Correlation of Co-development and other collaborative initiatives:	112
4.3.3 Co-design-	113
4.3.3.1 Co-design and Size of Organisation	113
4.3.3.2 Co-design and Ownership	117
4.3.3.3 Co-design and Supply Chain Structure	120
4.3.3.4 Co-design and Age of Organisation	123
4.3.3.5 Correlation of Co-design and other collaborative initiatives:	126
4.3.4 Co-manufacturing-	127
4.3.4.1 Co-manufacturing and Size of Organisation	127
4.3.4.2 Co-manufacturing and Ownership	129
4.3.4.3 Co-manufacturing and Supply Chain Structure	133
4.3.4.4 Co-manufacturing and Age of Organisation	136
4.3.4.5 Correlation of Co-manufacturing and other collaborative initiatives:	138
4.3.5 Aggregated Purchasing-	139
4.3.5.1 Aggregated Purchasing and Size of Organisation	139
4.3.5.2 Aggregated Purchasing and Ownership	142
4.3.5.3 Aggregated Purchasing and Supply Chain Structure	146
4.3.5.4 Aggregated Purchasing and Age of Organisation	149
4.3.5.5 Correlation of aggregated purchasing and other collaborative initiatives:	153
4.3.6 Co-logistics-	154
4.3.6.1 Co-logistics and Size of Organisation	154
4.3.6.2 Co-logistics and Ownership	157
4.3.6.3 Co-logistics and Supply Chain Structure	160
4.3.6.4 Co-logistics and Age of Organisation	163
4.3.6.5 Correlation of Co-logistics and other collaborative initiatives:	166
4.3.7 Joint problem solving-	167
4.3.7.1 Joint Problem Solving and Size of Organisation	167
4.3.7.2 Joint problem solving and Ownership	170
4.3.7.3 Joint problem solving and Supply Chain Structure	173
4.3.7.4 Joint Problem solving and Age of Organisation	176
4.3.7.5 Correlation of Joint problem solving and other collaborative initiatives:	178
4.3.8 Shared Resources -	180
4.3.8.1 Shared Resources and Size of Organisation	180
4.3.8.2 Shared resources and Ownership	182
4.3.8.3 Shared Resources and Supply Chain Structure	185
4.3.8.4 Shared resources and Age of Organisation	188
4.3.8.5 Correlation of shared resources and other collaborative initiatives:	191

4.3.9 CPFR-.....	193
4.3.9.1 CPFR and size of organisation.....	193
4.3.9.2 CPFR and Ownership	196
4.3.9.3 CPFR and Supply Chain Structure.....	199
4.3.9.4 CPFR and Age of Organisation:.....	202
4.3.9.5 Correlation of CPFR and other collaborative initiatives:.....	205
CHAPTER 5 - COMPARATIVE ANALYSIS	207
5.1 COMPARISON OF ECONOMY AND DEMOGRAPHY	207
5.1.1 GDP Growth Rate:	210
5.1.2 GDP per Capita Growth:	211
5.1.3 Agriculture, Value Added:	212
5.1.4 Manufacturing, Value Added:.....	213
5.1.5 Services, Value Added:	214
5.1.6 Industry, Value Added:	215
5.1.7 Energy Imports:.....	216
5.1.8 Exports of goods and services (annual % growth):	217
5.1.9 Imports of goods and services (annual % growth):	218
5.2 COMPARISON OF THE LOGISTICS ENVIRONMENT IN THE UK, INDIA AND CHINA	219
5.2.1 Air Transport:	219
5.2.2 Waterway Transport:	220
5.2.3 Rail Transport:.....	220
5.2.4 Road Transport:	221
5.3 COMPARISON FROM THE SURVEY RESULTS.....	223
5.3.1 Total Sales Volume:	223
5.3.2 Age of Organisation:	223
5.3.3 R&D Expenses:	224
5.3.4 Logistics Expenses:	225
5.3.5 Production Expenses:	226
5.4 COMPARISON OF SUPPLY CHAIN COLLABORATIONS.....	227
5.4.1 Joint Venture.....	227
5.4.2 Co-development	231
5.4.3 Co-design	236
5.4.4 Co-manufacturing.....	239
5.4.5 Aggregated purchasing.....	243
5.4.6 Co-logistics.....	247
5.4.7 Joint problem solving.....	250
5.4.8 Shared resources and Country.....	254
5.4.9. CPFR.....	257
5.5 ESSENTIAL REQUIREMENTS FOR COLLABORATION:	261
5.5.1 Mutual trust:	261
5.5.2 Mutual financial benefits and risk sharing:	261
5.5.3 Common goals and motivation.....	261
5.5.4 Common performance measurement system:	261
5.5.5 Willingness to be involved in collaboration:	262
5.5.6 Willingness and openness to share information and technical expertise:.....	262
5.5.7 Knowledge of benefits associated with collaboration:	262
5.5.8 Common processes structures and culture among partners:.....	262
5.5.9 Mutual commitment of the partners:	263
5.5.10 Mutual adjustment to the need of other partners:	263
5.6 PRIME REASONS FOR COLLABORATION:	264
5.6.1 Increase sales and market share:	264
5.6.2 Reduce costs:.....	265
5.6.3 Increase utilisation of resources:	265
5.6.4 Improve customer satisfaction:	265

5.6.5 Improve forecasts:	265
5.6.6 Increase technical know-how or expertise:	266
5.6.7 Introduce new products:	266
5.6.8 Improve response (lead) time:	266
5.6.9 Increase trust and confidence within partners:	266
5.7 MAJOR PROBLEMS OF COLLABORATION:	267
5.7.1 Misalignment of partners' business processes, structures and culture:.....	267
5.7.2 Lack of appropriate communication system:	268
5.7.3 Unwillingness to share information and technical expertise:.....	268
5.7.4 Unwillingness to share financial risks and benefits:	268
5.7.5 Lack of common performance measurement system:	268
5.7.6 Lack of collaborative vision:	269
5.7.6 Lack of motivation and commitment towards the collaboration:	269
5.7.7. Lack of trust and confidence with the partners:	269
5.8 MAJOR BENEFITS OF COLLABORATION:	270
5.8.1 Reduce costs across the supply chain:.....	270
5.8.2 Increased utilisation of resources:	271
5.8.3 Increase market share and revenue:.....	271
5.8.4 Improved forecasts:	271
5.8.5 Reduced product development costs and time:	271
5.8.6 Increased customer satisfaction:.....	272
5.8.7 Increased inventory turnover:.....	272
5.8.8 Decreased customer delivery time:	272
5.8.9 Better product availability:	272
CHAPTER 6: DISCUSSION.....	275
6.1 NON-RESPONSE BIAS	275
6.2 RELIABILITY AND COMMON METHOD BIAS	275
6.3 SUPPLY CHAIN COLLABORATION IN SMES	275
6.3.1 Network Collaborations	277
6.3.2 Collaborative Initiatives in SMEs	277
6.3.2.1 Collaborative Initiatives and Country	277
6.3.3 Collaborative Initiatives and Ownership	278
6.3.4 Collaborative Initiatives and Network Structure.....	279
6.4 COLLABORATIVE STRATEGIES AND ANOVA AND POST HOC TEST	279
6.5 RELATIONSHIP BETWEEN COLLABORATIVE STRATEGIES	280
6.5 ESSENTIAL REQUIREMENTS FOR COLLABORATION	281
6.6 PRIME REASONS FOR COLLABORATION:	282
6.7 MAJOR PROBLEMS OF COLLABORATION:	282
6.8 MAJOR BENEFITS OF COLLABORATION	282
6.9 CHAPTER SUMMARY	283
CHAPTER 7: CONCLUSIONS	286
7.1 INTRODUCTION	286
7.2 RESEARCH FINDINGS FROM RESEARCH QUESTIONS	286
7.2.1 SMEs and their collaborative relationships.....	287
7.2.2 SMEs and collaborative initiatives.....	287
7.2.3 Effectiveness of collaborative initiatives and their relationship.....	288
7.2.4. Requirements of collaborations.....	288
7.2.5. Reasons for collaborations	289
7.2.6. Major hurdles of collaborations	289
7.2.7. Major benefits of collaborations.....	289
7.3 CONTRIBUTION TO KNOWLEDGE AND FUTURE WORK	290
7.4 LIMITATIONS OF THE STUDY	292
7.5 SUMMARY	293

REFERENCES	295
APPENDIX 1: QUESTIONNAIRE.....	304
APPENDIX 2: SCALE AND RELIABILITY.....	310
APPENDIX 3: COLLABORATIVE INITIATIVES AND COUNTRY	311
APPENDIX 4: COLLABORATIVE INITIATIVES AND OWNERSHIP	312
APPENDIX 5: COLLABORATIVE INITIATIVES AND SUPPLY CHAIN STRUCTURE	313
APPENDIX 6: COLLABORATIVE INITIATIVES AND COUNTRY: ANOVA AND POST HOC TEST	314
APPENDIX 7: COLLABORATIVE INITIATIVES AND OWNERSHIP: ANOVA AND POST HOC TEST.....	315
APPENDIX 8: COLLABORATIVE INITIATIVES AND SUPPLY CHAIN STRUCTURE: ANOVA AND POST HOC TEST.....	316

LIST OF FIGURES

Figure 1.1 Organisation of this study.....	19
Figure 1: Typical classification of literature review.....	23
Figure 2.2: Internal environment of SME.....	27
Figure 2.3: Supply chain structure of SMEs and LEs.....	28
Figure 2.4: Scope of collaboration.....	30
Figure 2.5: Framework of collaboration in SMEs	32
Figure 2.6: Scope of external collaboration for SMEs.....	33
Figure 2.7: Needs, activities and benefits.	36
Figure 2.8: Needs, activities, and benefits of co-design	38
Figure 2.9: Needs, activities and benefits.	40
Figure 2.10: Needs, activities and benefits of CPFR	42
Figure 2.11: Needs, activities and benefits of co-logistics.....	44
Figure 2.12: Needs, activities and benefits of Joint Venture.	46
Figure 2.13: Needs, activities and benefits of shared resources.	47
Figure 2.14: Needs, activities and benefits of co-manufacturing.....	48
Figure 3.1: Research Methodology	55
Figure 3.2: Research choices	58
Figure 5.1: GDP Growth Rate	210
Figure 5.2: GDP per Capita Growth	211
Figure 5.3: Agriculture, Value Added	212
Figure 5.4: Manufacturing, Value Added.....	213
Figure 5.5: Services, Value Added.....	214
Figure 5.6: Industry, Value Added.....	215
Figure 5.7: Energy Imports, net	216
Figure 5.8: Exports of goods and services	217
Figure 5.9: Imports of goods and services	218
Figure 5.10: Air transport, freight.....	219
Figure 5.11: Container port traffic	220
Figure 5.12: Railways, goods transported.....	221
Figure 5.13: Roads, goods transported	222
Figure 5.12: Box Plot for annual sales volume.....	223
Figure 5.13: Box Plot for age of organisation.....	224
Figure 5.14: Box Plot for percentage of R&D cost.....	225
Figure 5.15: Box Plot for percentage of logistics cost.....	226
Figure 5.16: Box Plot for percentage of production cost.....	227

LIST OF TABLES

Table 2.1: Definitions of supply chain management.....	24
Table 2.2: Definition of SMEs	26
Table 2.3: Internal and external factors influences the SMEs and their supply chains.....	34
Table 2.4 Flow of Information and material between different functions and organisations.....	36
Table 2.5 Flow of Information and material between functions	37
Table 2.6 Flow of Information and material between different functions.....	39
Table 2.7: Flow of Information and materials.	42
Table 2.8:Flow of Information and material between different functions	43
Table 2.8 Flow of Information and material.	48
Table 2.9. Summary of Collaborative Strategies	52
Table 3. 1: Qualitative Versus Quantitative Methods	57
Table 3.2 Sample Profile: Number of respondents	70
Table 4.1: Respondent Countries	75
Table 4.2: Respondent Job Profile	76

Table 4.3: Respondent Industry Profile.....	77
Table 4.4: Respondent Supply Chain Structure Profile	78
Table 4.5: Respondent Ownership Profile	79
Table 4.6: Total sales volume	79
Table 4.7: Normality test for sales volume	79
Table 4.8: Percentage of research & development expenses allocated out of the sales volume	80
Table 4.9: Normality test for R&D expenses	80
Table 4.10: Total logistics expenses allocated out of the sales volume	81
Table 4.11: Normality test for logistics expenses	81
Table 4.12: Total production expenses allocated out of the sales volume	82
Table 4.13: Normality test for production expenses	82
Table 4.14: Years of establishment of organisation.....	83
Table 4.15: Normality test for years of establishment	83
Table 4.16: Supply chain collaboration and type of ownership	84
Table 4.17: Supply chain collaboration and supply chain structure.....	85
Table 4.18: Joint venture and size	86
Table 4.19: Average effectiveness: Joint venture and size	87
Table 4.20: Class interval for joint venture and size.....	87
Table 4.21: Joint venture and size- ANOVA and Post Hoc Test	88
Table 4.22: Joint venture and ownership	89
Table 4.23: Average effectiveness: Joint venture and ownership.....	89
Table 4.24: Class interval for joint venture and ownership.....	90
Table 4.25: Joint venture and ownership- ANOVA and Post Hoc Test.....	91
Table 4.26: Joint venture and supply chain structure.....	93
Table 4.27: Average effectiveness: Joint venture and supply chain structure	93
Table 4.28: Class interval for joint venture and supply chain structure.....	94
Table 4.29: Joint Venture and Supply chain structure- ANOVA and Post Hoc Test	94
Table 4.30: Joint venture and age.....	96
Table 4.31: Average effectiveness: Joint venture and age.....	96
Table 4.32: Class interval for joint venture and age.....	97
Table 4.33: Joint venture and age- ANOVA and Post Hoc Test	97
Table 4.34: Correlation of effectiveness of joint ventures with other collaborative initiatives	99
Table 4.35: Co-development and size	100
Table 4.36: Average effectiveness: Co-development and size	100
Table 4.37: Class interval for co-development and size	101
Table 4.38: Co-development and size- ANOVA and Post Hoc Test.....	102
Table 4.39: Co-development and ownership.....	103
Table 4.40: Average effectiveness: Co-development and ownership.....	104
Table 4.41: Class interval for co-development and ownership	104
Table 4.42: Co-development and ownership- ANOVA and Post Hoc Test	105
Table 4.43: Co-development and supply chain structure	107
Table 4.44: Average effectiveness: Co-development and supply chain structure	107
Table 4.45: Class interval for co-development and supply chain structure.....	108
Table 4.46: Co-development and Supply chain structure- ANOVA and Post Hoc Test.....	108
Table 4.46: Co-development and age.....	110
Table 4.47: Average effectiveness: Co-development and age.....	110
Table 4.48: Class interval for co-development and age	111
Table 4.49: Co-development and age- ANOVA and Post Hoc Test	111
Table 4.50: Correlation of effectiveness of co-development with other collaborative initiatives.....	113
Table 4.51: Co-design and size	114
Table 4.52: Average effectiveness: Co-design and size	114
Table 4.53: Class interval for co-design and size.....	115
Table 4.54: Co-design and size- ANOVA and Post Hoc Test.....	116
Table 4.55: Co-design and ownership.....	117
Table 4.56: Average effectiveness: Co-design and ownership	118

Table 4.57: Class interval for co-design and ownership	118
Table 4.58: Co-design and ownership- ANOVA and Post Hoc Test	119
Table 4.59: Co-design and supply chain structure	121
Table 4.60: Average effectiveness: Co-design and supply chain structure	121
Table 4.61: Class interval for co-design and supply chain structure.....	122
Table 4.62: Co-design and Supply chain structure- ANOVA and Post Hoc Test	122
Table 4.63: Co-design and age.....	123
Table 4.64: Average effectiveness: Co-design and age	124
Table 4.65: Class interval for co-design and age	124
Table 4.66: Co-design and age- ANOVA and Post Hoc Test	125
Table 4.67: Correlation of effectiveness of co-design with other collaborative initiatives.....	126
Table 4.68: Co-manufacturing and size	127
Table 4.69: Average effectiveness: Co-manufacturing and size.....	128
Table 4.70: Class interval for co-manufacturing and size.....	128
Table 4.71: Co-manufacturing and size- ANOVA and Post Hoc Test.....	129
Table 4.72: Co-manufacturing and ownership	130
Table 4.73: Average effectiveness: Co-manufacturing and ownership	130
Table 4.74: Class interval for co-manufacturing and ownership	131
Table 4.75: Co-manufacturing and ownership- ANOVA and Post Hoc Test	132
Table 4.76: Co-manufacturing and supply chain structure	134
Table 4.77: Average effectiveness: Co-manufacturing and supply chain structure.....	134
Table 4.79: Class interval for co-manufacturing and supply chain structure.....	135
Table 4.80: Co-manufacturing and Supply chain structure- ANOVA and Post Hoc Test	135
Table 4.81: Co-manufacturing and age	136
Table 4.82: Average effectiveness: Co-manufacturing and age	137
Table 4.83: Class interval for co-manufacturing and age	137
Table 4.84: Co-manufacturing and age- ANOVA and Post Hoc Test.....	138
Table 4.85: Correlation of effectiveness of co-manufacturing with other collaborative initiatives	139
Table 4.86: Aggregated Purchasing and size.....	140
Table 4.87: Average effectiveness: Aggregated Purchasing and size.....	141
Table 4.88: Class interval for aggregated Purchasing and size.....	141
Table 4.89: Aggregated Purchasing and size- ANOVA and Post Hoc Test	142
Table 4.90: Aggregated Purchasing and ownership	143
Table 4.91: Average effectiveness: Aggregated Purchasing and ownership	143
Table 4.92: Class interval for aggregated purchasing and ownership	144
Table 4.93: Aggregated Purchasing and ownership- ANOVA and Post Hoc Test.....	145
Table 4.94: Aggregated Purchasing and supply chain structure.....	147
Table 4.95: Average effectiveness: Aggregated Purchasing and supply chain structure.....	147
Table 4.96: Class interval for aggregated Purchasing and supply chain structure	148
Table 4.97: Aggregated Purchasing and Supply chain structure- ANOVA and Post Hoc Test	148
Table 4.98: Aggregated Purchasing and age	150
Table 4.98: Average effectiveness: Aggregated Purchasing and age	151
Table 4.99: Class interval for aggregated Purchasing and age.....	151
Table 4.100: Aggregated Purchasing and age- ANOVA and Post Hoc Test.....	152
Table 4.101: Correlation of effectiveness of aggregated purchasing with other collaborative initiatives	154
Table 4.102: Co-logistics and size	155
Table 4.103: Average effectiveness: Co-logistics and size.....	156
Table 4.104: Class interval for co-logistics and size.....	156
Table 4.105: Co-logistics and size- ANOVA and Post Hoc Test.....	157
Table 4.106: Co-logistics and ownership	158
Table 4.107: Average effectiveness: Co-logistics and ownership	158
Table 4.108: Class interval for co-logistics and ownership	159
Table 4.109: Co-logistics and ownership- ANOVA and Post Hoc Test	159
Table 4.110: Co-logistics and supply chain structure.....	161

Table 4.111: Average effectiveness: Co-logistics and supply chain structure.....	161
Table 4.112: Class interval for co-logistics and supply chain structure.....	162
Table 4.113: Co-logistics and Supply chain structure- ANOVA and Post Hoc Test	162
Table 4.114: Co-logistics and age	164
Table 4.115: Average effectiveness: Co-logistics and age	164
Table 4.116: Class interval for co-logistics and age.....	165
Table 4.117: Co-logistics and age- ANOVA and Post Hoc Test.....	165
Table 4.118: Correlation of effectiveness of co-logistics with other collaborative initiatives	166
Table 4.119: Joint problem solving and size	167
Table 4.120: Average effectiveness: Joint problem solving and size	168
Table 4.121: Class interval for joint problem solving and size.....	168
Table 4.122: Joint problem solving and size- ANOVA and Post Hoc Test	169
Table 4.123: Joint problem solving and ownership	170
Table 4.124: Average effectiveness: Joint problem solving and ownership.....	171
Table 4.125: Class interval for joint problem solving and ownership	171
Table 4.126: Joint problem solving and ownership- ANOVA and Post Hoc Test.....	172
Table 4.127: Joint problem solving and supply chain structure.....	174
Table 4.128: Average effectiveness: Joint problem solving and supply chain structure	174
Table 4.129: Class interval for joint problem solving and supply chain structure	175
Table 4.130: Joint problem solving and Supply chain structure- ANOVA and Post Hoc Test.....	175
Table 4.131: Joint problem solving and age.....	176
Table 4.134: Joint problem solving and age- ANOVA and Post Hoc Test	178
Table 4.135: Correlation of effectiveness of joint problem solving with other collaborative initiatives	179
Table 4.136: Shared resources and size.....	180
Table 4.137: Average effectiveness: Shared resources and size.....	181
Table 4.138: Class interval for Shared resources and size	181
Table 4.139: Shared resources and size- ANOVA and Post Hoc Test.....	182
Table 4.140: Shared resources and ownership	183
Table 4.141: Average effectiveness: Shared resources and ownership	183
Table 4.142: Class interval for Shared resources and ownership.....	184
Table 4.143: Shared resources and ownership- ANOVA and Post Hoc Test.....	184
Table 4.144: Shared resources and supply chain structure.....	186
Table 4.145: Average effectiveness: Shared resources and supply chain structure.....	186
Table 4.146: Class interval for shared resources and supply chain structure.....	187
Table 4.147: Shared resources and Supply chain structure- ANOVA and Post Hoc Test	188
Table 4.148: Shared resources and age	189
Table 4.149: Average effectiveness: Shared resources and age	189
Table 4.150: Class interval for Shared resources and age.....	190
Table 4.151: Shared resources and age- ANOVA and Post Hoc Test.....	191
Table 4.152: Correlation of effectiveness of Shared resources with other collaborative initiatives ...	192
Table 4.153: CPFR and size	193
Table 4.154: Average effectiveness: CPFR and size	194
Table 4.155: Class interval for CPFR and size	194
Table 4.156: CPFR and size- ANOVA and Post Hoc Test	195
Table 4.157: CPFR and ownership	197
Table 4.158: Average effectiveness: CPFR and ownership.....	197
Table 4.159: Class interval for CPFR and ownership	198
Table 4.160: CPFR and ownership- ANOVA and Post Hoc Test.....	198
Table 4.161: CPFR and supply chain structure.....	200
Table 4.162: Average effectiveness: CPFR and supply chain structure	200
Table 4.163: Class interval for CPFR and supply chain structure	201
Table 4.164: CPFR and Supply chain structure- ANOVA and Post Hoc Test.....	201
Table 4.165: CPFR and age.....	203
Table 4.166: Average effectiveness: CPFR and age.....	203

Table 4.167: Class interval for CPFR and age	204
Table 4.168: CPFR and age- ANOVA and Post Hoc Test	204
Table 4.169: Correlation of effectiveness of CPFR with other collaborative initiatives.....	206
Table 5.1 Demographic and Economic data	209
Table 5.2 Rankings on the logistics performance of the UK, India and China	222
Table 5.3: Joint venture and country	228
Table 5.4: Average effectiveness: Joint venture and country	228
Table 5.5: Class interval for joint venture and country	229
Table 5.6: Joint venture and country- ANOVA and Post Hoc Test	230
Table 5.7: Co-development and country	232
Table 5.8: Average effectiveness: Co-development and country	233
Table 5.9: Class interval for co-development and country.....	233
Table 5.10: Co-development and country- ANOVA and Post Hoc Test.....	234
Table 5.11: Co-design and country	236
Table 5.12: Average effectiveness: Co-design and country	237
Table 5.13: Class interval for co-design and country.....	237
Table 5.14: Co-design and country- ANOVA and Post Hoc Test.....	238
Table 5.15: Co-manufacturing and country	240
Table 5.16: Average effectiveness: Co-manufacturing and country.....	240
Table 5.17: Class interval for co-manufacturing and country.....	241
Table 5.18: Co-manufacturing and country- ANOVA and Post Hoc Test.....	241
Table 5.19: Aggregated purchasing and country.....	243
Table 5.20: Average effectiveness: Aggregated purchasing and country	244
Table 5.21: Class interval for aggregated purchasing and country	244
Table 5.22: Aggregated purchasing and country- ANOVA and Post Hoc Test	245
Table 5.23: Co-logistics and country	247
Table 5.24: Average effectiveness: Co-logistics and country.....	248
Table 5.25: Class interval for co-logistics and country	248
Table 5.26: Co-logistics and country- ANOVA and Post Hoc Test.....	249
Table 5.27: Joint problem solving and country	251
Table 5.28: Average effectiveness: Joint problem solving and country.....	251
Table 5.29: Class interval for joint problem solving and country	252
Table 5.30: Joint problem solving and country- ANOVA and Post Hoc Test	252
Table 5.31: Shared resources and country.....	254
Table 5.32: Average effectiveness: Shared resources and country.....	255
Table 5.33: Class interval for shared resources and country.....	255
Table 5.34: Shared resources and country- ANOVA and Post Hoc Test	256
Table 5.35: CPFR and country.....	258
Table 5.36: Average effectiveness: CPFR and country	258
Table 5.37: Class interval for CPFR and country	259
Table 5.38: CPFR and country- ANOVA and Post Hoc Test	259
Table 5.39: Essential requirements for collaboration.....	264
Table 5.40: Prime reasons for collaboration	267
Table 5.41: Major problems/hurdles of collaboration.....	270
Table 5.42: Major benefits of collaboration.....	274
Table 6.1 Correlations between Collaborative initiatives	281

Chapter 1: Introduction

1.1 Introduction

The motivation for the research work was developed from a combination of personal, intellectual and practical goals. I previously worked in a University in India where I was closely involved in rendering training and consultancy work to small and medium companies. Most of them were having difficulties in forming and coordinating strategic partnerships to improve their business performances. In terms of personal goals, my interest in seeking to understand and explain the dynamic evolution of inter-organisational collaborations to my MBA executive education students, due to my academic background, was the greatest motivator for starting this research journey. In particular, I wanted to understand why and how collaborations evolve in Small and medium-sized enterprises (SMEs). In terms of my intellectual goals, I was interested in exploring a theoretical and methodological framework which would enable me to explain what are the important factors contributing to the successful collaboration, what are the motivators for the formal collaboration, what are the major hurdles and problems encountered by the SMEs to enter such collaborative relationships, and how these collaborative issues influence the development of such business phenomenon. My intellectual interest to study collaboration in SMEs was developed due to an increasing concern on the current state of collaborative research by different scholars particularly in 2008-09, the time when I was starting this research. For this study SMEs were specifically chosen because they play an important role in developing economies due to its vital contribution in terms of employment opportunities, export potential and output. For country like India with a large labour force, SMEs are means of providing employment to millions of under and un-employed people, stimulating geographical decentralisation and increasing the productive use of scarce resources such as capital and entrepreneurship (Little et al, 1987). This study is carried out with the reasons as highlighted by researchers: (a) increasing demand to improve performance of SMEs (Krishnamurthy, 2007; Vaaland and Heide, 2007; Piers and Neto, 2008; Sinder et al, 2009; Thakkar et al, 2009), (b) increasing importance of the research on SMEs (Quayle, 2003; Sahay and Mohan, 2003; Mitja et al, 2006; Towers and Burnes, 2008), (c) limited research on the SMEs issue (Singh et al, 2005; Mitja et al, 2006; Vaaland and Heide, 2007) and (d) SMEs are different from large enterprises (LEs) in terms of: innovation ability, control structure and planning horizons (Huin et al, 2002; Arend and Wisner, 2005; Bhagwat and Sharma, 2006; William, 2006; Archer et al, 2008).

Hence, the goal of this research was an attempt to generate knowledge to develop a better understanding of the inter-organisational collaborations for SMEs, over time. Practically, there were different inter-related levels at which I wished to gain understanding. First of all, I expected that the research would contribute to knowledge about how and under what conditions collaborations develop in SMEs. Next, I expected to reveal the embedded state of inter-organisational collaborations by identifying relevant

theories and structures at the inter-organisational and intra-organisational levels. Additionally, I was interested in identifying relevant business issues which affect the development of supply chain collaboration over time.

I hope that the insights that I develop through this research would facilitate developing better understanding of the nature of supply chain collaborations in general and the conditions that underpin their evolution over time in particular. Gaining insights into these issues, I hope, would revitalise alliance research and contribute in exploring ways to engage with these complex supply chain collaborations in SMEs.

1.2 The background of the research

SMEs play an important and vital role in a country's growth by providing employment, promoting innovation, inciting competition, and building economic wealth (Little et al, 1987; Stennberg, 1999; Quayle, 2003; Towers, 2008). SMEs are considered to be an engine for growth in both developed and developing countries. The promotion of SMEs has formed a substantial part of industrial policies of both developed and developing economies (Little et al, 1987). Governments have recognised that the SME sector can assist in generating more employment and help to indigenise technology in order to create a competitive advantage and foster growth (Smeltzer, 2002; Quayle, 2003).

Generally, SMEs have a comparative disadvantage to larger enterprises in terms of management practices, organisational resources such as manpower, finance, marketing, R&D and IT, dynamic and informal strategies and business volume (Bhagwat and Sharma 2006). On the other hand, SMEs have the potential to play a crucial role in supporting balanced growth across the economy, demonstrating their importance (Bannock and Albach, 1991). As SMEs are smaller in size, the relationship between them is more intimate on one-to-one basis and thereby achieving the common goals to improve their resources, flexibility, networks, reduce the cost, and increase the ability to quickly implement innovations (Mitja et al, 2006).

Collaborations in supply chains continue to be a central focus in a firm's success and businesses are regularly striving to harness the collective capabilities of the networks to which they belong through the use of effective collaborative strategies. It is therefore vital for the firms to ensure sound and effective collaborative strategies in their supply chain practices. Supply chain collaboration has been a very important strategy for many organisations in the quest for new business opportunities. This area has been well discussed by various researchers (Wagner et al, 2002; Power, 2005; Jain et al, 2006; Knoppen and Christiaanse, 2007; Pramadari, 2007; Soosay et al, 2008). The literature supports the view that supply chain collaboration has a significant impact on organisational capabilities in improving performance and managing business uncertainties. Collaboration helps in facilitating access to information, knowledge creation and assists in designing flexible supply chains (Cassivi 2006). Many

researchers (Wagner et al, 2002; Power, 2005; Jain et al, 2006; Knoppen and Christiaanse, 2007; Pramattari, 2007; Soosay et al, 2008) concluded that successful collaborations lead to financial benefits of lower costs of inventory, lower personnel, reduced cycle time and improved profits due to increased sales, better delivery and increased speed to introduce new products in the market. In terms of non-financial benefits, collaboration help organisations focus on core competencies, enhance public image, increase sharing of information, ideas and technology, improve trust and interdependence, break down inter-partner barriers, less fire-fighting and stronger emphasis on the whole supply chain.

As the existing literature investigated supply chain collaborations in general, a limited research was carried out to investigate and examine the similar research issues within the context of smaller companies (Singh et al, 2005; Mitja et al, 2006; Vaaland and Heide, 2007), this study is conducted to focus on the supply chain collaboration in SMEs. The broad field of the research documented in this thesis is supply chain collaborations and the sub-field relates to the body of research that pays attention to the dynamic evolution of these collaborations. Of particular interest is on how and under what conditions collaborations evolve in SMEs.

For the purpose of this dissertation, I have used the definition provided by Gulati and Singh (1998, p.781) who defined collaborations as: “any voluntarily initiated co-operative arrangement between firms that involve exchange, sharing, or co-development of products, technologies, or services and it can include contributions by partners of capital, technology, or firm specific assets. They can occur as a result of a wide range of motives and goals, take a variety of forms, and occur across vertical and horizontal boundaries.”

This definition provides scope to include a wide range of supply chain collaborations including: inter-organisational collaboration, vertical and horizontal collaboration, and different collaborative strategies such as joint ventures, co-design, co-development, co-manufacturing, co-logistics, aggregated purchasing, shared resources and collaborative planning, forecasting and replenishment.

1.3 Research Need, scope and sample

Many researchers have studied the internal environment of SMEs and have identified important characteristics such as: lack of proper information systems’ architectures (Bhagwat and Sharma 2006), unwillingness to adopt internet procurement (Archer et al, 2008), involvement of top level in operational decisions, no clear line of portfolio responsibility and “blurred” departmental walls (Huin et al, 2002) These SME characteristics can be major barriers to the successful implementation of supply chain strategies. Quayle (2003) contended that in the UK SMEs, suppliers and customers are more focused on traditional operational issues such as quality, price, reliability and support rather than process issues such as R&D, e-commerce, purchase expertise, market response time, which can help in supply chain innovation. Vaaland and Heide (2007) found that SMEs are not rigorous in terms of formalised planning and control systems, pay less emphasis on upstream integration, and have gaps in their production management systems and vendor managed inventories. Previous literature has investigated

the internal and external supply chain environment of firms, their supply chain collaboration and impact of these collaborative strategies on the performance of firms, but little research has been conducted to examine the relationship between these strategies. Moreover, the previous literature has not sufficiently covered this research issue within the context of SMEs. This research seeks to explore the supply chain collaboration environment in the SMEs, to analyse the scope of vertical and horizontal collaboration in SMEs and also to examine the relationship between different collaborative strategies adopted by SMEs. This study is confined to SMEs in only three countries (India, China and the UK) due to limitation of time, cost and scope of the research work. Moreover, sampling frame (11740 SMEs) consisted of only those SMEs that were enrolled in: the FAME database in the UK, the Madhya Pradesh Audyogik Kendra Vikas Nigam Limited (MPAKVN) and the Madhya Pradesh Laghu Udyog Nigam Limited Indore in India, and the China Business Database in China. The questionnaire packs were sent to nearly 20 percent (2400) of the sampling frame. Finally the survey resulted in 365 valid responses with a usable response rate of 15.2 percent.

1.4 Objectives of the research

The research aims to examine and investigate the important and decisive factors of supply chain collaborations in SMEs, the major requirements of collaborations, reasons and problems with collaboration, benefits of collaborative initiatives, and the effectiveness of each collaborative initiative. The survey approach was used to collect data from companies. In addition to analysing the current collaborative environment and trends in SMEs, it also cites abundant theories and concepts from academic papers for identifying the collaboration and initiatives. It was my intention to understand and explain why inter-organisational collaborations evolve as they do. Following Mentzer (2001) and Barrat (2004), I have chosen to focus on the areas of supply chain collaboration in SMEs and how these collaborations influence the SMEs. This research addresses the broad issues of supply chain collaboration in SMEs, who to collaborate with and what to collaborate on.

Therefore, the main research questions are:

- Do SMEs develop and maintain collaborative relationships with their customers, suppliers, competitors and other organisations?
- Which collaborative initiatives are most commonly adopted by SMEs and do these collaborative initiatives differ in terms of country, ownership and supply chain structure?
- Are these collaborative initiatives effective and can they be statistically related to each other?

And other questions are:

- What are the requirements of supply chain collaborations in SMEs?
- What are the prime reasons for supply chain collaborations in SMEs?

- What are the major hurdles of supply chain collaborations in SMEs?
- What are the major benefits of supply chain collaborations in SMEs?

1.5 Outline of the chapters

In the following section, an outline of the chapters of the dissertation is provided. As shown in Figure 1.1, this thesis is structured in seven chapters.

Chapter 1 (Introduction) provides the motivation of the study, study background, research need, scope and sample, objectives of the research, and outline of the chapters.

Chapter 2 (Literature Review) is organised into three sections. Section one comprises of introduction which covers the overview of the current business environment and the SMEs. Section 2 covers Literature review and background. This section is divided into three parts: Overview of supply chain management and SMEs, Collaboration in SMEs, and Collaborative initiatives in SMEs. In the first part, a brief overview of definition of supply chain management and SMEs is included. It also covers the internal and external environment of SMEs and their characteristics. The second part covers the collaborative environment, scope of collaboration and framework of collaboration with SMEs. The third part is a discussion on different collaborative initiatives, their needs and benefits.

Chapter 3 (Research Methodology) is organised in different sections: research choices, survey approach, questionnaire design, the sample selection, data collection, respondents, and data analysis. This chapter discusses various issues of the empirical approach used for this study.

Chapter 4 (Data Analysis) provides the descriptive results of the survey and discussion of the results. It is divided in two main parts: the first part describes the characteristics of the respondents, the second part describes about the collaborative initiatives covered in the survey. It is a detailed discussion on the collaborative initiatives using statistical measures of central tendency and dispersion, theory of estimation, one-way analysis of variance (ANOVA) and correlation. ANOVA was used to test whether there are significant differences in the collaborative initiatives and correlation analysis was carried out for finding out the relationship between different collaborative initiatives.

Chapter 5 (Comparative Analysis) depicts the comparison of the economy and demography of India, China and the UK, the comparison of the supply chain initiatives in these three countries using ANOVA and post-hoc analysis, and the comparison of requirements of collaboration, reasons of collaboration, problems of collaboration and benefits of collaboration in the three countries. ANOVA was used to test whether there are significant differences in the collaborative initiatives in terms of countries and chi-square test was conducted to find out the differences between countries.

Chapter 6 (Discussion) is discussion of the findings of the survey results. This chapter provides an overview of the study findings.

Chapter 7 (Conclusion) summarises the implications for theory and practice. I conclude the chapter by reflecting on limitations of this research, the contributions of this research and by sketching out possible

direction for research.

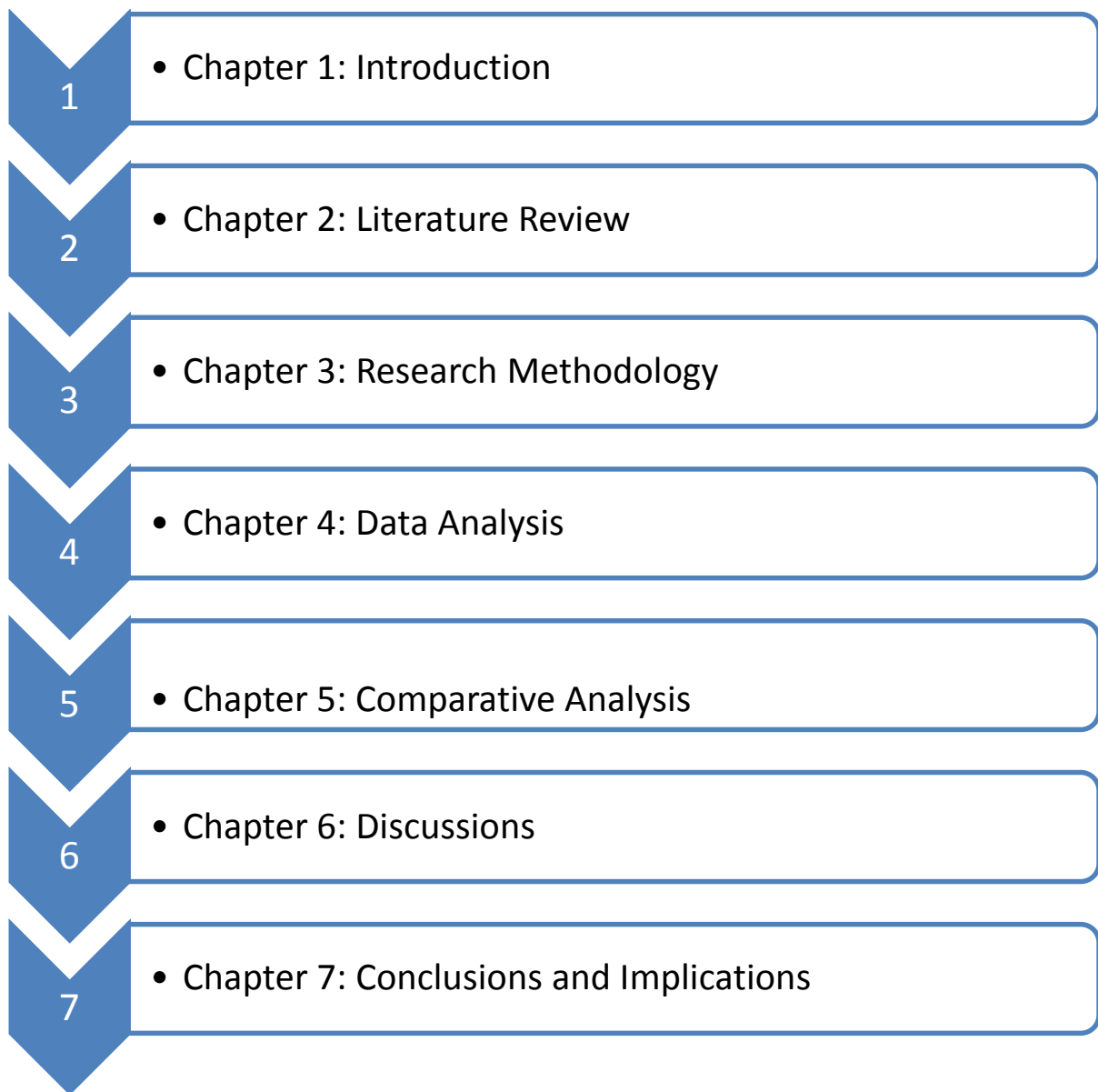


Figure 1.1 Organisation of this study

Chapter 2-Literature Review

2.1. Introduction

Small and medium-sized enterprises are vital in a country's development by providing employment, promoting innovation, inciting competition and building economic wealth (Little et al, 1987; Stennberg, 1999; Quayle, 2003; Towers, 2008). In a study (Jahanshahi et al, 2011), carried out to analyse the relationship between government policy and the growth of entrepreneurship, it was found that those countries have succeeded in achieving higher growth of SMEs, who have given much more emphases on entrepreneurship development program. Through the positive relationship between the policies and growth of SMEs, governments have recognised that the SME sector can assist in generating more employment, indigenising technology and flexibility of operations to create competitive advantage for the industry. "It is commonplace for governments to have policies to encourage the growth of local SMEs as they can help to directly alleviate poverty by increasing income levels and creating jobs" (Jahanshahi et al, 2011, p. 66).

In the present uncertain and turbulent business environment, organisations are frequently changing their supply chain strategies to achieve their basic objectives of optimising cost, revenue, and profit and customer satisfaction. Many researchers (Pires and Neto 2008, Soosay et al 2008, Cassivi 2006) have noted that supply chains are exposed to strong pressures to reduce product development costs, product price and delivery time, improve product quality, customer services and environmentally friendly products; reduce product life cycles; rapidly introduce new products and supply into new markets. Christopher and Peck (2004) commented that, 'supply chain managers must balance downward cost pressures and the need for efficiency to meet market demands'.

There are many external drivers and supply disruptions which compel organisations to redesign and restructure their supply chains. Being involved in today's global supply chains has become a challenging and complex process for SMEs as they are highly vulnerable to disruptions such as disasters, shortage of supplies, discontinuity of suppliers, transportation deadlocks, communication failures and demand fluctuation, which are most of the time uncertain and unpredictable in nature. The vulnerability of the small firm (SMEs) changes with the environment, and its survival depends to a large extent on how it interacts with the external partners (Vancheswaran & Gautam, 2011).

It is also found that SMEs generally have a comparative disadvantage to LEs in terms of management practices, organisational resources such as man power, finance, marketing, R&D, IT and technical support and inventory levels; dynamic and informal strategies; and business volume (Bhagwat and Sharma, 2006). With a smaller size, narrow span of operations, and scarce resources, SME businesses

tend to be less advanced in their supply chain management (Jayaram et al, 2014, p. 472). The present market is characterised by volatile demand and high speed of changes in a business environment which requires competition between entire supply chains or networks rather than individual firms, thus collaborative working is the prime need (Christopher 2000).

Collaboration is a process where two or more organisations work together by sharing knowledge, learning and building consensus for common goals. It is a business strategy in which two or more firms in the supply chain are actively working together as one entity towards a common objective of increasing the efficiency of the whole network. Mentzer (2001) defined collaboration as ‘a means by which all companies in the supply chain are actively working towards common objectives’.

The modern business scenario is changing fundamentally, there is increased shift to cross-functional and inter-firm dependencies, which require sharing of one or more business functions with customers and suppliers and making them an integral part of the business. Wagner et al (2002) cited that IDV Ireland (customer, who makes Baileys Irish Cream) and Killen Corrugated Paper Products (supplier, who provides cardboard box packaging to IDV) shared their technologies, business processes and people to reduce price, improve product quality, improve packaging print quality and improve logistics performance. This also helped both the firms reduce dead stock from over-ordering or re-scheduling, stabilise delivery planning, improve design, improve capacity utilisation and productivity. Collaboration is characterised by mutuality of information/knowledge, benefits, rewards and risks (Mentzer 2001, Barratt 2004). Such sharing increases understanding between supply chain partners and ultimately their performances in the network (Mentzer et al 2000). Inter-organisational coordination results in cost saving and generating surplus money for the partners in the supply chain (Jain et al 2006). Firms that work collaboratively obtain greater optimisation of resources, recognition and reward when facing competition in the changing business environment. Sharing the processes has a significant impact on the collaboration performance (Kim and Oh 2005)

Collaborations in supply chains help the organisation to be more resilient. Resilience is the ability of a supply chain to regain its original or desired state after disruptions. Sheffi (2005) defined resilience as ‘measures of company’s ability and speed at which it can, return to its normal production level (production, services, fill rate, and so on) following a disruption’. Christopher and Peck (2004) defined resilience as ‘the ability of a system to return to its original state or move to a new more desirable state after being disturbed’. Lakovou *et al* (2007) identified the risks that supply chains are exposed to and commented that ‘every organisation is exposed to risks, firms need to first understand these risks, and then design solutions to limit their impact’. Researchers like Christopher and Peck (2004), Lee (2004), Sheffi (2005), Lakovou et al (2007), Fawcett et al (2008) and Khan et al (2009) supported collaboration as one of the important supply chain strategies for increasing resilience of the organisation.

Collaboration in supply chains should be the prime focus of organisations that want to increase their competitiveness and business operations in highly turbulent and uncertain business environment and time. The empirical examples of supply chain disruptions such as Hurricane Ivan in 2004, Indian Ocean Tsunami in 2004, Hurricane Katrina and Rita in 2005, Indonesia Disaster in 2006, Drought in Argentina in 2009, Terrorist Attack in USA in 2001 and Mumbai (India) in 2008, show a big impact on the organisations performance. This includes decline in demand and sales, increase in cost, decrease market share, labour unrest, strikes and lay-offs, loss of reputation and goodwill of company and insolvency of the organisation.

SMEs are highly susceptible to disruption and the market changes due to the limitation of resources such as capital, people, appropriate plant and machinery, advanced technology and R&D. Researchers like Quayle (2003), Archer et al (2008), Huin et al (2002) have concluded that SMEs have many organisational barriers of personnel, capital, planning and operational which must be recognised and eliminated before adopting a successful supply chain strategy. This can help them face the tough competition posed by larger organisations. Thus SMEs should focus on collaborative strategies which enhance their ability to routinely deal with changes and constantly adapt in terms of sustainability and survival due to sudden fluctuations of demand and supply.

Thus, it has put many new responsibilities on the shoulders of the strategic thinkers and managers of the SMEs to design such supply chains which can face all these disruptions and to do so at low cost. Gaonkar and Viswanadham (2003) commented that ‘uncertainty rules the supply chain and in truth, schedule execution as per the plan generated by supply chain planning is just a myth. Because supply chain performance is inherently unpredictable and chaotic, supply chain practitioners often must seek safety mechanism to protect against disruptions’. Although the probability of unpredictable events and disruption cannot be eliminated or reduced but supply chains can be made more compatible to face them effectively and efficiently.

2.2. Literature Review and Background:

The literature for the present work is divided in to three areas as depicted in Figure 2.1, these are: 1) supply chain management; 2) overview of SMEs and their supply chains; and 3) Collaborative initiatives for SMEs

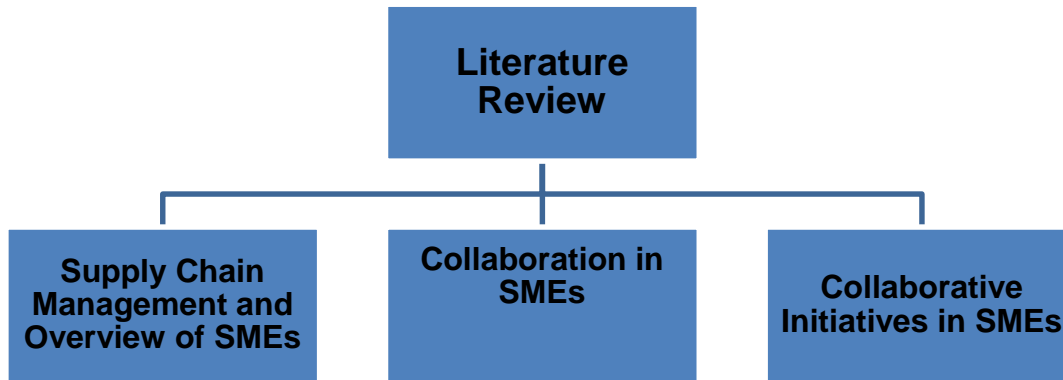


Figure 1.1: Typical classification of literature review

2.2.1.1 Supply Chain Management:

The concept of supply chain management has gained significant importance among researchers and practitioners since the early 1990s. Since then many researchers have defined supply chain management taking different aspects into consideration. The present research focusses on collaboration in supply chain management, it is important to define supply chain management from different points of views. Some selective definitions of supply chain management are presented in Table 2.1.

No.	Source/Author	Definition
1.	Piers and Neto (2008)	Supply Chain comprises of the processes involving suppliers-customers, connecting companies from the initial source of raw material to the end product consumption point.
2.	Council of Supply Chain Management Professionals (2007)	Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service suppliers and customers. In essence, supply chain management integrates supply and demand management within and across companies.
3.	Christopher (2004)	The network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer.
4.	Ho et al. (2002)	SCM is the philosophy of management that involves the management and integration of a set of selected key business processes from end user through original suppliers, that provides products, services, and information that add value for customers and other stakeholders through the collaborative efforts of supply chain members
5.	Mentzer et al.(2001)	a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from source to customer. These individual members help each other to improve the long-term performance of each one and the supply chain as a whole.
6.	http://www.eduka.com/News/Glossary-of-Terms.aspx	Supply chain management is the control of materials, information, and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer. Supply chain management involves coordinating and integrating these flows both within and among companies. The ultimate goal of any effective supply chain management system is to reduce inventory (with the assumption that products are available when needed).

Table 2.1: Definitions of supply chain management

From these definitions it can be concluded that supply chain management is: A systematic and holistic approach which integrates all the key elements of business right from suppliers, manufactures, distributors, retailers to the end user so as to ensure a proper flow of material, supplies and products which not only meets the customers' expectations of quality and quantity at right time and at right place but also the organisation's objectives on the maximisation of revenues and market share.

Supply chain management has been viewed as a comprehensive approach which integrates the dependent and independent activities from the point of source to consumption. Supply chain strategies focus on integration of internal and external business activities and processes to improve customer satisfaction and performance of the members of the chain. Successful supply chain management has potential benefits of inventory reduction, improved delivery service and shorter product development cycle. Despite these enticing benefits organisational, intra-organisational and inter-organisational barriers exist in the supply chains (Fawett et al 2008).

Modern supply chains are not only simply linear chains or processes, but they are complex networks in which products and information flows travel within and between nodes (Christopher, 2004). Organisations in supply chains are compelled to restructure and re-engineer relentlessly to increase their effectiveness and satisfy customers (Soosay, 2008). Gaonkar and Viswanathan (2003) commented, ‘In today’s supply chains, the partners in the chain are globally dispersed, but they achieve a high degree of coordination through tightly integrated electronic communication. Increasingly, competition nowadays is between supply chain networks, and as a result it is important to select partners that provide a distinct competitive edge’.

SMEs comprise the majority of enterprises in the developed and developing countries and therefore their contribution to entrepreneurship, gross domestic product and employment is very large and substantial (Little et al, 1987; Stennberg, 1999; Towers, 2008). Despite this important contribution, supply chain management within SMEs has received little attention (Quayle, 2003; Jayaram et al, 2014).

2.2.1.2 Definition of SMEs and their supply chains

As the research is focussed on SME sector, it is important to define SMEs in a clear way. Defining the SME sector is quite difficult, as there are differences in what is appropriate to describe as “small” in different countries. Despite the common focus of providing support to the SMEs by the various governments, there is no single definition for a SME internationally. Moreover lack of a formal means of defining a SME has resulted into different approaches adopted by various government and countries. However, the common criteria used to define the SME are number of employees, annual turnover and investment in plant and machinery as reflected by the balance sheet. Table 2.2 depicts the definition of SMEs adopted by various countries on the basis of number of employees and investment/turnover:

Country	Category of Industry	Criteria	Source/ (Reference)
UK	Small	Turnover \leq £6.5 million and \leq 50 employees	HMRC (1)
	Medium	Turnover \leq £25.9 million and \leq 250 employees	
European Commission	Micro	Turnover \leq €2 million and \leq 10 employees	European Commission (2)
	Small	Turnover \leq €10 million and \leq 50 employees	
	Medium	Turnover \leq €50 million and \leq 250 employees	
India	Small	\leq Rs 5 crore investment in plant and machinery	Reserve Bank of India (3)
	Medium	investment in plant and machinery \geq Rs 5 crore but \leq Rs 10 crore	
China	Small and Medium	\leq 250 employees	SME Forum China (4)

Table 2.2: Definition of SMEs

1. <http://www.hmrc.gov.uk/manuals/camanual/ca23170.htm>,
2. http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm,
3. <http://www.rbi.org.in/scripts/FAQView.aspx?Id=84>
4. http://www.icsme-china.com/upload/european_business_in_china_position_paper__sme_2008_2009_.pdf

2.2.1.2 a: Internal environment of SME

Many researchers have studied the internal aspects of SMEs and have identified important characteristics such as: lack of proper information systems architectures (Bhagwat and Sharma 2006), unwillingness to adopt internet business procurement (Archer et al 2008), involvement of top level in operational decisions, no clear line of portfolio responsibility “blurred” departmental walls, significant gaps in the planned forecast and real demand (Huin et al, 2002) which are major barriers in successful implementation of supply chain strategies. Quayle (2003) contended that in UK SMEs, their suppliers and customers are more focused on traditional operational issues like quality, price, reliability and support rather than process issues like R&D, e-commerce, purchase expertise, market response time, which help in supply chain innovation. Vaaland and Heide (2007) found that SMEs are not rigorous in terms of formalised planning and control systems, pay less emphasis on upstream integration, have gaps in their production management systems and vendor managed inventories. Figure 2.2 depicts the internal environment of SMEs

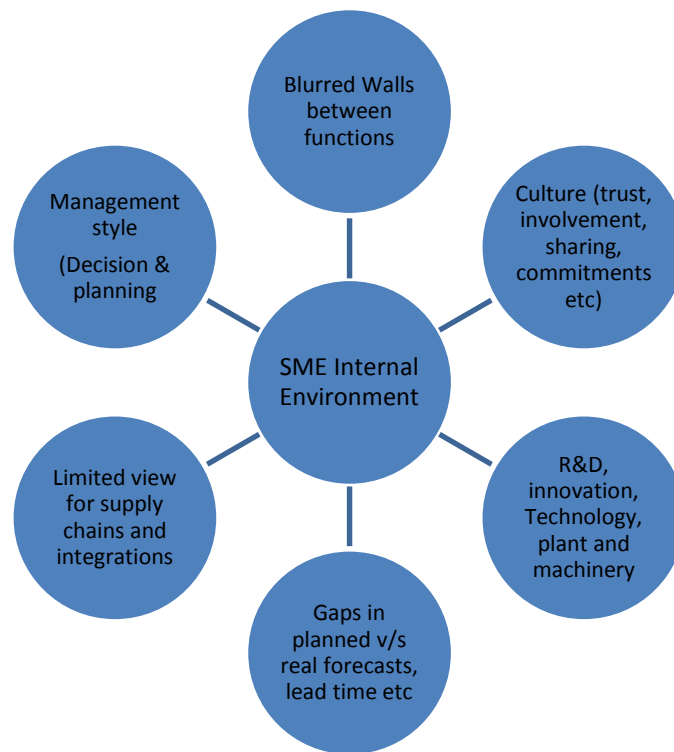


Figure 2.2: Internal environment of SME

SMEs play an important role in the supply chain network for the LEs in the chain. Nassimbeni (1998) referred to the term ‘system or network’ of companies as a vast range of inter-organisational relations and identified three basic characteristics of networking:

- Networks are constituted by two or more firms.
- The exchange process is relational in nature.
- Dynamic forms of communication and coordination develop between parties

He categorised inter-organisational links as ‘supply networks’, ‘agreements and joint ventures’ and ‘regional industrial systems’ on the basis of the main objectives, main areas and main vehicles involved in the network interactions. In a complex supply chain structure an SME has other SMEs and LEs as suppliers and customers as depicted in Figure 2.3 which exhibits a typical and complex structure of a supply chain comprising of SMEs and LEs. Smeltzer (2002) suggested that all companies involved in the complex supply chain should be linked effectively and electronically so as to maximise the overall benefits of collaborations.

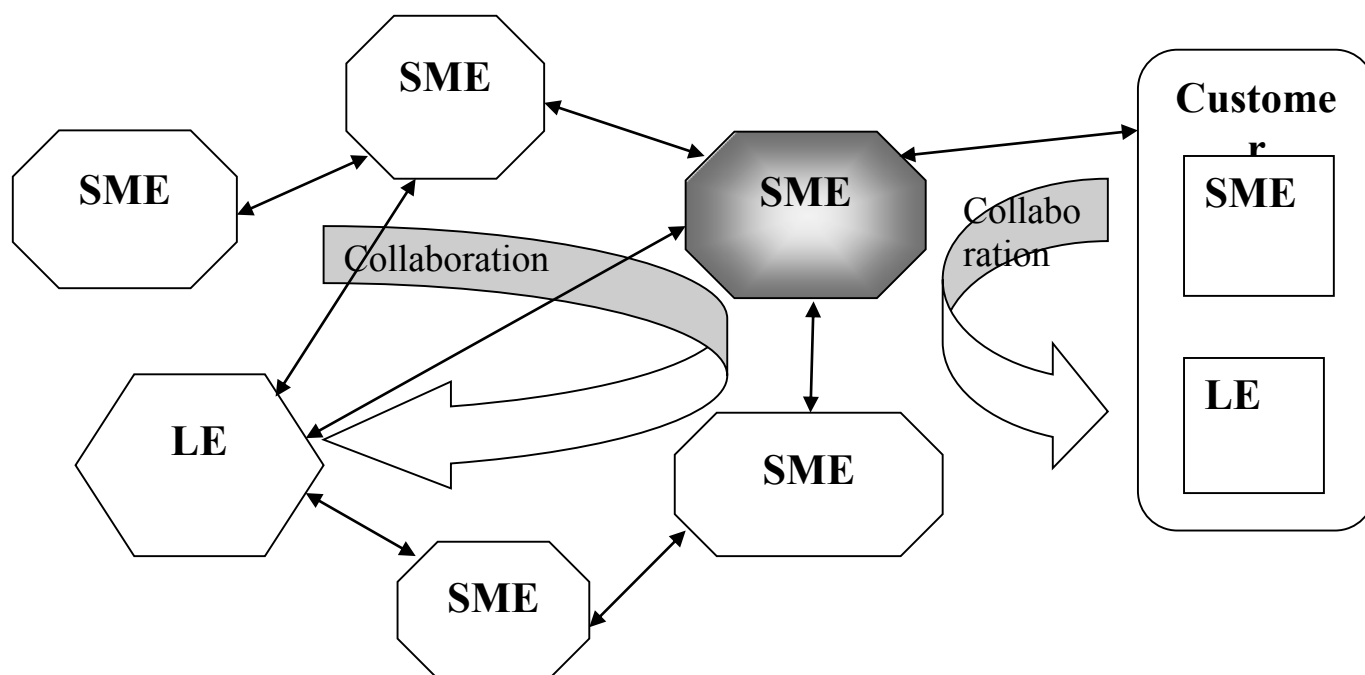


Figure 2.3: Supply chain structure of SMEs and LEs

In most of the supply chains, SMEs and LEs are suppliers and customers for each other thus it is essential that they collaborate together to work efficiently. Such collaboration is characterised by a long-term business relationship, close co-operation and co-ordinated activities, shared common objectives, creating visibility, shared merits of closer ties and bridging distinct groups within and across firms (Leeuw and Fransoo, 2009).

2.2.2.3. Collaboration in SMEs

Supply chain collaboration has been a very important strategy for many organisations in the quest for business opportunities. This area has been well discussed by various people from industry and academics. The literature supports the view that supply chain collaboration has a significant impact on the organisational capabilities in improving the performance and managing business uncertainties. Collaboration helps in facilitating access to information, knowledge creation and assists in designing flexible supply chains (Cassivi 2006). Many researchers (Wagner et al, 2002; Power, 2005; Jain et al, 2006; Knoppen and Christiaanse, 2007; Pramatai, 2007; Soosay et al 2008,) concluded that successful collaborations lead to financial benefits of lower costs of inventory, lower personnel, reduced cycle time and improved profits due to increased sales, better delivery and increased speed to introduce new

products in the market. In terms of non financial benefits, collaboration help organisations focus on core competencies, enhance public image, increase sharing of information, ideas and technology, improve trust and interdependence, breakdown inter-partner barriers, less fire-fighting and stronger emphasis on whole supply chain. Thus successful collaboration provides competitive advantages over other supply chains.

Cao and Zhang (2011) in a study (on manufacturing companies) found a positive relationship between supply chain collaboration and better firm performance. Their study revealed that effective supply chain collaborations lead to leads to competitive advantage in terms of increase in market share, enhanced capacity and flexibility, improved inventory turnover, cost reduction, revenue enhancement, improved customer responsiveness, better use of resources in the supply chain, improved quality of products offered, improved ability to engage in process and product innovation. The positive relationship implies that, all partners in the supply chain should try to create a win-win situation in order for a supply chain as a whole to perform well to achieve business synergy and compete with other supply chains.

Successful implementation of collaborative strategies is a major challenge for most of the organisations. Christopher (2004) stated that there should be different supply chains for different suppliers and customers due to their specific needs and because ‘a single supply chain cannot meet all the expectations in an efficient and effective manner’. In such a case each supply chain requires a different strategy and a different culture to support that strategy (Barratt, 2004). This leads to a major challenge before the managers can design and implement different networks with their suppliers and customers but then they are face big questions about where to collaborate, what to collaborate and how to collaborate. Researchers have discussed such issues related to the ‘who’ and ‘what’ of collaboration. It is important for the firms to identify who are the key partners in the supply chain and what business processes require collaboration.

- *Who to collaborate with:* collaborate with key suppliers and customers who represent a large portion of your business (Mentezer et al, 2000), firms need to collaborate with a small number of strategically important customers and suppliers (Barratt, 2004).
- *What to collaborate on:* organisations must identify their various key components, systems and commodities and decide which business activities need collaboration. This is referred to as a ‘segmentation approach’. Not everything in the supply chain is of equal importance (Mentezer et al, 2000). Customers and suppliers can be segmented by way of their needs and then separate supply chain strategies to meet the specific needs of various segments (Barratt, 2004).

Effective collaboration between partners requires commitment of the partners, mutual trust, help, openness and common interest among them, working together and adjusting to the needs of others. Such initiatives will help the partners in breaking down the barriers and increase the longevity of relations. Mentezer (2000) referred to collaboration as ‘marriage’; a long term commitment between partners and

added that it is like a ‘crew-race’ in which players need to find out a way to work together to win. Information sharing and coordination between supply chain partners has been a major strategy for improving the performance of the chain but caution should also be exercised as sharing of information is a costly affair and will be of no use if not used intelligently. Haung et al (2003) commented that ‘it is very important to share the right information at the right time in the right format by the right people under the right environment to maximise the mutual benefits of the supply chain as a whole as well as the individual business players’.

2.2.2.1 Scope of Collaboration for SMEs

The literature suggests that organisations collaborate both vertically with suppliers and customers and horizontally with their competitors and other organisations that are not in their supply networks. The present research adopted the scope of collaboration from Barratt (2004) who identified variety of forms of potential supply chain collaboration and divided them into two main categories; vertical collaboration with customers and suppliers, and horizontal collaboration with competitors and non-competitors. Following Barratt’s scope of collaboration in general, this research adopted a framework for collaboration for SMEs as depicted in Figure 2.4.

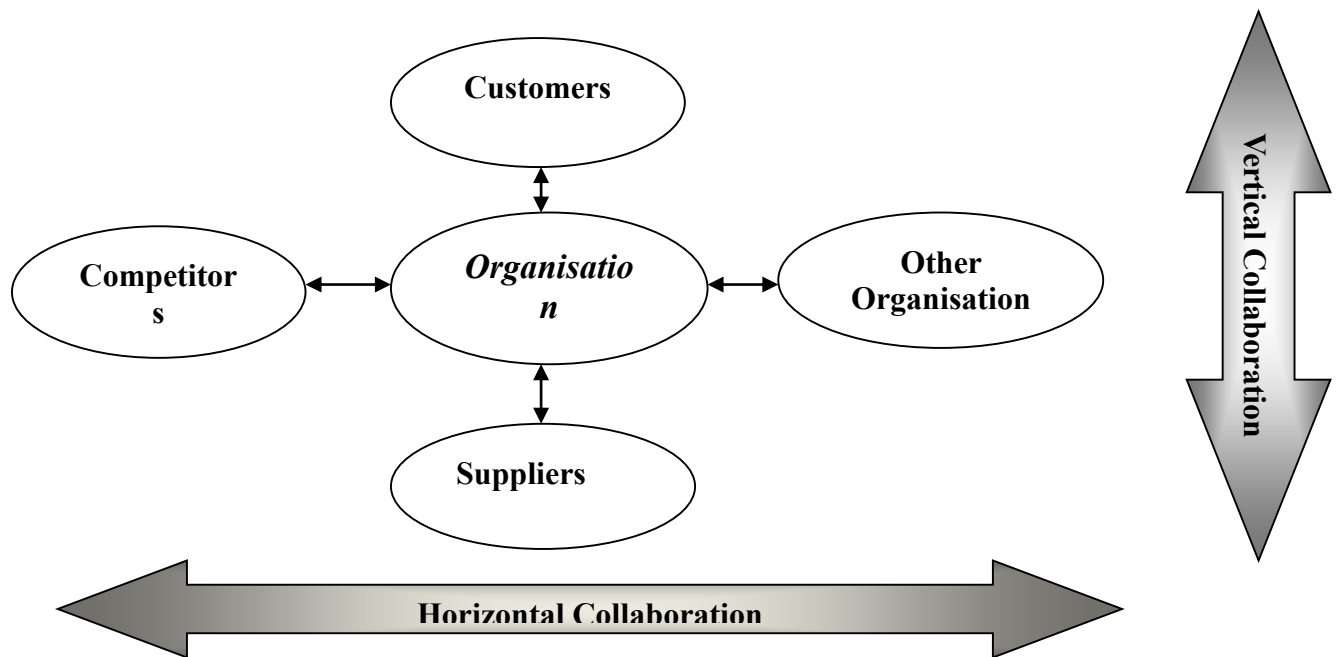


Figure 2.4: Scope of collaboration (adopted from Barratt, 2004)

SMEs, in general, have limited funds for strategic issues like R&D, knowledge creation and transfer, automated manufacturing facilities and marketing strategies. Therefore SMEs should look forward for collaborative strategies to overcome these limitations. SMEs can collaborate both vertically (upstream with suppliers and downstream with customers) and horizontally with the competitors and other

organisations. Mason et al (2007) empirically showed the advantages of vertical and horizontal collaborations with partners to optimise the transportation efficiency. Such a joint approach helps the firms to reduce transportation costs, enhance visibility, improve service levels, enhance customer satisfaction and improve logistics performance. There is a need for greater emphasis on identifying the major players and the business operations which should be internal collaboration. The literature suggests that most of the SMEs have ‘traditional’ or ‘closed loops’ in planning and decision processes, frequent negotiation process which consumes time and energy, inadequate communication systems for information sharing, their key managers are overloaded with operational issues and have limited view of the supply chain (Towers and Burnes, 2008; Mentzer et al, 2000). SMEs also have barriers such as expensive technology investment, personnel training and lack of mutual trust which hinder them from becoming an effective partner in the supply chain (Huang et al, 2003). Supply chain relationship is positively affected by mutuality of trust, involvement, power and commitment (Giannakis, 2007). SMEs are a very important part of supply chains therefore it is essential to integrate their internal business activities and create an effective supply chain culture in order to get fruitful results of collaboration.

2.2.2.2 Framework for collaborations in SMEs

The major part of literature on supply chain collaboration supports for vertical collaboration with customers and suppliers for both SMEs and LEs. Literature on horizontal collaboration with competitors and other organisations is more confined to LEs rather than SMEs. Following Mentzer et al, (2000) and Barratt (2004) this research adopted a general framework that SMEs should strive for both vertical and horizontal collaboration in order to work most effectively in their supply chains. Figure 2.5 depicts the framework of collaboration in SMEs.

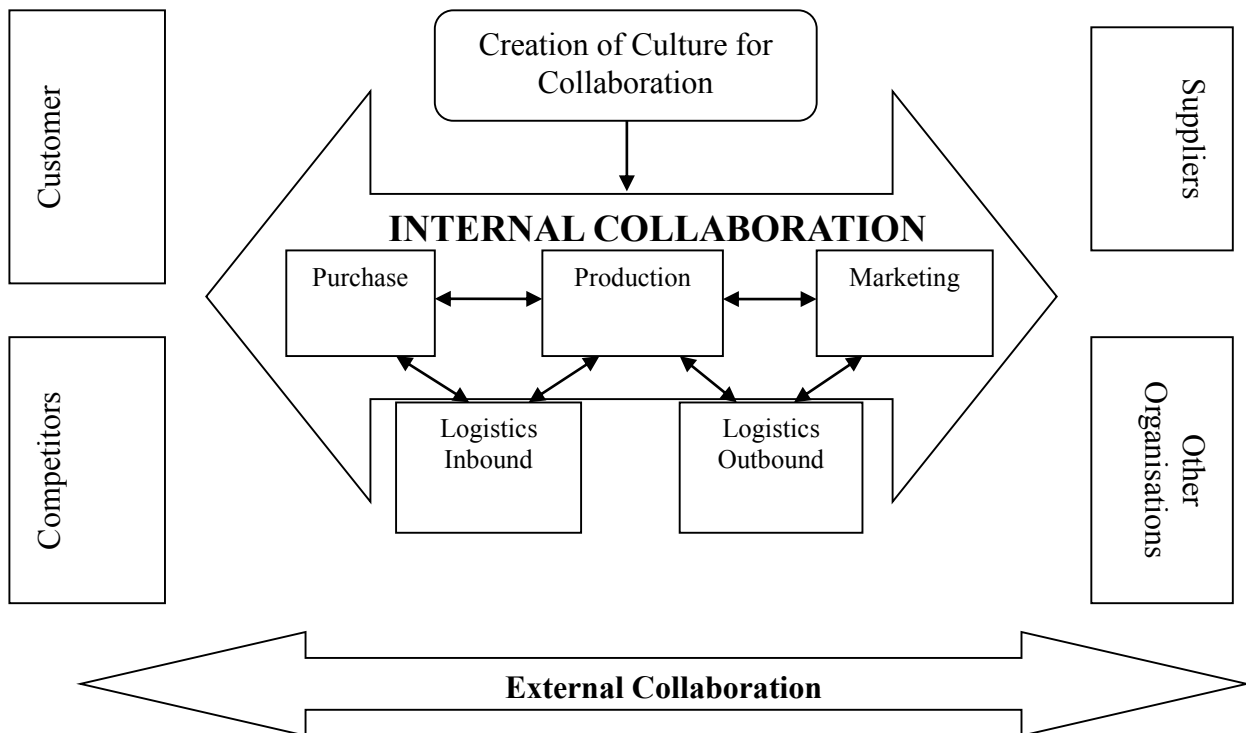


Figure 2.5: Framework of collaboration in SMEs (adopted from Mentezer et al, 2000; and Barratt, 2004)

a) Internal Collaboration

Johnson and Kristal (2008) suggested organisations should remove cross-functional barriers between various departments and involve them in strategic planning and decision. This is an important organisational climatic condition that fosters cooperation in the business activities. Thus, SMEs should try to achieve complete internal integration of their own business processes of production, marketing, purchasing and logistics (Ireland and Bruce, 2000; Ellinger, 2002; Fawcett and Magnam, 2002). This requires collaboration of these functions in order to understand each function properly which would make them capable of improving their internal performance. However, ‘internal collaboration must be married with external collaboration, integrating processes in terms of developing closer relationships and sharing information with external firms’ (Barratt, 2004, p.33). Therefore, firms should actively look forward for both internal and external collaboration. This research work does not under-estimate the importance of internal collaboration however it is not covered in the present work.

b) External Collaboration

External collaboration is a very complex process due to different supply chain structures, the flow of material and information between and within partners, the role and inter-relationship between partners and the value structure of the product or services (Srai and Gregory 2008). CPFR, co-manufacturing, co-innovation, the creation of a collaborative culture, advanced information systems, collaborative design, supplier segmentation and development, aggregate procurement, collaborative transportation and distribution are some collaborative initiatives employed by firms. In order to be effective and

efficient organisations need to analyse their capabilities first and then decide for the selection of appropriate strategies depending upon their supply chain structures. Figure 2.6 depicts the scope of external collaboration for SMEs.

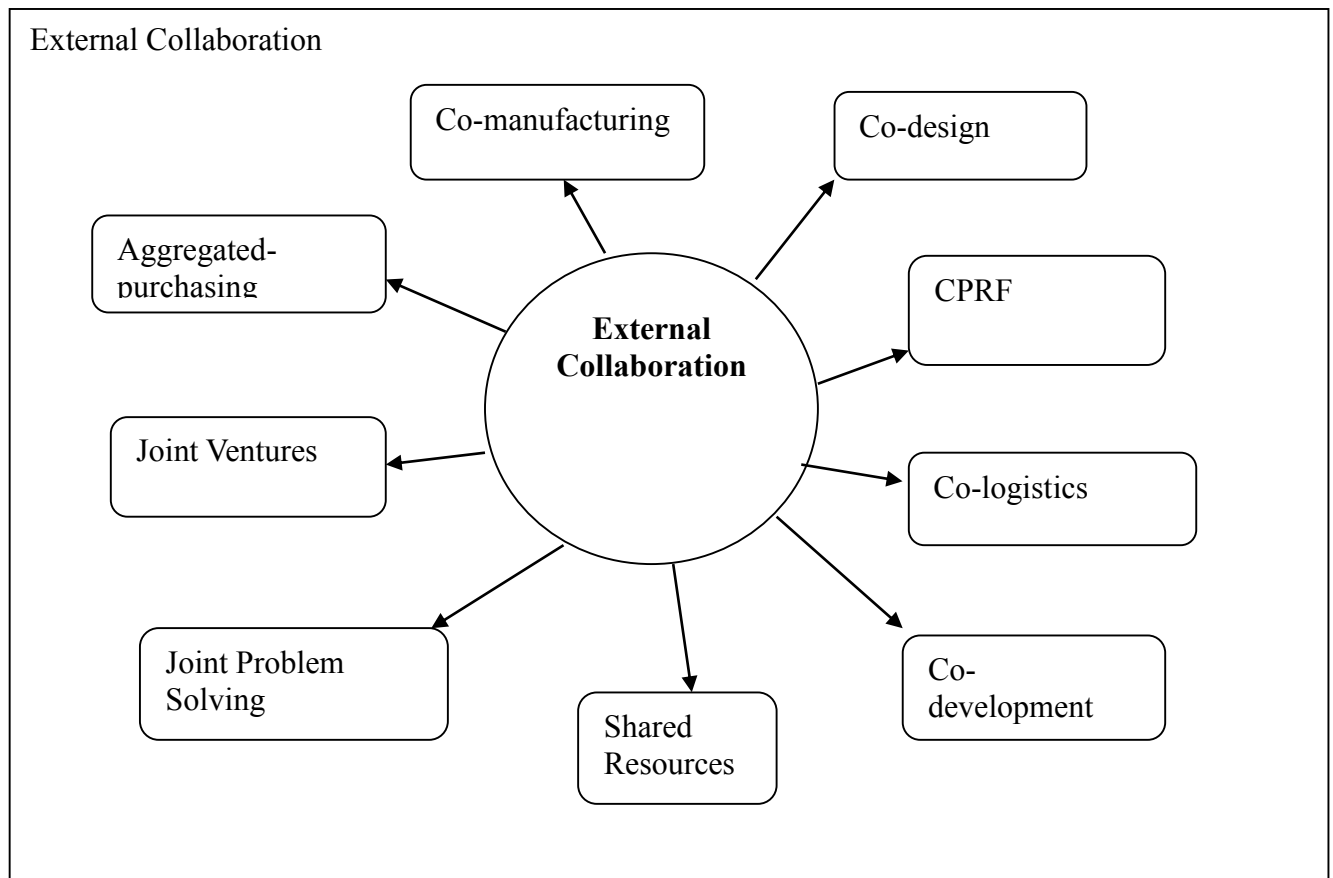


Figure 2.6: Scope of external collaboration for SMEs.

Archer et al (2008) identified important internal and external factors (adoption influencers) which have significant positive and negative impacts on the SMEs and their supply chains. Table 2.3 summarises the factors which influences the SME business and their supply chains.

Factors	Adoption influencers	Internal/External Factor
Strategic	Characteristics of the firm	Internal Factors
	Management strategy	
	Financial (amount, predictability, ROI)	
	Compelling overall benefits	
	Information sharing, Alliances	
Organisational	New organisational capabilities	Internal Factors
	Organisational readiness	
	Resistance to change	
	Amount of change in behaviour required	
Transactions and Products	Demand volatility	External Factors
	Transaction cost reduction	
	Reduction in information distortion	
	Improved information quantity	
	Transaction volumes	
	Relative power of largest customer or supplier	
	Transaction product complexity	
Environmental	Special customer demands	External Factors
	Influence of major customers, suppliers	
	Improved supplier relationship	
	Long term relationship with customers, suppliers	
Technological	Operational, infrastructure incompatibility	External Factors
	Characteristics of new technologies	
	Involvement of major partners	
	Easy, rapid technological solutions	
Source: adapted from Archer et al (2008)		

Table 2.3: Internal and external factors influences the SMEs and their supply chains

The internal and external environments of the SMEs play an important role in their business performance and their supply chains. Archer et al (2008) also emphasised the need of learning in the SME community for these influencers. SMEs also have other influencers such as expensive technology investment, personnel training and lack of mutual trust which hinder them from becoming an effective partner in the supply chain (Huang et al, 2003). Thus SMEs should be made aware of the important factors and their influences on their supply chain and how collaborations can be helpful in improving their organisations performances. This calls for education of the SME community on the potential applications and benefits of collaborative initiatives in their supply chains.

2.2.3. Collaborative Initiatives for SMEs

2.2.3.1. Co-Development

Many research studies have suggested that an organisation will perform better if it has a high degree of supply chain integration which involves multiple business processes across customers, suppliers, competitors and other firms. As organisations recast relationships with their partners, they are beginning to extend partnerships into the area of product and process development. Co-development refers to the sharing of technological, marketing and production information with the business partners. As one of the important strategy collaborative product and process development has been an attraction for many researchers and firms. Product and process co-development is becoming more important for organisations but it is a very complex process as it requires involvement of different people, systems and skills. Co-development phase can be synchronised by process standardisation, knowledge sharing, alignment of existing practices and continuous elimination of waste within the joint development cycles (Evans and Jukes, 2000). Lau et al (2007) contended that co-development of products and processes with suppliers, customers and internal functional units are critical for firms to acquire resources and new ideas to develop new products. They emphasised that supplier co-development, customer co-development and internal co-development are three dimensions of supply chain integration to improve business performance. Co-development efforts result in lower development costs, fewer engineering changes, higher quality, shorter time to market, acquisition of new ideas for products and reduction in cycle times (Lau *et al*, 2007; Huang *et al*, 2003).

Due to changing market and shrinking product life cycles, organisations have to boost their flexibility and responsiveness in terms of product development. Collaborative product development is a useful initiative in these circumstances to satisfy the customers demand (Wang et al, 2009). SMEs should involve their customers, suppliers and other organisations in the co-development of products and processes to improve their organisational performances and results. Researchers have identified various information and materials which move within and across organisation in the co-developmental relationship. Table 2.4 depicts the flow of information and material between different functions and organisations for co-development initiative.

Factors	Flow of information and materials
Marketing	Product demand, Sales transactions, Promotional Events, Payment records/data, Pricing Policy, Customised & Standardised Information
Production	Details of process design and development, details of production activities (work flow, production runs, idle time, under time, down time, waste, rework data, technical expertise, cycle time)
Procurement	Details of procurement activities and facilities, cost sheet for purchase activities, details inbound and outbound logistics activities

Table 2.4 Flow of Information and material between different functions and organisations

Co-development initiatives result in many competitive advantages such as: reduced lead time during development, transaction costs and time to market, decreased product development costs (mould fee, product design change fee, product data processing fee and drawing exchange fee, product development time and improved component re-use percentage (Clark 1989, Dyer 1997, Wang et al 2009). Figure 2.7 depicts the needs, activities and benefits of co-development.

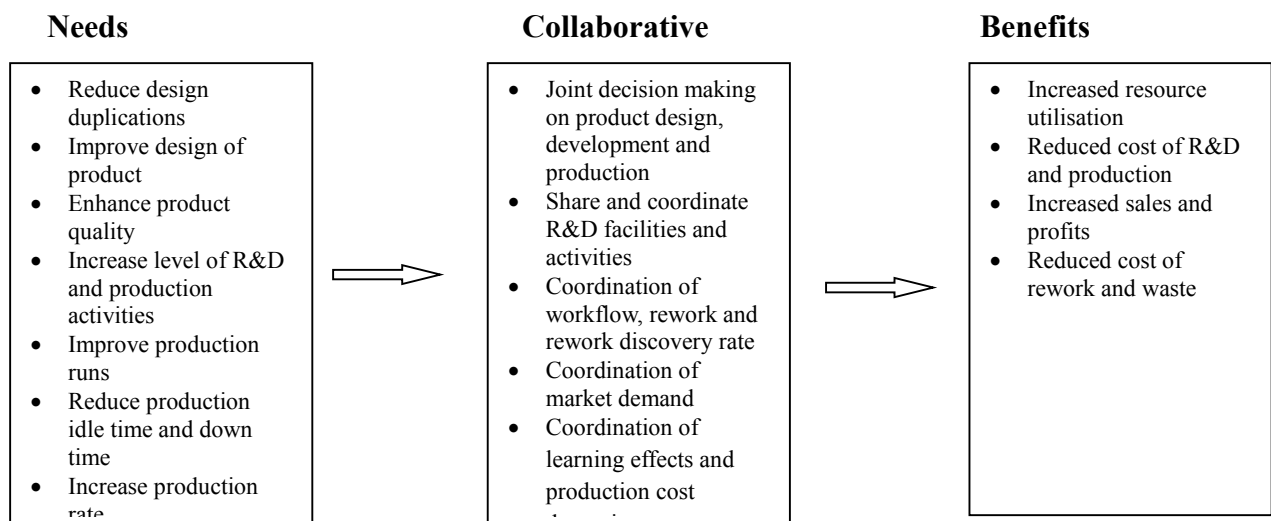


Figure 2.7: needs, activities and benefits of co-development.

(Sources: Clark, 1989; Dyer, 1997; Huang et al, 2003; Lau et al, 2007; Wang et al, 2009)

2.2.3.2. Co-Design

Joint product design and development has become vital for most business firms. Firms are partnering with others to improve design, add new and more features, speed up time to market and gain competitive advantages in the market. Co-design is a business strategy to design products across a global network of supply chains and its partners to sustain the competitive pressures of the market. Wang et al (2009) suggested manufacturers to adopt collaborative product development (CPD) strategy to increase competitive advantages. 'The CPD describes a process that involves not only the collaboration of

dispersed product development functions, but also information management during numerous product development stages’.

Brian and Fry (2006) commented that ‘as multinational corporations adapt to increasingly global supply chains, product design decisions are affecting their supply chain costs and efficiency to an unprecedented degree’. They concluded that organisations can achieve measurable benefit such as reduced product variety and product size, manage SKUs, increase pallet-loading efficiency, manage increased lead time, leverage key components and improve supplier management with the help of designing an effective supply chain. Collaborative processes accelerate the sharing of new product information and ensure product quality.

Zang et al (2009) contended that supply chain configuration is an effective means to deal with product differentiation and customisation. ‘The lynchpin of supply chain configuration lies in the co-ordination of product, process and logistics decision in relation to a variety of customer orders. Substantial benefits can be expected through proper co-ordination of supply chain decisions with the design and production of the products’.

Wang et al (2009) commented that, ‘‘collaboration between the centre factory and design house mainly focuses on the product idea creation and design (i.e. shape). Product creation derives from the centre factory or design house. From the centre factory aspect, it dominates the process of product idea creation. The design house helps to improve the design ability and product development cost. From the design house aspect, it has specialised professional capabilities following product design and market trends to assist in creating product ideas and design for the centre factory’’.

Based on the research studies of Brian and Fry (2006) and Wang et al, (2009), Table 2.5 depicts the flow of information and material between different functions and organisations for co-design initiative.

Factors	Flow of information and materials
Survey Results	Customer feedback in products and their design, change in preferences, new ideas and concepts (customised & standardised Information)
Product	Product mix and their design, development and production details, cost sheet for design and development, Product Life Cycle details, Product demand and turnover rate, Lead time, Delivery time data
Production	Details of production activities (work flow, production runs, idle time, under time, down time, waste, rework data, technical expertise, cycle time)
R&D	Details of R&D activities and facilities, cost sheet for R&D activities, product innovation lead times.

Table 2.5 Flow of Information and material between functions for co-design.

Figure 2. 8 depicts the needs, activities and benefits of co-design initiative.

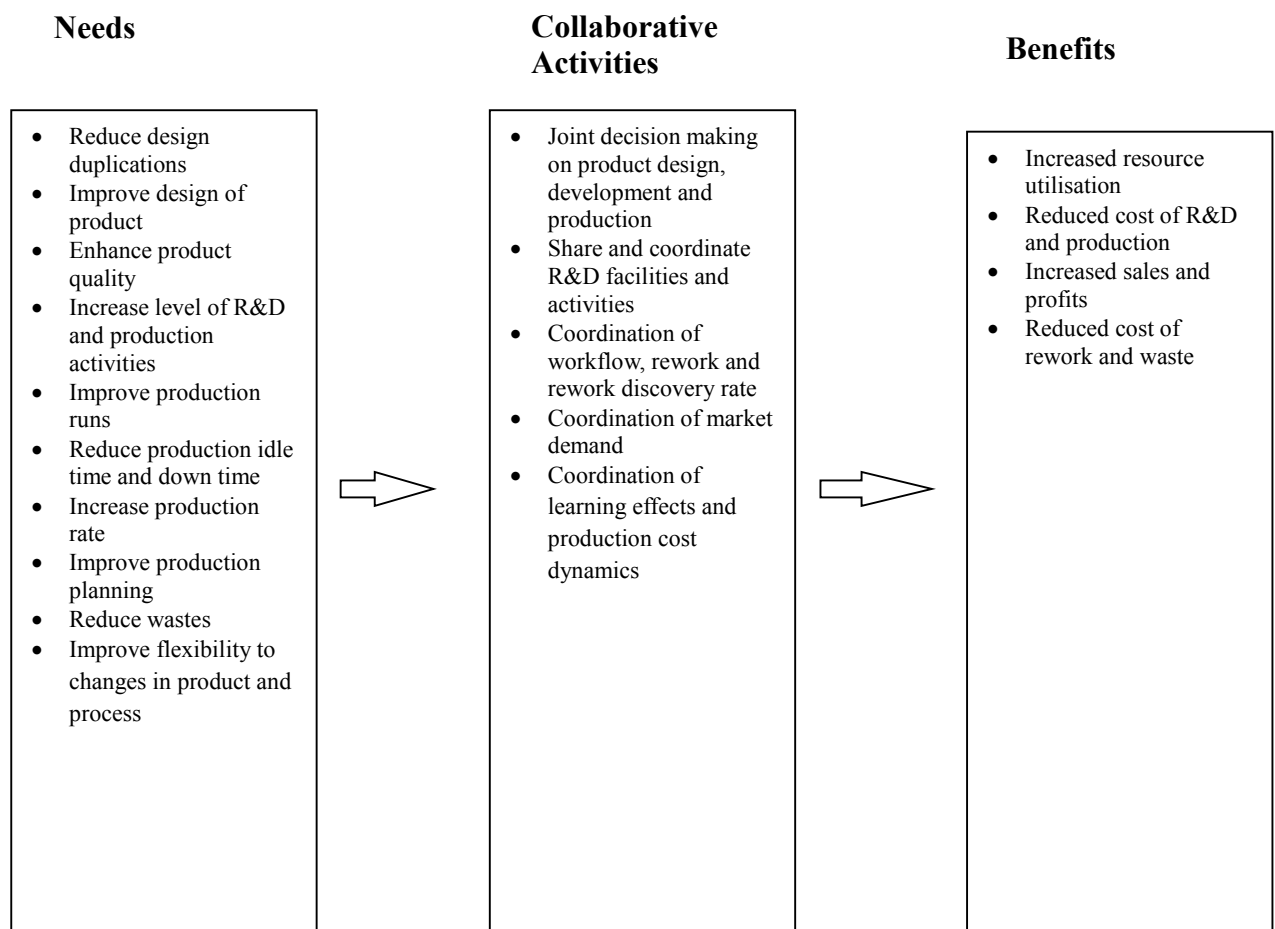


Figure 2.8: needs, activities, and benefits of co-design

2.2.3.3. Aggregated Purchasing

Purchasing cost can be a substantial part of organisational operating cost. For some of the industry like HP and IBM, purchasing cost can be as high as 50-60% of its total cost. Thus organisations strive to control its purchasing cost through integration of its purchases across the chain. Co-purchasing is one of the strategic issues through which firms take competitive advantages of reduced purchase price of material, reduced purchasing manpower, reduction of incidental cost related to purchase process, improved visibility and less investment in inventory. Co-purchasing involves integration of suppliers and rationalisation of distributors which results in low cost of purchase and improved services. Organisations should collaborate with their supply chain partners to take advantage of the co-purchasing initiatives.

A supply chain network of a manufacturer contains all of its upstream suppliers. Through proper configuration of all of them companies can satisfy the requirements in terms of cost, quantity and lead time of ordered items on time. This improves the financial performance relating to the costs of transporting the ordered items at the right quantities to the right destinations, the costs of producing the items and the inventory costs (Zhang et al, 2009).

Based on the literature review, Table 2.6 reflects the flow of information and material for the aggregated purchasing initiative

Factors	Flow of information and materials
Product	Product mix and demand quantity, type and classification of Inventory, inventory status report (current levels & orders, stock data, EOQ/ROP data, turnover rate, lead time, delivery time data)
Suppliers	Details of suppliers (rating and segmentation, location, rates and quantity discounts offered)
Shipment	Modes of shipment, equipments/ containers, Quantity of shipment & Shipment frequency, Shipment routes & location, Cost of shipment

Table 2.6 Flow of Information and material between different functions for aggregated purchasing

Figure 2.9 depicts the needs, activities and benefits of aggregated purchasing.

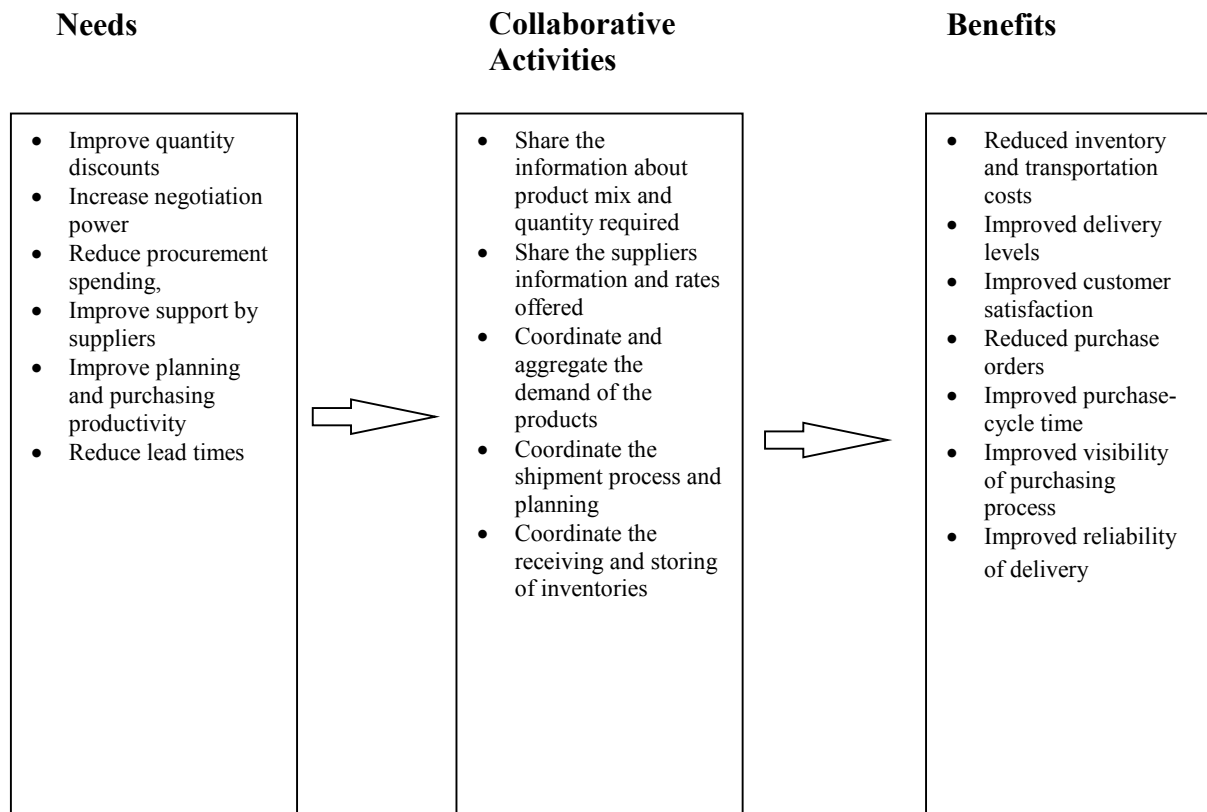


Figure 2.9: needs, activities and benefits of aggregated purchasing.

2.2.3.4. Collaborative Planning, Forecasting and Replenishment (CPFR)

CPFR is a joint strategy of supply chain partners to align and integrate the demand and supply side to create an effective environment to meet customers' demands. CPFR has been proved to be a useful strategy in reducing inventory level, increasing accuracy of forecasts, enhancing store shelf stock rates, reducing logistics costs, increasing sales, reducing lost sales opportunities and improving business relationship between supply chain partners. Many researchers have shown that CPFR helps firms to accurately forecast and determine the level of inventory and customer service which increases organisational capabilities to meet demand fluctuations. CPFR helps the firm to reduce its inventory, improve its forecast accuracy and increased sales. Chang et al (2007) developed an augmented CPFR model to enable the retailers and their suppliers to timely respond to fluctuation of demand. This model helped the retailers to forecast accurately by analysing the competitors' promotional information from the market.

Danese (2007) discussed that the CPFR goals, supply network's structure, product/market characteristics, number of interacting members and the level of integration are the important variables which significantly affect the responsiveness and effectiveness of collaboration. She added that when companies implement CPFR, the collaboration is limited to data communication but in order to be more responsive companies need to synchronise their plans.

Nakano (2009) advocated for aggregation of various elements such as sharing operational information, joint planning, joint establishment of objectives and redesigning work routines and processes for effective collaborative forecasting and planning. He suggested for information sharing, decision synchronisation and incentive alignment as important issues in such initiatives.

Du et al (2009) applied CPFR as a framework to develop an agricultural product procurement system and empirically showed that demand forecasts can be improved with CPFR and purchasers can reduce the inventory levels and losses, increase the chances of generating revenues, improve return to assets, improve distribution efficiency and save management costs. Cassivi (2006) argued that collaborative planning with the partners can result in: reduction of errors, faster transactions processed, fewer information losses, simplified information access and reduction of inventory. The small firms, through effective collaboration, can share information with partners to support collaborative planning and forecasting activities (Cassivi, 2006; Nakano, 2009).

Holmstrom et al (2002) argued that CPFR can also be used as a solution needed for mass customisation. It helps to maximise the profitability of retail space while simultaneously improving the value of the consumer. Danese (2007) identified contingent factors that influence CPFR collaborations: CPFR goals, product/market characteristics, supply network structure and CPFR development stage.

Based on the literature mentioned above, Table 2.7 depicts the important information and material flow

for CPFR initiative

Factors	Flow of information and materials
Consumer Demand & Sales Forecasts	Demand & Sales Fluctuation for the past periods (including exceptional situation), Market Share growth/fall data, POS data (Product history demand), Sales transactions, Promotional Events, Payment records/data, Pricing Policy, Customised & Standardised Information
Inventory Policy	Type and classification of Inventory, Product mix/ Inventory report, Current levels & Orders (stock data), EOQ/ROP data, Turnover rate, Lead time, Delivery time data
Shipment	Modes of shipment, equipments/ containers, Quantity of shipment & Shipment frequency, Shipment routes & location, Cost of shipment
Production	Production planning data, Capacity Planning data, Technical expertise, cycle time
Performance Indicators	On-time delivery data/ Due date performance, Customer satisfaction, Transportation Cost, Responsiveness to customer requests, Incentive/reward Systems

Table 2.7: Flow of Information and materials for CPFR.

Based on the researches (Cassivi, 2006; Chang et al, 2007; Danese, 2007; Nakano, 2009) Figure 2.10 depicts the needs, activities and benefits of CPFR.

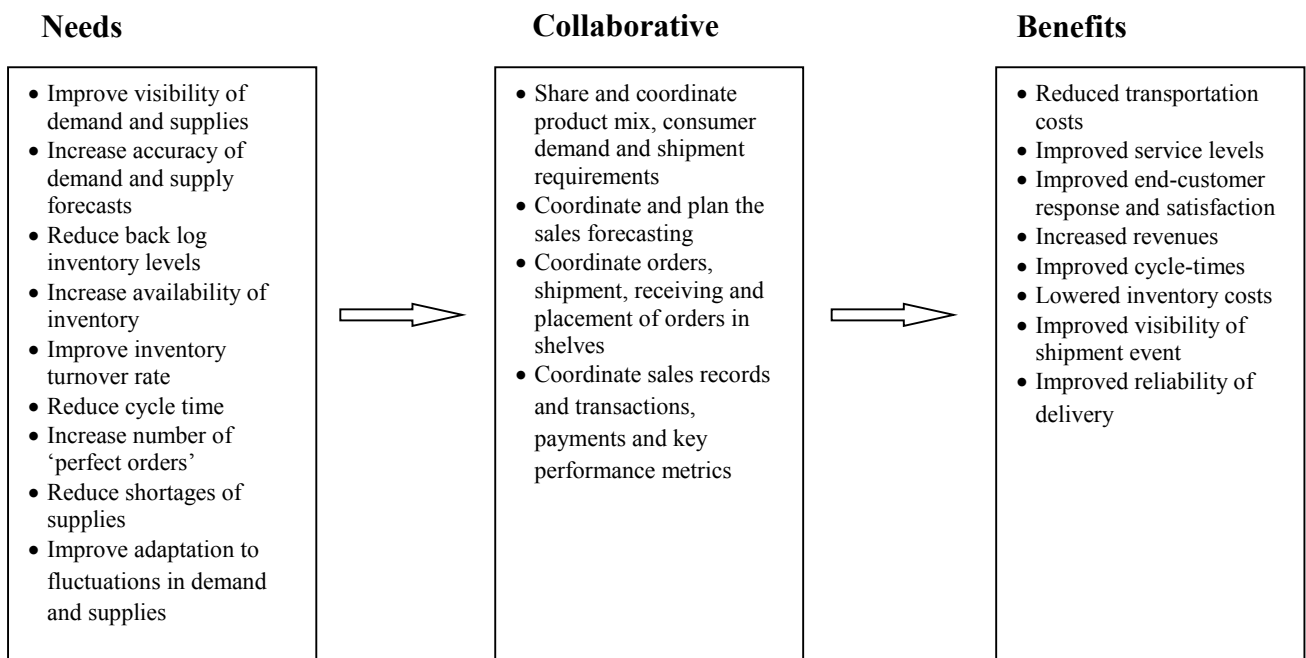


Figure 2.10: needs, activities and benefits of CPFR

2.2.3.5 Co-Logistics

Co-logistics is an integrated effort of different organisation with an overall objective of reducing the transportation cost at a large scale. It refers to the sharing of storage facilities or/ and third-party transportation with cooperative partners. It is the corporate strategic alliance based on logistics and advantage-complementing, risk-sharing and interest-sharing loose network established among two or more enterprises in order to realise their own logistic strategic objectives through various agreements and contracts (Yong, 2003). Through Co-logistics, organisations can maintain their core competitiveness and can solve the problem of lack in competence so that logistic service level can be improved (Hertz and Alfredsson, 2003).

Literature supports that co-logistics increases profitability of the firms involved in such collaborations. Mason et al (2007) empirically proved that collaborative transportation approach improves logistics performance like cost minimisation, improved service levels, visibility and customer satisfaction. Table 2.8 depicts the flow of information and material for the co-logistics initiative whereas Figure 2.11 depicts the needs, activities and benefits of co- logistics.

Factors	Flow of information and materials
Inventory	Type and classification of Inventory, Product mix/ Inventory report, Demand & Supply of each inventory, Stock data, EOQ/ROP data, Turnover rate, Lead time, Delivery time data
Shipment	Shipment modes & equipments/ containers, Vehicle loads, Cost of Load, Location of loads, Vehicle capacity, Shipment routes, shipment movement & shipment frequency, in-bound & out-bound shipment time and cycle.
Mutual Sharing	Delivery cost, Product return cost, Risk sharing, logistics savings, cost to identify out-of-stock causes

Table 2.8:Flow of Information and material between different functions for co-logistics

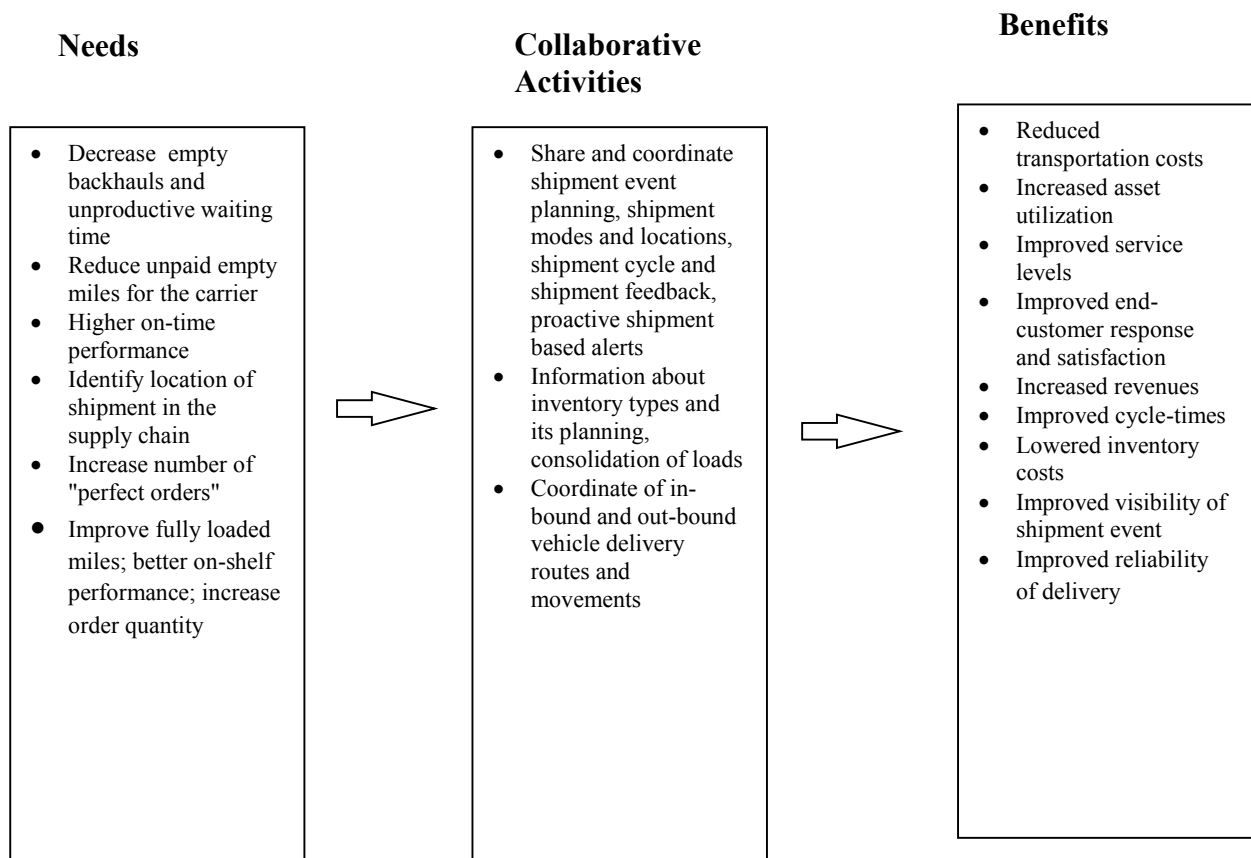


Figure 22.11: Needs, activities and benefits of co-logistics

2.2.3.6. Joint Venture

Joint Venture (JV) is a collaborative alliance in which two or more businesses join a partnership to undertake business activities together (Blaszyk and Mischel, 2007). It is also important to note that JV refers to a new and independent legal entity owned by business partners, which is distinct from its parent organisations. Alleen (nd) considered this distinct unit is one of the most powerful tools in today's competitive market that helps to improve effectiveness of creating new products and services or entering in new markets. In JV, partners agree to share their capital, technology, human resource under shared control. In this autonomy venture, employees are responsible to attain mutual objectives of parent partners via fully utilizing parents' resources and capabilities (Blaszyk and Mischel, 2007).

The literature supports the view that organisations collaborate for increasing responsiveness due to frequent changes in the market. It can be collaborating in product design or innovation or it can be developing the source of supplies jointly (Bengtsson and Kock, 2000). Thus such relationship is complex in nature as it consists of two different approaches of interaction. The goal is to create mutually beneficial exchanges and value additions. Partners in joint ventures are involved in a relationship that consists of common interests. The main benefits of such collaborative relationship are: sharing of knowledge, pooling of competencies, more risk taking abilities, proactive approach and healthy competition (Zineldin, 2004)

Bengtsson and Kock (2000) categorised 'cooperation-dominated' and 'equal' relationship which exists between companies on the basis of their self-interest. Firms co-operate in product and process innovation, research facilities, complex machinery and equipments, global distribution channels, common supply bases, advertising and promotion skills, sharing managerial expertise, intra-corporate financing, transfer pricing, currency swaps, market expansion and branding (Lou 2005, Mariani 2007, Bengtsson and Koc 2000, Eriksson 2008). Figure 2.12 depicts the needs, activities and benefits of JV.

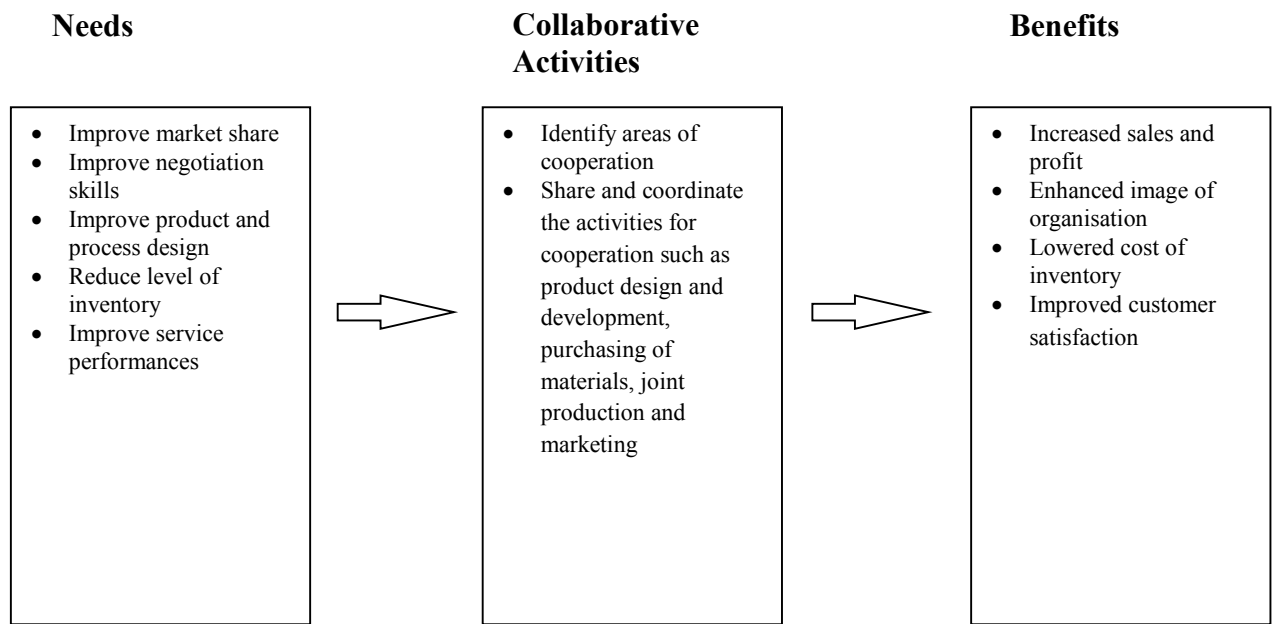


Figure 32.12: Needs, activities and benefits of Joint Venture.

2.2.3.7 Shared Resources and Services

Shared resources and services refer to the resource sharing by the individuals and/or organisations, for example shared IT and back-office functions. It is a collaborative strategy in which organisations select business function to promote efficiency, value generation and cost savings (Cassivi, 2006). In other words, they refer to the active pursuit of organisations in sharing, mutual-exist, equivalency on their composition, functions and mechanism and organisation members act in coordination and realise resource optimisation through controlling or standardisation etc (Maglaras and Zeevi, 2003). Resource sharing aims to optimise resource disposition and value creation based on information and supported by reasonable organisational structure, taking technologies as means to promote overall capacity of the organisation in adaptability and innovation. The reason for choosing shared resources is that maximal resource sharing can effectively realise the value transfer of resource factor so as to deliver the most proper resources to the most appropriate user at the most correct time (Akin and Harker, 2003).

Cassivi (2006) emphasised the importance of shared resources in supply chains and commented that “firms must share resources in order to stay in competition”. Many researchers have identified adoption of shared resources as one of the major factors which differentiate between SMEs and larger organisations. Bigger organisations tend to influence business partners to adopt innovations and shared resources to improve performances (Archer et al 2008). Organisations are trying to generate newer ideas and bring them to the market in order to succeed in the competition. Supply chain partnering enables the firms to integrate and link operations for increased effectiveness as well as embark on both radical and incremental innovations (Soosay et al 2008). Figure 2.13 depicts the needs, activities and benefits

of shared resources.

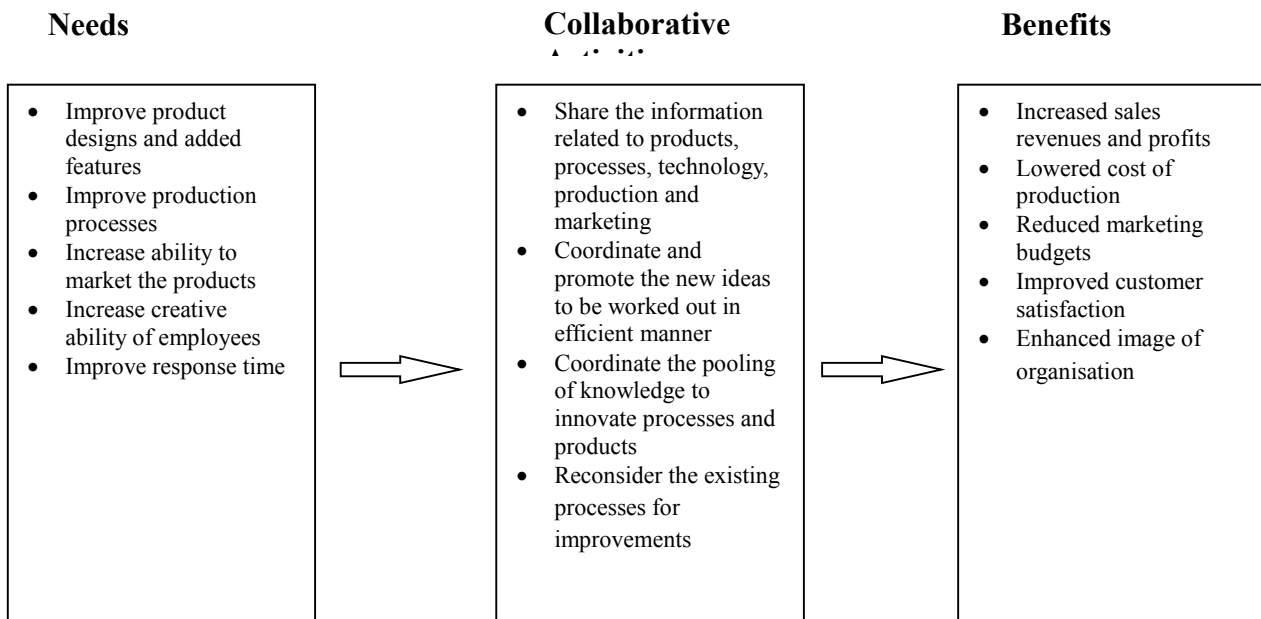


Figure 2.13: Needs, activities and benefits of shared resources.

2.2.3.8. Co-manufacturing

Co-manufacturing is designing and producing a common or similar product by coordination among partners of the supply chain. It is usually sharing of the manufacturing facilities with an objective of reducing the cost and improving the quality of the product. Co-manufacturing strategy help the firms reduce investment in plant and machinery, advanced technologies, complex processes and other manufacturing resources. Such approach facilitates firms to meet unexpected demands by temporary workers or by outsourcing (Prater, 2001). The choice of Co-manufacturing is based on the reason that it can realise resource sharing, shorten product production cycle and obviously enhance enterprises' market competitiveness (Johansen *et al*, 2007).

Collaboration in the manufacturing will be beneficial for the SMEs due to the fact that they are small business meaning fewer resources, they can introduce a combination of expertise, special products, specialised repairs. This aims to accomplish the task that any single production entity cannot achieve or if it does achieve with heavy costs, so that overall benefit surpasses simple adding of each benefit (Li *et. al.*, 2007).

Table 2.8 depicts the flow of information and material for the co-manufacturing initiative whereas Figure 2.14 depicts the needs, activities and benefits of co- manufacturing.

Product	Product mix and demand, Sales forecasts, Pricing Policy,
Production	Details of process design and development, details of production activities (work flow, production runs, idle time, under time, down time, waste, rework data, technical expertise, cycle time), details of capacity
Procurement	Details of procurement activities and facilities, cost sheet for purchase activities, details inbound and outbound logistics activities

Table 2.8 Flow of Information and material for co-manufacturing.

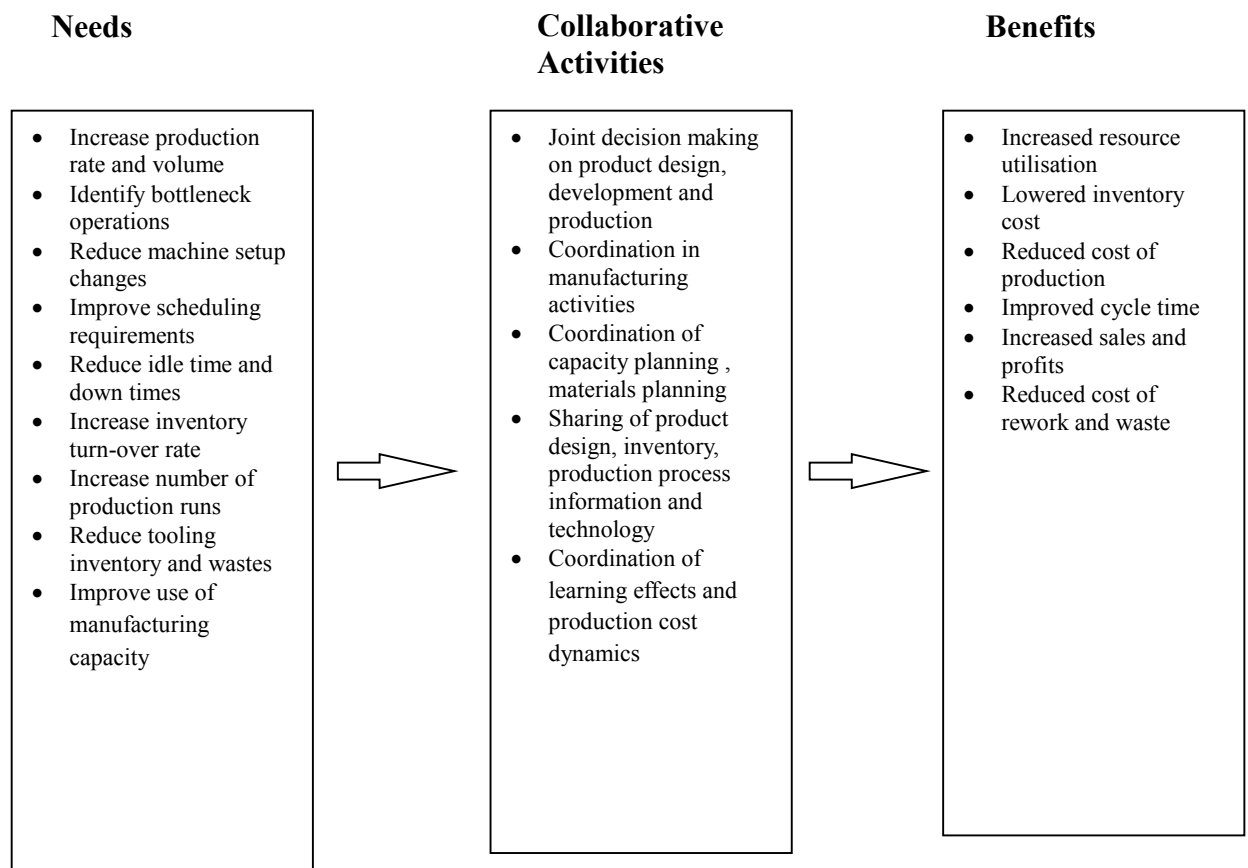


Figure 42.14: Needs, activities and benefits of co-manufacturing

2.2.3.9 Joint Problem Solving

Joint problem solving refers to one group that possesses certain decision-making capacities that forms the final solution for a problem through discussion and mutual engagement. Its essence is how a group conducts a cooperative action determination with efforts devoted from each member (Klein and Scholz, 2001). The reason why joint problem solving gains more and more popularity is that it can provide more integrated information and knowledge so that more creative plans can be generated (Dennis, 1996). Joint problem solving ensures reasonable and correct decision making by providing more abundant

information and viewpoints. In this process many members take part collaboratively to broaden the knowledge, to correct the errors and to take group decisions which are more accurate and reliable (Hirokawa *et al*, 1996).

Moreover, it provides more creative plans. As information owned by the group is abundant both in varieties and quantities, more optional plans can be made and the decision-making can have more choosing space (Dennis, 1996). Since different viewpoints in the group might have conflicts, it is possible for more creative plans to take place. Additionally, it promotes member initiative and the acceptability of the plans. Many decisions turn out to fail after being chosen due to the reason that nobody accepts the solution. If engaging those to be influenced by the decision or those to carry out the plan in the decision-making process, the acceptance of the plan will be promoted and members' initiatives can be increased through the engagement at the same time (Mohammed and Ringseis, 2001).

Based on the literature covered in this section, Table 2.9 summarises the areas of collaboration, needs for collaboration and benefits of collaboration for different collaborative initiatives.

What to collaborate	Examples	Benefits
<u>Co-logistics</u>		
Share and coordinate shipment event planning, shipment modes and locations, shipment cycle and shipment feedback, proactive shipment based alerts	Decrease empty backhauls and unproductive waiting time Reduce unpaid empty miles for the carrier Higher on-time performance	Reduced transportation costs Increased asset utilization Improved service levels Improved end-customer response and satisfaction
Information about inventory types and its planning, consolidation of loads	Identifying location of shipment in the supply chain Increase number of "perfect orders"	Increased revenues Improved cycle-times Lowered inventory costs
Coordination of in-bound and out-bound vehicle delivery routes and movements	Improve fully loaded miles; better on-shelf performance; increased order quantity	Improved visibility of shipment event Improved reliability of delivery
<u>Co-design and Co-development</u>		
Joint decision making on product design, development and production	Reduce design duplications Improve design of product Enhance product quality	Increased resource utilisation Reduced cost of R&D and production
Share and coordinate R&D facilities and activities	Increase level of R&D and production activities	Increased sales and profits Reduced cost of rework and waste
Coordination of workflow, rework and rework discovery rate	Improve production runs Reduce production idle time and down time	
Coordination of market demand	Increase production rate	
Coordination of learning effects and production cost dynamics	Improve production planning Reduce wastes Improve flexibility to changes in product and process	
<u>Co-manufacturing</u>		
Joint decision making on product design, development and production	Increase production rate and volume Identifying bottleneck operations Reduce machine setup changes	Increased resource utilisation Lowered inventory cost Reduced cost production
Coordination in manufacturing activities	Improve scheduling requirements Lower idle time and down times	Improved cycle time Increased sales and profits
Coordination of capacity planning , materials planning	Increase inventory turn-over rate Increase number of production runs	Reduced cost of rework and waste
Sharing of product design, inventory, production process	Reduce tooling inventory and wastes Improve use of manufacturing capacity	

information and technology
 Coordination of learning effects
 and production cost dynamics

CPFR

Share and coordinate product mix, consumer demand and shipment requirements	Improve visibility of demand and supplies	Reduced transportation costs
Coordinate and plan the sales forecasting	Increase accuracy of demand and supply forecasts	Improved service levels
Coordinate orders, shipment, receiving and placement of orders in shelves	Reduce back log inventory levels	Improved end-customer response and satisfaction
Coordinate sales records and transactions, payments and key performance metrics	Increase availability of inventory	Increased revenues
	Improve inventory turnover rate	Improved cycle-times
	Reduce cycle time	Lowered inventory costs
	Increase number of 'perfect orders'	Improved visibility of shipment event
	Reduce shortages of supplies	Improved reliability of delivery
	Improve adaptation to fluctuations in demand and supplies	

Aggregated purchasing

Share the information about product mix and quantity required	Improve quantity discounts	Reduced inventory and transportation costs
Share the suppliers information and rates offered	Increase negotiation power	Improved delivery levels
Coordinate and aggregate the demand of the products	Reduce procurement spending,	Improved customer satisfaction
Coordinate the shipment process and planning	Improve support by suppliers	Reduced purchase orders
Coordinate the receiving and storing of inventories	Improve planning and purchasing productivity	Improved purchase-cycle time
	Reduce lead times	Improved visibility of purchasing process
		Improved reliability of delivery

Joint Ventures

Identify areas of cooperation	Improve market share	Increased sales and profit
Share and coordinate the activities for cooperation such as product design and development, purchasing of materials, joint production and marketing	Improve negotiation skills	Enhanced image of organisation
	Improve product and process design	Lower cost of inventory
	Reduce level of inventory	Improved customer satisfaction
	Improve service performances	

Shared Resources

Share the information related to	Improve product designs and added	Increased sales revenues and
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products, processes, technology, production and marketing	features	profits
Coordinate and promote the new ideas to be worked out in efficient manner	Improve production processes	Lowered cost of production
Coordinate the pooling of knowledge to innovate processes and products	Increase ability to market the products	Reduced marketing budgets
Reconsider the existing processes for improvements	Increase creative ability of employees	Improved customer satisfaction
	Improve response time	Enhanced image of organisation

Table 2.9. Summary of Collaborative Strategies

2.3 Summary

In summary, the literature review has identified a number of important collaborative initiatives, such as joint ventures, product co-development, product co-design, co-manufacturing, aggregated procurement, co-logistics, joint problem solving, shared resources and collaborative planning, forecasting and replenishment, to be employed by organisations in their supply chains and with their network partners. However, organisations need to analyse their capabilities first and then make a judicious selection of the most appropriate collaborative approaches. In this study the author has concerned with joint ventures, co-development, co-design, co-manufacturing, aggregated procurement, co-logistics, joint problem solving, shared resources and collaborative planning, forecasting and replenishment and tried to find out which of these initiatives are most commonly used by manufacturing SMEs.

Based on the review of existing literature, this research is an attempt to explore the scope of supply chain collaboration in SMEs, examine the different forms (type) of collaborative practices being employed by the SMEs with their supply chain partners, investigate the effectiveness of these collaborative practices, and identify if there are any meaningful relationships between these practices. From the literature the author has formulated the following research questions.

- Do SMEs develop and maintain collaborative relationships with customers, suppliers, competitors and other organisations?
- Which collaborative initiatives are popular in SMEs and do these collaborative initiatives differ in terms of country, ownership and supply chain structure?
- Are these collaborative initiatives effective and can they be statistically related to each other?

And other questions are:

- What are the requirements of supply chain collaborations in SMEs?
- What are the prime reasons for collaborations in SMEs?
- What are the major hurdles of supply chain collaboration in SMEs?
- What are the major benefits of collaborations in SMEs?

A non-structural approach was adopted for investigating the scope of supply chain collaboration in SMEs for three different countries. The use of such an approach is advocated by Bekaert and Harvey (2000), who suggest that due to the lack of a theoretical basis, a non-structural approach should be preferred in conducting comparative studies. Such a deductive research approach for empirical investigation is also suggested by Bryman and Bell (2011)

Chapter3 –Research Methodology

3.1 Introduction

All data collection requires planning, which is usually done through a research design. Research design is a general plan of how the researcher will go about answering the research questions, specifying the sources of data collection and the constraints (e.g. access to data, time, location and money) (Saunders et al, 2012). Research design is a blueprint for fulfilling research objectives and it provides a framework for the collection and analysis of data (Bryman and Bell, 2007, Blumberg, 2011). Research design is a written plan, often before the data is collected, which explains and justifies: what data is to be collected, how and where from, how the data will be analysed and how this will provide answers to the research questions. It requires a development of tools and technologies of both physical and social kind. It can be divided in terms of the type of data collected and the degree and form of structure imposed in the data collection and recording of that data. The degree of structure refers to the deductive and the inductive forms (David and Sutton, 2004).

Sarantakos (2005) outlined important steps in quantitative research: identification of research topic, methodology selection, methodological selection of construct, sampling procedure, data collection, data analysis with interpretation and reporting. Following these steps for quantitative research design, the present study adopted a research methodology which is depicted in the form of a schematic diagram as in Figure 3.1. This included defining the research problem using available literature, discussions with experts and academicians and studying economic scenarios of the countries, design of the survey instrument (questionnaire), deciding on an appropriate sample for the study, pilot study for questionnaire modification and finalisation, questionnaire administration and data collection in three countries, analysis of data, survey results, discussion and conclusion.

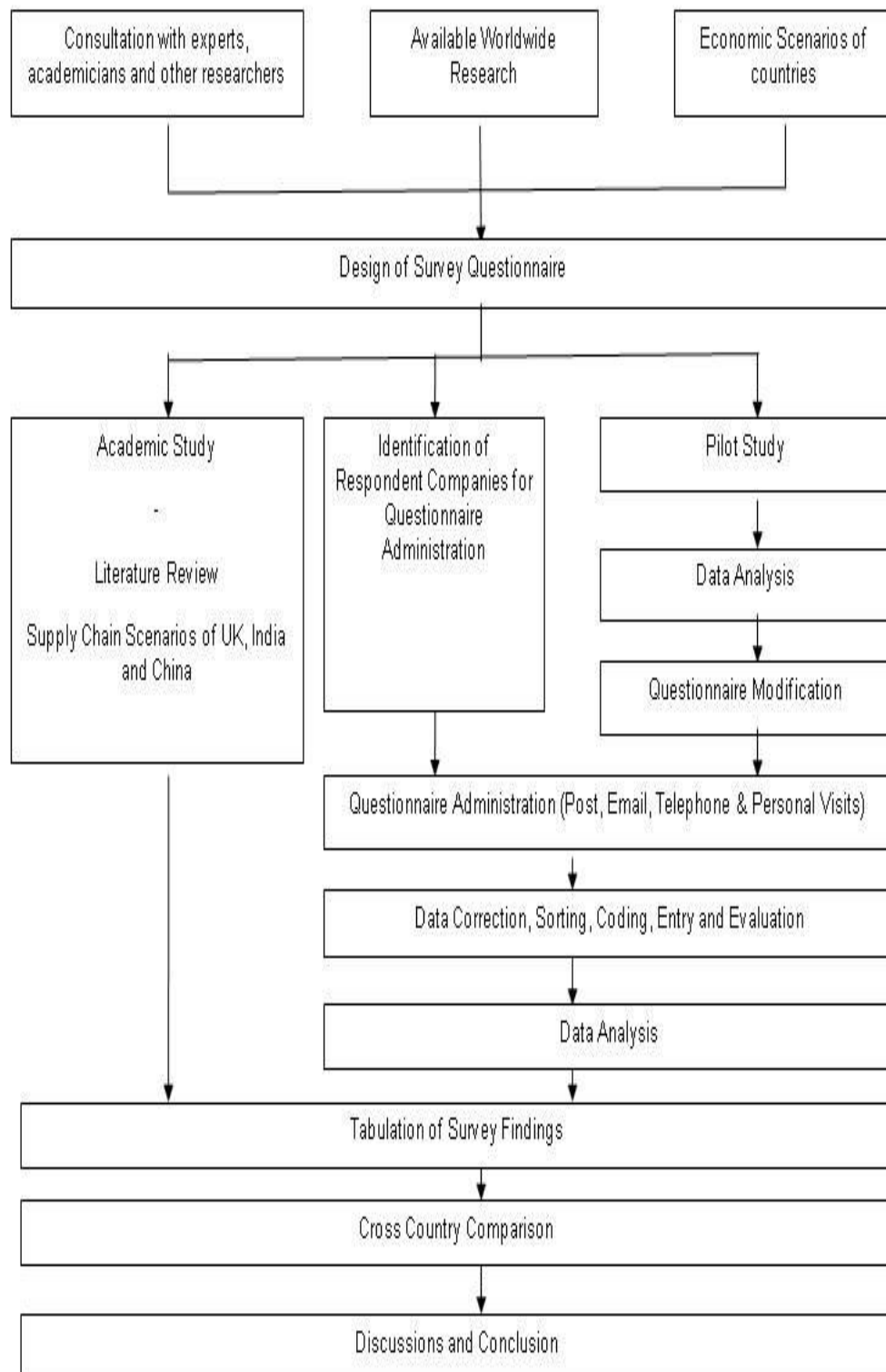


Figure 3. 1: Research Methodology (modified from Sahay and Mohan, 2007)

3.2 Research Choice: Quantitative and Qualitative

Quantitative research refers to the systematic empirical investigation of quantitative properties and phenomena and their relationships. Saunders et al (2012) stated that ‘quantitative is predominantly used for data collection techniques (e.g. a questionnaire) or data analysis procedure (e.g. graphs or statistics) that generates or uses numerical data’. The objective of quantitative research is to develop and employ mathematical models, theories and/or hypotheses pertaining to the phenomena. “The process of measurement is central to quantitative research because it provides the fundamental connection between empirical observation and mathematical expression of quantitative relationships” (Bryman and Bell, 2007).

On the other hand, ‘Qualitative is used predominantly for any data collection techniques (such as interview) or data analysis procedure (such as categorising data) that generates or uses non-numerical data. Qualitative therefore can refer to data other than words, such as pictures and video tapes’ (Saunders et al, 2012). Qualitative researchers aim to gather an in-depth understanding of human behaviour and the reasons that govern such behaviour. The qualitative method investigates the *why* and *how* of decision making, not just *what*, *where* or *when*. Hence, smaller but focused samples are more often needed, rather than large samples (Cresswell, 2009, Saunders et al, 2012). Qualitative research is a method of inquiry used in many different academic disciplines.

The main difference between qualitative and quantitative research is not ‘quality’ but procedure. The major differences between quantitative and qualitative methods are shown in Table 3.1.

Quantitative Research	Qualitative Research
<ul style="list-style-type: none"> Numbers and words Point of view of researcher Emphasis on theory testing and verification Focus on facts and/or reasons of social events Logical and critical approach Controlled measurement Objective ‘outsider view’ distant from data Measurement Scale: all types (nominal, ordinal, scale, ratio) Hypothetical-deductive; hypothesis formulated before the study; focus on hypothesis testing Sampling: well planned before data collection; is representative Data collection: use of quantitative methods; employs assistants Data analysis: mostly quantitative and statistical analysis Result oriented Reporting: Particularistic and analytical; integrated findings Inductive generalisation (generalisation by population membership) 	<ul style="list-style-type: none"> Words, pictures, video tapes Points of view of participants Emphasis on understanding and theory emergent Focus on understanding from respondent’s/informant’s point of view Interpretation and rational approach Observation and measurements in natural settings Subjective ‘insider view’ and closeness to data Measurement Scale: Mostly nominal Explorative oriented; hypothesis formulated through/after the study Sampling: well planned often during data collection; is not representative Data collection: use of qualitative methods; usually single-handed Data analysis: mainly qualitative, often collection and analysis occurs simultaneously Process oriented Reporting: Holistic perspective; mostly not integrated findings. Selective and analytic generalisation (generalisation by comparison of properties and contexts of individual organism)

Table 3. 1: Qualitative Versus Quantitative Methods (Sources: Reichardt and Cook, 1979, Bryman and Bell, 2007, Sarantakos, 2009)

The apparent surface distinction of quantitative information (numbers) and qualitative information (words) can lead to confusion because qualitative and quantitative methods may be used according to both constructionist and positivist epistemologies, and be underpinned by both nominalist and realist ontologies (Smith et al, 2008).

Quantitative research and qualitative research are sometimes taken to refer to distinct paradigms and as such are regarded as being incompatible. It has been argued that quantitative and qualitative research derives from completely different epistemological and ontological traditions. However, researchers (Ragin, 1987; Kaplan and Duchon, 1988; Patton, 1990; Strauss and Corbin, 1990; Gable, 1994; and Mingers, 2001) have adopted a more pragmatic stance and, while recognising the fact that quantitative

and qualitative research express different epistemological and ontological commitments, they accept that much can be gained by combining their respective strengths. The apparent incommensurability of quantitative and qualitative research is usually resolved either by ignoring the epistemological and ontological issues or by asserting that research methods and sources of data are in fact much less wedded to epistemological presuppositions than is commonly supposed. A research method is no more than a technique for gathering data and is largely independent of wider considerations to do with the nature of valid knowledge. “A research method is simply a technique for data collection. It can involve a combination of specific instrument, such as a self-completion questionnaire or a structured interview schedule” (Bryman and Bell, 2007).

Saunders (2009) suggested research choices using single data collection techniques (mono-method) and more complex data collection techniques (multiple methods) as shown in Figure 3.2.

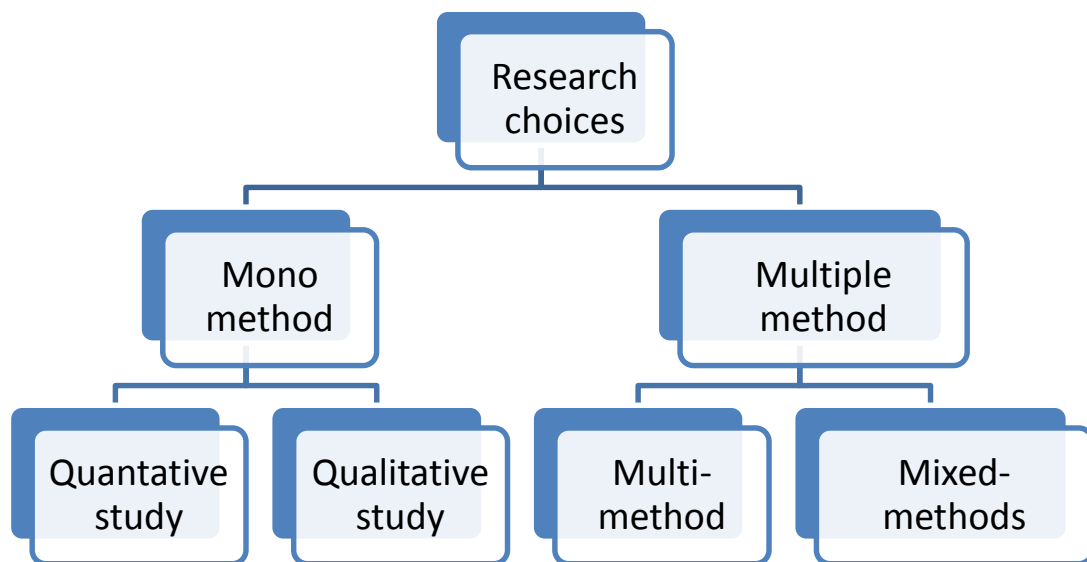


Figure 3.2: Research choices

Usage of more than one data collection technique (multi-method) is gaining popularity within business and management research because it is likely to overcome weaknesses associated with using only one method as well as providing scope for richer approach to data collection, however this approach to integration may be risky, since there is a danger that the respective value of each form may be diluted (Saunders et al, 2012). Bertrand and Fransoo (2002) emphasised on doing quantitative empirical research in the field of OM where causal relationships between variables are developed, analysed or tested. Empirical research deals with articulating the theoretical foundation for the study. It also includes determining whether the problem under investigation involves theory building or theory verification (Blumberg, 2011). Empirical research provides a strong foundation for making realistic assumptions in research in operations management. Models which are based on unsupported assumptions are no more justified than empirical studies with weak methodology. When the assumptions are not realistic, the results cannot be generalised (Flynn et al, 1990). The present study employed mono-method research

design by employing survey method using combination of mail, email, telephonic and in person methods to collect the data through structured questionnaire. This study employed self-completion questionnaires through mails and emails in two countries (UK and China) while in India telephonic and in person methods were employed to collect the primary data. These combined methods provided: access to a larger number of respondents, deeper understanding of the research issues, greater internal validity and external validity, and generalisation of the study. The present research is summarised as a mono-method empirical study through structured questionnaire completed using mixed approaches of mail, email, telephonic and in person.

3.2 The Survey Approach

Survey research plays an important role when it comes to primary data collection and it allows the collection of large amount of data in an efficient manner (Zikmund, 2002). The use of a survey approach is advocated by many researchers (Flynn, 1990; Forza, 2002; Zikmund, 2002; David and Sutton, 2004; Bryman and Bell, 2007; Saunders et al, 2012) who suggested conducting a survey research when the research objective is to contribute to the general body of knowledge in a particular area of interest and to gain preliminary insight on a topic. Specifically, the use of a survey study is appropriate given that the current study involves an exploratory examination of the research questions under investigation. The survey research involves a larger number of respondents (Zikmund, 2002) and therefore offers greater opportunity to claim that what one finds is not idiosyncratic (David and Sutton, 2004). The survey research comprises of different stages of research: translating theoretical domain into empirical domain; pilot testing; data collection for theory testing; data analysis; clarifying results; and report writing (Forza, 2002).

In the field of operations management, using empirical data for research studies has been gaining popularity. Forza (2002) found that in literature, articles that are based on empirical results accounted for approximately 30 percent and within this subset of empirical work, survey based researches were leading with almost 60 percent, furthermore survey research was being used to investigate phenomena in very different OM sub-fields. Larson and Poist (2004) also found that 30 to 60% of articles in *Transportation Journal* between 1992 and 2003 were based on survey research and they emphasised that surveys are important for research in the field of supply chain management and logistics. Kotzab et al (2005, pp 432) commented that “one of the main difficulties in research methodology in the field of SCM research is that empirical theory building and quantitative empirical research is still in its infancy” and advocated for survey based research which offers great opportunity for further advancing SCM theory. Kotzab et al (2005) further advocated that quantitative empirical research can be descriptive or normative. Descriptive empirical research creates model and theories that describe the causal relationships between variables while normative empirical research assist is developing policies, strategies and actions to improve the current situation. “Such empirical approach isolates the

phenomenon from the context for logical analysis” (pp. 435).

Following this trend of using survey research in OM and SCM, the author has employed a survey research approach for investigating the scope of collaborative strategies employed by SMEs in the UK, India and China. The survey method, a deductive approach, gave access to a larger number of respondent SMEs which in turn broadened the coverage of the study and thus allowed external validity and generalisation of the study. Survey approach starts from theory and establishes testable hypothesis to determine if the theory holds in particular contexts or with specific examples. This approach is concordant with the scientific method which reflects the positivist paradigm (Burns and Burns, 2008). Case study research, on the other hand, suffers from major limitation of external validity as the main task of the researcher is to explain what is going on in a particular organisational setting rather than producing a theory that can be generalisable to a larger population. “Replication of cases often reveals variation in results due to human variability, different samples, subtle differences in the research conditions” (Saunders et al, 2012). In other words a host of variables can intrude in unknown ways and change results from one occasion to another (Burns and Burns, 2008). Therefore survey research was adopted in this study as it offered a holistic view of the issues under investigation by providing an in depth insight into the supply chain practices of SMEs and the findings of the research may equally be applicable to other research setting and other organisations in general.

Researchers (Malhotra and Grover, 1998; Forza, 2002; Saunders et al, 2012) also supported the use of a survey method for exploratory, confirmatory and descriptive studies. Exploratory survey research takes place when the objective is to gain preliminary insight on a topic, and provides the basis for more in-depth survey. Usually there is no model and concepts of interest need to be better understood and measured. Confirmatory (or explanatory) survey takes place with a specific objective of testing the adequacy of the concepts developed in relation to the phenomenon (Saunders et al, 2012). While a descriptive survey is aimed at understanding and describing the phenomenon under investigation (Forza, 2002). Axiomatic quantitative research starts with a condensed description of the characteristics of the operational process that is going to be studied. Note that studying a process can be descriptive whereas studying a problem can be normative research. Such research aims to contribute in two ways: study of a new variant of the process or problem, and to study a process or problem that has been studied before but provides a new, or in some respects better solution to the problem (Bertrand and Fransoo, 2002). Following the same arguments, this study is aimed at both exploring (descriptive) and explaining (normative) the concept of supply chain collaborations in the small and medium-sized enterprises. Hence, the objective in the present research work is of exploration of the current supply chain environment of SMEs, therefore only a survey research method was adopted. In addition to this, the other objective was to carry out a comparative analysis of three different countries rendering a survey study the most economical.

3.3 Questionnaire Design

Questionnaire was the only technique used to collect primary data without considering any other methods because the study aimed to cover three different countries. The key reasons to select this method were: the targeted respondents (SMEs) were from three different geographical locations, a relatively large sample size, short time to collect completed responses, and the financial implication of the data collection stage. Furthermore, it was considered as a self-completed instrument (a questionnaire) which was administered by post, email, telephonic interviews and personal visits.

The survey questionnaire was designed for collecting the primary data. It was developed to gather information on the relevant variables covered in the study. The researcher studied the relevant literature on supply chain collaborations, examined other surveys and conducted personal discussions with key persons in the industry and academics working in this area of research. The personal discussions held with the experts helped to ensure that validity and item reliability of the questionnaire were taken care of whilst finalising the questionnaire for data collection. Additionally in the questionnaire, objective information was asked rather than subjective information (opinions and attitudes) to reduce the risk of common method bias and to improve reliability and validity of our data.

While developing the measurement instrument (the questionnaire) the author considered four fundamental types of scales: nominal, ordinal, interval and ratio. Interval and ratio scales are used for identifying differences in amount of degree. In the questionnaire, age of the company and sales volume of company were measured using interval and ratio scales. The effectiveness of the collaborative strategies was measured using ordinal scales whereas other variables were measured using the nominal scales. The choice of scale depends on the ease with which both the respondent can answer and the subsequent analysis can be done (Forza, 2002). Multiple measurement methods reduce the possibility of an overstated empirical relationship, which can arise when the data are collected by a single method (Saunders et al, 2012). Therefore in the study, mixed measurement scales were used to collect the information.

In the study, the different collaborative initiatives were defined in simple terms so that the respondents could sensibly respond to the questions. These definitions were covered at the end of the questionnaire. Appendix A lists the survey items measuring each dependent and independent variable and the internal reliability of the scales formed by the items. In the study, collaborative effectiveness was taken as a dependent variable and measured on a scale of 1 to 10 for each of the possible supply chain partners (supplier, customer, competitor, other organisation) and other variables such as country, ownership, supply chain structure, collaborative relationship and collaborative initiatives were measured as categorical variables. The effectiveness rating with each supply chain partner was considered as a scale measure and these effectiveness ratings were tested for reliability and internal consistency.

By whatever method the questionnaires are administered (by post, email, through telephonic interviews,

or on site) the nature of questions asked can affect the actual design of the survey questionnaires and the data collection phase (Bryman and Bell, 2007). The length of the questionnaire and nature of questions influence the response rate and the concentration of the respondent. While constructing and framing the questions, the researcher should consider the respondent's level of understanding and keep the language of the questionnaire as simple as possible (Forza, 2002). For the purpose of this study, variables were translated into simple sentences to form the relevant questions. The concepts of collaboration and collaborative strategies, in particular, were illustrated simply and understandably. Additionally, ambiguity in questions was eliminated as much as possible. Moreover, the questions or statements were not long in structure as suggested by Saunder (2009). Finally the questionnaire was developed following some basic rules such as courtesy, respectability, and readability which are additional successful factors for data collection (Forza, 2002; Saunders et al, 2012; Blumberg, 2011).

In order to let respondents feel confident, spend less time to answer questions and complete the questionnaire, the majority of questions were framed as closed-ended questions. Few open-ended questions were also used for requesting respondent details at the beginning of the questionnaire. Within the closed-ended questions, the types of industry, ownership, supply chain structure and effectiveness rating questions were designed to improve the accuracy and meaningfulness of responses. Scale variables were also used for sales volume and different costs elements (expenditures on R&D, logistics and production) measured as percentage of the sales turnover. In addition, a definition of all collaborative initiatives was provided to participants to respond to the questions properly.

The contents of the questions included in the questionnaire were derived as per the literature review. The questionnaire covered a range of the key factors and variables which were believed to be related to supply chain collaboration. The questionnaire was divided into two main sections: A and B. Section A was on organisational overview and it was divided into two parts: part 1 was designed to collect the general information about respondents and part 2 was designed to collect general information of the organisation covering number of years of establishment of the organisation, type of ownership, sales volume, percentage of R&D, logistics and manufacturing expenses. Section B focused on a supply chain overview which included three parts: part 1 covered the overview of supply chain structure; part 2 included the overview of formal supply chain collaboration covering the effectiveness of different supply chain initiatives, requirements for collaboration, reasons of collaboration, problems of collaborations and benefits of collaboration ; and part 3 covered the reasons for non-collaboration. In section A open-ended questions were asked to collect the required information whereas in section B closed-ended questions were mostly used to collect the required information.

The questionnaire was structured to explore the influence of independent variables on supply chain partnerships. In addition, other variables such as annual sales volume and cost percentages were included for understanding the capital structure of the SMEs. Variables such as ownership type, supply chain structure were made closed ended nominal responses whereas formal collaboration was

categorised as nominal with 'yes' or 'no' option. The questionnaire was designed in a manner that respondents who recognised that their organisations do not collaborate formally were given the option to move to the last section of the questionnaire related to reasons for non-collaboration. In all other cases where respondents answered that their organisations collaborate externally, were provided with an option to answer the questions related to the specific initiatives they used with different supply chain partners, the effectiveness of the initiatives, essential requirements for collaborations, principal reasons for collaboration, hurdles associated with collaborative initiatives and benefits from such collaborative initiatives. The questions were structured using simple words and statements so that respondents felt confident to respond to all questions in order to ensure fully completed questionnaires. This was to prevent the possibility of missing data in the questionnaire.

The next stage was to pre-test the questionnaire. According to Flynn et al (1990), pilot testing is an integral part of questionnaire construction. It provides feedback on how easy the questionnaire is to complete and which concepts are unclear or out of the respondents' range of knowledge and/or responsibility. Forza (2002) commented that 'pre-testing of the questionnaire helps the researcher to validate what has been designed. Pre-testing can identify problems even though the researcher has followed all the previous steps with great attention.' The study adopted the suggestion given by Dillman (1978) and Forza (2002) to include three types of people in pre-testing of the questionnaire: colleagues, experts from industry and target respondents.

The questionnaire was pre-tested with the help of discussions and interviews with other researchers, industry experts and potential respondents. Dillman (1978) highlighted the role of these people in the pre-testing phase: colleagues test the research objectives in the questionnaire, industry experts check and prevent the inclusion of an unimportant question, and target respondents provide feedback on everything that influences the answer. Saunders (2009) highlighted the importance of the feedback on the survey questionnaire during the pre-testing stage. 'The responses (feedback) provide an idea of face validity, reliability and suitability of the questions'. It also helps to test the protocol and perform the exploratory assessment for the adequacy of measurement of variables. Furthermore, researchers can check the effect of missing and non-response data.

The draft questionnaire was sent to several faculty members, research students and other experts. This provided valuable feedback on the questionnaire in terms of its layout, structure, wording and sequence of questions. With this feedback, the questionnaire was edited, refined and redesigned. Afterwards the questionnaire was sent for the pilot study using 20 randomly selected respondents from the sample. Responses from these returned questionnaires were analysed to identify any problems with the questions and other issues related to the questionnaire. This analysis also provided support for checking the validity and reliability issues. Later on, the 20 respondents were excluded from the sample. The questionnaire was therefore validated and finalised with the help of feedback provided by these people. As suggested by Saunders (2009) a thank you email was sent to all the respondents who completed the

questionnaire and provided feedback during the pilot testing stage.

Although the unit of analysis in this survey was an industrial SME, the data was collected from those people who work in these SMEs. Some people had knowledge about the supply chain management and collaborative practices while others knew different aspects of their company. As suggested by Forza (2002) appropriate respondents in the SMEs should be identified for required information. Answers from respondents who lack the requisite knowledge could not be trusted, and consequently increased the random or bias error. Following this the research targeted only the owners, directors or managers who had complete knowledge about their business and their supply chain practices. As such people are very busy and the consequent difficulty in getting access to them, a survey using a questionnaire was considered as the only option of data collection.

Targeted respondents (SMEs in this study) were asked to complete the questionnaires, and developing effective relationships with the respondents is a difficult task. Another hurdle faced by most of the researchers is accessing or reaching the correct respondent. Flynn et al. (1997) suggested a contact strategy to identify potential respondents and secure their commitment to complete the questionnaire before distribution. In this study, inclusion of the covering letter explaining the objectives of the research made it possible to motivate the respondent to participate. The author has included the name of the respondent while sending the questionnaire packs via post. This also established a personal connection to acquire missing data (Forza, 2002). This strategy was not required for the face to face survey.

3.4 The Sample

Empirical research depends upon a representative sample which is assumed to reflect the population as accurately as possible. Therefore the sample size, sample design and selection of the sample are very important for the research study and are significant to generalise the research results. Bryman and Bell (2007) commented that: ‘sample is a segment and subset of the population and representative sample is a microcosm of the population’. A sample refers to a representative proportion of the population which is chosen by the researcher for a research study (Burns, 2008).

One of the most important issues in designing the survey study is the type and number of respondents who will be included in the study. A correct sampling enables the researcher to study a relatively small part of the target population, and yet obtain data that are representative of the whole (Sarantakos, 2005). Many researchers (Sarantakos, 2005, Saunders et al, 2012, Burns, 2008) have advocated using a sample because of many associated advantages: effectiveness of the survey, economy of time, less effort to collect data, financial implication of the study and high degree of accuracy in data collection. Sampling enables a researcher to be more effective in terms of time and cost on data collection by considering only data from a subgroup rather than all possible cases. This study adopted sampling due to the constraints of time, resources and budget. As a result, the study identified the sampling units mainly through online databases in the UK, India and China.

An ideal sample for this work would have been drawn from the total population of the SMEs in the UK, India and China. Researchers such as Forza (2002), Bryman and Bell (2007) and Saunders (2009) have suggested a random selection (probability sampling) in order to select a sample which is more likely to be true representation of the population thereby keeping sampling error to a minimum. Drawing such a random sample from the sampling frame from three different countries was not easy and feasible therefore the study selected a sample of the SMEs that were registered in: the FAME database in the UK, the Madhya Pradesh Audyogik Kendra Vikas Nigam Limited (MPAKVN) and the Madhya Pradesh Laghu Udyog Nigam Limited Indore in India, and the China Business Database in China.

Stratified random sampling is a commonly used sampling method for sample selection, which provides more information when the population is divided into strata and from each stratum a random selection of respondents is selected (Forza, 2002). For the purpose of this study, the strata were industry type and size, since the level of network collaboration could be different depending upon the type and size of the SMEs. The study used 'industrial' and 'number of employees' as the criteria to identify the SMEs in these three countries. Additionally, the study employed 'contact details' of the SMEs including name, position, email addresses and telephone numbers of higher level individuals (e.g. owner, partner, CEO, director and manager levels) as the inclusion criteria. These members were chosen because of their extensive knowledge of their organisations, supply chain structures and strategies. This way the study tried to ensure that the research questionnaire was properly completed by these key people in the organisation. However this increased the risk of a low response rate which did actually occur during the data collection. Although the study compromised on the low response rate, it improved the quality of responses and thereby increased the reliability of the research under investigation. On the basis of these criteria, a sample frame consisting of 11740 SMEs was derived.

In addition to the above random selection method, the author used his network in India to contact relevant SMEs in India for questionnaire administration. This technique is referred as convenience sampling which is one type of non-probability sampling. This type of sampling was used because most of the questionnaire packs which were sent to SMEs in India did not return due to many reasons: postal cost and delays, lack of interest by the respondents to complete the questionnaire, and on occasion the respondents were not sure of the terms used in the questionnaire. To overcome these hurdles, the author visited India to collect data using telephonic interviews and personal visits. The company contact details were found on the internet, yellow pages and the telephone directory of the Bharat Sanchar Nigam Limited in India. Moreover, personal contact addresses were obtained by contacting the reception staff of these SMEs.

Sample size is related to the level of confidence (usually 0.95), if the sample is selected according to probability sampling. Researchers (Forza, 2002; Bryman and Bell, 2007) consented that a statistical power of about 0.8 represents a reasonable and realistic value for research in social sciences, typically in most social sciences the level of significance is taken as 0.05. According to Goodal (1995), if the

statistical power is 0.8, α is 0.05, the sample should be at least 274 units. In this research, data from 365 respondents SMEs were collected which is more than the minimum requirement of 274 respondents. To ensure the respondents were more than the minimum number of 274, data was collected through questionnaires administered by post, e-mail and telephone in the UK and China whereas telephonic and personal (in-person) surveys were conducted in India. Although it was time consuming, the use of an in-person survey in India ensured that the sample is sufficient enough to generalise the results.

3.5 Data Collection

Data collection is the process of gathering the information related to a research question or study. It is not simply collecting data but obtaining useful data. It is planning for and obtaining useful information on a particular study the researcher is interested in. Data collection techniques are a very important part in the research work. "Data collection techniques refer to the systematic, focused and orderly collection of data for the purpose of obtaining information from it, to solve/answer the research problems or questions" (Ghauri et al., 1995). These techniques can be broadly classified as qualitative research and quantitative research. Qualitative research emphasises words in the collection and analysis of data, as a research strategy it is inductive, constructivist and interpretivist whereas quantitative research emphasises quantification in the collection and analysis of data, which is deductive and objective (Bryman and Bell, 2007). This research work relied on the total design method of Dillman (1978) for data collection. As the respondents were higher-level employees in the companies, most of Dillman's suggestions were implemented by including the covering letter, pre-paid return envelope in the questionnaire pack and follow-ups in the later stage. This provided more completed responses.

Prior to commencing the data collection, ethical clearance was sought from the Ethical Approval Committee of the University. The author followed the ethical principles as suggested by Bryman and Bell (2007): whether there is harm to participants, whether there is a lack of informed consent, whether there is an invasion of privacy, and whether deception is involved. Through this study, it was ensured that the participants or respondents were in no way directly harmed or adversely affected as a result of their participation in the study. All the respondents were provided with a covering letter with details of the study and therefore provided sufficient information about the study to make an informed decision about whether or not they want to respond to the survey questionnaire. The respondents were given the option to refuse to participate in the study. This study also gave an option to all the participants that they could answer only those questions where they felt confident to respond to without compromising the confidentiality and sensitivity of the information. In this way, it was ensured that a respondent had an opportunity to withdraw from the questionnaire partly or completely. Furthermore, the completed responses were coded so that the personal details of the respondents could be kept confidential. "Deception occurs when the researchers represent their research as something other than what it is." (Bryman and Bell, 2007). The author through inclusion of the covering letter, telephonic discussion and

personal visits made the fact clear that this piece of study is only for research and academic purpose and the information collected would remain confidential. Following the ethical approval, the data collection procedure commenced with the questionnaires sent to targeted respondents.

The pre-survey contact was made by mails, e-mail and telephone to all potential participants before sending the questionnaire packs. The content of the pre-survey contact included the basic information of the study and the researchers involved in the study. The first objective of sending this information was to develop the initial point of contact with the potential respondents. The second objective was to identify and analyse their interest and willingness to participate in this research study. The results were not encouraging for this study as most of them did not respond to the email, however, people who were on social networks showed their interest in the study. After this step, the questionnaire packs were sent to the each contact person or SME from the survey list (sampling frame). As the questionnaire packs were sent to the key individuals in the companies, a low response rate was the key problem related to this study. In order to improve the response rate, the author sent another pack of questionnaires to them after 2 weeks and finally emailed/telephoned after one week to follow-up on the questionnaire.

3.5.1 Strategy for data collection

Saunders (2009) suggested to evaluate all possible data collection methods and to use the most appropriate methods depending upon the research questions (s) and objectives. This study used different methods for collecting the data: post and email for the questionnaire in the UK, email for Chinese SMEs, and telephonic and personal visits for Indian SMEs. The rationale of adopting different method is derived from Jennifer et al (1989) who suggested that researchers should employ more than one procedure when investigating a research problem. Thus, using different strategies enhanced confidence in data collection and its findings.

In survey research, the common methods employed for data collection are questionnaires and interviews. “If the researcher leaves behind his bias in an effort to comprehend the benefits and limitations of all empirical methodologies, multiple approaches may be powerful to build a correct picture of the research study” (Forza, 2002). The research reliability and validity can be increased using multiple methods and by triangulation of data collection. For instance, a researcher could combine methods to investigate the same phenomenon using interviews, questionnaires, direct observations, content analysis of documents, and archival research (Voss, et al., 2002). Each methodology examines specific information separately.

In this study, a questionnaire is mainly used to collect data from SMEs. The questionnaires were administered by post, email, telephone and in-person interviews. The telephonic and in-person responses contributed more than 50 per cent of the data. According to Forza (2002) a telephonic survey has the merits of: rapid data collection, lower cost, anonymity, and large-scale access. While on the other hand, it has demerits of: less control, and credibility over the interview situation.

The author identified many industrial SMEs that employed relevant supply chain practices. This constituted the sampling frame from which an appropriate sample was drawn using both probability and non-probability sampling method. In the first phase the questionnaire packs were sent by post and email. One week later, follow-ups were conducted through emails and telephone to all the recipients; it was used to express the acknowledgement to those who responded to the questionnaire and to remind the non-respondents. Most of the data responses from the UK and China were collected through this method. Finally in the next phase, questionnaires were administered over the telephone and personal visits. Through this method most of the responses from India were collected. Usage of these three steps increased the response rate since adopting mailed questionnaires and follow-up had a lower response rate. Each method had merits as well as disadvantages. Mailed questionnaires had the following advantages: cost savings, convenience, no time restraint, anonymity, and reduction of interviewer bias. On the contrary, it had a low response rate, longer response time, and partly completed questionnaires. The telephonic and in-person method had advantages such as: flexibility in ordering the questions; scope of asking for details, capability of explanation, opportunity to provide clarification for questions covered in the questionnaire, improved response rate and increased completion of the responses. On the other hand it suffered from disadvantages such as: higher cost of data collection, possibility of interviewer bias, more time, and more stress for data collector.

The mailed method of data collection helped to study more SMEs which in turn broadened the coverage of this study in the three countries. “Spending a larger amount of time observing or interviewing a small number of persons offers greater opportunity to know them better. Spending less time with each person or group, and so allowing the research to involve a larger number of people offers greater opportunity to claim that what one finds is not idiosyncratic” (David and Sutton, 2004). The telephonic and in-person data collection provided a clear understanding of the current business environment of SMEs particularly the supply chain practices. This approach helped the author: to know the point of views of the interviewers, to understand and interpret the actual business problems, to critically emphasise the practical aspects of the business, and to provide a holistic approach from the point of view of literature and practice. Research through interview helped the researcher to- think abstractly, step back and critically realise situations, recognise and avoid biases, obtain valid and reliable information, have theoretical and social sensitivity and the ability to keep an analytical distance while at the same time utilising past experience, and a shrewd sense of observation and interaction (Van Maanen, 1983; Strauss and Corbin, 1990). Furthermore, usage of such method for data collection ensured the fitness of the data and the reality (both internal and external validity) of the study.

3.6 Respondents

In absence of a single definition of SMEs in three countries, it was important to define SMEs in a clear

way. Moreover, the concept and definition of SME might differ from respondents to respondents. Therefore for the purpose of this survey, all the respondents were given the same concepts and definition of SME based on the common criteria (number of employees ≤ 250 in each country) used to define the SME. The study tried to cover as many SMEs as possible to be included in the sample survey therefore respondents were selected from a wide range of companies producing different products such as: electrical components (wires, switches, lightings, switch gears, connectors), construction projects (individual houses, group houses, fabricators, flooring, contractors), mining (stone, sand, stone crushing), construction-related (tiles manufacturing, sanitation, plumbing, plastic and metal pipes, metal and wooden doors, bricks), heavy manufacturing (cement, steel, crushers, rolling mills), pharmaceutical and chemical (medicines, cleaning products, pest control), food-related (spices, bakery, pickles, food processing), auto components/parts (tanks, sheets, engine parts), plastic and rubber products, engineering (small appliances, precision gears, tools, metal sheet), paper products (paper, cardboards, packaging material), garments (cotton extraction, cotton processing, fibres, tailoring), furniture (steel furniture, wooden furniture, aluminium sections) and general products (granules, polishing). In the U.K., 31.4 percent of firms that responded to the questionnaire were engineering, 18.6 percent were from general industries and 10.2 percent were from pharmaceutical and chemical industries. In India, pharmaceutical/chemical industries (17.1 percent), construction- related (15.5 percent) and engineering firms (14.3 percent) were the key respondents whereas engineering firms (29.3 percent), general industries (28.9 percent) and electrical/electronics (23.6 percent) were the major industries which participated in the survey in China. A sample profile is provided in Table 3.2.

Sample Profile	UK	India	China	Total (%)
Job Position				
Owner/Partner/Promoter	0	90	0	90 (24.7)
Chairman/MD/GM	36	25	5	66 (18.1)
Director/Manager-Supply Chain Management	17	5	0	22 (6.0)
Director/Manager- Operations/Production/Manufacturing	16	11	4	31 (8.5)
Director/Manager-Logistics/Purchase	18	0	0	18 (4.9)
Director/Manager-Sales/Marketing	9	23	11	43 (11.8)
Director/ Manager-Others	22	21	52	95 (26.0)
Type of Industry				
Pharmaceutical and Chemical Material/Products	12	30	2	44 (12.1)
Food/Food Processing and Beverage	10	13	0	23 (6.3)
Construction	9	27	0	36 (9.9)
Heavy Industries	3	18	5	26 (7.1)
Furniture	8	11	0	19 (5.2)
Engineering	37	25	21	83(22.7)
Electrical, Electronics and Computer Part/Components	7	18	17	42 (11.5)
Plastic and Rubber Products	1	5	3	9 (2.5)
Paper Products and Printing/Packaging	6	12	2	20 (5.5)
General	25	16	22	63 (17.2)

Table 3.2 Sample Profile: Number of respondents

The author sent the questionnaire pack to nearly 20 percent (2400) of the sampling frame. As the survey involved three different countries, it took nearly 11 months for the data collection including follow-ups for missing information. 119 packs of questionnaires were returned because either the contact persons had left the company or the companies had moved, 58 packs were returned because the targeted respondents were not interested in completing the questionnaire and 32 packs were returned because of the company's policy not to participate in any survey. Out of 418 completed and returned (17.4% response rate) questionnaires we eliminated 53 for various reasons: completed by lower level staff such as clerical or junior staff, omissions (a lot of missing information) and respondents not being able to respond to the questions properly. This resulted in 365 valid responses with a usable response rate of 15.2 percent. Although the response rate was not high, we found it to be satisfactory. Researchers (Flynn et al, 1990; Bryman and Bell, 2007) suggested reaching a response rate which is more than 15 to 20 percent for social sciences. Malhotra and Grover (1998) set the limit at 20 per cent. Forza (2002) suggested sending the mail again as the reminder to increase the response rate. With an aim to increase

the respondent rate and credibility, the questionnaire packs were sent to multiple locations in the UK, India and China.

Despite all the efforts to motivate the respondents to complete the questionnaire, some data were missed. The study used a follow-up strategy to contact the respondents to obtain details about the missing data. In data analysis, missing data can create many problems and therefore handling missing data is an important step in the data collection process. Forza (2002) suggested two broad strategies to handle missing data: deletion and estimation. When data is missing randomly, the missing values are normally unbiased and the missing values can be eliminated. However, it can be less efficient than if no data is missing. In the estimation strategy missing values are estimated in some way and statistical analysis of the data is continued, as if the data were complete (Anderson et al., 1983). In this study, missing data are deleted instead of estimated.

3.7 Data analysis

Data analysis is normally divided into two phases. The first one is preliminary data analysis and the second one is hypothesis testing (Forza, 2002). Preliminary data analysis is conducted before testing the hypothesis or performing measurement quality assessments. In the preliminary analysis, central tendencies, dispersion, frequency distribution, and correlations are usually performed. This study also showed the central measures and dispersion of some variables to understand the basic background of the respondent SMEs. In hypothesis testing, parametric tests are generally more powerful than the non-parametric tests. This research used the parametric test on interval data for collaborative initiatives. Descriptive analysis, correlation, t-test, and analysis of variance were used to understand the nature of collaborative practices employed by the SMEs.

The study used a number of variables to understand and analyse the supply chain practices in the SMEs. These variables are: supply chain collaboration; collaborative initiatives, effectiveness of collaborative initiatives, essential requirements for effective collaboration, reasons for entering into collaborative initiatives, problems associated with collaboration, benefits arising from collaboration and reasons of non-collaboration. Additionally, the study used other variables such as: number of years of establishment, type of ownership, existing supply chain structure, and annual sales volume to gain deeper understanding of the SMEs and differences in supply chain practices considering these different characteristics of SMEs as independent variables.

As the data set was drawn from a single respondent in each SME, common method variance was checked to ensure that the data had no major problems with response bias. Harmann's single-factor test was used to test the common method variance. The collaborative strategies were extracted to one factor with no rotation; only one factor emerged with 41.87 % of variance which explained that there is lot of

other variance to be explained by a single factor therefore suggesting that common method bias was not a problem in the study.

An analysis of variance was also conducted to identify the difference in the collaborative initiatives considering different characteristics of SMEs as independent variables. Further, post hoc analysis was conducted to find out any statistical differences in collaborative initiatives in terms of different characteristics of SMEs. Finally, correlation tests were conducted to find out any significant relationship between the effectiveness of different collaborative strategies.

3.7.1 Description of variables

The simplest way to conduct descriptive data analysis was to summarise the data for individual variables so that specific values of central measures and dispersions could be illustrated using tables and graphs. For the categorical (nominal) variables frequency distribution table was commonly used to measure and assess these items. Through bar charts and pie charts, the study made use of the proportionate segment to find out the frequency or share of occurrence separately. For the rank (ordinal) and scale data descriptive statistics (mean, median, mode, standard deviation) were used to interpret their characteristics. In summary, this descriptive analysis gave a general overview of questionnaire responses and distribution of initiative effectiveness.

3.7.2 Comparison of variables

The study made wide use of cross-tabulation (contingency table) to examine the interdependence between the different categorical variables. Variables such as: country, age of SME, ownership type, supply chain structure, country were used as control variables to identify and find the differences of SC collaboration, collaborative initiatives, and perspectives of collaboration factors (requirement, reason, hurdle, benefit). Furthermore, chi-square values were used to find out any association between these variables.

3.7.3 Relationship between variables

For the nominal (categorical) data variables, the chi-square test was conducted to determine any probability of association (relationship) among the variables rather than conducting and employing the coefficient of correlation concept. The p-value in the chi-square table guides whether there is a need to reject the null hypothesis or accept it. The chi-square test was used to find the association or relationship among variables to conclude which elements may influence the strategic decision of supply chain collaboration. In addition to the chi-square test, correlation tables were used to analyse the relationship between the rank and scale variables used in the study. The relationship between different collaborative strategies was analysed using the bi-variate correlation method.

3.8 Chapter Summary

There are a few limitations of doing a survey-based research work. A well-known difficulty with survey research is the risk of measurement errors arising from subjectivity and bias. Measurement errors and measurement quality are discussed in terms of reliability and validity. Reliability is concerned with the question of whether the results of the study are repeatable, whether or not the measures are consistent and stable (Bryman and Bell, 2007). In other words reliability is connected with stability, accuracy and consistency in measures whereas validity is concerned with the integrity of the conclusions that are generated from the research (Forza 2002).

The researcher should bear in mind that collection of actual, right and complete data is very important and effective collection of data is a key issue to generalize the research study. This study adopted a good research strategy to collect the right and appropriate data by following these stages of a research work: research design, measurement instrument and pilot testing, sampling design, data collection method (mixed method) and data analysis. The data for this study was collected according to the research design. The use of multiple methods for data collection increased validity, generalisability and reliability of this research.

Many researchers (Nunnally, 1978; Sarantakos, 2005; Saunders et al, 2012; Burns and Burns, 2008) suggested the use of different methods (test-retest, alternative form, spilt halves and internal consistency method) to test the reliability of a research. The internal consistency method is used for testing inter-correlation in this research work. The survey questionnaire measured effectiveness of a collaborative initiative on a scale of 1 to 10 and the Cronbach's alpha values for the nine collaborative initiatives ranging from 0.65 to 0.89. These values are in line with Nunnally's (1978) suggestion that new developed measures can be accepted if Cronbach coefficient alpha coefficient is 0.6 or more. Validity of research represents the set of aspects of the theoretical construct measured, and does not include items that are not included in the theoretical construct. The empirical assessment of construct validity concentrates on the convergence between measurements of the same construct and separation between measures of different constructs (Forza, 2002).

Every research study serves two purposes: to increase knowledge within the discipline and to increase knowledge within oneself as a researcher in order to evaluate and understand new developments within the discipline (Devlin, 2006). This study covered these two highlighted purposes. Supply chain collaboration in SMEs is an emerging field and thus this research would contribute to the existing body of knowledge. Moreover this piece of research work definitely increased the author's knowledge level and will further help him develop as a professional researcher in this field.

As the research work explored the supply chain collaborative patterns in SMEs, the research approach adopted tends to be abductive where known premises were used to generate testable conclusion

(Saunders et al, 2012). Data collected was used to explore a phenomenon, identify themes and patterns and locate these in a conceptual framework. This research is not based on pre-determined hypotheses and tried to identify patterns of supply chain collaborations in the SMEs context. This approach to data collection and analysis is allowed greater flexibility (Burns and Burns, 2008).

Chapter4 -Data Analysis

4.1. Characteristics of Respondents

This section presents the demographic information of the respondents which includes their country, job position, type of industry, description of supply chain structure, type of ownership, total sales volume and percentage of research and development expenses, logistics expenses and production expenses allocated out of the sales volume.

As the data is collected from three different countries, it was intended to maintain same survey quotas (i.e. one third for each segment) for each of country in order to achieve a balanced analysis. However, for a variety of reasons (time, cost, accessibility to SMEs and incontrollable response rates) those segment quotas were not achieved. In this situation, researcher was left to the option of weight the survey data during the analysis phase of the study, however it increases risk to the validity of results (Saunders et al, 2012). Moreover, researchers (Blumberg, 2011; Burns and Burns, 2008; Saunders et al, 2012), have questioned the validity of using statistics to make inferences from the sample if cases are weighted. In order to maintain the validity and reliability of the findings, data weighting is not adopted in this study.

4.1.1 Country:

Out of 365 responses received in this supply chain collaboration study, 32.33 percent responses were from the U.K, 47.95 percent from India and 19.72 percent responses were received from China. The details were summarised in the Table 4.1.

Country	Frequency	Percentage	Cumulative Percentage
UK	118	32.33	32.33
India	175	47.95	80.28
China	72	19.72	100.00
Total	365	100.00	

Table 4.1: Respondent Countries

4.1.2 Job Position:

The study aimed to explore the detailed supply chain strategies employed by the SMEs, therefore respondents with a job position of managers and higher levels were targeted in this study. This was very important for this research work to get a detailed, responsible and integrated view of a firm's supply chain collaborative practices. Moreover, the high percentage (93.2 percent) of responses from managerial and above levels had improved the reliability of the survey's findings.

In the U.K, 30.5 percent of survey participants were positioned as Chairman or Managing Director

(MD) or General Manager (GM), 15.3 percent were Director or Manager (Logistics/Purchase) and 14.4 percent were Director or Manager (Supply Chain Management). In India, half of (51.4 percent) the survey participants were Owner or Business Partner or Promoters of the business, 14.3 percent were positioned as Chairman or MD or GM and 13.1 percent were Director or Manager (Sales and Marketing). In China, nearly one fourth (24.7 percent) survey respondents were Owner or Partner or Promoter, 19.2 percent were Director or Manager (Planning/Finance/Human Resource) and 18.1 percent were Chairman or MD or GM. The specific details about job profile were summarised in Table 4.2.

Job Position	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Owner/Partner/Promoter	0	0.0	90	51.4	0	0.0	90	24.7
Chairman/MD/GM	36	30.5	25	14.3	5	6.9	66	18.1
Director/Manager-Supply Chain Management	17	14.4	5	2.9	0	0.0	22	6.0
Director/Manager- Operations/Production/Manufacturing	16	13.6	11	6.3	4	5.6	31	8.5
Director/Manager-Logistics/Purchase	18	15.3	0	0.0	0	0.0	18	4.9
Director/Manager-Sales/Marketing	9	7.6	23	13.1	11	15.3	43	11.8
Director/ Manager-Planning/Finance/HR	16	13.6	20	11.4	34	47.2	70	19.2
Other Executives	6	5.1	1	0.6	18	25.0	25	6.8
Total	118	100.0	175	100.0	72	100.0	365	100.0

(F:Frequency, %: Valid percentage)

Table 4.2: Respondent Job Profile

4.1.3 Type of Industry

The study covered as many industrial SMEs to be included in the sample survey therefore, survey respondents were selected from a wide range of companies producing different products such as: electrical components (wires, switches, lightings, switch gears, connectors), construction projects (individual houses, group houses, fabricators, flooring, contractors), mining (stone, sand, stone crushing), construction-related (tiles manufacturing, sanitation, plumbing, plastic and metal pipes, metal and wooden doors, bricks), heavy manufacturing (cement, steel, crushers, rolling mills), pharmaceutical and chemical (medicines, cleaning products, pest control) food-related (spices, bakery, pickles, food processing) auto components/parts (tanks, sheets, engine parts) plastic and rubber products, engineering (small appliances, precision gears, tools, metal sheet) paper products (paper, cardboards, packaging material), garments (cotton extraction, cotton processing, fibers, tailoring), furniture (steel furniture, wooden furniture, aluminum sections) and general products (granules, polishing).

In the U.K., 31.4 percent of firms that responded to the survey questionnaire were engineering, 18.6 percent were from general industries and 10.2 percent were from pharmaceutical and chemical

industries. In India, pharmaceutical/chemical industries (17.1 percent), construction-related (15.5 percent) and engineering firms (14.3 percent) were the key respondents whereas engineering firms (29.3 percent), electrical/electronics (23.6 percent) and general industries (16.7 percent) were the major industries which participated in the survey in China. More details of the type of industries included in this study were summarised in Table 4.3.

Type of Industry	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Pharmaceutical and Chemical Material/Products	12	10.2	30	17.1	2	2.8	44	12.1
Food/Food Processing and Beverage	10	8.5	13	7.4	0	0.0	23	6.3
Construction (includes Tiles, Roofing and Bricks)	9	7.6	27	15.5	0	0.0	36	9.9
Heavy Industries (includes Cement, Steel and Mining)	3	2.5	18	10.3	5	6.9	26	7.1
Furniture (includes Wooden, Steel, and Aluminum fabrication)	8	6.8	11	6.3	0	0.0	19	5.2
Engineering (includes Automation, Tools, Machinery and Auto components)	37	31.4	25	14.3	21	29.3	83	22.7
Electrical, Electronics and Computer Part/Components	7	5.9	18	10.3	17	23.6	42	11.5
Plastic and Rubber Products	1	0.8	5	2.9	3	4.2	9	2.5
Paper Products and Printing/Packaging	6	5.1	12	6.9	2	2.8	20	5.5
General (includes Medical Equipments, Textile and Appwerel)	22	18.6	15	8.6	12	16.7	49	13.4
Others	3	2.5	1	0.6	10	13.9	14	3.8
Total	118	100.0	175	100.0	72	100.0	365	100.0

(F:Frequency, %: Valid percentage)

Table 4.3: Respondent Industry Profile

4.1.4 Supply Chain Structure:

The questionnaire included questions on the type of supply chain structure of the SMEs. The present study has used a combination of three concepts to identify various supply chain structures. First, a supply chain is the network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer (Christopher, 1992). Second, supply chain management is an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user (Cooper et al., 1997). Third, the present supply chains are not linear; rather a complex network of supply chains, in which an organisation has several supply chains coming into (upstream), going through and going out of (downstream) the organisation (Chartered Institute of Purchasing and Supply-CIPS). In a way, a supply chain comprises of different organisation which integrates suppliers (upstream), distributors and retailer (downstream) and finally the consumer. Therefore considering this definition of supply chain, supply chain structures were identified as: Supplier-Manufacturer-Retailer (S-M-R), Supplier-Manufacturer-Wholesaler-Retailer (S-M-W-R), Supplier-Manufacturer-Distributor-Retailer (S-M-D-R) and Supplier-Manufacturer-Wholesaler-Distributor-Retailer (S-M-W-D-R).

The respondents were asked to describe their company's supply chain structure. However, most of the respondents did not identify their company as one of the node (supplier or manufacturer or wholesaler or distributor or retailer). Therefore, in the analysis factors such as: the type of nodes, and the possibility that a company represent more than one node, were not considered due to lack of this kind of information in the returned questionnaires.

In the UK, it was found that almost 80 percent of the respondent SMEs had supply chain structure of S-M-R (53.4 percent) and S-M-D-R (25.4 percent). Majority of Indian respondent firms had S-M-W-D-R (34.3 percent) and S-M-D-R (25.7 percent) supply chain structure. The respondents from China were more likely to have simpler supply chain structure of S-M-R (31.5 percent) and S-M-W-D-R (25.2 percent). Table 4.4 depicts the details of supply chain structure of respondents.

Description of Supply Chain Structure	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Supplier-manufacturer-retailer	63	53.4	35	20.0	17	23.6	115	31.5
Supplier-manufacturer-wholesaler-retailer	9	7.6	35	20.0	17	23.6	61	16.7
Supplier-manufacturer-distributor-retailer	30	25.4	45	25.7	16	22.2	91	24.9
Supplier-manufacturer-wholesaler-distributor-retailer	10	8.5	60	34.3	22	30.6	92	25.2
Others	6	5.1	0	0.0	0	0.0	6	1.6
Total	118	100.0	175	100.0	72	100.0	365	100.0

(F:Frequency, %: Valid percentage)

Table 4.4: Respondent Supply Chain Structure Profile

4.1.5 Ownership Profile

For the purpose of this study, a local company is considered to be started locally (within one country), a foreign company is considered to be started in a foreign country, and a local-foreign company is a joint venture of local and foreign company. It is not considered how and where the products of these companies are manufactured and sold (whether locally or in foreign markets). The respondents were asked to describe the type of ownership of their companies that was categorised as: local, foreign and local-foreign joint venture. It is found that there were more foreign companies in the UK whereas there was higher percentage of local companies in both India and China. The result showed that around 29.0 percent of Indian firms had joint ventures with other organisations; however, there were only few SMEs who were foreign in nature. The percentage of foreign SMEs was more in both the UK and China. Table 4.5 depicts details of the ownership type of the SMEs which participated in this survey.

Type of Ownership	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Local organisation	57	48.3	119	68.0	43	59.7	219	60.0
Foreign organisation	58	49.2	6	3.4	16	22.2	80	21.9
Local-foreign joint venture	3	2.5	50	28.6	13	18.1	66	18.1
Total	118	100.0	175	100.0	72	100.0	365	100.0

(F:Frequency, %: Valid percentage)

Table 4.5: Respondent Ownership Profile

4.1.6 Total Sales Volume:

The total sales volume figure was completed by 88.3 percent of the respondents. The mean sales volume (5% trimmed) was 15.19 million pounds and the median sales value was 12.58 million pounds. It was also found that overall sales volume was skewed (0.65) towards positive side. Table 4.6 depicts more details about the frequency, central tendency and dispersion of sales volume.

Sales Volume (Million Pounds)		
Frequency	Valid Respondents	322
	Missing- Not Responded	43
Central Tendency & Dispersion	Mean	15.19
	5 % Trimmed Mean	14.16
	Median	12.58
	Standard Deviation	11.49
	Skewness	0.65

Table 4.6: Total sales volume

Test of normality (Table 4.7) was conducted to check if the sales volume is normally distributed. The significant value of .000 suggested violation of the assumption of normality, which is quite common in larger samples.

Tests of Normality	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
The approximate total sale of organisation in 2010 (Million Pounds)	.112	322	.000	.924	162	.000

a. Lilliefors Significance Correction

Table 14.7: Normality test for sales volume

4.1.7 Research and Developmental Expenses:

The respondents were asked to complete the data regarding R&D expenses measured as percentage of total sales volume. Median was considered as an average value as the percentage of R&D expenses data is positively skewed (4.39). It was found that SMEs incur on an average of 2.5 percent out of the sales volume on their R&D activities Table 4.8 provides more details on this.

R&D Expenses (% of Sales volume)		
Frequency	Valid Respondents	323
	Missing- Not Responded	42
Central Tendency & Dispersion	Mean	5.17
	5 % Trimmed Mean	3.88
	Median	2.50
	Standard Deviation	8.51
	Skewness	4.39

Table 4.8: Percentage of research & development expenses allocated out of the sales volume

Normality test (Table 4.9) was conducted to check if the R&D expense is distributed normally. The significant value of .000 suggested a violation of the assumption of normality.

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
The percentage of R&D costs/budget allocated out of the sale volume	.272	323	.000	.559	323	.000

a. Lilliefors Significance Correction

Table 4.9: Normality test for R&D expenses

4.1.8 Logistics Expenses:

The respondents were asked to complete the data regarding logistics expenses measured as percentage of the total sales volume. The mean logistics expenses (5% trimmed) were 12.26 percent of the sales volume and the median value was 12.00 percent. It was also found that logistics expenses were positively skewed (1.82). Table 4.10 depicts more details about the frequency, central tendency and dispersion of the logistics expenses.

Logistics Expenses (% of Sales volume)		
Frequency	Valid Respondents	331
	Missing- Not Responded	34
Central Tendency & Dispersion	Mean	13.04
	5 % Trimmed Mean	12.26
	Median	12.00
	Standard Deviation	9.47
	Skewness	1.82

Table 4.10: Total logistics expenses allocated out of the sales volume

Test of normality (Table 4.11) was conducted to check if the logistics expenses were normally distributed. The significant value of .000 suggested that the percentage of logistics cost was not distributed normally.

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
The percentage of logistics costs/budget allocated out of the sale volume	.109	331	.000	.880	331	.000

a. Lilliefors Significance Correction

Table 4.11: Normality test for logistics expenses

4.1.9 Production Expenses:

The respondents were asked to complete the data regarding production expenses measured as percentage of total sales volume. The mean production expenses (5% trimmed) were 38.31 percent of the sales volume and the median value was 37.00 percent. Table 4.12 depicts more details about the frequency, central tendency and dispersion of the production expenses.

Production Expenses (% of Sales volume)		
Frequency	Valid Respondents	319
	Missing- Not Responded	46
Central Tendency & Dispersion	Mean	38.73
	5 % Trimmed Mean	38.31
	Median	37.00
	Standard Deviation	21.59
	Skewness	0.22

Table 4.12: Total production expenses allocated out of the sales volume

Normality test (Table 4.13) was conducted to check if the production expense is distributed normally. The significant value of .000 suggested violation of the assumption of normality.

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
The percentage of production costs/budget allocated out of the sale volume	.100	319	.000	.976	319	.000

a. Lilliefors Significance Correction

Table 4.13: Normality test for production expenses

While designing the questionnaire, it was intended to analyse the supply chain collaboration on the basis of Sales, R&D expenses, Logistics expenses and Production expenses. However due to the sensitivity and confidentiality of the data, most of the respondents were hesitant to provide accurate information and they provided an average value for sales. The other variables (R&D expenses, logistics expenses and production expenses) are expressed as percentage of sales value, therefore no further analysis is carried out to find out behaviour of supply chain collaboration in this perspective.

4.1.10 Years of Establishment of Organisation:

For finding the age of the SMEs, the respondents were asked to complete the number of years of establishment of their company. Based on the responses, the mean value (5% trimmed) was found to be 23.17 years whereas the median was 16 years. It was also found that overall data was highly skewed (2.96) towards positive side. Table 4.14 depicts more details about the frequency, central tendency and the dispersion of age of SMEs.

Years of Establishment		
Frequency	Valid Respondents	363
	Missing- Not Responded	2
Central Tendency & Dispersion	Mean	27.73
	5 % Trimmed Mean	23.17
	Median	16.00
	Standard Deviation	31.18
	Skewness	2.96

Table 4.14: Years of establishment of organisation

Test of normality (Table 4.15) was conducted to check if the number of years of establishment follows normal distribution curve. The significant value of .000 suggested violation of the assumption of normality.

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
How long ago did the organisation establish its operation?	.234	363	.000	.667	363	.000

a. Lilliefors Significance Correction

Table 4.15: Normality test for years of establishment

4.2. Supply Chain Collaboration

4.2.1 Supply Chain Collaboration and Ownership:

For the purpose of this study, formal collaboration is defined as: “any voluntarily initiated co-operative arrangement between firms that involve exchange, sharing, or co-development of products, technologies, or services and it can include contributions by partners of capital, technology, or firm specific assets. They can occur as a result of a wide range of motives and goals, take a variety of forms, and occur across vertical and horizontal boundaries.” (Gulati and Singh ,1998, p.781)

The respondents were asked to respond to the question: Does your organisation formally collaborate with external organisations? Based on the response to this question, the supply chain collaboration and type of ownership were analysed. With the chi-square and ANOVA test, it was concluded that the frequencies in the cells were different not because of chance error but there were statistically significant differences in them.

On the basis of type of ownership and supply chain collaboration, it was found that 63.9 percent of local organisations (140 out of 219 responses), 71.3 percent (57 out of 80) of foreign organisations and 86.4 percent (57 out of 66) of local-foreign joint venture organisations collaborate formally with external organisation. Table 4.16 shows detail of the ownership type and level of external collaboration (expressed in %) for different countries.

Type of Ownership Collaboration	UK(N=118)		India(N=175)		China(N=72)		Total(N=365)	
	Yes	%	Yes	%	Yes	%	Yes	%
Local organisation	43	75.4	67	56.3	30	69.8	140	63.9
Foreign organisation	43	74.1	1	16.7	13	81.3	57	71.3
Local-foreign joint venture	1	33.3	45	90.0	11	84.6	57	86.4
Total	87	73.7	113	64.6	54	75.0	254	69.6

Table 4.16: Supply chain collaboration and type of ownership

4.2.2 Supply Chain Collaboration and Supply Chain Structure:

The questionnaire included question on the type of supply chain structure of the SMEs which were categorised into: Supplier-manufacturer-retailer (S-M-R), Supplier-manufacturer-wholesaler-retailer (S-M-W-R), Supplier-manufacturer-distributor-retailer (S-M-D-R) and Supplier-manufacturer-wholesaler-distributor-retailer (S-M-W-D-R). Based on the response to this question and the question of the external collaboration (Yes or No), chi-square value (at 0.005 level) and ANOVA value (at 0.001 level) were calculated to establish that differences in cell value were because of statistical reasons not just because of chance error.

In the UK, it was found that 100 percent of companies with S-M-W-R structure collaborate externally, around 80 percent of the respondent with S-M-D-R and S-M-W-D-R structures collaborated externally. Indian SMEs with supply chain structure S-M-W-R (77.1 percent) and S-M-D-R (75.6 percent) were more likely to collaborate externally with other companies. Similarly in China, companies with structures of S-M-D-R (87.6 percent) and S-M-W-R (82.6 percent) had more probability of entering into supply chain collaboration as compared to any other supply chain structures. An interesting finding was that SMEs with a bit of complex supply chain structure (S-M-W-R- 82 percent and S-M-D-R- 79.1 percent) collaborated more as compared to a relatively simpler supply chain structure (S-M-R- 64.3 percent). Table 4.17 depicts more details of supply chain structure and collaboration.

Description of Supply Chain Structure Collaboration	UK(N=118)		India(N=175)		China(N=72)		Total(N=365)	
	Yes	%	Yes	%	Yes	%	Yes	%
Supplier-manufacturer-retailer	43	68.3	21	60.0	10	58.8	74	64.3
Supplier-manufacturer-wholesaler-retailer	9	100	27	77.1	14	82.6	50	82.0
Supplier-manufacturer-distributor-retailer	24	80.0	34	75.6	14	87.6	72	79.1
Supplier-manufacturer-wholesaler-distributor-retailer	8	80.8	31	51.7	16	72.7	55	59.8
Total	84	73.7	113	64.7	54	75.0	254	69.6

Table 4.17: Supply chain collaboration and supply chain structure

4.3 Types of collaboration (Collaborative Initiatives):

In the questionnaire, the companies which collaborate with external organisation were further asked to respond to detail of their supply chain initiative and the partner with whom they collaborate. Based on the analysis of the different collaborative initiatives and supply chain partners, the following findings were analysed. All of the tables and the cell values were tested for their statistical differences using ANOVA and chi-square tests.

4.3.1. Joint Venture-

4.3.1.1 Joint Venture and Size of Organisation

a) Descriptive Results-

The micro organisations (companies with annual sales volume up to £ 2 million) had more inclination for joint venture with other organisation (34.2 percent) whereas 21.1 percent of micro organisations had joint ventures with their suppliers. However joint venture with competitors was not found in micro organisations. In such organisations horizontal joint ventures (with competitors and/or other organisations) were found to be more as compared to vertical joint venture (with suppliers and/or customers). The overall joint venture initiative was nearly 55 percent in the micro organisations.

For small organisations (companies with annual sales volume up from £ 2 million to 10 million), joint venture with suppliers and other organisations emerged to be the most commonly used strategy whereas joint ventures with the rest of the other partners were not common used. It was also found that such organisations were equally focused on both horizontal joint ventures and vertical joint ventures. On a combined basis joint venture was a common initiative in small organisations.

As far as medium-sized organisations (companies with annual sales volume up from £ 10 million to 42 million) were concerned, they were more inclined in joint ventures with other organisations (35.4 percent) than with suppliers or customers or other organisations. They were more involved in horizontal joint ventures as compared to vertical joint ventures. The overall joint venture initiative was very popular in such organisations.

The overall data responses showed more inclination for joint ventures with other organisations (31 percent) and less with the competitors (6.1 percent). The horizontal joint ventures were more when compared to the vertical joint ventures. Table 4.18 provides more details about joint venture with supply chain partners.

Joint Venture with:	Micro		Small		Medium		Total	
	F	%	F	%	F	%	F	%
Supplier	8	21.1	15	23.4	25	19.7	48	21.0
Customer	6	15.8	7	10.9	22	17.3	35	15.3
Competitor	0	0.0	5	7.8	9	7.1	14	6.1
Other Organisation	13	34.2	13	20.3	45	35.4	71	31.0
Vertical	10	26.3	18	28.1	33	26.0	61	26.6
Horizontal	13	34.2	17	26.6	49	38.6	79	34.5
Overall	21	55.3	31	48.4	77	60.6	129	56.3
Number of companies in collaborative relationship	38	100.0	64	100.0	127	100.0	229	100.0

Table 4.18: Joint venture and size

In terms of average effectiveness of joint venture initiatives with respect to size, the results showed similar values for mean and median. However, the standard deviation was different for all the three types of organisations. A high standard deviation indicates that the average effectiveness is spread out over a large range of values whereas a low standard deviation indicates that the average effectiveness tend to be very close to the mean. This signifies that micro and small companies have volatile effectiveness of joint venture initiative whereas medium companies have relatively stable effectiveness of joint venture initiatives. Moreover all the three groups had negative skewness which implies that most of the effectiveness value lies above mean. Table 4.19 provides more details.

		Average Effectiveness: Joint Venture			Total
		Micro	Small	Medium	
Frequency	Yes	18	29	70	131
	No	20	35	57	123
Central Tendency & Dispersion	Mean	7.33	7.03	6.96	7.06
	Median	8.00	7.00	7.00	7.00
	Standard Deviation	2.06	2.15	1.88	1.94
	Skewness	-1.78	-0.84	-0.85	-0.96
	Minimum	1.00	1.00	1.00	1.00
	Maximum	10.00	10.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.19: Average effectiveness: Joint venture and size

b) Estimated Values

Based on the actual percentage (or proportion) of SMEs entering into joint venture relationship and based on the actual mean and standard deviation values of the joint venture effectiveness, the estimated values for the SMEs population were predicted using estimation theory. The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. On an overall basis, at 95% Margin of Error (MOE) the estimated percentage of SMEs in the joint venture relationship would be from 45 to 58 percentage while at 99% MOE, 43 to 60 percent of the SMEs were expected to have joint ventures with their supply chain partners. At 95% MOE, the average effectiveness would range from 7.05 to 7.07 on a 10 point scale and at 99% MOE the estimated mean score will be 7.04 to 7.08. It can be expected that joint venture relationship will be popular up to 60 percent in the SME population and the mean effectiveness would be high up to 7.08. Specific details related to the three groups were shown in the Table 4.20.

		Class Interval for Average Effectiveness: Joint Venture			Total
		Micro	Small	Medium	
Estimated Percentage	@95% MOE	31 to 63	33 to 58	46 to 64	45 to 58
	@99% MOE	26 to 68	29 to 61	44 to 67	43 to 60
Estimated Mean Score	@95% MOE	7.22 to 7.44	6.96 to 7.10	6.93 to 6.99	7.05 to 7.07
	@99% MOE	7.19 to 7.47	6.94 to 7.12	6.92 to 7.00	7.04 to 7.08

Table 4.20: Class interval for joint venture and size

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and a post-hoc test were conducted to

explore the impact of country on joint venture initiative. Responses were divided into three groups: micro, small and medium-sized organisations. Eta squared values were also used to determine the effect size of the results. Eta squared is calculated as: sum of squares between groups divided by the total sum of squares. Statisticians classify 0.01 as a small effect, 0.06 as a medium effect and 0.14 as a large effect. The detailed results were tabulated in the Table 4.21.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	0.17	0.836	-	-	-
	228					
1B and 2	2	0.67	0.513	-	-	-
	228					
1C and 2	2	1.53	0.225	-	-	-
	228					
1D and 2	2	2.42	0.093	-	-	-
	228					
1E and 2	2	0.05	0.951	-	-	-
	228					
1F and 2	2	1.36	0.259	-	-	-
	228					
1G and 2	2	1.29	0.276	-	-	-
	228					
1H and 2	2	0.25	0.780	-	-	-
	116					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Size of organisation;** 1- Micro, 2- Small, 3- Medium.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between size of organisation.

Table 4.21: Joint venture and size- ANOVA and Post Hoc Test

The results showed that there were no statistical differences at the $p < 0.05$ level in joint venture initiative for the three groups.

4.3.1.2 Joint Venture and Ownership

a) Descriptive Results-

For the joint venture initiatives, almost one-fourth and one-fifth of the local SMEs were involved with other organisations and suppliers respectively whereas only 6.4 percent of local companies had joint ventures with their competitors. Local SMEs had a nearly equal inclination for vertical and horizontal relationship for the joint ventures. The overall joint venture initiative was nearly 45 percent with respect to local companies.

On the other hand, foreign SMEs were more involved with their suppliers and customers for their joint

venture relationship. Joint venture with competitors was found to be a less popular strategy with only 7.0 percent involved in it. Vertical joint ventures were more (nearly 10 percent) as compared to horizontal joint ventures. On an overall basis joint ventures in foreign SMEs were more common as compared to local SMEs.

Local-foreign SMEs had a much higher tendency (71.9 percent) to be involved with other organisation for the joint ventures. And a result of this their horizontal joint ventures were more popular than vertical joint ventures. The overall basis almost 90 percent of such SMEs had joint ventures with their supply chain partners.

The overall data responses showed more inclination for joint ventures with other organisations (33.1 percent) and less with the competitors (5.5 percent). The horizontal joint venture is nearly 12 percent more as compared to vertical joint ventures. Table 4.22 provides more details about joint venture with supply chain partners.

Joint Venture with:	Local		Foreign		Local-foreign		Total	
	F	%	F	%	F	%	F	%
Supplier	28	20.0	15	26.3	7	12.3	50	19.7
Customer	20	14.3	10	17.5	5	8.8	35	13.8
Competitor	9	6.4	4	7.0	1	1.8	14	5.5
Other Organisation	33	23.6	10	17.5	41	71.9	84	33.1
Vertical	35	25.0	18	31.6	10	17.5	63	24.8
Horizontal	37	26.4	13	22.8	42	73.7	92	36.2
Overall	62	44.3	30	52.6	51	89.5	143	56.3
Number of companies in collaborative relationship	140	100.0	57	100.0	57	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 4.22: Joint venture and ownership

In terms of average effectiveness of joint venture initiatives with respect to ownership, the average effectiveness for both local and local-foreign SMEs were better as compared to foreign SMEs. The standard deviation and range values were also different for all the three ownership types. Table 4.23 provides more details about the central tendency and dispersion.

		Average Effectiveness: Joint Venture			
		Local	Foreign	Local-foreign	Total
Frequency	Yes	52	28	51	131
	No	88	29	6	123
Central Tendency & Dispersion	Mean	7.07	6.73	7.22	7.06
	Median	8.00	7.50	7.00	7.00
	Standard Deviation	2.23	2.14	1.45	1.94
	Skewness	-1.03	-1.00	-0.15	-0.96
	Minimum	1.00	1.00	4.00	1.00
	Maximum	10.00	9.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.23: Average effectiveness: Joint venture and ownership

b) Estimated Values

For local-foreign SMEs, at 95% Margin of Error (MOE) the estimated percentage of such SMEs in the

joint venture relationship will be from 56 to 81 percentage while at 99% MOE, 52 to 85 percent of such SMEs will have joint ventures with their supply chain partners. At 95% MOE, the average effectiveness of such SMEs will range from 6.65 to 7.73 on a 10 point scale and at 99% MOE the estimated mean score will be 6.47 to 7.90. It can be expected that joint venture relationship will be popular up to 89 percent in the local-foreign SME population and the mean effectiveness will be high up to 7.60. Specific details relating to the three ownership type were shown in the Table 4.24.

Class Interval for Average Effectiveness: Joint Venture					
		Local	Foreign	Local-foreign	Total
Estimated Percentage	@95% MOE	29 to 45	36 to 62	56 to 81	82 to 89
	@99% MOE	28 to 46	32 to 66	52 to 85	79 to 99
Estimated Mean Score	@95% MOE	6.70 to 7.44	6.18 to 7.29	6.65 to 7.73	6.85 to 7.60
	@99% MOE	6.58 to 7.55	6.00 to 7.46	6.47 to 7.90	6.37 to 7.72

Table 4.24: Class interval for joint venture and ownership

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and a post-hoc test were conducted to explore the impact of ownership of organisation on joint venture initiative. Responses were divided into three groups: Local, Foreign and Local-foreign joint venture. Eta squared values were also used to determine the effect size of the results. The detailed results were tabulated in the Table 4.25.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	1.78	0.169	0.01	-	-
	253				-	-
1B and 2	2	0.95	0.387	0.01	-	-
	253				-	-
1C and 2	2	1.00	0.367	0.01	-	-
	253				-	-
1D and 2	2	31.37	0.000	0.20	0.484 (1 & 3)	0.000
	253				0.544 (2 & 3)	0.000
1E and 2	2	1.50	0.223	0.01	-	-
	253				-	-
1F and 2	2	26.93	0.000	0.18	0.473 (1 & 3)	0.000
	253				0.509 (2 & 3)	0.000
1G and 2	2	19.4	0.000	0.13	0.453 (1 & 3)	0.000
	253				0.368 (2 & 3)	0.000
1H and 2	2	0.57	0.563	0.01	-	-
	130				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Ownership;** 1- Local, 2-Foreign, 3-Local-foreign joint venture.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between ownership.

Table 24.25: Joint venture and ownership- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in joint venture initiative for the three respondents groups. The results were:

- The value $F(2, 253) = 5.05$, $p = 0.007$ showed significant difference between joint venture with other organisation according to ownership type. The actual difference in mean scores between the groups was very high. The effect size, calculates using Eta squared, was 0.20. Post-hoc comparison using the Tukey HSD test indicated that the mean score for local-foreign SMEs was significantly different from local SMEs (0.484, $p = 0.000$) and foreign SMEs (0.544, $p = 0.000$). However local SMEs and foreign SMEs did not significantly differ from each other.
- The value $F(2, 253) = 26.93$, $p = 0.000$ showed significant difference between horizontal joint venture (joint ventures with competitors and/or other organisation) according to type of ownership. The actual difference in mean scores between the groups was quite high. The effect size, calculates using Eta squared, was 0.18. Post-hoc comparison using the Tukey HSD test indicated that the mean score local-foreign SMEs was significantly different from local SMEs (0.473, $p = 0.000$) and foreign SMEs (0.509, $p = 0.000$). However local SMEs and foreign SMEs did not significantly differ from each other.

- iii. The value $F(2, 253) = 19.40$, $p = 0.00$ showed significant difference between joint venture with any of the supply chain partners according to ownership. The actual difference in mean scores between the groups was quite high. The effect size, calculated using Eta squared, was 0.18. Post-hoc comparison using the Tukey HSD test indicated that the mean score local-foreign SMEs was significantly different from local SMEs (0.453, $p = 0.000$) and foreign SMEs (0.368, $p = 0.000$). However local SMEs and foreign SMEs did not significantly differ from each other.

4.3.1.3 Joint Venture and Supply Chain Structure

a) Descriptive Results-

SMEs with S-M-R structure were inclined towards other organisation (20.3 percent) and suppliers (18.9 percent) for their joint venture relationship. They were less involved with their competitors for joint ventures. Such structures had higher probability to be involved in vertical joint ventures as opposed to horizontal joint ventures. The overall inclination for joint venture initiative is nearly 47 percent for such supply chain structures.

A similar pattern was found in the S-M-W-R structures also. 38 percent and 24 percent of such structures were involved with other organisations and suppliers respectively for the joint venture initiative. None of such structure had joint venture with the competitors. However, such structures had higher inclination for horizontal relations (38 percent) as compared to vertical relations (28 percent) with respect to joint ventures. There were 64 percent chances to enter in joint venture for S-M-W-R structures.

S-M-D-R structures too had more involvement with other organisation (29.3 percent) followed by suppliers (15.3 percent) and customers (11.1 percent) for their joint venture relationship. Again the horizontal joint ventures had higher percentage as compared to vertical joint ventures for such supply chain structures. On an overall basis such structures had more likeliness (.64) to enter in joint ventures with their supply chain partners.

Half of the SMEs with more complex supply chain structures (S-M-W-D-R) joint ventures with other organisations. 20 percent of such SMEs had joint ventures with their suppliers. Again horizontal joint ventures were more as compared to vertical joint ventures. On an overall basis 65 percent of such structures had joint ventures with partners. Table 4.26 provides more details about joint ventures with supply chain partners.

Joint Venture with:	S-M-R		S-M-W-R		S-M-D-R		S-M-W-D-R	
	F	%	F	%	F	%	F	%
Supplier	14	18.9	12	24.0	11	15.3	11	20.0
Customer	13	17.6	6	12.0	8	11.1	6	10.9
Competitor	4	5.4	0	0.0	4	5.6	5	9.1
Other Organisation	15	20.3	19	38.0	21	29.2	27	49.1
Vertical	21	28.4	14	28.0	14	19.4	12	21.8
Horizontal	17	23.0	19	38.0	25	34.7	29	52.7
Overall	35	47.3	32	64.0	38	52.8	36	65.5
Number of companies in collaborative relationship	74	100.0	50	100.0	72	100.0	55	100.0

(F:Frequency, %: Valid percentage)

Table 4.26: Joint venture and supply chain structure

In terms of average effectiveness of joint venture initiatives with respect to structure of supply chain, the results showed similar values of mean and median for all the supply chain structures except S-M-R. However the standard deviation and range values were different for all the supply chain structures. Both S-M-W-R and S-M-W-D-R structures had lower values of skewness as compared to the other two structures. The minimum and maximum scores for the effectiveness also differed for each of the supply chain structures. Table 4.27 provides more details.

		Average Effectiveness: Joint Venture			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Frequency	Yes	32	31	34	32
	No	42	19	38	23
Central Tendency & Dispersion	Mean	6.61	7.48	7.18	7.01
	Median	7.50	8.00	7.50	7.00
	Standard Deviation	2.52	1.36	1.88	1.82
	Skewness	-0.88	-0.30	-1.23	-0.22
	Minimum	1.00	5.00	1.00	3.00
	Maximum	10.00	10.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.27: Average effectiveness: Joint venture and supply chain structure

b) Estimated Values

For SMEs with S-M-W-R supply chain structure, at 95% MOE the estimated percentage of such SMEs in the joint venture relationship will be from 49 to 75 percent while at 99% MOE, 44 to 80 percent of such SMEs will have joint ventures with their supply chain partners. At 95% MOE, the average effectiveness of such SMEs will range from 7.11 to 7.86 on a 10 point scale and at 99% MOE the estimated mean score will be 6.99 to 7.98. It can be expected that joint venture relationship will be popular up to 71 percent in the S-M-W-D-R structures SME population and the mean effectiveness will be high up to 7.64. Specific details related to the supply chain structure and estimated values are shown in the Table 4.28.

Class Interval for Average Effectiveness: Joint Venture					
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Estimated Percentage	@95% MOE	32 to 55	49 to 75	36 to 59	45 to 71
	@99% MOE	28 to 58	44 to 80	32 to 62	41 to 75
Estimated Mean Score	@95% MOE	6.03 to 7.18	7.11 to 7.86	6.74 to 7.61	6.53 to 7.49
	@99% MOE	5.85 to 7.36	6.99 to 7.98	6.61 to 7.75	6.38 to 7.64

Table 4.28: Class interval for joint venture and supply chain structure

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and a post-hoc test were conducted to explore the impact of supply chain structure on joint venture initiative. Responses were divided into four groups: S-M-R, S-M-W-R, S-M-D-R and S-M-W-D-R. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.29.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	3	1.42	0.225	0.02	-	-
	253				-	-
1B and 2	3	2.26	0.063	0.03	-	-
	253				-	-
1C and 2	3	2.21	0.068	0.03	-	-
	253				-	-
1D and 2	3	3.74	0.006	0.06	0.288 (1 & 4)	0.005
	253				-	-
1E and 2	3	1.24	0.293	0.02	-	-
	253				-	-
1F and 2	3	3.48	0.009	0.05	0.298* (1 & 4)	0.004
	253				-	-
1G and 2	3	1.50	0.20	0.02	-	-
	253				-	-
1H and 2	3	0.927	0.451	0.03	-	-
	130				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Supply Chain Structure;** 1 S-M-R, 2 S-M-W-R, 3 S-M-D-R, 4 S-M-W-D-R.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between supply chain structures.

Table 4.29: Joint Venture and Supply chain structure- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in joint venture initiative for the three respondents groups. The results are:

- i. The value $F(3, 253) = 3.74$, $p = 0.005$ showed significant difference between joint venture with other organisation according to supply chain structures. The actual difference in mean scores between the groups was moderate. The effect size, calculates using Eta squared, was 0.06. Post-hoc comparison using the Tukey HSD test indicated that the mean score for structure 'S-M-R' was significantly different from structure 'S-M-W-D-R' (0.288, $p = 0.005$) but not from any other structures.
- ii. The value $F(3, 253) = 3.48$, $p = 0.004$ showed significant difference between joint venture with competitors and/or other organisation according to supply chain structures. The actual difference in mean scores between the groups was moderate. The effect size, calculates using Eta squared, was 0.05. Post-hoc comparison using the Tukey HSD test indicated that the mean score for structure 'S-M-R' was significantly different from structure 'S-M-W-D-R' (0.298, $p = 0.004$) but not from any other structures.

4.3.1.4 Joint Venture and Age of Organisation

a) Descriptive Results-

The organisations which were aged less than 10 years had more inclination for joint venture with other organisations (30.5 percent) whereas 13.9 percent of such organisations had joint ventures with their suppliers. However, percentage of joint venture with competitors was found very low in such organisations. In such companies percentage of horizontal joint ventures were more as compared to percentage of vertical joint venture. The overall joint venture initiative was nearly 46 percent in these organisations.

For organisations that were aged between 10 and 24 years, joint venture with other organisations and suppliers emerged to be the most commonly used strategy whereas joint ventures with rest of the other partners were not common. It was found that such organisations were more inclined towards horizontal joint ventures as compared to vertical joint ventures. On a combined basis joint venture was very common initiative in such organisations.

As far as organisations which were aged more than 25 years were concerned, they were equally inclined in joint ventures with suppliers (27.2) and other organisations (26.2 percent) than with competitors. Such firms were found to have nearly equal involvement in vertical and horizontal joint ventures. The overall joint venture initiative was very popular in such organisations.

The overall data responses showed more inclination for joint ventures with other organisations (33 percent) and less with competitors (5.1 percent). As a result, the horizontal joint ventures were more than when compared to vertical joint ventures. Table 4.30 provides more details about joint venture with

supply chain partners.

Joint Venture with:	Less than 10 yrs		10 to 24 yrs		25 and more		Total	
	F	%	F	%	F	%	F	%
Supplier	10	13.89	12	15.19	10	13.89	12	15.19
Customer	6	8.33	6	7.59	6	8.33	6	7.59
Competitor	2	2.78	0	0.00	2	2.78	0	0.00
Other Organisation	22	30.56	35	44.30	22	30.56	35	44.30
Vertical	11	15.28	16	20.25	11	15.28	16	20.25
Horizontal	23	31.94	35	44.30	23	31.94	35	44.30
Overall	33	45.83	48	60.76	33	45.83	48	60.76
Number of companies in collaborative relationship	72	100.00	79	100.00	72	100.00	79	100.00

Table 4.30: Joint venture and age

In terms of average effectiveness of joint venture initiatives with respect to age, the results showed similar values for mean. However, the standard deviation and range values were different for all the three types of organisations. Moreover all the three groups had negative skewness which implies that most of the effectiveness value lies above mean. Table 4.31 provides more details:

		Average Effectiveness: Joint Venture			Total
		Less than 10 yrs	10 to 24 yrs	25 and more	
Frequency	Yes	31	45	55	131
	No	41	34	48	123
Central Tendency & Dispersion	Mean	7.08	7.27	6.87	7.06
	Median	7.00	8.00	7.00	7.00
	Standard Deviation	1.74	1.64	2.25	1.94
	Skewness	-0.29	-0.51	-1.15	-0.96
	Minimum	3.00	3.00	1.00	1.00
	Maximum	10.00	10.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.31: Average effectiveness: Joint venture and age

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. On an overall basis, at 95% MOE the estimated percentage of SMEs in the joint venture relationship would be from 45 to 58 percentages while at 99% MOE, 43 to 60 percent of the SMEs are expected to have joint ventures with their supply chain partners. At 95% MOE, the average effectiveness would range from 7.05 to 7.07 on a 10 point scale and at 99% MOE the estimated mean score will be 7.04 to 7.08. For the organisations aged between 10 and 24 years, it can be expected that

joint venture relationship will be popular up to 71 percent and the mean effectiveness would be high up to 7.32. Specific details related to the three groups are shown in the Table 4.32.

Class Interval for Average Effectiveness: Joint Venture					
		Less than			
		10 yrs	10 to 24 yrs	25 and more	Total
Estimated Percentage	@95% MOE	32 to 54	46 to 68	44 to 63	45 to 58
	@99% MOE	28 to 58	43 to 71	41 to 66	43 to 60
Estimated Mean Score	@95% MOE	7.03 to 7.13	7.23 to 7.31	6.83 to 6.91	7.05 to 7.07
	@99% MOE	7.02 to 7.14	7.22 to 7.32	6.81 to 6.93	7.04 to 7.08

Table 4.32: Class interval for joint venture and age

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and a post-hoc test were conducted to explore the impact of age of organisation on joint venture initiative. Responses were divided into three groups: organisations aged less than 10 years, organisations aged between 10 and 24 years and organisations aged more than 25 years. Eta squared values were also used to determine the effect age of the results. The detailed results are tabulated in the Table 4.33.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	3.14	0.045	0.02	-	-
	253					
1B and 2	2	5.50	0.005	0.04	0.140* (1 & 2)	0.021
	253				0.147* (2 & 3)	0.011
1C and 2	2	6.82	0.001	0.05	0.89* (1 & 2)	0.028
	253					
1D and 2	2	3.5	0.032	0.02	-	-
	253					
1E and 2	2	5.19	0.006	0.04	0.19* (1 & 3)	0.008
	253					
1F and 2	2	1.63	0.197	-	-	-
	253					
1G and 2	2	2.25	.107	-	-	-
	253					
1H and 2	2	0.51	0.60	-	-	-
	253					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Age of organisation;** 1- up to 10 years, 2- 10 -24 years, 3- 25 years and more.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between age of age of organisation.

Table 4.33: Joint venture and age- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in the joint venture relationship for the three respondents groups.

- i. Although the value $F(2, 253) = 3.14$, $p = 0.045$ suggested significant difference between joint venture with suppliers according to age of organisation, the post-hoc comparison did not indicate that the mean score was significantly different according to the age of company.
- ii. The value $F(2, 253) = 5.50$, $p = 0.005$ showed significant difference between joint venture with customers according to the age of organisation. The actual difference in mean scores between the groups was not high (Eta squared value of 0.04). Post-hoc comparison indicated that the mean score for organisations which were aged less than 10 years was significantly different from organisations which were aged between 10 and 24 years (0.140 , $p = 0.021$); moreover mean score for organisations which were aged between 10 and 24 years was significantly different from organisations which were aged more than 25 years (0.147 , $p = 0.011$).
- iii. The value $F(2, 253) = 3.14$, $p = 0.045$ showed significant difference between joint venture with competitors according to the age of organisation; however, post-hoc comparison did not indicate that the mean score was significantly different according to age of company.
- iv. The value $F(2, 253) = 5.19$, $p = 0.006$ showed significant difference between vertical joint venture relationship age of organisation. The actual difference in mean scores between the groups was not high (Eta squared value of 0.04). Post-hoc comparison indicated that the mean score for organisations that were aged less than 10 years was significantly different from the organisations which were aged more than 25 years (0.19 , $p = 0.008$).

4.3.1.5 Correlation of Joint Venture and other collaborative initiatives:

The relationship between joint venture initiatives with other type of collaborative initiatives was analysed using bi-variate correlation method. Due to restriction of number of cases, the separate correlation analysis using country, ownership and supply chain structures as independent variables was not possible. However the correlation analysis was possible for all the responses taken a whole. Moreover with the absence of any definite independent variable regression analysis was not conducted to avoid complexity of results. Spearman's rho values (non-parametric test) were used to measure the correlation as some of the variables failed the normality test. The relationship of joint venture with other collaborative initiatives is summarised in the correlation matrix shown in Table 4.34.

Effectiveness of:		Effectiveness of Joint Ventures with:			
		Supplier	Customer	Competitor	Other Organisation
Joint Ventures with:	Supplier	-	.848**	-	.931**
Co-development with:	Supplier	.684**	.552*	-	-
	Customer	.697*	-	-	-
	Other Organisation	-	-	-	.453*
Co-design with:	Customer	.789**	.889*	-	.672**
Co-manufacturing with:	Supplier	-	.750*	-	-
	Customer	-	-	-	.973**
	Other Organisation	-	-	-	.430*
Joint Problem Solving with:	Supplier	.567**	-	-	-
Shared Resources with:	Supplier	.715*	-	-	-
CPFR with:	Supplier	.695**	.684*	-	-

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.34: Correlation of effectiveness of joint ventures with other collaborative initiatives

It was found that within joint venture initiative, joint venture with supplier is positively correlated to joint venture with other organisation ($r = 0.931$) and also with joint venture with customer ($r = 0.848$). Joint ventures also found to have strong relation with co-design with customer. Except joint venture with competitors, all other joint ventures were positively related to co-design with customer. CPFR with supplier is also positively related to joint ventures with suppliers ($r = 0.695$) and with customers ($r = 0.684$). In conclusion, joint ventures found to have positive effect on other collaborative initiatives.

4.3.2 Co-development-

4.3.2.1 Co-development and Size of Organisation

1) Descriptive Results-

For their co-development initiatives, almost 32 percent and 29 percent of the micro organisations were involved with other organisations and customers respectively whereas none of such companies had co-developments with their competitors. Such companies exhibited more inclination for vertical relations as compared to horizontal relationship for the co-developments. The overall co-development initiative was 63 percent which is very with respect to size of the organisation.

On the other hand, small companies were equally involved with their suppliers and customers for the co-development relationship. Co-development with competitors was found to be a very less popular strategy with only 4.7 percent of such companies involved in it. Vertical co-developments were more (nearly 14 percent) as compared to horizontal co-developments.

Medium-sized organisations had more inclination towards co-developments with suppliers (26.0 percent) and customers (20.5 percent). As a result of this, their vertical co-developments were more

than their horizontal joint ventures. On a combined basis almost 40 percent of such firms had co-development with their supply chain partners.

The overall data responses showed more inclination for co-developments with other suppliers and customers and less with competitors. The vertical co-developments were more as compared to horizontal co-developments. Table 4.35 provides more details about co-development with supply chain partners.

Co-development with:	Micro		Small		Medium		Total	
	F	%	F	%	F	%	F	%
Supplier	6	15.8	12	18.8	33	26.0	51	22.3
Customer	11	28.9	12	18.8	26	20.5	49	21.4
Competitor	0	0.0	3	4.7	8	6.3	11	4.8
Other Organisation	12	31.6	7	10.9	20	15.7	39	17.0
Vertical	15	39.5	19	29.7	44	34.6	78	34.1
Horizontal	12	31.6	10	15.6	25	19.7	47	20.5
Overall	24	63.2	26	40.6	59	46.5	109	47.6
Number of companies in collaborative relationship	38	100.0	64	100.0	127	100.0	229	100.0

Table 34.35: Co-development and size

In terms of average effectiveness of co-development initiatives with respect to size, the results showed similar values for mean and median. However, the standard deviation and range were different for all the three types of organisations. Moreover all the three groups had negative skewness which implies that most of the effectiveness value lies above mean. Table 4.36 provides more details:

		Average Effectiveness: Co-development			
		Micro	Small	Medium	Total
Frequency	Yes				
	No	21	24	52	107
		17	40	75	147
Central Tendency & Dispersion	Mean	6.90	6.63	6.53	6.54
	Median	7.00	7.00	6.50	7.00
	Standard Deviation	2.17	1.91	1.63	1.86
	Skewness	-1.07	-0.68	-0.09	-0.54
	Minimum	1.00	2.00	3.00	1.00
	Maximum	10.00	10.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.36: Average effectiveness: Co-development and size

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. At 95% Margin of Error (MOE) the estimated percentage of micro organisations in the co-development relationship would be from 39 to 71 percentage while at 99% MOE, 34 to 76 percent of such companies were expected to have co-developments with their supply chain partners. At 95% MOE, the average effectiveness of such firms would range from 6.79 to 7.01 on a 10 point scale and at 99% MOE the estimated mean score will as high as 7.05. Specific details related to the three groups are shown in the Table 4.37.

		Class Interval for Average Effectiveness: Co-development			
		Micro	Small	Medium	Total
Estimated Percentage	@95% MOE	39 to 71	26 to 49	32 to 49	36 to 48
	@99% MOE	34 to 76	22 to 53	30 to 52	34 to 50
Estimated Mean Score	@95% MOE	6.79 to 7.01	6.57 to 6.69	6.50 to 6.56	6.53 to 6.55
	@99% MOE	6.75 to 7.05	6.55 to 7.71	6.49 to 6.57	5.52 to 6.56

Table 4.37: Class interval for co-development and size

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and a post-hoc test were conducted to explore the impact of size on co-development initiative. Responses were divided into three groups: micro, small and medium-sized organisations. The detailed results are tabulated in the Table 4.38.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	1.19	0.305	-	-	-
	228					
1B and 2	2	0.80	0.449	-	-	-
	228					
1C and 2	2	1.26	0.286	-	-	-
	228					
1D and 2	2	3.83	0.023	0.03	0.26* (1 & 2)	0.020
	228					
1E and 2	2	0.52	0.592	-	-	-
	228					
1F and 2	2	1.92	0.148	-	-	-
	228					
1G and 2	2	2.52	.082	-	-	-
	228					
1H and 2	2	0.31	0.734	-	-	-
	116					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Size of organisation;** 1- Micro, 2- Small, 3- Medium.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between size of organisation.

Table 4.38: Co-development and size- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-development with other organisations for the three respondents groups.

- The value $F(2, 228) = 3.83$, $p = 0.023$ showed significant difference between co-development with other organisation according to size. The actual difference in mean scores between the groups was not high. The effect size, calculates using Eta squared, was 0.03. Post-hoc comparison using the Tukey HSD test indicated that the mean score for micro organisations was significantly different from small organisations (0.26, $p = 0.005$) but not from medium-sized organisations. Moreover, small and medium-sized organisations did not significantly differ from each other.
- The results also showed that there were no statistical differences at the $p < 0.05$ level in joint venture initiative with other supply chain partner for the three groups.

4.3.2.2 Co-development and Ownership

a) Descriptive Results-

For their co-development initiatives, almost 26 percent, 20 percent and 14 percent of the local SMEs were involved with customers, suppliers and other organisations respectively whereas only 4.3 percent of local companies had co-developments with their competitors. Local SMEs were more inclined towards vertical co-development as opposed to the horizontal co-developments. The overall co-development initiative was nearly 45 percent with respect to local companies.

Foreign SMEs were more involved with their suppliers for their co-development relationship. Co-development with competitors was found to be a very less popular strategy with only 5.3 percent of such SMEs were involved in it. Vertical co-developments were nearly 14 percent more than that of horizontal co-developments. On an overall basis co-developments in foreign SMEs were more common as compared to local SMEs.

Foreign-local SMEs were more inclination for co-developments with other organisations (29.8 percent) and less with competitors (3.5 percent). Horizontal co-developments were more popular than vertical co-developments for such SMEs. On an overall basis 47.4 percent of such SMEs had co-developments with their supply chain partners.

The overall data responses showed a tendency to be equally involved with suppliers and customers for co-development initiative. The horizontal co-development was nearly 10 percent less as compared to vertical co-developments. Table 4.39 provides more details about co-development with supply chain partners.

Co-development with:	Local		Foreign		Foreign-Local		Total	
	F	%	F	%	F	%	F	%
Supplier	27	19.3	18	31.6	7	12.3	52	20.5
Customer	36	25.7	9	15.8	6	10.5	51	20.1
Competitor	6	4.3	3	5.3	2	3.5	11	4.3
Other Organisation	20	14.3	10	17.5	17	29.8	47	18.5
Vertical	49	35.0	21	36.8	10	17.5	80	31.5
Horizontal	23	16.4	13	22.8	19	33.3	55	21.7
Overall	63	45.0	29	50.9	27	47.4	119	46.9
Number of companies in collaborative relationship	140	100.0	57	100.0	57	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 4.39: Co-development and ownership

In terms of average effectiveness of co-development initiatives with respect to ownership, the average effectiveness for foreign SMEs is better than that of the local and local-foreign SMEs. The standard deviation and range values were also different for all the three ownership types. Negative skewness for both the local and foreign SMEs indicated that most of the effectiveness score were above the mean value. Table 4.40 provides more details on this.

		Average Effectiveness: Co-development			
		Local	Foreign	Local-foreign	Total
Frequency	Yes	55	25	27	107
	No	85	32	30	147
Central Tendency & Dispersion	Mean	6.70	6.92	5.83	6.54
	Median	7.00	7.00	6.00	7.00
	Standard Deviation	2.03	1.93	1.18	1.86
	Skewness	-1.05	-0.29	0.30	-0.54
	Minimum	1.00	3.00	4.00	1.00
	Maximum	10.00	10.00	8.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.40: Average effectiveness: Co-development and ownership

b) Estimated Values

For local SMEs, at 95% MOE the estimated percentage of such SMEs in the co-development relationship will be from 31 to 47 percent while at 99% MOE, 30 to 49 percent of such SMEs will have co-developments with their supply chain partners. At 95% MOE, the average effectiveness of foreign SMEs will range from 6.42 to 7.42 on a 10 point scale and at 99% MOE the estimated mean score will be 6.26 to 7.58. It can be expected that co-development relationship will be common up to 50 percent on an overall SME population and the mean effectiveness will be high up to 6.84. Specific details related to the three ownership types are shown in the Table 4.41.

		Class Interval for Average Effectiveness: Co-development			
		Local	Foreign	Local-foreign	Total
Estimated	@95% MOE	31 to 47	31 to 57	34 to 60	36 to 48
Percentage	@99% MOE	30 to 49	27 to 61	30 to 64	34 to 50
Estimated Mean Score	@95% MOE	6.37 to 7.04	6.42 to 7.42	5.53 to 6.14	6.31 to 6.76
	@99% MOE	6.26 to 7.15	6.26 to 7.58	5.43 to 6.24	6.23 to 6.84

Table 4.41: Class interval for co-development and ownership

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and a post-hoc test were conducted to explore the impact of ownership of organisation on co-development initiative. The detailed results are tabulated in the Table 4.42.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	3.44	0.033	0.02	0.193* (2 & 3)	0.029
	253				-	-
1B and 2	2	3.38	0.036	0.02	0.152* (1 & 3)	0.042
	253				-	-
1C and 2	2	0.10	0.90	0.00	-	-
	253				-	-
1D and 2	2	3.31	0.038	0.02	0.155* (1 & 3)	0.029
	253				-	-
1E and 2	2	3.39	0.035	0.02	0.175* (1 & 3)	0.044
	253				-	-
1F and 2	2	3.49	0.032	0.01	0.169* (1 & 3)	0.024
	253				-	-
1G and 2	2	0.28	0.754	0.00	-	-
	253				-	-
1H and 2	2	2.77	0.658	-	-	-
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Ownership;** 1- Local, 2-Foreign, 3-Local-foreign joint ventures.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between ownership.

Table 4.42: Co-development and ownership- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-development initiative for the three respondents groups. The results are:

- The value $F(2, 253) = 3.44$, $p = 0.033$ showed significant difference between co-development with suppliers according to type of ownership. Eta squared value of 0.02 implied that the actual difference in mean scores between the groups was not moderate. Tukey HSD test indicated that the mean score for foreign and local-foreign SMEs was significantly different (0.193, $p = 0.029$) No other significant differences were found between local and foreign SMEs and local and local-foreign SMEs.
- The value $F(2, 253) = 3.38$, $p = 0.036$ showed significant difference between co-development with customers according to type of ownership. Eta squared value of 0.02 implied that the actual difference in mean scores between the groups was low. Post-hoc comparison indicated that the mean score for local and local-foreign SMEs was significantly different (0.152, $p = 0.042$). No other significant differences were found between local and foreign SMEs and foreign and local-foreign SMEs.

- iii. Although $F(2, 253) = 3.31$, $p = 0.035$ showed significant difference between co-development with other organisation according to ownership type but the actual difference in mean scores between the groups was low (Eta squared value 0.02). Tukey HSD test indicated that the mean score for local and local-foreign SMEs was significantly different (0.155, $p = 0.029$).
- iv. Although $F(2, 253) = 3.39$, $p = 0.0223$ showed significant difference between vertical co-development (co-developments with suppliers and or customers) according to ownership type. The actual difference is not very high as indicated by Eta squared value. Post-hoc comparison indicated that the mean score for local and local-foreign SMEs was significantly different (0.175, $p = 0.044$). No other significant differences were found between local and foreign SMEs and foreign and local-foreign SMEs.
- v. The value $F(2, 253) = 26.93$, $p = 0.000$ showed significant difference between horizontal co-development according to the type of ownership. The actual difference in mean scores between the groups was low. The effect size, calculates using Eta squared, was 0.01. Post-hoc comparison using the Tukey HSD test indicated that the mean score of local SMEs was significantly different from local-foreign SMEs (0.169, $p = 0.024$).

4.3.2.3 Co-development and Supply Chain Structure

a) Descriptive Results-

SMEs with S-M-R structure were more inclined towards customers (27 percent) and suppliers (25.7 percent) for their co-development relationship. They were less involved with their competitors for co-development relations. Such structures had higher likelihood toward vertical co-developments as compared to horizontal co-developments. The overall inclination for co-development initiative was nearly 51 percent for such supply chain structures.

A different pattern is found in the S-M-W-R structures where 24 percent of such structures were involved with other organisations for their co-development initiative. None of such structure had co-development with the competitors. However such structures had higher inclination for horizontal relations as compared to vertical relations with respect to co-developments. On an overall basis 40 percent of such SMEs had co-developments with the chain partners.

S-M-D-R structures had more involvement with customers (18.1 percent) followed by suppliers (16.7 percent) and other organisation (12.5 percent) for their co-development relationship. The horizontal co-developments had lower percentage as compared to vertical co-developments for such supply chain structures.

On the other hand, half of the SMEs with more complex supply chain structures (S-M-W-D-R) had co-developments with their partners. Such structure found to have more co-developments with suppliers (25 percent) and customers (20 percent). Again horizontal co-developments were less as compared to vertical co-developments. Table 4.43 provides more details about co-development with supply chain

partners.

Co-development with:	S-M-R		S-M-W-R		S-M-D-R		S-M-W-D-R	
	F	%	F	%	F	%	F	%
Supplier	19	25.7	5	10.0	12	16.7	14	25.5
Customer	20	27.0	6	12.0	13	18.1	11	20.0
Competitor	3	4.1	0	0.0	3	4.2	4	7.3
Other Organisation	14	18.9	12	24.0	9	12.5	11	20.0
Vertical	28	37.8	9	18.0	22	30.6	19	34.5
Horizontal	16	21.6	12	24.0	12	16.7	14	25.5
Overall	38	51.4	19	38.0	32	44.4	28	50.9
Number of companies in collaborative relationship	74	100.0	50	100.0	72	100.0	55	100.0

(F:Frequency, %: Valid percentage)

Table 4.43: Co-development and supply chain structure

In terms of average effectiveness of co-development initiatives with respect to structure of supply chain, the results showed higher value of mean for S-M-W-R supply chain structure as compared to other structures. S-M-W-R structures had positive value of skewness while all others had a negative value for the skewness. The minimum score for the effectiveness was also higher for the S-M-W-R supply chain structure as compared to other structures. Table 4.44 provides more details:

		Average Effectiveness: Co-development			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Frequency	Yes	32	19	30	24
	No	42	31	42	31
Central Tendency & Dispersion	Mean	6.47	7.37	6.60	5.98
	Median	7.00	7.00	7.00	6.00
	Standard Deviation	1.88	1.67	1.96	1.76
	Skewness	-0.95	0.06	-0.72	-0.35
	Minimum	1.00	5.00	1.00	2.00
	Maximum	9.00	10.00	10.00	9.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.44: Average effectiveness: Co-development and supply chain structure

b) Estimated Values

For SMEs with S-M-W-D-R supply chain structure, at 99% MOE the estimated percentage of such SMEs in the co-development relationship will be from 26 to 61 percent while at 95% MOE, 31 to 57 percent of such SMEs will have co-development with their supply chain partners. At 99% MOE, the average effectiveness of such SMEs will range from 5.37 to 6.59 on a 10 point scale and at 95% MOE the estimated mean score will be 5.51 to 6.44. Specific details related to the type of supply chain structure are shown in the Table 4.45.

Class Interval for Average Effectiveness: Co-development					
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Estimated	@95% MOE	32 to 55	25 to 51	30 to 53	31 to 57
Percentage	@99% MOE	28 to 58	20 to 56	27 to 57	26 to 61
Estimated Mean Score	@95% MOE	6.04 to 6.90	6.90 to 7.83	6.15 to 7.05	5.51 to 6.44
	@99% MOE	5.90 to 7.03	6.76 to 7.98	6.01 to 7.19	5.37 to 6.59

Table 4.45: Class interval for co-development and supply chain structure

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and a post-hoc test were conducted to explore the impact of supply chain structure on co-development initiative. Responses were divided into four groups: S-M-R, S-M-W-R, S-M-D-R and S-M-W-D-R. The detailed results are tabulated in the Table 4.46.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	3	2.55	0.040	0.03	0.33* (2 & 4)	0.046
	253				-	-
1B and 2	3	1.19	0.315	-	-	-
	253				-	-
1C and 2	3	2.42	0.49	-	-	-
	253				-	-
1D and 2	3	0.80	0.522	-	-	-
	253				-	-
1E and 2	3	1.19	0.108	-	-	-
	253				-	-
1F and 2	3	0.47	0.753	-	-	-
	253				-	-
1G and 2	3	0.78	0.533	-	-	-
	253				-	-
1H and 2	3	1.74	0.694	-	-	-
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Supply Chain Structure;** 1 S-M-R, 2 S-M-W-R, 3 S-M-D-R, 4 S-M-W-D-R.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between supply chain structures.

Table 4.46: Co-development and Supply chain structure- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-development initiative for the three respondents groups. The results are:

- i. Although $F(3, 253) = 2.55$, $p = 0.040$ showed significant difference between co-development with suppliers according to structure of supply chain but the actual difference was not moderate as suggested by Eta squared value of 0.03. Post-hoc comparison indicated that the mean score for structure 'S-M-W-R' was significantly different from structure 'S-M-W-D-R' (0.33, $p = 0.046$).

4.3.2.4 Co-development and Age of Organisation

a) Descriptive Results-

The organisations which were aged less than 10 years had more inclination for co-development with other organisation (16.7 percent) and 18.1 percent of such organisations had co-developments with their customers, however, percentage of co-development with competitors was found less (4.2 percent). In such companies percentage of horizontal co-developments was less as compared to percentage of vertical co-development. The overall co-development initiative was nearly 45 percent in these organisations.

For organisations that were aged between 10 and 24 years, co-development with other organisations and customers emerged to be the more commonly used strategy whereas co-developments with rest of the other partners were not common. It was found that such organisations were more inclined towards horizontal co-developments as compared to vertical co-developments. On a combined basis co-development was a common initiative in such organisations.

As far as organisations which aged more than 25 years were concerned, they were more inclined in co-developments with suppliers (34.0 percent) and customers (24.3 percent) than with competitors. Such firms were found to have more involvement in vertical co-developmental relations as compared to horizontal co-developments. The overall co-development initiative was popular in such organisations.

The overall data responses showed equal inclination for co-developments with suppliers and customers rather than with other organisations or competitors. As a result, the horizontal co-developments were less as compared to vertical co-developments. Table 4.46 provides more details about co-development with supply chain partners.

Co-development with:	Less than 10 yrs		10 to 24 yrs		25 and more		Total	
	F	%	F	%	F	%	F	%
Supplier	10	13.9	7	8.9	35	34.0	52	20.5
Customer	13	18.1	13	16.5	25	24.3	51	20.1
Competitor	3	4.2	0	0.0	8	7.8	11	4.3
Other Organisation	12	16.7	19	24.1	16	15.5	47	18.5
Vertical	20	27.8	15	19.0	45	43.7	80	31.5
Horizontal	15	20.8	19	24.1	21	20.4	55	21.7
Overall	32	44.4	31	39.2	56	54.4	119	46.9
Number of companies in collaborative relationship	72	100.00	79	100.00	72	100.00	79	100.00

Table 4.46: Co-development and age

In terms of average effectiveness of co-development initiatives with respect to age, the results showed similar values for mean and median. The range value was found to be similar for all the three types of organisations. Moreover all the three groups had negative skewness which implies that most of the effectiveness value lies above mean. Table 4.47 provides more details:

		Average Effectiveness: Co-development			Total
		Less than 10 yrs		25 and more	
			10 to 24 yrs		
Frequency	Yes	30	30	47	107
	No	42	49	56	147
Central Tendency & Dispersion	Mean	6.30	6.48	6.72	6.54
	Median	7.00	6.00	7.00	7.00
	Standard Deviation	1.64	2.08	1.87	1.86
	Skewness	-1.12	-0.34	-0.54	-0.54
	Minimum	1.00	1.00	2.00	1.00
	Maximum	9.00	10.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.47: Average effectiveness: Co-development and age

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. On an overall basis, at 95% MOE the estimated percentage of SMEs in the co-development relationship would be from 36 to 48 percentages while at 99% MOE, 34 to 50 percent of the SMEs were expected to have co-developments with their supply chain partners. At 95% MOE, the average effectiveness would range from 6.35 to 6.55 on a 10 point scale and at 99% MOE the estimated mean score will be as high as 6.56. For the organisations aged less than 10 years, it can be expected that co-development relationship will be popular up to 57 percent and the mean effectiveness would be high up to 7.36. Specific details related to the three groups are shown in the Table 4.48.

Class Interval for Average Effectiveness: Co-development					
		Less than			
		10 yrs	10 to 24 yrs	25 and more	Total
Estimated Percentage	@95% MOE	30 to 53	27 to 49	36 to 55	36 to 48
	@99% MOE	27 to 57	24 to 52	33 to 58	34 to 50
Estimated Mean Score	@95% MOE	6.26 to 7.34	6.43 to 6.53	6.68 to 6.76	6.53 to 6.55
	@99% MOE	6.24 to 7.36	6.41 to 6.55	6.67 to 6.77	5.52 to 6.56

Table 4.48: Class interval for co-development and age

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and a post-hoc test were conducted to explore the impact of age of organisation on co-development initiative. Responses were divided into three groups: organisations aged less than 10 years, organisations aged between 10 and 24 years and organisations aged more than 25 years. The detailed results are tabulated in the Table 4.49.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	10.19	0.000	0.08	0.201* (1 & 3)	0.003
	253				0.251* (2 & 3)	0.003
1B and 2	2	0.97	0.379	-	-	-
	253					
1C and 2	2	3.30	0.038	0.02	0.18* (2 & 3)	0.029
	253					
1D and 2	2	1.18	0.308	-	-	-
	253					
1E and 2	2	6.92	0.001	0.06	0.498* (2 & 3)	0.001
	253					
1F and 2	2	0.19	0.821	-	-	-
	253					
1G and 2	2	2.18	0.115	-	-	-
	253					
1H and 2	2	0.47	0.624	-	-	-
	116					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Age of organisation;** 1- up to 10 years, 2- 10 -24 years, 3- 25 years and more.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between age of age of organisation.

Table 4.49: Co-development and age- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in the co-development

relationship for the three respondents groups:

- i. Although the value $F(2, 253) = 10.19$, $p = 0.000$ suggested significant difference between co-development with suppliers according to age of organisation. The actual difference in mean scores between the groups was high (Eta squared value of 0.08). Post-hoc comparison indicated that the mean score for organisations which were aged more than 25 years was significantly different from organisations which were aged between 10 and 24 years (0.251 , $p = 0.003$) and also with organisations which were aged less than 10 (0.201 , $p = 0.003$).
- ii. The value $F(2, 253) = 3.30$, $p = 0.038$ showed significant difference between co-development with competitors according to age of organisation. The actual difference in mean scores between the groups was not high (Eta squared value of 0.02). The result indicated that the mean score for organisations which were aged more than 25 years was significantly different from organisations which were aged between 10 and 24 years (0.18 , $p = 0.029$).
- iii. The value $F(2, 253) = 6.92$, $p = 0.001$ showed significant difference between vertical co-development relationship age of organisation. The actual difference in mean scores between the groups was moderate and the Post-hoc comparison indicated that the mean score for organisations that were aged between 10 and 24 years was significantly different from organisations which were aged more than 25 years (0.498 , $p = 0.001$).

4.3.2.5 Correlation of Co-development and other collaborative initiatives:

The relationship between co-development with other type of relationship was analysed using bi-variate correlation method. Due to restriction of number of cases, the separate correlation analysis using country, ownership and supply chain structures as independent variables was not possible. However the correlation analysis was possible for all the responses taken as a whole. Moreover with the absence of any definite independent variable regression analysis was not conducted to avoid complexity of results. Spearman's rho values (non-parametric test) were used to measure the correlation as some of the variables failed the normality test. The relationship of co-development with other collaborative initiatives is summarised in the correlation matrix shown in Table 4.50.

Effectiveness of:		Effectiveness of Co-development with:			
		Supplier	Customer	Competitor	Other Organisation
Joint Ventures with:	Supplier	.684**	.697**	-	-
	Customer	.552**	-	-	.453*
Co-development with:	Supplier	-	.896**	-	.642*
	Other Organisation	-	.994**	-	-
Co-design with:	Supplier	.690**	-	-	-
	Customer	.702**	.660**	-	.795**
CPFR with:	Supplier	.494*	.534*	-	.759**
	Customer	-	.686**	-	.596**

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.50: Correlation of effectiveness of co-development with other collaborative initiatives

It was found that within co-development initiative, co-development with supplier had a strong positive relation with co-development with customer ($r = 0.896$) and was also positively related to co-development with other organisation ($r = 0.642$). Moreover co-development with customers and co-development with other organisations were strongly related ($r = 0.994$). Co-development with suppliers was also found to have positive relation with co-design with suppliers and co-design with customer. Relationship between co-developments with competitors and any other collaborative initiatives were found in the data. CPFR with supplier was found to be positively related to all the co-developments except with competitors. In conclusion, co-development found to have positive effect on some other collaborative initiatives.

4.3.3 Co-design-

4.3.3.1 Co-design and Size of Organisation

1) Descriptive Results-

For their co-designs initiatives, almost 37 percent and 21 percent of the micro organisations were involved with customers and other organisations respectively whereas only 2.6 percent of such companies had co-designs with their competitors. Such companies had more inclination for vertical relations as compared to horizontal relationship for the co-designs. The overall co-designs initiative was very popular with a percentage of 69 percent.

Small companies were equally involved with their suppliers and customers for the co-designs relationship. Co-designs with competitors was found to be a very less popular strategy with only 6.3 percent of such companies involved in it. Vertical co-designs were more than double in percentage as compared to horizontal joint ventures.

Medium-sized organisations had more inclination towards co-designs with suppliers (22.0 percent) and

customers (19.7 percent). As a result of this, the percentage of vertical co-designs was more than double of the horizontal co-designs percentage. On a combined basis almost 46 percent of such firms had co-designs with their supply chain partners.

The overall data responses showed more inclination for co-designs with other suppliers and customers and less with competitors. The vertical co-designs were more as compared to horizontal co-designs. Table 4.51 provides more details about co-design with supply chain partners.

Co-design with:	Micro		Small		Medium		Total	
	F	%	F	%	F	%	F	%
Supplier	6	15.8	16	25.0	28	22.0	50	21.8
Customer	14	36.8	16	25.0	25	19.7	55	24.0
Competitor	1	2.6	4	6.3	3	2.4	8	3.5
Other Organisation	8	21.1	8	12.5	19	15.0	35	15.3
Vertical	18	47.4	28	43.8	42	33.1	88	38.4
Horizontal	9	23.7	12	18.8	20	15.7	41	17.9
Overall	26	68.4	36	56.3	58	45.7	120	52.4
Number of companies in collaborative relationship	38	100.0	64	100.0	127	100.0	229	100.0

Table 4.51: Co-design and size

In terms of average effectiveness of co-design initiatives with respect to size, the results showed similar values for mean and median. However the standard deviation and range were different for all the three types of organisations. Additionally, all the three groups had negative skewness which implies that most of the effectiveness value lies above mean. Table 4.52 provides more details:

		Average Effectiveness: Co-design			
		Micro	Small	Medium	Total
Frequency	Yes	22	34	53	125
	No	16	30	74	129
Central Tendency & Dispersion	Mean	6.59	6.71	6.40	6.42
	Median	7.00	7.00	6.00	7.00
	Standard Deviation	2.04	1.90	1.63	1.77
	Skewness	-0.87	-0.34	-0.26	-0.46
	Minimum	2.00	2.00	3.00	1.00
	Maximum	10.00	10.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.52: Average effectiveness: Co-design and size

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. At 95% Margin of Error (MOE) the estimated percentage of micro organisations

in the co-design relationship would be from 42 to 74 percentage while at 99% MOE, 37 to 79 percent of such companies are expected to have co-designs with their supply chain partners. For small firms, at 95% MOE, the average effectiveness would range from 6.65 to 6.77 on a 10 point scale and at 99% MOE the estimated mean score will be as high as 7.79. Specific details related to the three groups are shown in the Table 4.53.

		Class Interval for Average Effectiveness: Co-design			
		Micro	Small	Medium	Total
Estimated Percentage	@95% MOE	42 to 74	41 to 65	33 to 50	43 to 55
	@99% MOE	37 to 79	37 to 69	30 to 53	41 to 57
Estimated Mean Score	@95% MOE	6.48 to 6.70	6.65 to 6.77	6.37 to 6.43	6.41 to 6.43
	@99% MOE	6.45 to 6.73	6.63 to 7.79	6.36 to 6.44	5.40 to 6.44

Table 4.53: Class interval for co-design and size

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and a post-hoc test were conducted to explore the impact of size on co-design initiative. Responses were divided into three groups: micro, small and medium-sized organisations. The detailed results are tabulated in the Table 4.54.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	0.59	0.554	-	-	-
	228					
1B and 2	2	2.41	0.093	-	-	-
	228					
1C and 2	2	1.00	0.370	-	-	-
	228					
1D and 2	2	0.68	0.508	-	-	-
	228					
1E and 2	2	1.80	0.168	-	-	-
	228					
1F and 2	2	0.64	0.528	-	-	-
	228					
1G and 2	2	3.35	.037	0.03	0.228* (1 & 3)	0.036
	228					
1H and 2	2	0.32	0.727	-	-	-
	108					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H-average effectiveness , **Variable 2: Size of organisation;** 1- Micro, 2- Small, 3- Medium.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between size of organisation.

Table 4.54: Co-design and size- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-design with other organisations for the three respondents groups:

- The value $F(2, 228) = 3.35$, $p = 0.037$ showed significant difference between co-design initiative according to size. However, the actual difference in mean scores between the groups was not high as suggested by the Eta squared value. Post-hoc comparison indicated that the mean score for micro organisations was significantly different from medium-sized organisations (0.22, $p = 0.036$) but not from small organisations. Moreover, small and medium-sized organisations did not significantly differ from each other.
- The results also showed that for the three groups there were no statistical differences at the $p < 0.05$ level in joint venture initiative with individual supply chain partners or in terms of vertical or horizontal relations.

4.3.3.2 Co-design and Ownership

a) Descriptive Results-

For their co-design initiatives, nearly 30 percent and 20 percent of the local SMEs were involved with customers and suppliers respectively whereas only 3.6 percent of local companies had co-designs with their competitors. Local SMEs had more inclination for vertical co-design as compared to horizontal co-designs. The overall co-design initiative was nearly 55 percent with respect to local companies.

Similarly, foreign SMEs were more involved towards vertical co-design rather than vertical co-design which is reflected by 30 percent and 23 percent of the SMEs which involved with their suppliers and customers respectively for the co-design relationship. Co-design with competitors and other organisation were found to be very less popular strategies.

Local-foreign SMEs had a much higher tendency (36.8 percent) to be involved with other organisation for their co-design relations and as a result of this, their horizontal co-designs were more than three times that of their vertical co-designs. The overall basis almost 56 percent of such SMEs had co-designs with their supply chain partners. Table 4.55 provides more details about co-design with supply chain partners.

Co-design with:	Local		Foreign		Foreign-Local		Total	
	F	%	F	%	F	%	F	%
Supplier	28	20.0	17	29.8	5	8.8	50	19.7
Customer	42	30.0	13	22.8	5	8.8	60	23.6
Competitor	5	3.6	1	1.8	3	5.3	9	3.5
Other Organisation	23	16.4	3	5.3	21	36.8	47	18.5
Vertical	58	41.4	25	43.9	10	17.5	93	36.6
Horizontal	26	18.6	4	7.0	33	57.9	63	24.8
Overall	77	55.0	27	47.4	32	56.1	136	53.5
Number of companies in collaborative relationship	140	100.0	57	100.0	57	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 4.55: Co-design and ownership

In terms of average effectiveness of co-design initiatives with respect to ownership, the average effectiveness for foreign SMEs was higher than that of both local and local-foreign SMEs. Foreign SMEs were found to be positively skewed as opposed to the other two types. Table 4.56 provides more details:

		Average Effectiveness: Co-design			
		Local	Foreign	Local-foreign	Total
Frequency	Yes	70	23	32	125
	No	70	34	25	129
Central Tendency & Dispersion	Mean	6.47	6.70	6.13	6.42
	Median	7.00	6.00	6.00	7.00
	Standard Deviation	2.00	1.61	1.31	1.77
	Skewness	-0.66	0.40	-0.52	-0.46
	Minimum	1.00	4.00	3.00	1.00
	Maximum	10.00	10.00	8.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.56: Average effectiveness: Co-design and ownership

b) Estimated Values

For local SMEs, at 95% MOE the estimated percentage of such SMEs in the co-design relationship will be from 42 to 58 percent while at 99% MOE, 40 to 60 percent of such SMEs will have co-design with their supply chain partners. At 95% MOE, the average effectiveness of foreign SMEs will range from 6.28 to 7.11 on a 10 point scale and at 99% MOE the estimated mean score will be 6.15 to 7.24. It can be expected that co-design relationship will be coming up to 73 percent in the local-foreign SME population and the mean effectiveness will be high up to 6.57. Specific details related to the three ownership types are shown in the Table 4.57.

		Class Interval for Average Effectiveness: Co-design			
		Local	Foreign	Local-foreign	Total
Estimated	@95% MOE	42 to 58	28 to 53	43 to 69	43 to 55
Percentage	@99% MOE	40 to 60	24 to 57	39 to 73	41 to 57
Estimated Mean Score	@95% MOE	6.14 to 6.80	6.28 to 7.11	5.78 to 6.47	6.21 to 6.64
	@99% MOE	6.04 to 6.91	6.15 to 7.24	5.68 to 6.57	6.14 to 6.71

Table 4.57: Class interval for co-design and ownership

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and a post-hoc test were conducted to explore the impact of ownership of organisation on co-design initiative. The detailed results are tabulated in the Table 4.58.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	4.08	0.018	0.03	0.211* (2 & 3)	0.013
	253				-	-
1B and 2	2	5.22	0.006	0.04	0.122* (1 & 3)	0.004
	253				-	-
1C and 2	2	0.519	0.601	-	-	-
	253				-	-
1D and 2	2	10.57	0.000	0.08	0.204* (1 & 3)	0.002
	253				0.316* (2 & 3)	0.000
1E and 2	2	6.01	0.003	0.04	0.238* (1 & 3)	0.004
	253				0.263* (2 & 3)	0.009
1F and 2	2	10.82	0.000	0.08	0.217* (1 & 3)	0.001
	253				0.333* (2 & 3)	0.004
1G and 2	2	0.57	0.566	-	-	-
	253				-	-
1H and 2	2	0.74	0.477	-	-	-
	106				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Ownership;** 1- Local, 2-Foreign, 3-Local-foreign joint ventures.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between ownership.

Table 4.58: Co-design and ownership- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-design initiative for the three respondents groups. The results are:

- Although $F(2, 253) = 4.08$, $p = 0.018$ showed significant difference between co-development with supplier according to ownership type but the actual difference in mean scores between the groups was not moderate (Eta squared value 0.03). Tukey HSD test indicated that the mean score for foreign and local-foreign SMEs was significantly different (0.211, $p = 0.013$).
- Although $F(2, 253) = 5.22$, $p = 0.006$ showed significant difference between co-development with customer according to ownership type but the actual difference in mean scores between the groups was not moderate (Eta squared value 0.04). Post-hoc comparison indicated that the mean score for local and local-foreign SMEs was significantly different (0.122, $p = 0.004$).
- The value $F(2, 253) = 10.57$, $p = 0.000$ showed significant difference between co-design with other organisation according to ownership type. The actual difference in mean scores between the groups was high. The Eta squared value was 0.08. Post-hoc comparison using the Tukey HSD test indicated that the mean score for local-foreign SMEs was significantly different from

local SMEs (0.204, $p = 0.002$) and foreign SMEs (0.316, $p = 0.000$). However local SMEs and foreign SMEs did not significantly differ from each other.

- iv. The value $F(2, 253) = 6.01$, $p = 0.003$ showed significant difference between vertical co-design with suppliers and/or customers according to ownership type but the actual difference in mean scores between the groups was not moderate (Eta squared value 0.04). Tukey HSD test indicated that the mean score for local-foreign SMEs was significantly different from local SMEs (0.238, $p = 0.004$) and foreign SMEs (0.263, $p = 0.009$). Whereas local SMEs and foreign SMEs did not significantly differ from each other
- v. The value $F(2, 253) = 10.82$, $p = 0.000$ showed significant difference between co-design with competitors and/or other organisation according to the type of ownership. The actual difference in mean scores between the groups was high as reflected by the effect size value of 0.18. Post-hoc comparison indicated that the mean score of local-foreign SMEs was significantly different from local SMEs (0.217, $p = 0.001$) and foreign SMEs (0.333, $p = 0.004$). However local SMEs and foreign SMEs did not significantly differ from each other.

4.3.3.3 Co-design and Supply Chain Structure

a) Descriptive Results-

SMEs with S-M-R structure were inclined towards customers (28.4 percent) and suppliers (25.7 percent) for their co-design relationship. They were less likely to be involved with their competitors for co-designs. Such structures had higher probability to be involved in vertical co-designs (43.2 percent) as opposed to horizontal co-designs (18.9 percent). The overall inclination for co-design initiative was nearly 58 percent for such supply chain structures.

A similar pattern was found in the S-M-W-R structures also. 16 percent and 12 percent of such structures were involved with customers and suppliers respectively for the co-design initiative whereas only 2 percent of such structure had co-design with the competitors. Moreover such structures had higher inclination for vertical relations (26 percent) as compared to horizontal relations (20 percent) with respect to co-designs. There was 42 percent likelihood to enter in co-design for S-M-W-R structures.

S-M-D-R structures too had more involvement with suppliers and customers. Again the vertical co-design had higher percentage as compared to horizontal co-designs for such supply chain structures. On an overall basis such structures had more likeliness (.61) to enter in co-designs with their supply chain partners.

One fourth of the SMEs with more complex supply chain structures (S-M-W-D-R) had co-designs with customers. 18.2 percent of such SMEs had co-designs with other organisation. However, horizontal co-design and vertical co-designs did not differ by large percentage. On an overall basis 47.3 percent of such structures had co-designs with partners. Table 4.59 provides more details about co-design with supply chain partners.

Co-design with:	S-M-R		S-M-W-R		S-M-D-R		S-M-W-D-R	
	F	%	F	%	F	%	F	%
Supplier	19	25.7	6	12.0	18	25.0	5	9.1
Customer	21	28.4	8	16.0	16	22.2	14	25.5
Competitor	2	2.7	1	2.0	1	1.4	4	7.3
Other Organisation	13	17.6	9	18.0	14	19.4	10	18.2
Vertical	32	43.2	13	26.0	30	41.7	16	29.1
Horizontal	14	18.9	10	20.0	15	20.8	13	23.6
Overall	43	58.1	21	42.0	44	61.1	26	47.3
Number of companies in collaborative relationship	74	100.0	50	100.0	72	100.0	55	100.0

(F:Frequency, %: Valid percentage)

Table 4.59: Co-design and supply chain structure

In terms of average effectiveness of co-design initiatives with respect to structure of supply chain, the results showed similar values of mean for all the supply chain structures except S-M-W-D-R. Moreover the skewness was negative for all the supply chain structures. The minimum and maximum scores for the effectiveness also differed for all the structures. Table 4.60 provides more details:

		Average Effectiveness: Co-design			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Frequency	Yes	37	21	42	23
	No	37	29	30	32
Central Tendency & Dispersion	Mean	6.35	6.95	6.52	5.96
	Median	6.00	7.00	7.00	6.00
	Standard Deviation	1.75	1.94	1.76	1.72
	Skewness	-0.12	-0.16	-1.23	-0.52
	Minimum	2.00	4.00	1.00	2.00
	Maximum	10.00	10.00	9.00	9.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.60: Average effectiveness: Co-design and supply chain structure

b) Estimated Values

For SMEs with S-M-D-R supply chain structure, at 95% MOE the estimated percentage of such SMEs in the co-design relationship will be from 47 to 70 percent while at 99% MOE, 43 to 73 percent of such SMEs will have co-design with their supply chain partners. At 95% MOE, the average effectiveness of such SMEs will range from 6.12 to 6.93 on a 10 point scale and at 99% MOE the estimated mean score will be between 5.99 and 7.06. It can be expected that co-design relationship will be popular up to 60 percent in the S-M-W-R structured SMEs and the mean effectiveness will be high up to 7.66. Specific details related to the type of supply chain structure are shown in the Table 4.61.

Class Interval for Average Effectiveness: Co-design					
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Estimated	@95% MOE	39 to 61	28 to 56	47 to 70	29 to 55
Percentage	@99% MOE	35 to 65	24 to 60	43 to 73	25 to 59
Estimated Mean Score	@95% MOE	5.95 to 6.75	6.42 to 7.49	6.12 to 6.93	5.50 to 6.41
	@99% MOE	5.85 to 6.88	6.25 to 7.66	5.99 to 7.06	5.36 to 6.55

Table 4.61: Class interval for co-design and supply chain structure

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and a post-hoc test were conducted to explore the impact of supply chain structure on co-design initiative. The detailed results are tabulated in the Table 4.62.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	3	3.33	0.110	-	-	-
	253				-	-
1B and 2	3	0.73	0.584	-	-	-
	253				-	-
1C and 2	3	2.95	0.061	-	-	-
	253				-	-
1D and 2	3	0.131	0.971	-	-	-
	253				-	-
1E and 2	3	1.79	0.130	-	-	-
	253				-	-
1F and 2	3	0.18	0.949	-	-	-
	253				-	-
1G and 2	3	1.51	0.190	-	-	-
	253				-	-
1H and 2	3	1.05	0.348	-	-	-
	106				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Supply Chain Structure;** 1 S-M-R, 2 S-M-W-R, 3 S-M-D-R, 4 S-M-W-D-R.
- **Mean Difference*:-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between supply chain structures.

Table 4.62: Co-design and Supply chain structure- ANOVA and Post Hoc Test

The results showed that there were no statistical differences at the $p < 0.05$ level in co-design initiative for the three respondents groups.

4.3.3.4 Co-design and Age of Organisation

a) Descriptive Results-

The organisations which were aged less than 10 years had more inclination for co-design with other organisation (22.2 percent) and 19.1 percent of such organisations had co-designs with their customers, whereas only 1.4 percentage of such firms had co-design relations with their competitors. In such companies percentage of horizontal co-designs was less as compared to percentage of vertical co-design. The overall co-design initiative was more common (56 percent) in such organisations.

For organisations that were aged between 10 and 24 years, co-design with other organisations and customers emerged to be the more commonly used strategy whereas co-designs with competitors was rarely used initiative. It was found that such organisations were equally inclined towards horizontal and vertical co-design relationship.

As far as organisations which aged more than 25 years were concerned, they were more inclined in co-designs with suppliers (29.1 percent) and customers (30.1 percent). Such firms were found to have more involvement in vertical co-designs as compared to horizontal co-designs. The overall co-design initiative was popular in such organisations.

The overall data responses showed more inclination for co-designs with suppliers, customers and other organisations. As a result, the horizontal co-designs were less as compared to vertical co-designs. Table 4.33 provides more details about co-design with supply chain partners.

Co-design with:	Less than 10 yrs		10 to 24 yrs		25 and more		Total	
	F	%	F	%	F	%	F	%
Supplier	11	15.3	9	11.4	30	29.1	50	19.7
Customer	14	19.4	15	19.0	31	30.1	60	23.6
Competitor	1	1.4	2	2.5	6	5.8	9	3.5
Other Organisation	16	22.2	18	22.8	13	12.6	47	18.5
Vertical	24	33.3	20	25.3	49	47.6	93	36.6
Horizontal	17	23.6	19	24.1	17	16.5	53	20.9
Overall	40	55.6	37	46.8	59	57.3	136	53.5
Number of companies in collaborative relationship	72	100.00	79	100.00	72	100.00	79	100.00

Table 4.63: Co-design and age

In terms of average effectiveness of co-design initiatives with respect to age, the results showed similar values for mean and median. The range value was found to be similar for all the three types of organisations. Moreover all the three groups had negative skewness which implied that most of the effectiveness value lies above mean. Table 4.64 provides more details:

		Average Effectiveness: Co-design			Total
		Less than 10 yrs	10 to 24 yrs	25 and more	
Frequency	Yes	38	37	50	125
	No	34	42	53	129
Central Tendency & Dispersion	Mean	6.34	6.32	6.56	6.42
	Median	7.00	6.00	7.00	7.00
	Standard Deviation	1.65	1.76	1.90	1.77
	Skewness	-0.66	-0.24	-0.56	-0.46
	Minimum	2.00	1.00	2.00	1.00
	Maximum	9.00	10.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.64: Average effectiveness: Co-design and age

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. On an overall basis, at 95% MOE the estimated percentage of SMEs in the co-design relationship would be from 43 to 55 percentages while at 99% MOE, 41 to 57 percent of the SMEs are expected to have co-designs with their supply chain partners. At 95% MOE, the average effectiveness would range from 6.41 to 6.43 on a 10 point scale and at 99% MOE the estimated mean score will be as high as 6.44. For the organisations aged less than 10 years, it can be expected that co-design relationship will be popular up to 68 percent and the mean effectiveness would be high up to 6.40. Specific details related to the three groups are shown in the Table 4.65.

		Class Interval for Average Effectiveness: Co-design			Total
		Less than 10 yrs	10 to 24 yrs	25 and more	
Estimated Percentage	@95% MOE	41 to 64	36 to 58	39 to 58	43 to 55
	@99% MOE	38 to 68	32 to 61	36 to 61	41 to 57
Estimated Mean Score	@95% MOE	6.30 to 6.38	6.28 to 6.36	6.52 to 6.60	6.41 to 6.43
	@99% MOE	6.28 to 6.40	6.26 to 7.38	6.51 to 6.61	5.40 to 6.44

Table 4.65: Class interval for co-design and age

c) Statistical Results-

A one-way between-groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of age of organisation on co-design initiative. Responses were divided into three groups: organisations aged less than 10 years, organisations aged between 10 and 24 years and organisations aged more than 25 years. The detailed results are tabulated in the Table 4.66.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	5.21	0.006	0.04	0.197* (2 & 3)	0.008
	253					
1B and 2	2	2.02	0.134	-	-	-
	253					
1C and 2	2	1.39	0.251	-	-	-
	253					
1D and 2	2	2.00	0.138	-	-	-
	253					
1E and 2	2	5.15	0.006	0.04	0.231* (2 & 3)	0.005
	253					
1F and 2	2	0.99	0.371	-	-	-
	253					
1G and 2	2	1.08	0.348	-	-	-
	253					
1H and 2	2	0.24	0.78	-	-	-
	124					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Age of organisation;** 1- up to 10 years, 2- 10 -24 years, 3- 25 years and more.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between age of age of organisation.

Table 4.66: Co-design and age- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in the co-design relationship for the three respondents groups.

- Although the value $F(2, 253) = 5.21$, $p = 0.006$ suggested significant difference between co-design with suppliers according to the age of organisation. The actual difference in mean scores between the groups was not moderate (Eta squared value of 0.04). Post-hoc comparison indicated that the mean score for organisations which were aged more than 25 years was significantly different from organisations which were aged between 10 and 24 years (0.197, $p = 0.008$).
- The value $F(2, 253) = 5.15$, $p = 0.006$ showed significant difference between vertical co-design relationship age of organisation. The actual difference in mean scores between the groups was

not moderate and the Post-hoc comparison indicated that the mean score for organisations that were aged between 10 and 24 years was significantly different from organisations which were aged more than 25 years (0.231 $p = 0.005$).

4.3.3.5 Correlation of Co-design and other collaborative initiatives:

The relationship between co-design relationships with other types of relationship was analysed using bi-variate correlation method. Due to restriction of number of cases, the separate correlation analysis using country, ownership and supply chain structures as independent variables was not possible. However the correlation analysis was possible for all the responses taken as a whole. Moreover with the absence of any definite independent variable regression analysis was not conducted to avoid complexity of results. Spearman's rho values (non-parametric test) were used to measure the correlation as some of the variables failed the normality test. The relationship of co-design with other collaborative initiatives is summarised in the correlation matrix shown in Table 4.67.

Effectiveness of:		Effectiveness of Co-design with:			
		Supplier	Customer	Competitor	Other Organisation
Joint Ventures with:	Supplier	-	.789**	-	-
	Customer	-	.889*	-	-
	Other Organisation	-	.672**	-	-
Co-development with:	Supplier	.690**	.702**	-	-
	Customer	-	.660**	-	.906**
	Other Organisation	-	.795**	-	.769**
Co-design with:	Customer	.796**	-	-	.935**
Co-manufacturing with:	Supplier	-	.607*	-	.744*
	Other Organisation	-	-	-	.752**
Aggregated Purchasing with:	Other Organisation	-	.553*	-	-
Co-logistics with:	Other Organisation	-	-	-	.916**
Joint Problem Solving with:	Supplier	.571**	-	-	-
	Customer	.649**	.564**	-	.680**
	Other Organisation	-	-	-	.392*
Shared Resources with:	Other Organisation	-	-	-	.763**
CPFR with:	Customer	-	-	-	.392*

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.67: Correlation of effectiveness of co-design with other collaborative initiatives

It was found that within co-design initiative, co-design with customer is positively correlated to co-design with other organisation ($r = 0.935$) and also with co-design with suppliers ($r = 0.796$). Except co-design with competitors, all other co-designs were found to have strong relation with other collaborative initiatives.

4.3.4 Co-manufacturing-

4.3.4.1 Co-manufacturing and Size of Organisation

1) Descriptive Results-

It was found that those micro organisations were more involved with other organisations for the co-manufacturing initiative, whereas only 2.6 percent of such companies had co-manufacturing with their customers. Such companies were found to have less inclination for vertical relations as compared to horizontal relationship for the co-manufacturing initiative. The overall co-manufacturing initiative was very popular with a percentage of around 40 percent.

Small companies were found to be more involved with their suppliers for the co-manufacturing relationship. Co-manufacturing with customers and competitors emerged to be a less popular strategy with only 6.3 percent and 7.8 percent respectively of such companies involved in it. Vertical co-manufacturing was slightly more than in percentage as compared to horizontal co-manufacturing.

Medium-sized organisations had more inclination towards co-manufacturing with suppliers (21.3 percent) and other organisations (23.6 percent). The percentage of vertical co-manufacturing was same as that of the horizontal co-manufacturing. On a combined basis almost 45 percent of such firms had co-manufacturing with their supply chain partners.

The overall data responses showed more inclination for co-manufacturing with other organisations and suppliers and less for customers and competitors. The percentage for vertical co-manufacturing was the same as that of the percentage of horizontal co-manufacturing. Table 4.68 provides more details about co-manufacturing with supply chain partners.

Co-manufacturing with:	Micro		Small		Medium		Total	
	F	%	F	%	F	%	F	%
Supplier	5	13.2	12	18.8	27	21.3	44	19.2
Customer	1	2.6	4	6.3	9	7.1	14	6.1
Competitor	2	5.3	5	7.8	7	5.5	14	6.1
Other Organisation	8	21.1	10	15.6	30	23.6	48	21.0
Vertical	6	15.8	15	23.4	31	24.4	52	22.7
Horizontal	10	26.3	14	21.9	31	24.4	55	24.0
Overall	15	39.5	27	42.2	57	44.9	99	43.2
Number of companies in collaborative relationship	38	100.0	64	100.0	127	100.0	229	100.0

Table 4.68: Co-manufacturing and size

In terms of average effectiveness of co-manufacturing initiatives with respect to size, the results showed similar values for mean and median. However, the standard deviation and range were different for all the three types of organisations. Additionally, except for a small organisation the two other groups had negative skewness which implied that most of the effectiveness value lies above mean. Table 4.69 provides more details.

		Average Effectiveness: Co-manufacturing			
		Micro	Small	Medium	Total
Frequency	Yes	11	25	51	102
	No	27	39	76	152
Central Tendency & Dispersion	Mean	6.82	6.80	6.40	6.47
	Median	8.00	7.00	6.00	6.00
	Standard Deviation	2.27	1.32	1.50	1.52
	Skewness	-0.79	0.40	-0.22	-0.11
	Minimum	2.00	4.00	1.75	1.75
	Maximum	10.00	10.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.69: Average effectiveness: Co-manufacturing and size

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. At 95% Margin of Error (MOE) the estimated percentage of small organisations in the co-manufacturing relationship would be from 27 to 51 percentage while at 99% MOE, 23 to 55 percent of such companies are expected to have co-manufacturing relationship with their supply chain partners. For small firms, at 95% MOE, the average effectiveness would range from 6.76 to 6.84 on a 10 point scale and at 99% MOE the estimated mean score will be as high as 6.875. Specific details related to the three groups are shown in the Table 4.70.

		Class Interval for Average Effectiveness: Co-manufacturing			
		Micro	Small	Medium	Total
Estimated Percentage	@95% MOE	15 to 43	27 to 51	32 to 49	34 to 46
	@99% MOE	10 to 48	23 to 55	29 to 51	32 to 48
Estimated Mean Score	@95% MOE	6.70 to 6.94	6.76 to 6.84	6.38 to 6.42	6.46 to 6.48
	@99% MOE	6.67 to 6.97	6.75 to 6.85	6.37 to 6.43	5.45 to 6.49

Table 4.70: Class interval for co-manufacturing and size

c) Statistical Results-

A one-way between-groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of size on co-manufacturing initiative. Responses were divided into three groups: micro, small and medium-sized organisations. The detailed results are tabulated in the Table 4.71.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	0.62	0.539	-	-	-
	228					
1B and 2	2	0.53	0.606	-	-	-
	228					
1C and 2	2	0.22	0.801	-	-	-
	228					
1D and 2	2	0.18	0.443	-	-	-
	228					
1E and 2	2	0.63	0.537	-	-	-
	228					
1F and 2	2	0.14	0.870	-	-	-
	228					
1G and 2	2	0.19	0.826	-	-	-
	228					
1H and 2	2	0.71	0.491	-	-	-
	86					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H-average effectiveness , **Variable 2: Size of organisation;** 1- Micro, 2- Small, 3- Medium.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between size of organisation.

Table 4.71: Co-manufacturing and size- ANOVA and Post Hoc Test

The results did not show any statistical differences at the $p < 0.05$ level in co-manufacturing strategy for the three respondents groups.

4.3.4.2 Co-manufacturing and Ownership

a) Descriptive Results-

For their co-manufacturing initiatives, almost one-fourth and one-fifth of the local SMEs were involved with other organisations and suppliers respectively whereas only 8.6 percent of local companies had co-manufacturing with their competitors. Local SMEs had more inclination for horizontal relationship as opposed to vertical relationship for the co-manufacturing. The overall co-manufacturing initiative was nearly 50 percent with respect to local companies.

Foreign SMEs were more involved with their suppliers and less with the rest of the partners. Vertical co-manufacturing was 23 percent while horizontal co-manufacturing was exhibited by only 5.3 percent

of such SMEs. On an overall basis, co-manufacturing in foreign SMEs is not a common supply chain initiative.

Local-foreign SMEs had a tendency (35.1 percent) to be involved with other organisations for the co-manufacturing initiative. As a result of this, their horizontal co-manufacturing was more than vertical co-manufacturing. On an overall basis, almost 53 percent of such SMEs had co-manufacturing with their supply chain partners.

The overall data responses showed more inclination for co-manufacturing with other organisations (24 percent) and less with competitors (5.5 percent). The horizontal co-manufacturing was nearly 4 percent more as compared to vertical co-manufacturing. Table 4.72 provides more details about co-manufacturing with supply chain partners.

Co-manufacturing with:	Local		Foreign		Foreign-Local		Total	
	F	%	F	%	F	%	F	%
Supplier	29	20.7	9	15.8	11	19.3	49	19.3
Customer	6	4.3	5	8.8	3	5.3	14	5.5
Competitor	12	8.6	1	1.8	3	5.3	16	6.3
Other Organisation	39	27.9	2	3.5	20	35.1	61	24.0
Vertical	31	22.1	13	22.8	13	22.8	57	22.4
Horizontal	44	31.4	3	5.3	21	36.8	68	26.8
Overall	69	49.3	15	26.3	30	52.6	114	44.9
Number of companies in collaborative relationship	140	100.0	57	100.0	57	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 54.72: Co-manufacturing and ownership

In terms of average effectiveness of co-manufacturing initiatives with respect to ownership, the average effectiveness for both local and foreign SMEs was better when compared to that of the local-foreign SMEs. The standard deviation and range values were also different for all the three ownership types. Table 4.73 provides more details:

		Average Effectiveness: Co-manufacturing			
		Local	Foreign	Local-foreign	Total
Frequency	Yes	61	11	30	102
	No	79	46	27	152
Central Tendency & Dispersion	Mean	6.53	6.82	6.22	6.47
	Median	6.00	7.00	6.00	6.00
	Standard Deviation	1.72	1.33	1.09	1.52
	Skewness	-0.33	0.09	0.93	-0.11
	Minimum	1.75	5.00	5.00	1.75
	Maximum	10.00	9.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.73: Average effectiveness: Co-manufacturing and ownership

It is expected that for local-foreign SMEs, at 95% Margin of Error (MOE) the estimated percentage of such SMEs in the co-manufacturing relationship will be from 40 to 66 percentage while at 99% MOE,

36 to 70 percent of such SMEs will have co-manufacturing with their supply chain partners. At 95% MOE, the average effectiveness of such SMEs will range from 5.93 to 6.50 on a 10 point scale and at 99% MOE the estimated mean score will be 5.85 to 6.59. It can be expected that co-manufacturing relationship will be popular up to only 48 percent in the overall SME population and the mean effectiveness will be high up to 6.71. Specific details related to the three ownership types are shown in the Table 4.74.

		Class Interval for Average Effectiveness: Co-manufacturing			
		Local	Foreign	Local-foreign	Total
Estimated	@95% MOE	35 to 52	09 to 30	40 to 66	34 to 46
Percentage	@99% MOE	34 to 53	06 to 33	36 to 70	32 to 48
Estimated Mean Score	@95% MOE	6.24 to 6.81	6.47 to 7.16	5.93 to 6.50	6.28 to 6.65
	@99% MOE	6.15 to 6.90	6.37 to 7.27	5.85 to 6.59	6.22 to 6.71

Table 4.74: Class interval for co-manufacturing and ownership

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of ownership of organisation on co-manufacturing initiative. Responses were divided into three groups: Local, Foreign and Local-foreign. The detailed results are tabulated in the Table 4.75

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	0.31	0.732	-	-	-
	253				-	-
1B and 2	2	0.78	0.458	-	-	-
	253				-	-
1C and 2	2	1.16	0.192	-	-	-
	253				-	-
1D and 2	2	9.62	0.000	0.07	0.243* (1 & 2)	0.001
	253				0.316* (2 & 3)	0.000
1E and 2	2	0.08	0.912	-	-	-
	253				-	-
1F and 2	2	9.58	0.000	0.07	0.262* (1 & 2)	0.000
	253				0.316* (2 & 3)	0.012
1G and 2	2	4.65	0.010	0.07	0.316* (1 & 2)	0.014
	253				0.351* (2 & 3)	0.025
1H and 2	2	0.75	0.476	-	-	-
	106				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Ownership;** 1- Local, 2-Foreign, 3-Local-foreign joint ventures.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between ownership.

Table 4.75: Co-manufacturing and ownership- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-manufacturing initiative for the three respondents groups. The results are:

- The value $F(2, 253) = 9.62, p = 0.000$ showed significant difference between co-manufacturing with other organisations according to the ownership type. The actual difference in mean scores between the groups was moderate (Eta squared value is 0.07). Post-hoc comparison indicated that the mean score for foreign SMEs was significantly different from local SMEs (0.243, $p = 0.001$) and local-foreign SMEs (0.316, $p = 0.000$). However local SMEs and local-foreign SMEs did not significantly differ from each other.
- The value $F(2, 253) = 9.58, p = 0.000$ showed significant difference between co-manufacturing with competitors and/or other organisation according to type of ownership. The actual difference in mean scores between the groups was moderate. The effect size was 0.07. Tukey HSD test indicated that the mean score foreign SMEs was significantly different from local SMEs (0.262, $p = 0.000$) and local-foreign SMEs (0.316, $p = 0.012$). However local SMEs and local-foreign SMEs did not significantly differ from each other.

- iii. The value $F(2, 253) = 4.65$, $p = 0.010$ showed significant difference between overall co-manufacturing with according to ownership. The actual difference in mean scores between the groups was moderate (Eta squared value of 0.07). Post-hoc comparison indicated that the mean score of foreign SMEs was significantly different from local SMEs (0.316, $p = 0.014$) and local-foreign SMEs (0.351, $p = 0.025$). However local SMEs and local-foreign SMEs did not significantly differ from each other.

4.3.4.3 Co-manufacturing and Supply Chain Structure

a) Descriptive Results-

SMEs with S-M-R structure were inclined towards suppliers (25.7 percent) and other organisation (14.9 percent) for their co-manufacturing relationship. They were less likely to be involved with their customers and competitors for co-manufacturing. Such structures had higher probability to be involved in vertical co-manufacturing as opposed to horizontal co-manufacturing. The overall inclination for co-manufacturing initiative was nearly 40 percent for such supply chain structures.

A similar pattern was found in the S-M-W-R structures also. 28 percent and 14 percent of such structures were involved with other organisations and suppliers respectively for the co-manufacturing initiative. Such structure had less inclination for co-manufacturing with the customers and competitors. However such structures had higher inclination for horizontal relations (30 percent) as compared to vertical relations (20 percent) with respect to co-manufacturing. There was 46 percent likelihood to enter in co-manufacturing for S-M-W-R structures.

S-M-D-R structures too had more involvement with other organisation (27.8 percent) followed by suppliers (22.2 percent) for their co-manufacturing relationship. Again the horizontal co-manufacturing had higher percentage as compared to vertical co-manufacturing for such supply chain structures. On an overall basis, such structures had more likeliness (.54) to enter into co-manufacturing with their supply chain partners.

27.3 percent of the SMEs with more complex supply chain structures (S-M-W-D-R) adopted co-manufacturing with other organisations. 10.9 percent of such SMEs had co-manufacturing with their suppliers. Again percentage of horizontal co-manufacturing was more as compared to that of vertical co-manufacturing. On an overall basis 38.2 percent of such structures had co-manufacturing with partners. Table 4.76 provides more details about co-manufacturing with supply chain partners.

Co-manufacturing with:	S-M-R		S-M-W-R		S-M-D-R		S-M-W-D-R	
	F	%	F	%	F	%	F	%
Supplier	19	25.7	7	14.0	16	22.2	6	10.9
Customer	4	5.4	3	6.0	3	4.2	3	5.5
Competitor	3	4.1	4	8.0	4	5.6	4	7.3
Other Organisation	11	14.9	14	28.0	20	27.8	15	27.3
Vertical	20	27.0	10	20.0	19	26.4	7	12.7
Horizontal	13	17.6	15	30.0	22	30.6	17	30.9
Overall	30	40.5	23	46.0	39	54.2	21	38.2
Number of companies in collaborative relationship	74	100.0	50	100.0	72	100.0	55	100.0

(F:Frequency, %: Valid percentage)

Table 4.76: Co-manufacturing and supply chain structure

In terms of average effectiveness of co-manufacturing initiatives with respect to structure of supply chain, the results showed similar values of mean and median for all the supply chain structures. However the standard deviation and range values were different for all the supply chain structures. Both S-M-W-R and S-M-D-R structures had positive values of skewness when compared to the other two structures with negative value of skewness. Table 4.77 provides more details:

		Average Effectiveness: Co-manufacturing			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Frequency	Yes	22	23	37	19
	No	52	27	35	36
Central Tendency & Dispersion	Mean	6.50	6.52	6.59	6.22
	Median	6.50	6.00	6.00	6.00
	Standard Deviation	1.63	1.47	1.36	1.79
	Skewness	-0.84	0.78	0.17	-0.26
	Minimum	2.00	4.00	4.00	1.00
	Maximum	9.00	10.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.77: Average effectiveness: Co-manufacturing and supply chain structure

b) Estimated Values

For SMEs with S-M-W-R supply chain structure, at 95% MOE the estimated percentage of such SMEs in the co-manufacturing relationship will be from 32 to 60 percent while at 99% MOE, 28 to 64 percent of such SMEs will have co-manufacturing with their supply chain partners. At 95% MOE, the average effectiveness of such SMEs will range from 6.13 to 6.93 on a 10 point scale and at 99% MOE the estimated mean score will be 5.99 to 7.06. It can be expected that co-manufacturing relationship will be popular up to 51 percent in the S-M-W-D-R structures SME population and the mean effectiveness will be high up to 6.84. Specific details related to the type of supply chain structure are shown in the Table 4.78.

Class Interval for Average Effectiveness: Co-manufacturing					
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Estimated	@95% MOE	19 to 40	32 to 60	40 to 63	22 to 47
Percentage	@99% MOE	16 to 43	28 to 64	36 to 67	18 to 51
Estimated Mean Score	@95% MOE	6.13 to 6.87	6.13 to 6.93	6.28 to 6.91	5.75 to 6.70
	@99% MOE	6.01 to 6.99	5.99 to 7.06	6.18 to 7.01	5.60 to 6.84

Table 64.79: Class interval for co-manufacturing and supply chain structure

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of supply chain structure on co-manufacturing initiative. Responses were divided into four groups: S-M-R, S-M-W-R, S-M-D-R and S-M-W-D-R. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.80.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	3	1.53	0.194	-	-	-
	253				-	-
1B and 2	3	1.18	0.319	-	-	-
	253				-	-
1C and 2	3	1.18	0.318	-	-	-
	253				-	-
1D and 2	3	1.21	0.306	-	-	-
	253				-	-
1E and 2	3	1.22	0.301	-	-	-
	253				-	-
1F and 2	3	1.13	0.342	-	-	-
	253				-	-
1G and 2	3	1.08	0.363	-	-	-
	253				-	-
1H and 2	3	1.60	0.658	-	-	-
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Supply Chain Structure;** 1 S-M-R, 2 S-M-W-R, 3 S-M-D-R, 4 S-M-W-D-R.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between supply chain structures.

Table 4.80: Co-manufacturing and Supply chain structure- ANOVA and Post Hoc Test

The results showed that there were no statistical differences at the $p < 0.05$ level in co-manufacturing initiative for the three respondents groups.

4.3.4.4 Co-manufacturing and Age of Organisation

a) Descriptive Results-

The organisations which were aged less than 10 years had more inclination for co-manufacturing with other organisation (20.8 percent) whereas 18.1 percent of such organisations had co-manufacturing with their suppliers. A low percentage of co-manufacturing with competitors and other organisations was found in such organisations. In such companies' percentage of horizontal co-manufacturing were slightly more when compared to the percentage of vertical co-manufacturing. The overall co-manufacturing initiative was nearly 42 percent in these organisations.

For organisations that were aged between 10 and 24 years, co-manufacturing with other organisations emerged to be the most commonly used strategy whereas co-manufacturing with customers and competitors were the least used strategy. It was found that such organisations had more inclination towards horizontal co-manufacturing when compared to vertical co-manufacturing. On a combined basis co-manufacturing was employed by half of such organisations.

As far as organisations which aged more than 25 years were concerned, they were inclined in co-manufacturing with suppliers and other organisations and less involved with customers and competitors. Such firms were found to have more involvement in vertical co-manufacturing when compared to horizontal co-manufacturing.

The overall data responses showed more inclination for co-manufacturing with other organisations and less with customers and competitors. Table 4.81 provides more details about co-manufacturing with supply chain partners.

Co-manufacturing with:	Less than 10 yrs		10 to 24 yrs		25 and more		Total	
	F	%	F	%	F	%	F	%
Supplier	13	18.1	13	16.5	23	22.3	49	19.3
Customer	4	5.6	1	1.3	9	8.7	14	5.5
Competitor	6	8.3	2	2.5	8	7.8	16	6.3
Other Organisation	15	20.8	28	35.4	18	17.5	61	24.0
Vertical	16	22.2	14	17.7	27	26.2	57	22.4
Horizontal	18	25.0	28	35.4	22	21.4	68	26.8
Overall	30	41.7	39	49.4	45	43.7	114	44.9
Number of companies in collaborative relationship	72	100.00	79	100.00	72	100.00	79	100.00

Table 4.81: Co-manufacturing and age

In terms of average effectiveness of co-manufacturing initiatives with respect to age, the results showed similar values for mean and median. However, the standard deviation and range values were different for all the three types of organisations. Moreover all the three groups had negative skewness which implied that most of the effectiveness value lies above mean. Table 4.82 provides more details about central tendency and dispersion.

		Average Effectiveness: Co-manufacturing			Total
		Less than 10 yrs	10 to 24 yrs	25 and more	
Frequency	Yes	27	38	37	102
	No	45	41	66	152
Central Tendency & Dispersion	Mean	6.31	6.50	6.55	6.47
	Median	6.00	6.00	7.00	6.00
	Standard Deviation	1.78	1.21	1.63	1.52
	Skewness	0.19	0.86	-0.74	-0.11
	Minimum	2.00	5.00	2.00	2.00
	Maximum	10.00	10.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.82: Average effectiveness: Co-manufacturing and age

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. On an overall basis, at 95% MOE the estimated percentage of SMEs in the co-manufacturing relationship would be from 34 to 46 percentages while at 99% MOE, 32 to 48 percent of the SMEs are expected to have co-manufacturing with their supply chain partners. At 95% MOE, the average effectiveness would range from 6.46 to 6.48 on a 10 point scale and at 99% MOE the estimated mean score will be high up to 6.49. For the organisations aged between 10 and 24 years, it can be expected that co-manufacturing relationship will be popular up to 63 percent and the mean effectiveness would be high up to 6.54. Specific details related to the three groups are shown in the Table 4.83.

		Class Interval for Average Effectiveness: Co-manufacturing			Total
		Less than 10 yrs	10 to 24 yrs	25 and more	
Estimated Percentage	@95% MOE	26 to 49	37 to 59	27 to 45	34 to 46
	@99% MOE	23 to 52	34 to 63	24 to 48	32 to 48
Estimated Mean Score	@95% MOE	6.26 to 6.36	6.47 to 6.53	6.52 to 6.58	6.46 to 6.48
	@99% MOE	6.25 to 6.37	6.46 to 6.54	6.51 to 6.59	5.45 to 6.49

Table 4.83: Class interval for co-manufacturing and age

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of age of organisation on co-manufacturing initiative. Responses were divided into three groups: organisations aged less than 10 years, organisations aged between 10 and 24 years and

organisations aged more than 25 years. Eta squared values were also used to determine the effect age of the results. The detailed results are tabulated in the Table 4.84.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	0.54	0.583	-	-	-
	253					
1B and 2	2	2.41	0.092	-	-	-
	253					
1C and 2	2	1.38	0.251	-	-	-
	253					
1D and 2	2	4.30	0.014	-	-	-
	253					
1E and 2	2	0.93	0.399	-	-	-
	253					
1F and 2	2	2.35	0.097	-	-	-
	253					
1G and 2	2	0.49	0.609	-	-	-
	253					
1H and 2	2	0.19	0.825	-	-	-
	116					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Age of organisation:** 1- up to 10 years, 2- 10 -24 years, 3- 25 years and more.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between age of age of organisation.

Table 74.84: Co-manufacturing and age- ANOVA and Post Hoc Test

The results showed that there were not statistical differences at the $p < 0.05$ level in the co-manufacturing relationship for the three respondents groups.

4.3.4.5 Correlation of Co-manufacturing and other collaborative initiatives:

The relationship between co-manufacturing initiatives with other types of collaborative initiatives was analysed using bi-variate correlation method. Due to restriction of the number of cases, the separate correlation analysis using country, ownership and supply chain structures as independent variables was not possible. However the correlation analysis was possible for all the responses taken as a whole. Moreover, with the absence of any definite independent variable regression analysis was not conducted to avoid complexity of results. Spearman's rho values (non-parametric test) were used to measure the correlation as some of the variables failed the normality test. The relationship of co-manufacturing with other collaborative initiatives is summarised in the correlation matrix shown in Table 4.85.

Effectiveness of:		Effectiveness of Co-manufacturing with:			
		Supplier	Customer	Competitor	Other Organisation
Joint Ventures with:	Supplier	.750*	-	-	-
Co-development with:	Customer	-	-	-	.879**
	Other Organisation	-	-	-	.786**
Co-design with:	Customer	.607*	-	-	-
	Other Organisation	.744*	-	-	.752**
Aggregated Purchasing with:	Supplier	.855**	-	-	-
	Competitor	-	-	.975**	-
	Other Organisation	.536*	-	-	-
Co-logistics with:	Supplier	.755*	-	-	-
	Customer	.708*	-	-	-
	Competitor	.900*	-	-	-
	Other Organisation	.766**	-	-	-
Joint Problem Solving with:	Supplier	-	-	-	.409*
	Customer	-	-	-	.665*
Shared Resources with:	Customer	-	.975**	-	.907*
	Other Organisation	-	-	-	.521*
CPFR with:	Supplier	-	.892*	-	-

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.85: Correlation of effectiveness of co-manufacturing with other collaborative initiatives

It was found that co-manufacturing with suppliers and co-manufacturing with other organisation had positive relation with most of the other collaborative initiatives. However, within co-manufacturing initiatives none of the initiatives were found to be related with each other. In conclusion, co-manufacturing was found to have positive effect on other collaborative initiatives.

4.3.5. Aggregated Purchasing-

4.3.5.1 Aggregated Purchasing and Size of Organisation

1) Descriptive Results-

Micro organisations were found to be more involved with competitors and other organisations for the aggregated purchasing initiative whereas, only 5.3 percent of such companies had aggregated purchasing with their customers. Such companies were found to have less inclination for vertical relations as compared to horizontal relationship for the aggregated purchasing initiative. The overall aggregated purchasing initiative was very popular with a percentage of around 42 percent.

Similarly, small companies were more involved with their competitors and other organisation for the aggregated purchasing relationship. Aggregated purchasing with customers emerged to be a less popular strategy with only 9.4 percent of such companies involved in it. Vertical aggregated purchasing was nearly half in percentage than the percentage of horizontal aggregated purchasing.

Medium-sized organisations were also found to be more inclined towards aggregated purchasing with customers and other organisations. The percentage of horizontal aggregated purchasing was more than double of the percentage for vertical aggregated purchasing. On a combined basis almost 53 percent of such firms had aggregated purchasing with their supply chain partners.

The overall data responses showed more inclination for aggregated purchasing with other organisations and competitors and less for customers and suppliers. The percentage for vertical aggregated purchasing was less than that of the percentage of horizontal aggregated purchasing. Table 4.86 provides more details about aggregated purchasing with the supply chain partners.

Aggregated Purchasing with:	Micro		Small		Medium		Total	
	F	%	F	%	F	%	F	%
Supplier	5	13.2	8	12.5	15	11.8	28	12.2
Customer	2	5.3	6	9.4	11	8.7	19	8.3
Competitor	6	15.8	12	18.8	24	18.9	42	18.3
Other Organisation	6	15.8	17	26.6	33	26.0	56	24.5
Vertical	7	18.4	12	18.8	21	16.5	40	17.5
Horizontal	9	23.7	24	37.5	47	37.0	80	34.9
Overall	16	42.1	34	53.1	62	48.8	112	48.9
Number of companies in collaborative relationship	38	100.0	64	100.0	127	100.0	229	100.0

Table 4.86: Aggregated Purchasing and size

In terms of average effectiveness of aggregated purchasing initiatives with respect to size, the results showed similar values for mean and median. However, the standard deviation and range were different for all the three types of organisations. Additionally, the whole group had negative skewness which implies that most of the effectiveness value lies above mean. Table 4.87 provides more details.

		Average Effectiveness: Aggregated Purchasing			
		Micro	Small	Medium	Total
Frequency	Yes	14	32	56	118
	No	24	32	71	136
Central Tendency & Dispersion	Mean	6.36	6.19	6.42	6.35
	Median	6.00	6.00	6.25	6.00
	Standard Deviation	1.78	1.93	1.61	1.68
	Skewness	-0.16	-0.37	-0.53	-0.38
	Minimum	3.00	1.00	1.00	1.00
	Maximum	9.00	10.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.87: Average effectiveness: Aggregated Purchasing and size

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. At 95% Margin of Error (MOE) the estimated percentage of small organisations in the aggregated purchasing relationship would be from 38 to 62 percentage while at 99% MOE, 34 to 66 percent of such companies were expected to have aggregated purchasing relationship with their supply chain partners. For all the respondents taken together, at 95% MOE, the average effectiveness would range from 6.34 to 6.36 on a 10 point scale and at 99% MOE the estimated mean score will be as high as 6.37. Specific details related to the three groups are shown in the Table 4.88.

		Class Interval for Average Effectiveness: Aggregated Purchasing			
		Micro	Small	Medium	Total
Estimated Percentage	@95% MOE	22 to 52	38 to 62	35 to 53	40 to 53
	@99% MOE	17 to 57	34 to 66	33 to 55	38 to 55
Estimated Mean Score	@95% MOE	6.27 to 6.45	6.13 to 6.25	6.40 to 6.44	6.34 to 6.36
	@99% MOE	6.24 to 6.48	6.11 to 6.27	6.39 to 6.45	5.33 to 6.37

Table 4.88: Class interval for aggregated Purchasing and size

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of size on aggregated purchasing initiative. Responses were divided into three groups: micro, small and medium-sized organisations. The detailed results are tabulated in the Table 4.89.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	0.02	0.973	-	-	-
	228					
1B and 2	2	0.28	0.751	-	-	-
	228					
1C and 2	2	0.09	0.907	-	-	-
	228					
1D and 2	2	0.92	0.398	-	-	-
	228					
1E and 2	2	0.08	0.918	-	-	-
	228					
1F and 2	2	1.26	0.283	-	-	-
	228					
1G and 2	2	0.57	0.563	-	-	-
	228					
1H and 2	2	0.18	0.834	-	-	-
	86					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Size of organisation;** 1- Micro, 2- Small, 3- Medium.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between size of organisation.

Table 4.89: Aggregated Purchasing and size- ANOVA and Post Hoc Test

The results did not show any statistical differences at the $p < 0.05$ level in aggregated purchasing strategy for the three respondents groups.

4.3.5.2 Aggregated Purchasing and Ownership

a) Descriptive Results-

For their aggregated purchasing initiatives, almost 28 percent and 23 percent of the local SMEs were involved with other organisations and competitors respectively whereas 12.1 percent of local companies had aggregated purchasing with their suppliers. Local SMEs had less inclination for vertical as compared to their horizontal relationship for the aggregated purchasing. The overall aggregated purchasing initiative was nearly 53 percent with respect to local companies.

On the other hand, foreign SMEs were more involved with their suppliers and customers for their aggregated purchasing relationship. Aggregated purchasing with competitors was found to be a less popular strategy with only 5.3 percent involved in it. Vertical aggregated purchasing were more as compared to horizontal aggregated purchasing. On an overall basis, aggregated purchasing in foreign SMEs were less common when compared to local SMEs.

Foreign-local SMEs had a higher tendency (38.6 percent) to be involved with other organisation for the aggregated purchasing. As a result of this, their horizontal aggregated purchasing were more popular than vertical aggregated purchasing. On an overall basis, almost 67 percent of such SMEs had aggregated purchasing with their supply chain partners.

The overall data responses showed more inclination for aggregated purchasing with other organisations (25.6 percent) and less with customers (7.5 percent). The horizontal aggregated purchasing is nearly 21 percent more as compared to vertical aggregated purchasing. Table 4.90 provides more details about aggregated purchasing with supply chain partners.

Aggregated Purchasing with:	Local		Foreign		Foreign-Local		Total	
	F	%	F	%	F	%	F	%
Supplier	17	12.1	6	10.5	7	12.3	30	11.8
Customer	10	7.1	5	8.8	4	7.0	19	7.5
Competitor	32	22.9	3	5.3	15	26.3	50	19.7
Other Organisation	39	27.9	4	7.0	22	38.6	65	25.6
Vertical	22	15.7	10	17.5	10	17.5	42	16.5
Horizontal	57	40.7	7	12.3	31	54.4	95	37.4
Overall	74	52.9	16	28.1	38	66.7	128	50.4
Number of companies in collaborative relationship	140	100.0	57	100.0	57	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 84.90: Aggregated Purchasing and ownership

In terms of average effectiveness of aggregated purchasing initiatives with respect to ownership, the average effectiveness for foreign SMEs is more than both local and local-foreign SMEs. Additionally, the standard deviation and skewness values of foreign SMEs were more than the other two ownership types. Table 4.91 provides more details.

		Average Effectiveness: Aggregated Purchasing			
		Local	Foreign	Local-foreign	Total
Frequency	Yes	68	12	38	118
	No	72	45	19	136
Central Tendency & Dispersion	Mean	6.42	6.67	6.12	6.35
	Median	6.00	7.00	6.00	6.00
	Standard Deviation	1.68	2.42	1.42	1.68
	Skewness	-0.39	-1.14	0.11	-0.38
	Minimum	1.00	1.00	3.00	1.00
	Maximum	10.00	10.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.91: Average effectiveness: Aggregated Purchasing and ownership

b) Estimated Values

For local- foreign SMEs, at 95% Margin of Error (MOE) the estimated percentage of such SMEs in the aggregated purchasing relationship will be from 54 to 79 percent while at 99% MOE, 51 to 83 percent of such SMEs will have aggregated purchasing with their supply chain partners. At 95% MOE, the

average effectiveness of foreign SMEs will range from 6.04 to 7.30 on a 10 point scale and at 99% MOE the estimated mean score will be 5.84 to 7.49. It can be expected that aggregated purchasing relationship will be common up to 83 percent in the local-foreign SME population and the mean effectiveness will be high up to 6.60. Specific details related to the three ownership types were shown in the Table 4.92.

		Class Interval for Average Effectiveness: Aggregated Purchasing			
		Local	Foreign	Local-foreign	Total
Estimated	@95% MOE	40 to 57	10 to 32	54 to 79	40 to 53
Percentage	@99% MOE	39 to 58	07 to 35	51 to 83	38 to 55
Estimated Mean Score	@95% MOE	6.14 to 6.70	6.04 to 7.30	5.75 to 6.49	6.14 to 6.55
	@99% MOE	6.05 to 6.78	5.84 to 7.49	5.64 to 6.60	6.08 to 6.62

Table 4.92: Class interval for aggregated purchasing and ownership

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of ownership of organisation on aggregated purchasing initiative. Responses were divided into three groups: Local, Foreign and Local-foreign. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.93.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	0.58	0.944	-	-	-
	253				-	-
1B and 2	2	0.08	0.916	-	-	-
	253				-	-
1C and 2	2	5.13	0.007	0.04	0.176* (1 & 2)	0.013
	253				0.211* (2 & 3)	0.012
1D and 2	2	8.30	0.000	0.06	0.208* (1 & 2)	0.006
	253				0.316* (2 & 3)	0.000
1E and 2	2	0.07	0.927	-	-	-
	253				-	-
1F and 2	2	12.52	0.000	0.09	0.284* (1 & 2)	0.000
	253				0.421* (2 & 3)	0.000
1G and 2	2	9.42	0.000	0.07	0.248* (1 & 2)	0.004
	253				0.386* (2 & 3)	0.000
1H and 2	2	.62	0.537	-	-	-
	106				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Ownership;** 1- Local, 2-Foreign, 3-Local-foreign.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between ownership.

Table 4.93: Aggregated Purchasing and ownership- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in aggregated purchasing initiative for the three respondents groups. The results were:

- Although $F(2, 253) = 5.13$, $p = 0.007$ showed significant difference between aggregated purchasing with competitors according to type of ownership, but the actual difference in mean scores between the groups was not high (Eta squared value of 0.04). Post-hoc comparison indicated that the mean score for foreign SMEs was significantly different from local SMEs (0.176, $p = 0.013$) and local-foreign SMEs (0.211, $p = 0.012$). However, local SMEs and local-foreign SMEs did not significantly differ from each other.
- The value $F(2, 253) = 8.30$, $p = 0.000$ showed significant difference between aggregated purchasing with other organisation according to the ownership type. The actual difference in mean scores between the groups was moderate as evident from the effect size of 0.06. Tukey HSD test indicated that the mean score for foreign SMEs was significantly different from local SMEs (0.208, $p = 0.006$) and local-foreign SMEs (0.316, $p = 0.000$). However local SMEs and local-foreign SMEs did not significantly differ from each other.

- iii. The value $F(2, 253) = 12.52$, $p = 0.000$ showed significant difference between aggregated purchasing with competitors and/or other organisation according to the type of ownership. The actual difference in mean scores between the groups was moderate (Eta squared value of 0.09). Post-hoc comparison using the Tukey HSD test indicated that the mean score foreign SMEs was significantly different from local SMEs (0.284, $p = 0.000$) and local-foreign SMEs (0.421, $p = 0.000$). However local SMEs and local-foreign SMEs did not significantly differ from each other.
- iv. The value $F(2, 253) = 9.42$, $p = 0.000$ showed significant difference between overall aggregated purchasing according to ownership. The actual difference in mean scores between the groups was quite moderate as evident from Eta squared value of 0.07. Post-hoc comparison indicated that the mean score foreign SMEs was significantly different from local SMEs (0.248, $p = 0.004$) and local-foreign SMEs (0.386, $p = 0.000$). However local SMEs and local-foreign SMEs did not significantly differ from each other.

4.3.5.3 Aggregated Purchasing and Supply Chain Structure

a) Descriptive Results-

SMEs with S-M-R structure were equally inclined towards other organisation (10.8 percent) and customers (10.8 percent) for their aggregated purchasing relationship. They were more likely to be involved with their suppliers and competitors for aggregated purchasing. Such structures had a higher probability to be involved in vertical aggregated purchasing as opposed to horizontal aggregated purchasing. The overall inclination for aggregated purchasing initiative was nearly 43 percent for such supply chain structures.

A dissimilar pattern is found in the S-M-W-R structures wherein 34 percent and 24 percent of such structures were involved with other organisations and competitors respectively for the aggregated purchasing initiative. Such a structure had less likeliness for aggregated purchasing with the suppliers and customers. As a result of this trend, such structures had much higher inclination for horizontal relations (50 percent) as compared to vertical relations (6 percent) with respect to aggregated purchasing. There is 54 percent likelihood to enter in to aggregated purchasing for S-M-W-R structures.

S-M-D-R structures too had more involvement with other organisation (29.2 percent) followed by competitors (19.4 percent) for their aggregated purchasing relationship. Again the horizontal aggregated purchasing had much higher percentage as compared to vertical aggregated purchasing for such supply chain structures. On an overall basis such structures had more likeliness (.51) to enter in to aggregated purchasing with their supply chain partners.

On the other hand, nearly one third of the SMEs with more complex supply chain structures (S-M-W-D-R) aggregated purchasing with other organisations. 20 percent of such SMEs had aggregated

purchasing with their competitors. Again horizontal aggregated purchasing were more as compared to vertical aggregated purchasing. On an overall basis 55 percent of such structures had aggregated purchasing with partners. Table 4.94 provides more details about aggregated purchasing with supply chain partners.

Aggregated Purchasing with:	S-M-R		S-M-W-R		S-M-D-R		S-M-W-D-R	
	F	%	F	%	F	%	F	%
Supplier	13	17.6	1	2.0	6	8.3	8	14.5
Customer	8	10.8	2	4.0	3	4.2	5	9.1
Competitor	12	16.2	12	24.0	14	19.4	11	20.0
Other Organisation	8	10.8	17	34.0	21	29.2	18	32.7
Vertical	18	24.3	3	6.0	9	12.5	10	18.2
Horizontal	16	21.6	25	50.0	29	40.3	24	43.6
Overall	32	43.2	27	54.0	37	51.4	30	54.5
Number of companies in collaborative relationship	74	100.0	50	100.0	72	100.0	55	100.0

(F:Frequency, %: Valid percentage)

Table 4.94: Aggregated Purchasing and supply chain structure

In terms of average effectiveness of aggregated purchasing initiatives with respect to structure of supply chain, the results showed similar values of mean and median for all the supply chain structures except S-M-R. However, the standard deviation and range values were different for all the supply chain structures. Both S-M-W-R and S-M-W-D-R structures had lower values of skewness as compared to the other two structures. The minimum and maximum scores for the effectiveness also differed for all the structures. Table 4.95 provides more details.

		Average Effectiveness: Aggregated Purchasing			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Frequency	Yes	26	27	36	28
	No	48	23	36	27
Central Tendency & Dispersion	Mean	6.44	6.91	6.07	6.16
	Median	6.00	7.00	6.00	7.00
	Standard Deviation	1.57	1.72	1.33	2.04
	Skewness	0.20	-0.50	0.40	-1.02
	Minimum	3.00	3.00	4.00	1.00
	Maximum	10.00	10.00	10.00	9.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.95: Average effectiveness: Aggregated Purchasing and supply chain structure

b) Estimated Values

For SMEs with S-M-R supply chain structure, at 95% MOE the estimated percentage of such SMEs in the aggregated purchasing relationship will be from 24 to 46 percent while at 99% MOE, 21 to 49 percent of such SMEs will have aggregated purchasing with their supply chain partners. At 95% MOE, the average effectiveness of S-M-W-R structured SMEs will range from 6.43 to 7.38 on a 10 point scale and at 99% MOE the estimated mean score will be 6.28 to 7.53. It can be expected that aggregated

purchasing relationship will be popular up to 68 percent in the S-M-W-D-R structures, SME population and the mean effectiveness will be high up to 6.87. Specific details related to the type of supply chain structure are shown in the Table 4.96.

		Class Interval for Average Effectiveness: Aggregated Purchasing			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Estimated	@95% MOE	24 to 46	40 to 68	38 to 62	38 to 64
Percentage	@99% MOE	21 to 49	36 to 72	35 to 65	34 to 68
Estimated Mean Score	@95% MOE	6.08 to 6.80	6.43 to 7.38	5.76 to 6.38	5.62 to 6.70
	@99% MOE	5.97 to 6.91	6.28 to 7.53	5.67 to 6.47	5.45 to 6.87

Table 4.96: Class interval for aggregated Purchasing and supply chain structure

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of supply chain structure on aggregated purchasing initiative. Responses were divided into four groups: S-M-R, S-M-W-R, S-M-D-R and S-M-W-D-R. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.97.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	3	4.42	0.002	0.06	0.647* (2 & 4)	0.006
	253				0.583* (3 & 4)	0.016
1B and 2	3	1.58	0.179	-	-	-
	253				-	-
1C and 2	3	0.37	0.828	-	-	-
	253				-	-
1D and 2	3	3.19	0.014	0.05	0.232* (1 & 2)	0.029
	253				0.232* (1 & 4)	0.036
1E and 2	3	3.58	0.008	0.05	0.607* (2 & 4)	0.044
	253				-	-
1F and 2	3	3.20	0.014	0.05	0.284* (1 & 2)	0.011
	253				-	-
1G and 2	3	0.61	0.650	-	-	-
	253				-	-
1H and 2	3	1.62	0.174	-	-	-
	106				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Supply Chain Structure;** 1 S-M-R, 2 S-M-W-R, 3 S-M-D-R, 4 S-M-W-D-R.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between supply chain structures.

Table 4.97: Aggregated Purchasing and Supply chain structure- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in aggregated purchasing initiative for the three respondents groups. The results are:

- i. The value $F(3, 253) = 4.42$, $p = 0.002$ showed significant difference between aggregated purchasing with suppliers according to structure of supply chain. However the effect size was not very moderate (Eta squared value was 0.06). Post-hoc comparison using the Tukey HSD test indicated that the mean score for structure 'S-M-W-D-R' was significantly different from structure 'S-M-W-R' (0.647, $p = 0.006$) and from structure 'S-M-D-R' (0.583, $p = 0.016$).
- ii. The value $F(3, 253) = 3.19$, $p = 0.014$ showed significant difference between aggregated purchasing with other organisation according to supply chain structures. The actual difference in mean scores between the groups was not moderate as evident from the effect size value of 0.05. Post-hoc comparison indicated that the mean score for structure 'S-M-R' was significantly different from structure 'S-M-W-R' (0.232, $p = 0.029$) and from structure 'S-M-D-R' (0.232, $p = 0.036$), however no other differences were found between other structures.
- iii. The value $F(3, 253) = 3.58$, $p = 0.008$ showed significant difference between vertical aggregated purchasing according to structure of supply chain. However the effect size was not very moderate (Eta squared value was 0.05). Post-hoc comparison using the Tukey HSD test indicated that the mean score for structure 'S-M-W-D-R' was significantly different from structure 'S-M-W-R' (0.607, $p = 0.006$), however no other differences were found between other structures.
- iv. The value $F(3, 253) = 3.20$, $p = 0.014$ showed significant difference between horizontal aggregated purchasing with other organisations according to supply chain structures. The actual difference in mean scores between the groups was not moderate as evident from the Eta squared value of 0.05. Post-hoc comparison indicated that the mean score for structure 'S-M-R' was significantly different from structure 'S-M-W-R' (0.284, $p = 0.011$) but not from any other structures.

4.3.5.4 Aggregated Purchasing and Age of Organisation

a) Descriptive Results-

The organisations which were aged less than 10 years had more inclination for aggregated purchasing with other organisation (25.0 percent) and with their competitors (20.8 percent), however, percentage of aggregated purchasing with customers was found to be low (8.2 percent). In such companies percentage of horizontal aggregated purchasing was nearly double than percentage of vertical aggregated purchasing. The overall aggregated purchasing initiative was nearly 54 percent in these organisations.

For organisations that were aged between 10 and 24 years, aggregated purchasing with other

organisations and competitors emerged to be the more frequently used collaborative strategy whereas aggregated purchasing with the rest of the other partners were not common. It was found that such organisations were highly inclined towards horizontal aggregated purchasing as compared to vertical aggregated purchasing. On a combined basis aggregated purchasing was a very common initiative in such organisations.

As far as organisations which were aged more than 25 years were concerned, they were more inclined in aggregated purchasing with other organisations and suppliers. Such firms were found to have less involvement in vertical aggregated purchasing relations as compared to horizontal aggregated purchasing. The overall aggregated purchasing initiative was not very common in such organisations.

The overall data responses showed higher inclination for aggregated purchasing with other organisations and competitors rather than suppliers or customers. As a result, the horizontal aggregated purchasing were more than double as compared to vertical aggregated purchasing. Table 4.98 provides more details about aggregated purchasing with supply chain partners.

Aggregated Purchasing	Less than 10 yrs		10 to 24 yrs		25 and more		Total	
with:								
	F	%	F	%	F	%	F	%
Supplier	10	13.9	4	5.1	16	15.5	30	11.8
Customer	6	8.3	5	6.3	8	7.8	19	7.5
Competitor	15	20.8	24	30.4	11	10.7	50	19.7
Other Organisation	18	25.0	26	32.9	21	20.4	65	25.6
Vertical	14	19.4	8	10.1	20	19.4	42	16.5
Horizontal	28	38.9	41	51.9	26	25.2	95	37.4
Overall	39	54.2	47	59.5	42	40.8	128	50.4
Number of companies in collaborative relationship	72	100.00	79	100.00	72	100.00	79	100.00

Table 4.98: Aggregated Purchasing and age

In terms of average effectiveness of aggregated purchasing initiatives with respect to age, the results showed similar values for mean and median. The standard deviation was found to be dissimilar for all the three types of organisations. Moreover, all the three groups had negative skewness which implied that most of the effectiveness value lies above mean. Table 4.99 provides more details.

		Average Effectiveness: Aggregated Purchasing			Total
		Less than 10 yrs	10 to 24 yrs	25 and more	
Frequency	Yes	36	47	35	118
	No	36	32	68	136
Central Tendency & Dispersion	Mean	6.74	6.15	6.21	6.35
	Median	7.00	6.00	6.00	6.00
	Standard Deviation	1.65	1.44	1.98	1.68
	Skewness	-0.29	-0.85	-0.22	-0.38
	Minimum	3.00	1.00	1.00	1.00
	Maximum	9.00	9.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 94.98: Average effectiveness: Aggregated Purchasing and age

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. On an overall basis, at 95% MOE the estimated percentage of SMEs in the aggregated purchasing relationship would be from 40 to 53 percentages while at 99% MOE, 38 to 55 percent of the SMEs are expected to have aggregated purchasing with their supply chain partners. At 95% MOE, the average effectiveness would range from 6.34 to 6.36 on a 10 point scale and at 99% MOE the estimated mean score will be as high as 6.37. For the organisations aged between 10 and 24 years, it can be expected that aggregated purchasing relationship will be popular up to 74 percent and the mean effectiveness would be high up to 6.20. Specific details related to the three groups were shown in the Table 4.99.

		Class Interval for Average Effectiveness: Aggregated Purchasing			Total
		Less than 10 yrs	10 to 24 yrs	25 and more	
Estimated Percentage	@95% MOE	38 to 62	49 to 70	25 to 43	40 to 53
	@99% MOE	35 to 65	45 to 74	22 to 46	38 to 55
Estimated Mean Score	@95% MOE	6.07 to 6.78	6.11 to 6.19	6.17 to 6.25	6.34 to 6.36
	@99% MOE	6.68 to 6.80	6.10 to 6.20	6.16 to 6.26	5.33 to 6.37

Table 4.99: Class interval for aggregated Purchasing and age

c) Statistical Results-

A one-way between-groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of age of organisation on aggregated purchasing initiative. Responses were divided into three groups: organisations aged less than 10 years, organisations aged between 10 and 24 years and organisations aged more than 25 years. The detailed results are tabulated in the Table 4.100.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	2.58	0.078	-	-	-
	253					
1B and 2	2	0.11	0.887	-	-	-
	253					
1C and 2	2	5.71	0.004	0.04	0.197* (2 & 3)	0.003
	253					
1D and 2	2	1.85	0.159	-	-	-
	253					
1E and 2	2	1.70	0.183	-	-	-
	253					
1F and 2	2	7.10	0.001	0.05	0.267* (2 & 3)	0.001
	253					
1G and 2	2	3.47	0.033	0.02	0.187* (2 & 3)	0.033
	253					
1H and 2	2	1.40	0.249	-	-	-
	117					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Age of organisation;** 1- up to 10 years, 2- 10 -24 years, 3- 25 years and more.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between age of age of organisation.

Table 4.100: Aggregated Purchasing and age- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in the aggregated purchasing relationship for the three respondents groups:

- Although the value $F(2, 253) = 5.71$, $p = 0.004$ suggested significant difference between aggregated purchasing with competitors according to the age of organisation. The actual difference in mean scores between the groups was not high (Eta squared value of 0.04). Post-hoc comparison indicated that the mean score for organisations which were aged more than 25 years was significantly different from organisations which were aged between 10 and 24 years (0.197, $p = 0.003$).
- The value $F(2, 253) = 3.30$, $p = 0.038$ showed significant difference between horizontal aggregated purchasing according to age of organisation. The actual difference in mean scores

between the groups was not moderate (Eta squared value of 0.05). The result indicated that the mean score for organisations which were aged more than 25 years was significantly different from organisations which were aged between 10 and 24 years (0.267, $p = 0.001$).

- iii. The value $F(2, 253) = 6.92$, $p = 0.001$ showed significant difference between aggregated purchasing according to the age of organisation. The actual difference in mean scores between the groups was low and the post-hoc comparison indicated that the mean score for organisations that were aged between 10 and 24 years was significantly different from organisations which were aged more than 25 years (0.187 $p = 0.033$).

4.3.5.5 Correlation of aggregated purchasing and other collaborative initiatives:

The relationship between aggregated purchasing initiatives with other type of collaborative relations was analysed using bi-variate correlation method. Due to the restriction of number of cases, the separate correlation analysis using country, ownership and supply chain structures as independent variables was not possible. However the correlation analysis was possible for all the responses taken as a whole. Moreover with the absence of any definite independent variable regression analysis was not conducted to avoid complexity of results. Spearman's rho values (non-parametric test) were used to measure the correlation as some of the variables failed the normality test. The relationship of aggregated purchasing with other collaborative initiatives is summarised in the correlation matrix shown in Table 4.101.

Effectiveness of:		Effectiveness of Aggregated Purchasing with:			
		Supplier	Customer	Competitor	Other Organisation
Joint Ventures with:	Supplier	-	.973**	-	.430**
Co-development with:	Other Organisation	-	-	-	.578*
Co-design with:	Customer	-	-	-	.553*
Co-manufacturing with:	Supplier	.855*	-	-	.536*
	Competitor	-	-	.975**	-
Aggregated Purchasing with:	Other Organisation	-	.975**	.720**	-
Co-logistics with:	Supplier	.849*	-	-	-
	Customer	.771*	-	-	-
	Competitor	-	-	.886*	-
	Other Organisation	.975	-	.782*	.639*
Joint Problem Solving with:	Customer	-	-	-	.486**
Shared Resources with:	Supplier	-	-	.939**	-
	Customer	-	-	-	.955**
	Competitor	-	-	.922**	-
	Other Organisation	-	-	-	.474*
CPFR with:	Supplier	-	.785*	.347*	-
	Customer	-	-	.481**	.318*

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.101: Correlation of effectiveness of aggregated purchasing with other collaborative initiatives

It was found that within aggregated purchasing initiative, aggregated Purchasing with other organisations is positively correlated to aggregated purchasing with competitors ($r = 0.72$) and also with aggregated Purchasing with customer ($r = 0.975$). Interestingly aggregated purchasing with competitors was found to have strong relation with: co-manufacturing with competitors ($r = 0.975$); co-logistics with competitors ($r = 0.886$); co-manufacturing with other organisations ($r = 0.782$); Shared resources with suppliers ($r = 0.939$); and Shared resources with competitors ($r = 0.922$). Aggregated purchasing with other organisations was found to have moderate relations with most of the other collaborative initiatives. In conclusion, aggregated purchasing found to have positive effect on other collaborative initiatives.

4.3.6 Co-logistics-

4.3.6.1 Co-logistics and Size of Organisation

1) Descriptive Results-

Micro organisations were found to be equally involved with customers and other organisations for the co-logistics initiative whereas only 5.3 percent of such companies had co-logistics with their

competitors. Such companies were found to have equal inclination for vertical and horizontal relationship for the co-logistics initiative. The overall co-logistics initiative was less common with almost 26 percent.

On the other hand, small companies were more involved with their suppliers and customers as opposed to competitors and other organisation for the co-logistics relationship. Vertical co-logistics were nearly double in percentage than the percentage of horizontal co-logistics. On an overall basis, such companies exhibited around 40 percent of co-logistic relations with their supply chain partners.

Medium-sized organisations were also found with more inclined towards co-logistics with customers and supplies. The percentage of vertical co-logistics was more than that of the vertical co-logistics relationship. On a combined basis almost 43 percent of such firms had co-logistics with their supply chain partners.

The overall data responses showed more inclination for co-logistics with customers and suppliers and less with other organisations and competitors. The percentage for vertical co-logistics was more than that of the percentage of horizontal co-logistics. Table 4.102 provides more details about co-logistics with supply chain partners.

Co-logistics with:	Micro		Small		Medium		Total	
	F	%	F	%	F	%	F	%
Supplier	4	10.5	14	21.9	24	18.9	42	18.3
Customer	5	13.2	10	15.6	24	18.9	39	17.0
Competitor	2	5.3	2	3.1	11	8.7	15	6.6
Other Organisation	5	13.2	8	12.5	15	11.8	28	12.2
Vertical	6	15.8	18	28.1	36	28.3	60	26.2
Horizontal	6	15.8	8	12.5	22	17.3	36	15.7
Overall	10	26.3	25	39.1	54	42.5	89	38.9
Number of companies in collaborative relationship	38	100.0	64	100.0	127	100.0	229	100.0

Table 4.102: Co-logistics and size

In terms of average effectiveness of co-logistics initiatives with respect to size, the results showed dissimilar values for mean and median. Moreover, the standard deviation and range were also different for all the three types of organisations. Table 4.103 provides more details:

		Average Effectiveness: Co-logistics			Total
		Micro	Small	Medium	
Frequency	Yes	9	21	47	89
	No	29	43	80	165
Central Tendency & Dispersion	Mean	6.78	7.02	6.22	6.44
	Median	6.00	7.00	6.00	6.00
	Standard Deviation	1.79	1.58	1.84	1.72
	Skewness	-0.08	0.35	-0.13	0.02
	Minimum	4.00	4.00	1.00	1.00
	Maximum	9.00	10.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.103: Average effectiveness: Co-logistics and size

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. At 95% Margin of Error (MOE) the estimated percentage of medium-sized organisations in the co-logistics relationship would be from 29 to 45 percentage while at 99% MOE, 26 to 48 percent of such companies are expected to have co-logistics relationship with their supply chain partners. For the small firms, at 95% MOE, the average effectiveness would range from 6.97 to 7.07 on a 10 point scale and at 99% MOE the estimated mean score will as high as 7.08 Specific details related to the three groups are shown in the Table 4.104.

		Class Interval for Average Effectiveness: Co-logistics			Total
		Micro	Small	Medium	
Estimated Percentage	@95% MOE	10 to 37	21 to 44	29 to 45	29 to 41
	@99% MOE	6 to 41	18 to 48	26 to 48	27 to 43
Estimated Mean Score	@95% MOE	6.69 to 6.87	6.97 to 7.07	6.19 to 6.25	6.43 to 6.45
	@99% MOE	6.66 to 6.90	6.96 to 7.08	6.18 to 6.26	6.42 to 6.46

Table 4.104: Class interval for co-logistics and size

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of size on co-logistics initiative. Responses were divided into three groups: micro, small and medium-sized organisations. The detailed results are tabulated in the Table 4.105.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	1.05	0.351	-	-	-
	228					
1B and 2	2	0.39	0.671	-	-	-
	228					
1C and 2	2	1.12	0.327	-	-	-
	228					
1D and 2	2	0.02	0.973	-	-	-
	228					
1E and 2	2	1.27	0.281	-	-	-
	228					
1F and 2	2	0.37	0.691	-	-	-
	228					
1G and 2	2	1.61	0.20	-	-	-
	228					
1H and 2	2	1.61	0.20	-	-	-
	86					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Size of organisation;** 1- Micro, 2- Small, 3- Medium.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between size of organisation.

Table 4.105: Co-logistics and size- ANOVA and Post Hoc Test

The results did not show any statistical differences at the $p < 0.05$ level in co-logistics strategy for the three respondents groups.

4.3.6.2 Co-logistics and Ownership

a) Descriptive Results-

For their co-logistics initiatives, almost 16 percent and 14 percent of the local SMEs were involved with suppliers and customers respectively whereas only 8.6 percent of local companies had co-logistics with their competitors. Local SMEs had more inclination for vertical relationship as compared to horizontal relationship for the co-logistics. The overall co-logistics initiative was nearly 36 percent with respect to local companies.

Similarly, foreign SMEs were more involved with their suppliers and customers for their co-logistics relationship. Co-logistics with competitors found to be very less popular strategy with only 1.8 percent involved in it. Vertical co-logistics were nearly 5 times when compared to horizontal co-logistics. On an overall basis co-logistics in foreign SMEs were more common as compared to local SMEs.

Local-foreign SMEs had nearly equal tendency to be involved with supply chain partners for the co-

logistics. As a result of this their horizontal co-logistics were nearly the same as their vertical co-logistics. The overall basis almost 47 percent of such SMEs had co-logistics with their supply chain partners.

The overall data responses showed more inclination for co-logistics with suppliers and customers and less with competitors. The vertical co-logistics is nearly 10 percent more as compared to horizontal co-logistics. Table 4.106 provides more details about co-logistics with supply chain partners.

Co-logistics with:	Local		Foreign		Foreign-Local		Total	
	F	%	F	%	F	%	F	%
Supplier	23	16.4	15	26.3	8	14.0	46	18.1
Customer	19	13.6	13	22.8	9	15.8	41	16.1
Competitor	12	8.6	1	1.8	8	14.0	21	8.3
Other Organisation	18	12.9	3	5.3	8	14.0	29	11.4
Vertical	32	22.9	20	35.1	14	24.6	66	26.0
Horizontal	24	17.1	4	7.0	15	26.3	43	16.9
Overall	50	35.7	24	42.1	27	47.4	101	39.8
Number of companies in collaborative relationship	140	100.0	57	100.0	57	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 4.106: Co-logistics and ownership

In terms of average effectiveness of co-logistics initiatives with respect to ownership, the average effectiveness for both local and foreign SMEs is better when compared to local-foreign SMEs. The standard deviation and range values were also different for all the three ownership types. Table 4.107 provides more details:

		Average Effectiveness: Co-logistics			
		Local	Foreign	Local-foreign	Total
Frequency	Yes	43	19	27	89
	No	97	38	30	165
Central Tendency & Dispersion	Mean	6.47	7.32	5.78	6.44
	Median	6.00	7.00	5.00	6.00
	Standard Deviation	1.97	1.29	1.25	1.72
	Skewness	-0.10	-0.32	0.71	0.02
	Minimum	1.00	5.00	4.00	1.00
	Maximum	10.00	9.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.107: Average effectiveness: Co-logistics and ownership

b) Estimated Values

For local-foreign SMEs, at 95% Margin of Error (MOE) the estimated percentage of such SMEs in the co-logistics relationship will be from 34 to 60 percent while at 99% MOE, 30 to 64 percent of such SMEs will have co-logistics with their supply chain partners. At 95% MOE, the average effectiveness of foreign SMEs will range from 6.98 to 7.65 on a 10 point scale and at 99% MOE the estimated mean score will be 6.87 to 7.76. It can be expected that co-logistics relationship will be popular up to 40

percent in the local SME population and the mean effectiveness will be high up to 6.89. Specific details related to the three ownership types were shown in the Table 4.108.

Class Interval for Average Effectiveness: Co-logistics					
		Local	Foreign	Local-foreign	Total
Estimated	@95% MOE	23 to 38	21 to 46	34 to 60	29 to 41
Percentage	@99% MOE	22 to 40	17 to 49	30 to 64	27 to 43
Estimated Mean Score	@95% MOE	6.14 to 6.79	6.98 to 7.65	5.45 to 6.10	6.23 to 6.65
	@99% MOE	6.04 to 6.89	6.87 to 7.76	5.35 to 6.20	6.16 to 6.72

Table 4.108: Class interval for co-logistics and ownership

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of ownership of organisation on co-logistics initiatives. Responses were divided into three groups: Local, Foreign and Local-foreign. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.109.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	1.75	0.176	-	-	-
	253				-	-
1B and 2	2	1.27	0.281	-	-	-
	253				-	-
1C and 2	2	2.88	0.050	0.06	0.123* (2 & 3)	0.046
	253				-	-
1D and 2	2	1.40	0.248	-	-	-
	253				-	-
1E and 2	2	1.61	0.201	-	-	-
	253				-	-
1F and 2	2	3.84	0.023	0.03	0.193* (2 & 3)	0.016
	253				-	-
1G and 2	2	1.23	0.394	-	-	-
	253				-	-
1H and 2	2	4.88	0.010	0.10	1.538* (2 & 3)	0.007
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Ownership;** 1- Local, 2-Foreign, 3-Local-foreign.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between ownership.

Table 4.109: Co-logistics and ownership- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-logistics initiative

for the three respondents groups. The results are:

- i. Although $F(2, 253) = 2.88$, $p = 0.050$ showed significant difference between co-logistics with competitors according to type of ownership. The actual difference in mean scores between the groups was moderate as evident from the Eta squared value of 0.06. Post-hoc comparison indicated that the mean score for foreign SMEs was significantly different from local-foreign SMEs (0.123, $p = 0.046$) but not from local SMEs. Also local SMEs and foreign SMEs did not significantly differ from each other.
- ii. The value $F(2, 253) = 3.84$, $p = 0.023$ showed significant difference between co-logistics with competitors and/or other organisation according to type of ownership. The actual difference in mean scores between the groups was not moderate (Eta squared value of 0.03). Tukey HSD test indicated that the mean score foreign-local SMEs was significantly different from foreign SMEs (0.193, $p = 0.016$) but not from local SMEs. Moreover local SMEs and foreign SMEs did not significantly differ from each other.
- iii. Average Effectiveness: $F(2, 106) = 4.88$, $p = 0.010$ showed significant difference between average effectiveness of co-logistics according to ownership. The actual difference in mean scores between the groups was quite high (Eta squared value of 0.10). Post-hoc comparison indicated that the mean score foreign-local SMEs was significantly different from foreign SMEs (1.538 $p = 0.007$) but not from local SMEs (0.368, $p = 0.000$). Additionally local SMEs and foreign SMEs did not significantly differ from each other.

4.3.6.3 Co-logistics and Supply Chain Structure

a) Descriptive Results-

SMEs with S-M-R structure were more inclined towards customers and suppliers for their co-logistics relationship. They were less likely to be involved with their competitors for co-logistics. Such structures had higher probability to be involved in vertical co-logistics as opposed to horizontal co-logistics. The overall inclination for co-logistics initiative was nearly 34 percent for such supply chain structures.

A different pattern is found in the S-M-W-R structures wherein 24 percent of such structures were involved with other organisations for the co-logistics initiative. Such structure had more co-logistics with the competitors as compared to co-logistics with suppliers and customers. As a result such structures had higher inclination for horizontal relations (36 percent) as compared to vertical relations (22 percent) with respect to co-logistics. There was 52 percent likelihood to enter in co-logistics for S-M-W-R structures.

On the contrary, S-M-D-R structures had more involvement with suppliers and customers for their co-logistics relationship. The horizontal co-logistics had less percentage as compared to vertical co-logistics for such supply chain structures. On an overall basis, such structures had one third likeliness

to enter in co-logistics with their supply chain partners.

Similarly, SMEs with more complex supply chain structures (S-M-W-D-R) had more co-logistics with their suppliers and customers. Again horizontal co-logistics were less as compared to vertical co-logistics. On an overall basis 44 percent of such structures had co-logistics with partners. Table 4.110 provides more details about co-logistics with supply chain partners.

Co-logistics with:	S-M-R		S-M-W-R		S-M-D-R		S-M-W-D-R	
	F	%	F	%	F	%	F	%
Supplier	14	18.9	5	10.0	9	12.5	14	25.5
Customer	13	17.6	6	12.0	9	12.5	12	21.8
Competitor	3	4.1	7	14.0	6	8.3	4	7.3
Other Organisation	4	5.4	12	24.0	7	9.7	5	9.1
Vertical	21	28.4	11	22.0	14	19.4	18	32.7
Horizontal	5	6.8	18	36.0	11	15.3	8	14.5
Overall	25	33.8	26	52.0	24	33.3	24	43.6
Number of companies in collaborative relationship	74	100.0	50	100.0	72	100.0	55	100.0

(F:Frequency, %: Valid percentage)

Table 4.110: Co-logistics and supply chain structure

In terms of average effectiveness of co-logistics initiatives with respect to structure of supply chain, the results showed different values of mean and standard deviation for all the supply chain structures. In addition to this, both S-M-W-R and S-M-D-R structures had positive values of skewness as compared to negative values of the other two structures. Table 4.111 provides more details:

		Average Effectiveness: Co-logistics			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Frequency	Yes	19	25	22	22
	No	55	25	50	33
Central Tendency & Dispersion	Mean	7.29	6.28	6.50	5.95
	Median	7.00	6.00	6.00	6.00
	Standard Deviation	1.48	1.77	1.47	1.84
	Skewness	-0.25	0.77	0.10	-0.28
	Minimum	4.00	4.00	4.00	1.00
	Maximum	10.00	10.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.111: Average effectiveness: Co-logistics and supply chain structure

b) Estimated Values

For SMEs with S-M-W-R supply chain structure, at 95% MOE the estimated percentage of such SMEs in the co-logistics relationship will be from 36 to 64 percent while at 99% MOE, 32 to 68 percent of such SMEs will have co-logistics with their supply chain partners. At 95% MOE, the average effectiveness of such SMEs will range from 5.79 to 6.77 on a 10 point scale and at 99% MOE the estimated mean score will be 5.64 to 6.92. It can be expected that co-logistics relationship will be popular up to 57 percent in the S-M-W-D-R structured SME population and the mean effectiveness will be high up to 6.59. Specific details related to the type of supply chain structure are shown in the Table

4.112.

Class Interval for Average Effectiveness: Co-logistics					
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Estimated	@95% MOE	16 to 36	36 to 64	20 to 41	27 to 53
Percentage	@99% MOE	13 to 39	32 to 68	17 to 45	23 to 57
Estimated Mean Score	@95% MOE	6.95 to 7.63	5.79 to 6.77	6.16 to 6.84	5.47 to 6.44
	@99% MOE	6.85 to 7.73	5.64 to 6.92	6.05 to 6.95	5.32 to 6.59

Table 4.112: Class interval for co-logistics and supply chain structure

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of supply chain structure on co-logistics initiative. Responses were divided into four groups: S-M-R, S-M-W-R, S-M-D-R and S-M-W-D-R. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.113.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	3	2.85	0.054	-	-	-
	253				-	-
1B and 2	3	0.84	0.496	-	-	-
	253				-	-
1C and 2	3	1.62	0.169	-	-	-
	253				-	-
1D and 2	3	3.19	0.014	0.05	0.186* (1 & 2)	0.012
	253				-	-
1E and 2	3	1.53	0.192	-	-	-
	253				-	-
1F and 2	3	5.15	0.001	0.07	0.292* (1 & 2)	0.000
	253				0.207* (2 & 3)	0.019
						0.215* (2 & 4)
1G and 2	3	1.69	0.152	-	-	-
	253				-	-
1H and 2	3	2.56	0.144	-	-	-
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Supply Chain Structure;** 1 S-M-R, 2 S-M-W-R, 3 S-M-D-R, 4 S-M-W-D-R.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between supply chain structures.

Table 4.113: Co-logistics and Supply chain structure- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-logistics initiative

for the three respondents groups. The results are:

- i. The value $F(3, 253) = 3.19, p = 0.014$ showed significant difference between co-logistics with other organisation according to supply chain structures. The actual difference in mean scores between the groups was not moderate (Eta squared value of 0.05). Post-hoc comparison indicated that the mean score for structure 'S-M-R' was significantly different from structure 'S-M-W -R' (0.186, $p = 0.012$) and but not from any other structures.
- ii. Horizontal Co-logistics: $F(3, 253) = 5.15, p = 0.001$ showed significant difference between co-logistics with competitors and/or other organisation according to supply chain structures. The actual difference in mean scores between the groups was moderate as evident from the effect size value of 0.07. Tukey HSD test indicated that the mean score for structure 'S-M-W-R' was significantly different from structure 'S-M-R' (0.292, $p = 0.000$), from 'S-M-D-R' (0.207, $p = 0.019$) and from 'S-M-W-D-R' (0.215, $p = 0.023$).

4.3.6.4 Co-logistics and Age of Organisation

a) Descriptive Results-

The organisations which were aged less than 10 years had more inclination for co-logistics with other suppliers (16.7 percent) and 13.9 percent of such organisations had co-logistics with their customers, whereas only 8.3 percentage of such firms had co-logistics relations with their competitors. In such companies percentage of horizontal co-logistics was less as compared to percentage of vertical co-logistics.

For organisations that were aged between 10 and 24 years, co-logistics with suppliers and customers emerged to be the more frequently used strategy whereas co-logistics with competitors was less used in the collaborative initiative. It was found that such organisations were equally inclined towards horizontal and vertical co-logistics relationship.

As far as organisations which aged more than 25 years were concerned, they were more inclined in co-logistics with suppliers (21.4 percent) and customers (17.5 percent). Such firms were found to have more involvement in vertical co-logistics when compared to horizontal co-logistics. The overall co-logistics initiative was not found to be a commonly used initiative in such organisations.

The overall data responses showed more inclination for co-logistics with suppliers, customers and other organisations. As a result, the vertical co-logistics were more common as compared to horizontal co-logistics. Table 4.114 provides more details about co-logistics with supply chain partners.

Co-logistics with:	Less than 10 yrs		10 to 24 yrs		25 and more		Total	
	F	%	F	%	F	%	F	%
Supplier	12	16.7	12	15.2	22	21.4	46	18.1
Customer	10	13.9	13	16.5	18	17.5	41	16.1
Competitor	6	8.3	8	10.1	7	6.8	21	8.3
Other Organisation	8	11.1	10	12.7	11	10.7	29	11.4
Vertical	19	26.4	18	22.8	29	28.2	66	26.0
Horizontal	13	18.1	17	21.5	13	12.6	43	16.9
Overall	29	40.3	32	40.5	40	38.8	101	39.8
Number of companies in collaborative relationship	72	100.00	79	100.00	72	100.00	79	100.00

Table 4.114: Co-logistics and age

In terms of average effectiveness of co-logistics initiatives with respect to age, the results showed similar values for mean and median. The range value was found to be different for all the three types of organisations. Table 4.115 provides more details.

		Average Effectiveness: Co-logistics			Total
		Less than 10 yrs	10 to 24 yrs	25 and more	
Frequency	Yes	26	30	33	89
	No	46	49	70	165
Central Tendency & Dispersion	Mean	6.31	6.63	6.36	6.44
	Median	6.00	6.50	6.00	6.00
	Standard Deviation	1.57	1.65	1.91	1.72
	Skewness	0.59	-0.01	-0.19	0.02
	Minimum	4.00	4.00	1.00	1.00
	Maximum	10.00	9.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.115: Average effectiveness: Co-logistics and age

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. On an overall basis, at 95% MOE the estimated percentage of SMEs in the co-logistics relationship would be from 29 to 41 percentages while at 99% MOE, 27 to 43 percent of the SMEs are expected to have co-logistics with their supply chain partners. At 95% MOE, the average effectiveness would range from 6.43 to 6.45 on a 10 point scale and at 99% MOE the estimated mean score will be as high as 6.46. For the organisations aged less than 10 years, it can be expected that co-logistics relationship will be popular up to 51 percent and the mean effectiveness would be high up to 6.37. Specific details related to the three groups were shown in the Table 4.116.

Class Interval for Average Effectiveness: Co-logistics					
Less than					Total
		10 yrs	10 to 24 yrs	25 and more	
Estimated Percentage	@95% MOE	25 to 47	27 to 49	23 to 41	29 to 41
	@99% MOE	22 to 51	24 to 52	20 to 44	27 to 43
Estimated Mean Score	@95% MOE	6.27 to 6.35	6.59 to 6.67	6.33 to 6.40	6.43 to 6.45
	@99% MOE	6.25 to 6.37	6.58 to 6.68	6.31 to 6.42	6.42 to 6.46

Table 4.116: Class interval for co-logistics and age

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of age of organisation on co-logistics initiative. Responses were divided into three groups: organisations aged less than 10 years; organisations aged between 10 and 24 years; and organisations aged more than 25 years. The detailed results are tabulated in the Table 4.117.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	0.64	0.528	-	-	-
	253					
1B and 2	2	0.20	0.816	-	-	-
	253					
1C and 2	2	0.32	0.726	-	-	-
	253					
1D and 2	2	0.09	0.914	-	-	-
	253					
1E and 2	2	0.33	0.715	-	-	-
	253					
1F and 2	2	1.30	0.274	-	-	-
	253					
1G and 2	2	0.03	0.969	-	-	-
	253					
1H and 2	2	0.29	0.740	-	-	-
	86					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Age of organisation;** 1- up to 10 years, 2- 10 -24 years, 3- 25 years and more.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between age of age of organisation.

Table 4.117: Co-logistics and age- ANOVA and Post Hoc Test

The results showed that there were no statistical differences at the $p < 0.05$ level in the co-logistics relationship for the three respondents groups.

4.3.6.5 Correlation of Co-logistics and other collaborative initiatives:

The relationship between co-logistics relationship with other types of relationship was analysed using bi-variate correlation method. Due to the restriction of number of cases, the separate correlation analysis using country, ownership and supply chain structures as independent variables was not possible. However the correlation analysis was possible for all the responses taken as a whole. Moreover with the absence of any definite independent variable regression analysis was not conducted to avoid complexity of results. Spearman's rho values (non-parametric test) were used to measure the correlation as some of the variables failed the normality test. The relationship of co-logistics with other collaborative initiatives is summarised in the correlation matrix shown in Table 4.118.

Effectiveness of:		Effectiveness of co-logistics with:			
		Supplier	Customer	Competitor	Other Organisation
Co-development with:	Other Organisation	.697*	.900**	-	-
Co-design with:	Other Organisation				.916**
Co-manufacturing with:	Supplier	.755*	.708*	.900*	.766**
	Other Organisation				.827*
Aggregated Purchasing with:	Supplier	.849*	.771*	-	.975**
	Competitor			.886**	.782*
	Other Organisation			.825**	.639*
Co-logistics with:	Supplier		.946**		
	Competitor				.944**
Joint Problem Solving with:	Other Organisation				.821**
Shared Resources with:	Customer		.654*		
	Other Organisation			.687*	
CPFR with:	Supplier	.482*		.741**	.567*
	Customer			.807**	.751**

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.118: Correlation of effectiveness of co-logistics with other collaborative initiatives

It was found that within co-logistics initiative, co-logistics with supplier was strongly related to co-logistics with customer ($r = 0.946$) and co-logistics with competitors was also strongly related to co-logistics with other organisations ($r = 0.944$). Co-logistics also found to have strong relation with co-manufacturing with supplier. Interestingly, co-logistic with competitors was related to most of other collaborative initiatives. CPFR with supplier was also positively related to co-logistics with suppliers, competitors and other organisations. In conclusion, co-logistics emerged to have positive effect on other collaborative initiatives.

4.3.7 Joint problem solving-

4.3.7.1 Joint Problem Solving and Size of Organisation

a) Descriptive Results-

The results showed that micro organisations had more inclination for joint problem solving with suppliers and customers whereas only 5.3 percent of such companies had joint problem solving relation with their competitors. Vertical joint problem solving relations were found to be more as compared to horizontal joint problem solving. The overall joint problem solving initiative was nearly 40 percent for the micro firms.

The small organisations were also found to have more joint problem solving relations with suppliers, customers and other organisations. It found such organisations were more focused on vertical joint problem solving as compared to horizontal joint problem solving strategy. On a combined basis joint problem solving strategy was very common initiative in small organisation.

As far as medium-sized organisations were concerned, they were more inclined in joint problem solving with supplier and customers. As a result, such firms were more involved in vertical joint problem solving as compared to horizontal joint problem solving. The overall joint problem solving initiative was very popular in such organisations.

The overall data responses showed that joint problem solving relationship was very popular (69.3 percent). The horizontal joint problem solving initiatives were less as compared to vertical joint problem solving initiatives. Table 4.119 provides more details about joint problem solving with supply chain partners.

Joint problem solving with:	Micro		Small		Medium		Total	
	F	%	F	%	F	%	F	%
Supplier	9	23.7	27	42.2	52	40.9	88	38.4
Customer	8	21.1	16	25.0	50	39.4	74	32.3
Competitor	2	5.3	5	7.8	16	12.6	23	10.0
Other Organisation	5	13.2	17	26.6	36	28.3	58	25.3
Vertical	12	31.6	29	45.3	69	54.3	110	48.0
Horizontal	6	15.8	18	28.1	40	31.5	64	27.9
Overall	15	39.5	37	57.8	88	69.3	140	61.1
Number of companies in collaborative relationship	38	100.0	64	100.0	127	100.0	229	100.0

Table 4.119: Joint problem solving and size

In terms of average effectiveness of joint problem solving initiatives with respect to size, the results showed same values median. However, the values of standard deviation, range and skewness were different for all the three types of organisations. Table 4.120 provides more details:

		Average Effectiveness: Joint problem solving			
		Micro	Small	Medium	Total
Frequency	Yes	13	34	81	146
	No	25	30	46	108
Central Tendency & Dispersion	Mean	6.13	6.34	5.97	6.11
	Median	6.00	6.00	6.00	6.00
	Standard Deviation	1.68	1.33	1.54	1.50
	Skewness	-0.12	1.22	-0.40	0.03
	Minimum	3.00	4.00	2.00	2.00
	Maximum	9.00	10.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.120: Average effectiveness: Joint problem solving and size

b) Estimated Values

It is estimated that, at 95% Margin of Error (MOE) the estimated percentage of medium-sized organisation in the joint problem solving relationship would range from 55 to 72 percentage while at 99% MOE, 53 to 75 percent of the such firms are expected to have joint problem solving with their supply chain partners. For micro organisations, at 95% MOE, the average effectiveness would range from 6.69 to 6.87 on a 10 point scale and at 99% MOE the estimated mean score will be 6.66 to 6.90. It can be expected that joint problem solving relationship will be popular up to 65 percent in the SME population and the mean effectiveness would be high up to 6.13. Specific details related to the three groups were shown in the Table 4.121.

		Class Interval for Average Effectiveness: Joint problem solving			
		Micro	Small	Medium	Total
Estimated Percentage	@95% MOE	10 to 37	41 to 65	55 to 72	51 to 64
	@99% MOE	6 to 41	37 to 69	53 to 75	49 to 65
Estimated Mean Score	@95% MOE	6.69 to 6.87	6.30 to 6.38	5.95 to 5.99	6.10 to 6.12
	@99% MOE	6.66 to 6.90	6.29 to 6.39	5.94 to 6.00	6.09 to 6.13

Table 4.121: Class interval for joint problem solving and size

c) Statistical Results-

A one-way between-groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of country on joint problem solving initiative. The detailed results are tabulated in the Table 4.122.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	2.11	0.123	-	-	-
	228					
1B and 2	2	3.38	0.035	0.03	-	-
	228					
1C and 2	2	1.11	0.331	-	-	-
	228					
1D and 2	2	1.82	0.164	-	-	-
	228					
1E and 2	2	3.21	0.042	0.03	0.228* (1 & 3)	0.037
	228					
1F and 2	2	1.79	0.168	-	-	-
	228					
1G and 2	2	5.89	0.003	0.05	0.298* (1 & 3)	0.003
	228					
1H and 2	2	0.721	0.448	-	-	-
	127					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H-average effectiveness , **Variable 2: Size of organisation;** 1- Micro, 2- Small, 3- Medium.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between size of organisation.

Table 4.122: Joint problem solving and size- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in the joint problem solving relationship for the three respondents groups.

- The value $F(2, 228) = 3.21$, $p = 0.042$ showed significant difference between vertical joint problem solving relationship according to size. The actual difference in mean scores between the groups was not high (Eta squared value of 0.03). Post-hoc comparison indicated that the mean score for micro organisations was significantly different from medium-sized organisations (0.228, $p = 0.037$) and but not from small organisations. Moreover, small and medium-sized organisations did not significantly differ from each other.
- The value $F(2, 228) = 5.89$, $p = 0.003$ showed significant difference between joint problem solving relationship according to size. The actual difference in mean scores between the groups

was moderate with Eta squared value of 0.05). Post-hoc comparison indicated that the mean score for micro organisations was significantly different from medium-sized organisations (0.298, $p = 0.003$) and but not from small organisations. Moreover, small and medium-sized organisations did not significantly differ from each other.

4.3.7.2 Joint problem solving and Ownership

a) Descriptive Results-

For their joint problem solving initiatives, almost 43 percent and 36 percent of the local SMEs were involved with suppliers and customers respectively whereas 15 percent of local companies had joint problem solving with their competitors. Local SMEs had more inclination for vertical relationship as compared to horizontal relationship for the joint problem solving. The overall joint problem solving initiative was popular up to 63 percent with respect to local companies.

On a similar pattern, foreign SMEs were also more involved with their suppliers and customers for their joint problem solving relationship. Joint problem solving with competitors and other organisations found to be a very less popular strategy with only 1.8 percent involved in it. Vertical joint problem solving is much more as compared to horizontal joint problem solving. On an overall basis joint problem solving in foreign SMEs were common up to 46 percent in such SMEs.

On the contrary, local-foreign SMEs had a much higher tendency (57.9 percent) to be involved with other organisation for the joint problem solving. And a result of this, their horizontal joint problem solving is more popular than vertical joint problem solving. The overall basis almost 62 percent of such SMEs had joint problem solving with their supply chain partners.

The overall data responses showed more inclination for joint problem solving with suppliers and customers whereas less with competitors. The horizontal joint problem solving is nearly 17 percent less as compared to vertical joint problem solving. Table 4.123 provides more details about joint problem solving with supply chain partners.

Joint problem solving with:	Local		Foreign		Foreign-Local		Total	
	F	%	F	%	F	%	F	%
Supplier	60	42.9	17	29.8	22	38.6	99	39.0
Customer	50	35.7	14	24.6	16	28.1	80	31.5
Competitor	21	15.0	1	1.8	6	10.5	28	11.0
Other Organisation	38	27.1	1	1.8	33	57.9	72	28.3
Vertical	73	52.1	25	43.9	24	42.1	122	48.0
Horizontal	44	31.4	2	3.5	33	57.9	79	31.1
Overall	88	62.9	26	45.6	44	77.2	158	62.2
Number of companies in collaborative relationship	140	100.0	57	100.0	57	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 4.123: Joint problem solving and ownership

In terms of average effectiveness of joint problem solving initiatives with respect to ownership, the average effectiveness for both local and foreign SMEs were better as compared to local-foreign SMEs. The standard deviation and range values were also different for all the three ownership types. Table 4.124 provides more details:

		Average Effectiveness: Joint Problem Solving			
		Local	Foreign	Local-foreign	Total
Frequency	Yes	80	22	44	146
	No	60	35	13	108
Central Tendency & Dispersion	Mean	6.15	6.27	5.94	6.11
	Median	6.00	7.00	6.00	6.00
	Standard Deviation	1.51	1.67	1.42	1.50
	Skewness	0.50	-0.61	-0.65	0.03
	Minimum	3.00	3.00	2.00	2.00
	Maximum	10.00	8.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.124: Average effectiveness: Joint problem solving and ownership

b) Estimated Values

For foreign SMEs, at 95% Margin of Error (MOE) the estimated percentage of such SMEs in the joint problem solving relationship will be from 26 to 51 percentage while at 99% MOE, 22 to 55 percent of such SMEs will have joint problem solving with their supply chain partners. At 95% MOE, the average effectiveness of such SMEs will range from 5.84 to 6.71 on a 10 point scale and at 99% MOE the estimated mean score will be 5.70 to 6.84. It can be expected that joint problem solving relationship will be popular up to 92 percent in the local-foreign SME population and the mean effectiveness will be high up to 6.42. Specific details related to the three ownership type are shown in the Table 4.125.

		Class Interval for Average Effectiveness: Joint Problem Solving			
		Local	Foreign	Local-foreign	Total
Estimated	@95% MOE	49 to 65	26 to 51	66 to 88	51 to 64
Percentage	@99% MOE	48 to 67	22 to 55	63 to 92	49 to 65
Estimated Mean Score	@95% MOE	5.90 to 6.40	5.84 to 6.71	5.57 to 6.30	5.92 to 6.29
	@99% MOE	5.82 to 6.48	5.70 to 6.84	5.45 to 6.42	5.86 to 6.35

Table 4.125: Class interval for joint problem solving and ownership

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of ownership of organisation on joint problem solving initiative. Responses were divided into three groups: Local, Foreign and Local-foreign. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.126.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	1.44	0.237	-	-	-
	253				-	-
1B and 2	2	1.36	0.257	-	-	-
	253				-	-
1C and 2	2	3.69	0.026	0.03	0.132* (1 & 2)	0.019
	253				-	-
1D and 2	2	26.61	0.000	0.17	0.254* (1 & 2)	0.000
	253				0.308* (1 & 3)	0.000
					0.561* (2 & 3)	0.000
1E and 2	2	1.70	0.345	-	-	-
	253				-	-
1F and 2	2	23.01	0.000	0.15	0.279* (1 & 2)	0.000
	253				0.265* (1 & 3)	0.000
					0.544* (2 & 3)	0.000
1G and 2	2	6.60	0.002	0.05	0.316* (2 & 3)	0.001
	253				-	-
1H and 2	2	0.45	0.636	-	-	-
	106				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Ownership:** 1- Local, 2-Foreign, 3-Local-foreign.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between ownership.

Table 4.126: Joint problem solving and ownership- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in joint problem solving initiative for the three respondents groups. The results are:

- The value $F(2, 253) = 1.00$, $p = 0.368$ showed significant difference between joint problem solving with competitors according to type of ownership. The actual difference in mean scores between the groups was moderate as evident from the Eta squared value of 0.03. Post-hoc comparison indicated that the mean score for foreign SMEs was significantly different from local SMEs (0.132, $p = 0.019$) but not from local-foreign SMEs. Moreover local SMEs and local-foreign SMEs did not significantly differ from each other
- The value $F(2, 253) = 26.61$, $p = 0.000$ showed significant difference between joint problem solving with other organisation according to ownership type. The actual difference in mean scores between the groups was very high (Eta squared value of 0.17). Tukey HSD test indicated that the mean score for local SMEs was significantly different from local-foreign SMEs (0.308, $p = 0.000$) and foreign SMEs (0.254, $p = 0.000$). Moreover local-foreign SMEs and foreign SMEs did significantly differ from each other (0.561, $p = 0.000$).

- iii. Horizontal Joint problem solving: $F(2, 253) = 23.01$, $p = 0.000$ showed significant difference between joint problem solving with competitors and/or other organisation according to type of ownership. The actual difference in mean scores between the groups was quite high as evident from Eta squared value of 0.17. Post-hoc comparison indicated that the mean score for local SMEs was significantly different from local-foreign SMEs (0.265 , $p = 0.000$) and foreign SMEs (0.279 , $p = 0.000$). Moreover local-foreign SMEs and foreign SMEs did significantly differ from each other (0.544 , $p = 0.000$).
- iv. Overall Joint problem solving: $F(2, 253) = 6.60$, $p = 0.002$ showed significant difference between joint problem solving with competitors and or other organisation according to ownership. However the actual difference in mean scores between the groups was not moderate (Eta squared value of 0.05). Tukey HSD test indicated that the mean score foreign SMEs was significantly different from local-foreign SMEs (0.316 , $p = 0.001$) but not from local SMEs. Moreover local SMEs and local-foreign SMEs did not significantly differ from each other.

4.3.7.3 Joint problem solving and Supply Chain Structure

a) Descriptive Results-

SMEs with S-M-R structure were more inclined towards suppliers (41.9 percent) for their joint problem solving relationship. They were less likely to be involved with their competitors for joint problem solving. Such structures had higher probability to be involved in vertical joint problem solving as opposed to horizontal joint problem solving. The overall inclination for joint problem solving initiative was nearly 65 percent for such supply chain structures.

A dissimilar pattern is found in the S-M-W-R structures wherein 42 percent of such structures were involved with other organisations for the joint problem solving initiative. However such structures had nearly the same inclination for horizontal relations as well as vertical relations with respect to joint problem solving. There was 66 percent likelihood to enter in joint problem solving for S-M-W-R structures.

S-M-D-R structures had more involvement with suppliers (47.2 percent) followed by customers (27.8 percent) for their joint problem solving relationship. The horizontal joint problem solving had lower percentage as compared to vertical joint problem solving for such supply chain structures. On an overall basis such structure had more likeliness (.61) to enter in joint problem solving with their supply chain partners.

It was found that nearly one third of the SMEs with more complex supply chain structures (S-M-W-D-R) had joint problem solving with suppliers and customers whereas only 5.5 percent of such SMEs had joint problem solving with their competitors. Again percentage of horizontal joint problem solving was less as compared to that of vertical joint problem solving. On an overall basis, 58 percent of such

structures had joint problem solving with partners. Table 4.127 provides more details about joint problem solving with supply chain partners.

Joint problem solving with:	S-M-R		S-M-W-R		S-M-D-R		S-M-W-D-R	
	F	%	F	%	F	%	F	%
Supplier	31	41.9	14	28.0	34	47.2	19	34.5
Customer	22	29.7	17	34.0	20	27.8	20	36.4
Competitor	8	10.8	9	18.0	7	9.7	3	5.5
Other Organisation	16	21.6	21	42.0	16	22.2	18	32.7
Vertical	37	50.0	20	40.0	40	55.6	24	43.6
Horizontal	20	27.0	23	46.0	17	23.6	18	32.7
Overall	48	64.9	33	66.0	44	61.1	32	58.2
Number of companies in collaborative relationship	74	100.0	50	100.0	72	100.0	55	100.0

(F:Frequency, %: Valid percentage)

Table 4.127: Joint problem solving and supply chain structure

In terms of average effectiveness of joint problem solving initiatives with respect to structure of supply chain, the results showed similar values of mean and median for all the supply chain structures except S-M-W-D-R. However, the standard deviation and range values were different for all the supply chain structures. Both S-M-D-R and S-M-W-D-R structures had negative values of skewness as compared to the other two structures. Table 4.128 provides more details.

		Average Effectiveness: Joint Problem Solving			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Frequency	Yes	39	33	43	30
	No	35	17	29	25
Central Tendency & Dispersion	Mean	6.48	6.13	6.04	5.76
	Median	6.00	6.00	6.00	6.00
	Standard Deviation	1.77	1.33	1.39	1.34
	Skewness	0.02	0.81	-0.30	-1.00
	Minimum	3.00	4.00	2.00	2.00
	Maximum	10.00	10.00	9.00	8.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.128: Average effectiveness: Joint problem solving and supply chain structure

b) Estimated Values

For SMEs with S-M-W-R supply chain structure, at 95% MOE the estimated percentage of such SMEs in the joint problem solving relationship will be from 53 to 79 percent while at 99% MOE, 49 to 83 percent of such SMEs will have joint problem solving with their supply chain partners. At 95% MOE, the average effectiveness of S-M-R structured SMEs will range from 6.08 to 6.89 on a 10 point scale and at 99% MOE the estimated mean score will be 5.95 to 7.01. It can be expected that joint problem solving relationship will be popular up to 75 percent in the S-M-D-R structures SME population and the mean effectiveness will be high up to 6.47. Specific details related to the type of supply chain

structure are shown in the Table 4.129.

		Class Interval for Average Effectiveness: Joint Problem Solving			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Estimated	@95% MOE	41 to 64	53 to 79	48 to 71	41 to 68
Percentage	@99% MOE	38 to 68	49 to 83	45 to 75	37 to 72
Estimated Mean Score	@95% MOE	6.08 to 6.89	5.77 to 6.50	5.72 to 6.37	5.41 to 6.12
	@99% MOE	5.95 to 7.01	5.65 to 6.62	5.62 to 6.47	5.30 to 6.23

Table 4.129: Class interval for joint problem solving and supply chain structure

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of supply chain structure on joint problem solving initiative. Responses were divided into four groups: S-M-R, S-M-W-R, S-M-D-R and S-M-W-D-R. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.130.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	3	1.33	0.256	-	-	-
	253				-	-
1B and 2	3	0.35	0.861	-	-	-
	253				-	-
1C and 2	3	1.47	0.211	-	-	-
	253				-	-
1D and 2	3	2.05	0.087	-	-	-
	253				-	-
1E and 2	3	0.92	0.449	-	-	-
	253				-	-
1F and 2	3	1.93	0.103	-	-	-
	253				-	-
1G and 2	3	0.49	0.739	-	-	-
	253				-	-
1H and 2	3	1.98	0.100	-	-	-
	106				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Supply Chain Structure;** 1 S-M-R, 2 S-M-W-R, 3 S-M-D-R, 4 S-M-W-D-R.
- **Mean Difference*:-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between supply chain structures.

Table 4.130: Joint problem solving and Supply chain structure- ANOVA and Post Hoc Test

The results showed that no statistical differences at the $p < 0.05$ level in joint problem solving initiative

for the three respondents groups.

4.3.7.4 Joint Problem solving and Age of Organisation

a) Descriptive Results-

The organisations which were aged less than 10 years had similar inclination for joint problem solving with suppliers, customers and other organisation whereas only 9.7 percent of such organisations had joint problem solving with their competitors. In such companies percentage of vertical joint problem solving were more as compared to percentage of horizontal joint problem solving. The overall joint problem solving initiative was popular up to 62 percent in these organisations.

For organisations that were aged between 10 and 24 years, joint problem solving with other suppliers and with organisations found to be the most commonly used strategy. It was also found that such organisations were slightly more inclined towards vertical joint problem solving as compared to horizontal joint problem solving. On a combined basis joint problem solving was very popular initiative in such organisations.

As far as organisations which aged more than 25 years were concerned, they were more inclined in joint problem solving with suppliers. Such firms were found to have nearly double percentage of involvement in vertical joint problem solving relationship as compared to horizontal joint problem solving relationship. The overall joint problem solving initiative was popular in such organisations.

The overall data responses showed more inclination for joint problem solving with suppliers, customers and other organisations and less with the competitors. As a result, the horizontal joint problem solving was less as compared to vertical joint problem solving. Table 4.131 provides more details about joint problem solving with supply chain partners.

Joint Problem solving with:	Less than 10 yrs		10 to 24 yrs		25 and more		Total	
	F	%	F	%	F	%	F	%
Supplier	24	33.3	34	43.0	41	39.8	99	39.0
Customer	23	31.9	24	30.4	33	32.0	80	31.5
Competitor	7	9.7	10	12.7	11	10.7	28	11.0
Other Organisation	22	30.6	30	38.0	20	19.4	72	28.3
Vertical	34	47.2	37	46.8	51	49.5	122	48.0
Horizontal	24	33.3	32	40.5	23	22.3	79	31.1
Overall	45	62.5	53	67.1	60	58.3	158	62.2
Number of companies in collaborative relationship	72	100.00	79	100.00	72	100.00	79	100.00

Table 4.131: Joint problem solving and age

In terms of average effectiveness of joint problem solving initiatives with respect to age, the results showed similar values for median. However, the standard deviation and range values were different for all the three types of organisations. Moreover all the three groups had negative skewness which implies that most of the effectiveness value lies above mean. Table 4.132 provides more details:

		Average Effectiveness: Joint Problem solving			Total
		Less than	10 to 24 yrs	25 and more	
		10 yrs			
Frequency	Yes	41	52	53	146
	No	31	27	50	108
Central Tendency & Dispersion	Mean	5.93	6.02	6.33	6.11
	Median	6.00	6.00	6.00	6.00
	Standard Deviation	1.66	1.26	1.58	1.50
	Skewness	0.01	0.41	-0.19	0.03
	Minimum	2.00	3.00	3.00	2.00
	Maximum	10.00	10.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.132: Average effectiveness: Joint problem solving and age

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. On an overall basis, at 95% MOE the estimated percentage of SMEs in the joint problem solving relationship would be from 51 to 64 percentages while at 99% MOE, 49 to 65 percent of the SMEs are expected to have joint problem solving with their supply chain partners. At 95% MOE, the average effectiveness would range from 6.10 to 6.12 on a 10 point scale and at 99% MOE the estimated mean score will be 6.09 to 6.13. For the organisations aged between 10 and 24 years, it can be expected that joint problem solving relationship will be popular up to 80 percent and the mean effectiveness would be high up to 6.06. Specific details related to the three groups are shown in the Table 4.133.

		Class Interval for Average Effectiveness: Joint Problem solving			Total
		Less than	10 to 24 yrs	25 and more	
		10 yrs			
Estimated Percentage	@95% MOE	46 to 68	55 to 76	42 to 61	51 to 64
	@99% MOE	42 to 72	51 to 80	39 to 64	49 to 65
Estimated Mean Score	@95% MOE	5.58 to 5.95	5.99 to 6.05	6.30 to 6.36	6.10 to 6.12
	@99% MOE	5.87 to 5.99	6.98 to 6.06	6.29 to 6.37	6.09 to 6.13

Table 4.133: Class interval for joint problem solving and age

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of age of the organisation on joint problem solving initiative. Responses were divided into three groups: organisations aged less than 10 years, organisations aged between 10 and 24 years and organisations aged more than 25 years. Eta squared values were also used to determine the effect age

of the results. The detailed results are tabulated in the Table 4.134.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	0.76	0.466	-	-	-
	253					
1B and 2	2	0.03	0.968	-	-	-
	253					
1C and 2	2	0.17	0.84	-	-	-
	253					
1D and 2	2	0.39	0.20	-	-	-
	253					
1E and 2	2	0.07	0.926	-	-	-
	253					
1F and 2	2	3.62	0.028	0.03	0.189* (2 & 3)	0.023
	253					
1G and 2	2	0.74	0.478	-	-	-
	253					
1H and 2	2	0.93	0.396	-	-	-
	145					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H-average effectiveness , **Variable 2: Age of organisation;** 1- up to 10 years, 2- 10 -24 years, 3- 25 years and more.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between age of age of organisation.

Table 4.134: Joint problem solving and age- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in the joint problem solving relationship for the three respondents groups.

- The value $F(2, 253) = 3.62$, $p = 0.028$ showed significant difference between vertical joint problem solving relationship age of organisation. The actual difference in mean scores between the groups was not moderate (Eta squared value of 0.03). Post-hoc comparison indicated that the mean score for organisations that were aged between 10 and 24 years was significantly different from the organisations which were aged more than 25 years (0.189 , $p = 0.023$).

4.3.7.5 Correlation of Joint problem solving and other collaborative initiatives:

The relationship between joint problems solving initiative with other type of relationship was analysed using bi-variate correlation method. Due to the restriction of a number of cases, the separate correlation analysis using country, ownership and supply chain structures as independent variables was not possible. However the correlation analysis was possible for all the responses taken a whole. Moreover with the absence of any definite independent variable regression analysis was not conducted to avoid complexity of results. Spearman's rho values (non-parametric test) were used to measure the correlation

as some of the variables failed the normality test. The relationship of joint problem solving with other collaborative initiatives is summarised in the correlation matrix shown in Table 4.135.

Effectiveness of:		Effectiveness of Joint Problem Solving with:			
		Supplier	Customer	Competitor	Other Organisation
Joint Ventures with:	Supplier	.567**	-	-	-
Co-development with:	Supplier	.730**	-	-	-
	Customer	-	.454*	-	-
	Other Organisation	-	.582*	-	-
Co-design with:	Supplier	.571**	.649**	-	-
	Customer	-	.564**	-	-
	Other Organisation	-	.680**	-	.392*
Co-manufacturing with:	Other Organisation	.409*	.665**	-	-
Aggregated Purchasing with:	Other Organisation	-	.486**	-	-
Co-logistics with:	Other Organisation	-	-	-	.821**
Joint Problem Solving with:	Supplier		.772**	.718**	.476**
Shared Resources with:	Supplier	-	.754**	-	-
	Customer	-	.823**	-	-
	Competitor	-	-	.826*	-
	Other Organisation	-	-	-	.447*
CPFR with:	Supplier	.269*	.365*	-	.302*
	Customer	-	.302*	-	-

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.135: Correlation of effectiveness of joint problem solving with other collaborative initiatives

It was found that within joint problem solving initiative, joint problem solving with supplier was positively correlated to joint problem solving with customers ($r = 0.772$), competitors ($r = 0.718$) and other organisation ($r = 0.476$). Joint problem solving with customers also found to have relation with most of the other collaborative initiatives. CPFR with supplier was also positively related to joint problem solving with suppliers ($r = 0.269$), with customers ($r = 0.365$) and with other organisations ($r = 0.302$). In conclusion, joint problem solving found to have positive effects on other collaborative initiatives.

4.3.8 Shared Resources -

4.3.8.1 Shared Resources and Size of Organisation

1) Descriptive Results-

Micro organisations were found to be more involved with other organisations for the shared resources initiative whereas only 5.3 percent of such companies had shared resources with their competitors. Such companies were found to have more inclination for horizontal relationship as opposed to vertical relationships for the shared resources initiative. The overall shared resources initiative was common up to almost 40 percent.

On the other hand, small companies were more involved with the suppliers and other organisation as opposed to customers and competitors for the shared resources relationship. Vertical shared resources were nearly the same in percentage as the percentage of horizontal shared resources. On an overall basis, such companies exhibited around 58 percent of shared resources relations with their supply chain partners.

Medium-sized organisations were also found with more inclined towards other organisation for the shared resources initiative. On a combined basis shared resources with the supply chain partners was found to be very popular initiative in the medium-sized firms.

The overall data responses showed more inclination for shared resources with other organisations and less with the competitors. The overall percentage for shared resources was high as 61 percent. Table 4.136 provides more details about shared resources with supply chain partners.

Shared resources with:	Micro		Small		Medium		Total	
	F	%	F	%	F	%	F	%
Supplier	5	13.2	8	12.5	15	11.8	28	12.2
Customer	3	7.9	6	9.4	15	11.8	24	10.5
Competitor	2	5.3	5	7.8	4	3.1	11	4.8
Other Organisation	8	21.1	9	14.1	33	26.0	50	21.8
Vertical	7	18.4	11	17.2	23	18.1	41	17.9
Horizontal	10	26.3	12	18.8	34	26.8	56	24.5
Overall	15	39.5	37	57.8	88	69.3	140	61.1
Number of companies in collaborative relationship	38	100.0	64	100.0	127	100.0	229	100.0

Table 4.136: Shared resources and size

In terms of average effectiveness of shared resources initiatives with respect to size, the results showed different values for mean and median. Moreover, the standard deviation and range were also different for all the three types of organisations. Table 4.137 provides more details:

		Average Effectiveness: Co-logistics			Total
		Micro	Small	Medium	
Frequency	Yes	12	21	49	95
	No	26	43	78	159
Central Tendency & Dispersion	Mean	5.42	5.33	6.11	5.84
	Median	5.50	5.00	6.00	6.00
	Standard Deviation	0.90	1.72	1.98	1.77
	Skewness	-0.15	0.35	-0.66	-0.28
	Minimum	4.00	2.00	1.00	1.00
	Maximum	7.00	9.00	9.00	9.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.137: Average effectiveness: Shared resources and size

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. At 95% Margin of Error (MOE) the estimated percentage of medium-sized organisations in the shared resources relationship would be from 30 to 47 percentage while at 99% MOE, 27 to 50 percent of such companies are expected to have shared resources relationship with their supply chain partners. For such firms, at 95% MOE, the average effectiveness would range from 6.08 to 6.14 on a 10 point scale and at 99% MOE the estimated mean score will be as high as 6.15. Specific details related to the three groups are shown in the Table 4.138.

		Class Interval for Average Effectiveness: Co-logistics			Total
		Micro	Small	Medium	
Estimated Percentage	@95% MOE	17 to 46	21 to 44	30 to 47	31 to 43
	@99% MOE	12 to 51	18 to 48	27 to 50	30 to 45
Estimated Mean Score	@95% MOE	5.37 to 5.47	5.28 to 5.38	6.08 to 6.14	5.83 to 5.85
	@99% MOE	5.36 to 5.48	5.26 to 5.40	5.07 to 6.15	5.82 to 5.86

Table 4.138: Class interval for Shared resources and size

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of size on shared resources initiative. Responses were divided into three groups: micro, small and medium-sized organisations. The detailed results were tabulated in the Table 4.139.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	0.08	0.919	-	-	-
	228					
1B and 2	2	0.29	0.746	-	-	-
	228					
1C and 2	2	1.01	0.363	-	-	-
	228					
1D and 2	2	1.78	0.170	-	-	-
	228					
1E and 2	2	0.01	0.984	-	-	-
	228					
1F and 2	2	0.78	0.460	-	-	-
	228					
1G and 2	2	0.40	0.665	-	-	-
	228					
1H and 2	2	1.68	0.192	-	-	-
	127					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Size of organisation;** 1- Micro, 2- Small, 3- Medium.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between size of organisation.

Table 4.139: Shared resources and size- ANOVA and Post Hoc Test

The results did not show any statistical differences at the $p < 0.05$ level in shared resources strategy for the three respondents groups.

4.3.8.2 Shared resources and Ownership

a) Descriptive Results-

For their shared resources initiatives, almost 24 percent of the local SMEs were involved with other organisations whereas only 5.7 percent of local companies had shared resources with their competitors. Local SMEs had more inclination for vertical relationship compared to horizontal relationship for the shared resources. The overall shared resources initiative was nearly 40 percent with respect to local companies.

On the other hand, foreign SMEs were more involved with customers for their shared resources relationship. Shared resources with competitors were again found to be very less popular strategy with only 3.5 percent involved in it. Vertical shared resources were more (nearly 10 percent) as compared to horizontal shared resources. On an overall basis, shared resources in foreign SMEs were not common as compared to local SMEs.

Foreign-local SMEs had a higher tendency (38.6 percent) to be involved with other organisations for the shared resources. And a result of this their horizontal shared resources were more popular than vertical shared resources. The overall basis almost 47 percent of such SMEs had shared resources with their supply chain partners.

The overall data responses showed more inclination for shared resources with other organisations (23.6 percent) and less with competitors (4.7 percent). The horizontal shared resources were nearly 10 percent more as compared to vertical shared resources. Table 4.140 provides more details about shared resources with supply chain partners.

Shared resources with:	Local		Foreign		Foreign-Local		Total	
	F	%	F	%	F	%	F	%
Supplier	17	12.1	5	8.8	6	10.5	28	11.0
Customer	16	11.4	9	15.8	0	0.0	25	9.8
Competitor	8	5.7	2	3.5	2	3.5	12	4.7
Other Organisation	33	23.6	5	8.8	22	38.6	60	23.6
Vertical	25	17.9	12	21.1	6	10.5	43	16.9
Horizontal	36	25.7	7	12.3	24	42.1	67	26.4
Overall	57	40.7	17	29.8	27	47.4	101	39.8
Number of companies in collaborative relationship	140	100.0	57	100.0	57	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 4.140: Shared resources and ownership

In terms of average effectiveness of shared resources initiatives with respect to ownership, the average effectiveness for both foreign and local-foreign SMEs were better as compared to local SMEs. The standard deviation was similar for all the three ownership types. Table 4.141 provides more details:

		Average Effectiveness: Shared Resources			
		Local	Foreign	Local-foreign	Total
Frequency	Yes	53	15	27	95
	No	87	42	30	159
Central Tendency & Dispersion	Mean	5.60	6.27	6.09	5.84
	Median	6.00	6.00	6.00	6.00
	Standard Deviation	1.75	1.83	1.75	1.77
	Skewness	-0.36	-0.13	-0.29	-0.28
	Minimum	1.00	3.00	2.00	1.00
	Maximum	9.00	9.00	9.00	9.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.141: Average effectiveness: Shared resources and ownership

b) Estimated Values

For local-foreign SMEs, at 95% Margin of Error (MOE) the estimated percentage of such SMEs in the shared resources relationship will be from 34 to 60 percent while at 99% MOE, 30 to 64 percent of such SMEs will have shared resources with their supply chain partners. At 95% MOE, the average effectiveness of foreign SMEs will range from 5.79 to 6.74 on a 10 point scale and at 99% MOE the

estimated mean score will be 5.64 to 6.89. It can be expected that shared resources relationship will be popular up to 47 percent in the local SME population and the mean effectiveness will be high up to 5.98. Specific details related to the three ownership types are shown in the Table 4.142.

Class Interval for Average Effectiveness: Shared Resources					
		Local	Foreign	Local-foreign	Total
Estimated	@95% MOE	30 to 46	15 to 38	34 to 60	31 to 43
Percentage	@99% MOE	29 to 47	11 to 41	30 to 64	30 to 45
Estimated Mean Score	@95% MOE	5.31 to 5.89	5.79 to 6.74	5.64 to 6.55	5.63 to 6.06
	@99% MOE	5.22 to 5.98	5.64 to 6.89	5.49 to 6.69	5.56 to 6.13

Table 4.142: Class interval for Shared resources and ownership

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of ownership of organisation on shared resources initiative. Responses were divided into three groups: Local, Foreign and Local-foreign. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.143.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	0.24	0.781	-	-	-
	253				-	-
1B and 2	2	4.55	0.011	0.03	0.114* (1 & 3)	0.037
	253				0.158* (2 & 3)	0.013
1C and 2	2	0.36	0.715	-	-	-
	253				-	-
1D and 2	2	7.35	0.001	0.05	0.298* (2 & 3)	0.000
	253				-	-
1E and 2	2	1.21	0.298	-	-	-
	253				-	-
1F and 2	2	6.83	0.001	0.06	0.164* (1 & 3)	0.043
	253				0.298* (2 & 3)	0.001
1G and 2	2	1.89	0.152	-	-	-
	253				-	-
1H and 2	2	1.21	0.303	-	-	-
	106				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Ownership;** 1- Local, 2-Foreign, 3-Local-foreign joint venture.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between ownership.

Table 4.143: Shared resources and ownership- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in shared resources initiative for the three respondents groups. The results are:

- i. The value $F(2, 253) = 4.55$, $p = 0.011$ showed significant difference between shared resources with customer according to type of ownership but the actual difference in mean scores between the groups was low as evident from Eta squared value of 0.03. Post-hoc comparison indicated that the mean score for local-foreign SMEs was significantly different from both local SMEs (0.114, $p = 0.037$) and foreign SMEs (0.158, $p = 0.013$). However local SMEs and foreign SMEs did not significantly differ from each other.
- ii. The value $F(2, 253) = 7.35$, $p = 0.001$ showed significant difference between shared resources with other organisation according to ownership type. The actual difference in mean scores between the groups was not moderate (Eta squared value of 0.05). Tukey HSD test indicated that the mean score for local-foreign SMEs was significantly different from foreign SMEs (0.298, $p = 0.000$) and but not from local SMEs. Moreover local SMEs and foreign SMEs did not significantly differ from each other.
- iii. The value $F(2, 253) = 6.83$, $p = 0.001$ showed significant difference between shared resources with competitors and/or other organisation according to type of ownership. The actual difference in mean scores between the groups was moderate (the effect size value of 0.06). Post-hoc comparison indicated that the mean score local-foreign SMEs was significantly different from local SMEs (0.164, $p = 0.043$) and foreign SMEs (0.298, $p = 0.001$). However local SMEs and foreign SMEs did not significantly differ from each other.

4.3.8.3 Shared Resources and Supply Chain Structure

a) Descriptive Results-

SMEs with S-M-R structure were inclined towards other organisation (20.3 percent) and suppliers (13.5 percent) for their shared resources relationship. They were less likely to be involved with their competitors for shared resources. Such structures had lower probability to be involved in vertical shared resources as opposed to horizontal shared resources. The overall inclination for shared resources initiative was nearly 42 percent for such supply chain structures.

A similar pattern is found in the S-M-W-R structures also. 24 percent of such SMEs were involved with other organisations for the shared resources initiative whereas only 4 percent of such SMEs had shared resources with the competitors. Such SMEs had higher inclination for horizontal relations (26 percent) as compared to vertical relations (14 percent) with respect to shared resources. There was low likelihood (.38) to enter in to Shared resources for S-M-W-R structures.

S-M-D-R structures too had more involvement with other organisation (25 percent) for their shared resources relationship. Again the horizontal shared resources had higher percentage as compared to

vertical shared resources for such supply chain structures. On an overall basis such structures had less likeliness (.40) to enter in to shared resources with their supply chain partners.

Similarly, one fourth of the SMEs with more complex supply chain structures (S-M-W-D-R) had shared resources with other organisations while 12.7 percent of such SMEs had shared resources with their suppliers. Again horizontal shared resources were more as compared to vertical shared resources. On an overall basis 38.2 percent of such structures had shared resources with partners. Table 4.144 provides more details about Shared resources with supply chain partners.

Shared resources with:	S-M-R		S-M-W-R		S-M-D-R		S-M-W-D-R	
	F	%	F	%	F	%	F	%
Supplier	10	13.5	4	8.0	6	8.3	7	12.7
Customer	8	10.8	5	10.0	5	6.9	6	10.9
Competitor	6	8.1	2	4.0	2	2.8	1	1.8
Other Organisation	15	20.3	12	24.0	18	25.0	14	25.5
Vertical	15	20.3	7	14.0	11	15.3	9	16.4
Horizontal	19	25.7	13	26.0	20	27.8	14	25.5
Overall	31	41.9	19	38.0	29	40.3	21	38.2
Number of companies in collaborative relationship	74	100.0	50	100.0	72	100.0	55	100.0

(F:Frequency, %: Valid percentage)

Table 4.144: Shared resources and supply chain structure

In terms of average effectiveness of shared resources initiatives with respect to structure of supply chain, the results showed similar values of mean for both S-M-W-R and S-M-D-R supply chain structures and nearly same value of mean for both S-M-R and S-M-W-D-R. However the skewness values were different for all the supply chain structures. Table 4.145 provides more details.

		Average Effectiveness: Shared Resources			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Frequency	Yes	28	19	28	19
	No	46	31	44	36
Central Tendency & Dispersion	Mean	5.32	6.45	6.43	5.37
	Median	5.00	6.00	6.50	6.00
	Standard Deviation	1.59	1.89	1.40	1.86
	Skewness	0.09	-0.29	-0.06	-0.61
	Minimum	2.00	2.00	4.00	1.00
	Maximum	8.00	9.00	9.00	8.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.145: Average effectiveness: Shared resources and supply chain structure

b) Estimated Values

For SMEs with S-M-W-D-R supply chain structure, at 95% MOE the estimated percentage of such SMEs in the shared resources relationship will be from 43 to 69 percent while at 99% MOE, 39 to 74

percent of such SMEs will have shared resources with their supply chain partners. At 95% MOE, the average effectiveness of such SMEs will range from 5.23 to 6.09 on a 10 point scale and at 99% MOE the estimated mean score will be 5.09 to 6.23. It can be expected that shared resources relationship will be popular up to 56 percent in the S-M-W-R structures SME population and the mean effectiveness will be high up to 7.14. Specific details related to the type of supply chain structure are shown in the Table 4.146.

		Class Interval for Average Effectiveness: Shared Resources			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Estimated	@95% MOE	27 to 49	25 to 51	28 to 50	43 to 69
Percentage	@99% MOE	23 to 52	20 to 56	24 to 54	39 to 74
Estimated Mean Score	@95% MOE	4.96 to 5.68	5.92 to 6.97	6.11 to 6.75	5.23 to 6.09
	@99% MOE	4.48 to 5.80	5.76 to 7.14	6.00 to 6.85	5.09 to 6.23

Table 4.146: Class interval for shared resources and supply chain structure

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of supply chain structure on shared resources initiative. Responses were divided into four groups: S-M-R, S-M-W-R, S-M-D-R and S-M-W-D-R. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.147.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	3	0.78	0.538	-	-	-
	253				-	-
1B and 2	3	0.66	0.615	-	-	-
	253				-	-
1C and 2	3	2.29	0.060	-	-	-
	253				-	-
1D and 2	3	0.19	0.940	-	-	-
	253				-	-
1E and 2	3	0.39	0.809	-	-	-
	253				-	-
1F and 2	3	0.48	0.996	-	-	-
	253				-	-
1G and 2	3	0.78	0.989	-	-	-
	253				-	-
1H and 2	3	4.00	0.145	-	-	-
	106				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Supply Chain Structure;** 1 S-M-R, 2 S-M-W-R, 3 S-M-D-R, 4 S-M-W-D-R.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between supply chain structures.

Table 4.147: Shared resources and Supply chain structure- ANOVA and Post Hoc Test

The results showed that there were no statistical differences at the $p < 0.05$ level in shared resources initiative for the three respondents groups.

4.3.8.4 Shared resources and Age of Organisation

a) Descriptive Results-

The organisations which were aged less than 10 years had more inclination for shared resources with other organisation (26.4 percent) and 12.5 percent of such organisations had shared resources with their customers, whereas only 6.9 percentage of such firms had shared resources relations with their suppliers. In such companies percentage of horizontal shared resources was more as compared to percentage of vertical Shared resources. The overall Shared resources initiative was more common (63 percent) in such organisations.

For organisations that were aged between 10 and 24 years, shared resources with other organisations emerged to be the most commonly used strategy whereas shared resources with competitors was a rarely used initiative. It was also found that such percentage of horizontal shared resources was nearly double as compared to that of vertical shared resources. The shared resources initiative was very popular in such companies.

As far as organisations which aged more than 25 years were concerned, they were more inclined in Shared resources with other organisations and suppliers. Such firms were found to have nearly equal involvement in vertical Shared resources and horizontal Shared resources. The overall Shared resources initiative was popular in such organisations.

The overall data responses showed more inclination for Shared resources with other organisations. As a result, the horizontal Shared resources were more as compared to vertical Shared resources. Table 4.148 provides more details about Shared resources with supply chain partners.

Shared resources with:	Less than 10 yrs		10 to 24 yrs		25 and more		Total	
	F	%	F	%	F	%	F	%
Supplier	5	6.9	7	8.9	16	15.5	28	11.0
Customer	9	12.5	5	6.3	11	10.7	25	9.8
Competitor	7	9.7	2	2.5	3	2.9	12	4.7
Other Organisation	19	26.4	22	27.8	19	18.4	60	23.6
Vertical	12	16.7	11	13.9	20	19.4	43	16.9
Horizontal	26	36.1	22	27.8	19	18.4	67	26.4
Overall	45	62.5	53	67.1	60	58.3	158	62.2
Number of companies in collaborative relationship	72	100.00	79	100.00	72	100.00	79	100.00

Table 4.148: Shared resources and age

In terms of average effectiveness of Shared resources initiatives with respect to age, the results showed similar values for mean and median. The standard deviation was found to be different for all the three types of organisations. Moreover all the three groups had negative skewness which implied that most of the effectiveness value lies above mean. Table 4.149 provides more details:

		Average Effectiveness: Shared resources			Total
		Less than 10 yrs	10 to 24 yrs	25 and more	
Frequency	Yes	33	30	32	95
	No	39	49	71	159
Central Tendency & Dispersion	Mean	5.61	5.68	6.24	5.84
	Median	6.00	6.00	7.00	6.00
	Standard Deviation	1.66	1.36	2.16	1.77
	Skewness	-0.07	0.00	-0.75	-0.28
	Minimum	2.00	2.00	1.00	1.00
	Maximum	9.00	9.00	9.00	9.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.149: Average effectiveness: Shared resources and age

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. On an overall basis, at 95% MOE the estimated percentage of SMEs in the shared resources relationship would be from 31 to 43 percentages while at 99% MOE, 30 to 45 percent of the SMEs are expected to have Shared resources with their supply chain partners. At 95% MOE, the average effectiveness would range from 5.83 to 5.85 on a 10 point scale and at 99% MOE the estimated mean score will be as high as 5.85. For the organisations aged less than 10 years, it can be expected that shared resources relationship will be popular up to 61 percent and the mean effectiveness would be high up to 5.67. Specific details related to the three groups were shown in the Table 4.150.

		Class Interval for Average Effectiveness: Shared resources			Total
		Less than			
		10 yrs	10 to 24 yrs	25 and more	
Estimated Percentage	@95% MOE	34 to 57	27 to 49	22 to 40	31 to 43
	@99% MOE	31 to 61	24 to 52	19 to 43	30 to 45
Estimated Mean Score	@95% MOE	5.56 to 5.66	5.65 to 5.71	6.20 to 6.28	5.83 to 5.85
	@99% MOE	5.55 to 5.67	5.64 to 5.72	6.19 to 6.29	5.82 to 5.86

Table 4.150: Class interval for Shared resources and age

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of age of organisation on shared resources initiative. Responses were divided into three groups: organisations aged less than 10 years, organisations aged between 10 and 24 years and organisations aged more than 25 years. The detailed results are tabulated in the Table 4.151.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	1.87	0.156	-	-	-
	253					
1B and 2	2	0.87	0.419	-	-	-
	253					
1C and 2	2	2.86	0.061	-	-	-
	253					
1D and 2	2	1.30	0.273	-	-	-
	253					
1E and 2	2	0.47	0.630	-	-	-
	253					
1F and 2	2	3.52	0.031	0.03	0.177* (1 & 3)	0.025
	253					
1G and 2	2	2.36	0.096	-	-	-
	253					
1H and 2	2	1.24	0.294	-	-	-
	94					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Age of organisation;** 1- up to 10 years, 2- 10 -24 years, 3- 25 years and more.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between age of age of organisation.

Table 4.151: Shared resources and age- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in the shared resources relationship for the three respondents groups.

- Although the value $F(2, 253) = 3.52$, $p = 0.031$ suggested significant difference between horizontal shared resources according to the age of organisation, the actual difference in mean scores between the groups was not high (Eta squared value of 0.03). Post-hoc comparison indicated that the mean score for organisations which were aged more than 25 years was significantly different from organisations which were aged less than 10 years (0.177, $p = 0.025$).

4.3.8.5 Correlation of shared resources and other collaborative initiatives:

The relationship between Shared resources relationship with other types of relationship was analysed using bi-variate correlation method. Due to the restriction of a number of cases, the separate correlation analysis using country, ownership and supply chain structures as independent variables was not possible. However the correlation analysis was possible for all the responses taken as a whole. Moreover, with the absence of any definite independent variable regression analysis was not conducted to avoid complexity of results. Spearman's rho values (non-parametric test) were used to measure the

correlation as some of the variables failed the normality test. The relationship of shared resources with other collaborative initiatives is summarised in the correlation matrix shown in Table 4.152.

Effectiveness of:		Effectiveness of Shared Resources with:			
		Supplier	Customer	Competitor	Other Organisation
Co-development with:	Customer	-	-	-	.885**
	Other Organisation	-	.879**	-	.669*
Co-design with:	Other Organisation	-	-	-	.763**
Co-manufacturing with:	Customer	-	.975**	-	-
	Other Organisation	-	.907*	-	.521*
Aggregated Purchasing with:	Competitor	.939**	-	.922**	-
	Other Organisation	-	.955**	-	.474*
Co-logistics with:	Customer	-	.654*	-	-
	Competitor	-	-	-	.687*
	Other Organisation	-	-	-	.633*
Joint Problem Solving with:	Customer	.754**	.823**	-	-
	Competitor	-	-	.826*	-
	Other Organisation	-	-	-	.447*
Shared Resources with:	Supplier		.902**		
CPFR with:	Supplier	.555*	.890**		.385*
	Customer	.552*			

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.152: Correlation of effectiveness of Shared resources with other collaborative initiatives

It was found that within the Shared resources initiative, Shared resources with supplier was strongly related to Shared resources with customer ($r = 0.902$). Shared resources with customers found to have strong relation with most of the other collaborative initiatives. Similarly Shared resources with other organisations were found to have moderate relation with most of the other collaborative initiatives. CPFR with supplier was also positively related to Shared resources with suppliers ($r = 0.555$), with customers ($r = 0.890$) and the other organisations ($r = 0.385$). In conclusion, Shared resources were found to have positive effect on other collaborative initiatives.

4.3.9 CPFR-

4.3.9.1 CPFR and size of organisation

a) Descriptive Results-

The results showed that micro organisations had equal inclination for CPFR with suppliers and customers whereas none of such companies had CPFR relation with their competitors or other organisations. The overall percentage for CPFR initiative was nearly 26 percent for the micro firms.

The small organisations were also found to have more CPFR relations with suppliers and customers. It was emerged that such organisations were more commonly focused on vertical CPFR as compared to horizontal CPFR strategy. On a combined basis CPFR strategy was a very common initiative in small organisations.

As far as medium-sized organisations were concerned, they were also found to be more inclined in CPFR with supplier and customers. As a result, such firms were more involved in vertical CPFR as compared to horizontal CPFR. The overall CPFR initiative was very popular in such organisations.

The overall data responses showed that CPFR relationship was very popular (55.5 percent). Table 4.153 provides more details about CPFR with supply chain partners.

CPFR with:	Micro		Small		Medium		Total	
	F	%	F	%	F	%	F	%
Supplier	8	21.1	29	45.3	66	52.0	103	45.0
Customer	8	21.1	24	37.5	66	52.0	98	42.8
Competitor	0	0.0	0	0.0	3	2.4	3	1.3
Other Organisation	0	0.0	1	1.6	4	3.1	5	2.2
Vertical	10	26.3	34	53.1	82	64.6	126	55.0
Horizontal	0	0.0	1	1.6	5	3.9	6	2.6
Overall	10	26.3	34	53.1	83	65.4	127	55.5
Number of companies in collaborative relationship	38	100.0	64	100.0	127	100.0	229	100.0

Table 4.153: CPFR and size

In terms of average effectiveness of CPFR initiatives with respect to size, the results showed almost similar values of median. However, the values of standard deviation, range and skewness were different for all the three types of organisations. Table 4.154 provides more details.

		Average Effectiveness: CPFR			Total
		Micro	Small	Medium	
Frequency	Yes	9	31	75	134
	No	29	33	52	120
Central Tendency & Dispersion	Mean	5.50	5.77	5.55	5.60
	Median	5.50	6.00	5.50	5.50
	Standard Deviation	1.66	1.28	1.43	1.41
	Skewness	0.00	1.21	-0.17	0.13
	Minimum	3.00	4.00	1.00	1.00
	Maximum	8.00	10.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.154: Average effectiveness: CPFR and size

b) Estimated Values

It is estimated that, at 95% Margin of Error (MOE) the estimated percentage of medium-sized organisation in the CPFR relationship would be as high as 68 percent while at 99% MOE, 48 to 70 percent of such firms are expected to have CPFR with their supply chain partners. For small organisations, at 95% MOE, the average effectiveness would range from 5.73 to 5.81 on a 10 point scale and at 99% MOE the estimated mean score will be as high as 5.58. It can be expected that CPFR relationship will be popular up to 61 percent in the SME population and the mean effectiveness would be high up to 5.62. Specific details related to the three groups are shown in the Table 4.155.

		Class Interval for Average Effectiveness: CPFR			Total
		Micro	Small	Medium	
Estimated Percentage	@95% MOE	10 to 37	36 to 61	51 to 68	47 to 59
	@99% MOE	6 to 41	32 to 65	48 to 70	45 to 61
Estimated Mean Score	@95% MOE	5.41 to 5.51	5.73 to 5.81	5.53 to 5.57	5.59 to 5.61
	@99% MOE	5.39 to 5.61	5.72 to 5.82	5.52 to 5.58	5.58 to 5.62

Table 4.155: Class interval for CPFR and size

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of country on CPFR initiative. The detailed results are tabulated in the Table 4.156.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	5.86	0.003	0.05	0.243* (1 & 2)	0.042
	228				0.392* (1 & 3)	0.002
1B and 2	2	6.48	0.002	0.06	.309* (1 & 3)	0.002
	228					
1C and 2	2	1.21	0.298	-	-	-
	228					
1D and 2	2	0.75	0.471	-	-	-
	228					
1E and 2	2	9.30	0.000	0.08	0.286* (1 & 2)	0.019
	228				0.383* (1 & 3)	0.000
1F and 2	2	1.07	0.342	-	-	-
	228					
1G and 2	2	9.78	0.000	0.08	0.268* (1 & 2)	0.019
	228				0.390* (1 & 3)	0.000
1H and 2	2	0.313	0.732	-	-	-
	143					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Size of organisation;** 1- Micro, 2- Small, 3- Medium.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between size of organisation.

Table 4.156: CPFR and size- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in the CPFR relationship for the three respondents groups.

- The value $F(2, 228) = 5.86$, $p = 0.003$ showed significant difference between CPFR with suppliers according to size. The actual difference in mean scores between the groups was moderate (Eta squared value of 0.05). Post-hoc comparison indicated that the mean score for micro organisations was significantly different from medium-sized organisations (0.243, $p = 0.042$) as well from small organisations (0.392, $p = 0.002$). However, small and medium-sized organisations did not significantly differ from each other.
- The value $F(2, 228) = 6.48$, $p = 0.002$ showed significant difference between CPFR with customers according to size. The actual difference in mean scores between the groups was moderate (Eta squared value of 0.06). Post-hoc comparison indicated that the mean score for micro organisations was significantly different from medium-sized organisations (0.309, $p = 0.002$) but not from small organisations. Moreover, small and medium-sized organisations did not significantly differ from each other.

- iii. The value $F(2, 228) = 9.30, p = 0.000$ showed significant difference between vertical CPFR relationship according to size. The actual difference in mean scores between the groups was high (Eta squared value of 0.08). Post-hoc comparison indicated that the mean score for micro organisations was significantly different from medium-sized organisations (0.286, $p = 0.019$) as well from small organisations (0.383, $p = 0.000$). However, small and medium-sized organisations did not significantly differ from each other.
- iv. The value $F(2, 228) = 9.78, p = 0.000$ showed significant difference between overall CPFR relationship according to size. The actual difference in mean scores between the groups was high (Eta squared value of 0.08). Post-hoc comparison indicated that the mean score for micro organisations was significantly different from medium-sized organisations (0.268, $p = 0.019$) as well from small organisations (0.390, $p = 0.000$). However, small and medium-sized organisations did not significantly differ from each other.

4.3.9.2 CPFR and Ownership

a) Descriptive Results-

For their CPFR initiatives, almost 50 percent and 45 percent of the local SMEs were involved with suppliers and customers respectively, whereas only 2.1 percent and 2.9 percent of local companies had CPFRs with their competitors and other organisations respectively. Local SMEs had nearly more inclination for vertical relationship for their CPFR initiatives. The overall CPFR initiative was nearly 57 percent with respect to local companies.

Foreign SMEs were also inclined towards their suppliers and customers for their CPFR relationship. CPFR with competitors found to be avoided by such SMEs. As a result vertical CPFRs were more as compared to horizontal CPFRs. On an overall basis, CPFRs in foreign SMEs were less common as compared to local SMEs.

Similarly local-foreign SMEs had a much higher percentage to be involved with suppliers and customers for the CPFR relations as compared to local or foreign SMEs. And a result of this their vertical CPFRs were very high than the other two types of ownership. On an overall basis, almost 70 percent of such SMEs had CPFRs with their supply chain partners.

The overall data responses showed more inclination for CPFRs with suppliers and customers. The overall CPFR relationship is popular up to 57 percent in the SMEs. Table 4.157 provides more details about CPFR with supply chain partners.

CPFR with:	Local		Foreign		Foreign-Local		Total	
	F	%	F	%	F	%	F	%
Supplier	69	49.3	11	19.3	39	68.4	119	46.9
Customer	63	45.0	16	28.1	36	63.2	115	45.3
Competitor	3	2.1	0	0.0	0	0.0	3	1.2
Other Organisation	4	2.9	2	3.5	0	0.0	6	2.4
Vertical	80	57.1	25	43.9	40	70.2	145	57.1
Horizontal	5	3.6	2	3.5	0	0.0	7	2.8
Overall	80	57.1	26	45.6	40	70.2	146	57.5
Number of companies in collaborative relationship	140	100.0	57	100.0	57	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 4.157: CPFR and ownership

In terms of average effectiveness of CPFR initiatives with respect to ownership, the average effectiveness for foreign SMEs is better than both local and local-foreign SMEs. The standard deviation and range values were also different for all the three ownership types. Table 4.158 provides more details:

		Average Effectiveness: CPFR			
		Local	Foreign	Local-foreign	Total
Frequency	Yes	73	21	40	134
	No	67	36	17	120
Central Tendency & Dispersion	Mean	5.64	6.00	5.31	5.60
	Median	5.50	6.00	5.00	5.50
	Standard Deviation	1.40	1.97	1.01	1.41
	Skewness	-0.04	-0.30	0.52	0.13
	Minimum	1.00	2.00	4.00	1.00
	Maximum	10.00	9.00	8.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.158: Average effectiveness: CPFR and ownership

b) Estimated Values

For local-foreign SMEs, at 95% Margin of Error (MOE) the estimated percentage of such SMEs in the CPFR relationship will be from 58 to 82 percent while at 99% MOE, 55 to 86 percent of such SMEs will have CPFR with their supply chain partners. At 95% MOE, the average effectiveness of foreign SMEs will range from 5.49 to 6.51 on a 10 point scale and at 99% MOE the estimated mean score will be 5.33 to 6.67. It can be expected that CPFR relationship will be popular up to 63 percent in the local SME population and the mean effectiveness will be high up to 5.94. Specific details related to the three ownership types are shown in the Table 4.159.

Class Interval for Average Effectiveness: CPFR					
		Local	Foreign	Local-foreign	Total
Estimated	@95% MOE	44 to 60	24 to 49	58 to 82	47 to 59
Percentage	@99% MOE	43 to 63	20 to 53	55 to 86	45 to 61
Estimated Mean Score	@95% MOE	5.41 to 5.87	5.49 to 6.51	5.05 to 5.57	5.42 to 5.77
	@99% MOE	5.33 to 5.94	5.33 to 6.67	4.97 to 5.66	5.37 to 5.83

Table 4.159: Class interval for CPFR and ownership

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of ownership of organisation on CPFR initiative. Responses were divided into three groups: Local, Foreign and Local-foreign. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.160.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	15.77	0.000	0.11	0.300* (1 & 2)	0.000
	253				0.191* (1 & 3)	0.029
					0.491* (2 & 3)	0.000
1B and 2	2	7.41	0.001	0.05	0.182* (1 & 3)	0.048
	253				0.351* (2 & 3)	0.000
1C and 2	2	1.23	0.293	-	-	-
	253				-	-
1D and 2	2	0.99	0.399	-	-	-
	253				-	-
1E and 2	2	4.11	0.018	0.03	0.246* (2 & 3)	0.022
	253				-	-
1F and 2	2	1.03	0.356	-	-	-
	253				-	-
1G and 2	2	3.58	0.029	0.02	-	-
	253				-	-
1H and 2	2	1.71	0.184	-	-	-
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Ownership;** 1- Local, 2-Foreign, 3-Local-foreign joint ventures.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between ownership.

Table 4.160: CPFR and ownership- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in CPFR initiative for the three respondents groups. The results are:

- i. The value $F(2, 253) = 15.77$, $p = 0.000$ showed significant difference between CPFR with suppliers according to type of ownership. The actual difference in mean scores between the groups was high as evident from Eta squared value of 0.11. Post-hoc comparison using the Tukey HSD test indicated that the mean score for local SMEs was significantly different from local-foreign SMEs (0.191 , $p = 0.029$) and foreign SMEs (0.300 , $p = 0.000$). Moreover local-foreign SMEs and foreign SMEs did significantly differ from each other (0.491 , $p = 0.000$).
- ii. The value $F(2, 253) = 7.41$, $p = 0.001$ showed significant difference between CPFR with customer according to type of ownership. However the actual difference in mean scores between the groups was not moderate (Eta squared value of 0.05). Post-hoc comparison indicated that the mean score for local-foreign SMEs was significantly different from local SMEs (0.182 , $p = 0.048$) and foreign SMEs (0.351 , $p = 0.000$). However local SMEs and foreign SMEs did not significantly differ from each other.
- iii. The value $F(2, 253) = 4.11$, $p = 0.018$ showed significant difference between CPFR with suppliers and/or customers according to ownership type. However the actual difference in mean scores between the groups was low (Eta squared value of 0.03). Post-hoc comparison indicated that the mean score for local-foreign SMEs was significantly different from foreign SMEs (0.246 , $p = 0.022$) but not from local SMEs. Moreover local SMEs and foreign SMEs did not significantly differ from each other.

4.3.9.3 CPFR and Supply Chain Structure

a) Descriptive Results-

SMEs with S-M-R structure were inclined towards customers (36.5 percent) and suppliers (39.2 percent) for their CPFR relationship. They were no likely to be involved with their competitors for CPFRs. Such structures had higher probability to be involved in vertical CPFRs as opposed to horizontal CPFRs. The overall inclination for CPFR initiative was nearly 57 percent for such supply chain structures.

A similar pattern is found in the S-M-W-R structures also. 58 percent and 52 percent of such structures were involved with customers and suppliers respectively for the CPFR initiative. None of such structure had CPFR with the competitors. Moreover such structures had much higher inclination for vertical relations (62 percent) as compared to horizontal relations (2 percent) with respect to CPFRs. There was 62 percent likelihood to enter in CPFR for S-M-W-R structures.

S-M-D-R structures too had more involvement with suppliers (43.1 percent) and customers (38.9 percent) for their CPFR relationship. Again the horizontal CPFR had lower percentage as compared to

vertical CPFRs for such supply chain structures. On an overall basis, such structures had likeliness of .53 to enter in CPFRs with their supply chain partners.

Similarly, more than half of the SMEs with more complex supply chain structures (S-M-W-D-R) had CPFRs with their suppliers and customers. Vertical CPFR were more as compared to horizontal CPFRs. On an overall basis, 60 percent of such structures had CPFRs with partners. Table 4.161 provides more details about CPFR with supply chain partners.

CPFR with:	S-M-R		S-M-W-R		S-M-D-R		S-M-W-D-R	
	F	%	F	%	F	%	F	%
Supplier	29	39.2	26	52.0	31	43.1	31	56.4
Customer	27	36.5	29	58.0	28	38.9	29	52.7
Competitor	0	0.0	0	0.0	0	0.0	2	3.6
Other Organisation	3	4.1	1	2.0	0	0.0	1	1.8
Vertical	41	55.4	31	62.0	38	52.8	33	60.0
Horizontal	3	4.1	1	2.0	0	0.0	2	3.6
Overall	42	56.8	31	62.0	38	52.8	33	60.0
Number of companies in collaborative relationship	74	100.0	50	100.0	72	100.0	55	100.0

(F:Frequency, %: Valid percentage)

Table 4.161: CPFR and supply chain structure

In terms of average effectiveness of CPFR initiatives with respect to structure of supply chain, the results showed similar values of mean and median for all the supply chain structures except S-M-R. However, the standard deviation and range values were different for all the supply chain structures. Both S-M-W-R and S-M-W-D-R structures had positive values of skewness as compared to the negative value for the other two structures. Table 4.162 provides more details.

		Average Effectiveness: CPFR			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Frequency	Yes	35	30	37	31
	No	39	20	35	24
Central Tendency & Dispersion	Mean	5.77	5.53	5.50	5.66
	Median	6.00	5.00	5.00	5.00
	Standard Deviation	1.51	1.38	1.10	1.64
	Skewness	-0.42	1.16	0.32	-0.13
	Minimum	2.00	3.00	3.00	1.00
	Maximum	8.00	10.00	8.00	9.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.162: Average effectiveness: CPFR and supply chain structure

b) Estimated Values

For SMEs with S-M-W-D-R supply chain structure, at 95% MOE the estimated percentage of such SMEs in the CPFR relationship will be from 43 to 69 percent while at 99% MOE, 39 to 74 percent of such SMEs will have CPFR with their supply chain partners. At 95% MOE, the average effectiveness of S-M-R SMEs will range from 5.43 to 6.12 on a 10 point scale and at 99% MOE the estimated mean

score will be 5.32 to 6.22. It can be expected that CPFR relationship will be popular up to 78 percent in the S-M-W-R structures SME population and the mean effectiveness will be high up to 6.03. Specific details related to the type of supply chain structure are shown in the Table 4.163.

		Class Interval for Average Effectiveness: CPFR			
		S-M-R	S-M-W-R	S-M-D-R	S-M-W-D-R
Estimated	@95% MOE	36 to 59	46 to 74	40 to 63	43 to 69
Percentage	@99% MOE	32 to 62	42 to 78	36 to 67	39 to 74
Estimated Mean Score	@95% MOE	5.43 to 6.12	5.15 to 5.91	5.25 to 5.75	5.23 to 6.09
	@99% MOE	5.32 to 6.22	5.03 to 6.03	5.17 to 5.83	5.09 to 6.23

Table 4.163: Class interval for CPFR and supply chain structure

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of supply chain structure on CPFR initiative. Responses were divided into four groups: S-M-R, S-M-W-R, S-M-D-R and S-M-W-D-R. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the Table 4.164.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	3	1.29	0.274	-	-	-
	253				-	-
1B and 2	3	2.16	0.073	-	-	-
	253				-	-
1C and 2	3	8.89	0.000	0.12	0.393* (1 & 4)	0.000
	253				0.297* (3 & 4)	0.000
1D and 2	3	3.97	0.004	0.06	0.293* (1 & 4)	0.004
	253				0.313* (2 & 4)	0.004
1E and 2	3	0.35	0.843	-	-	-
	253				-	-
1F and 2	3	3.42	0.010	0.05	0.293* (1 & 4)	0.019
	253				0.333* (2 & 4)	0.011
1G and 2	3	0.32	0.859	-	-	-
	253				-	-
1H and 2	3	1.05	0.381	-	-	-
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Supply Chain Structure;** 1 S-M-R, 2 S-M-W-R, 3 S-M-D-R, 4 S-M-W-D-R.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between supply chain structures.

Table 4.164: CPFR and Supply chain structure- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in CPFR initiative for the three respondents groups. The results are:

- i. The value $F(3, 253) = 8.89$, $p = 0.000$ showed significant difference between CPFR with competitors according to structure of supply chain. The actual difference in mean scores between the groups was high as evident from Eta squared value of 0.12. Post-hoc comparison indicated that the mean score for structure 'S-M-W-D-R' was significantly different from structure 'S-M-R' (0.393 , $p = 0.000$) and from structure 'S-M-D-R' (0.297 , $p = 0.000$) but not from any other structures.
- ii. The value $F(3, 253) = 3.97$, $p = 0.004$ showed significant difference between CPFR with other organisation according to supply chain structures. The actual difference in mean scores between the groups was moderate (Eta squared value of 0.06). Tukey HSD test indicated that the mean score for structure 'S-M-W-D-R' was significantly different from structure 'S-M-R' (0.293 , $p = 0.004$) and from structure 'S-M-W-R' (0.313 , $p = 0.004$) but not from any other structures.
- iii. The value $F(3, 253) = 3.42$, $p = 0.010$ showed significant difference between horizontal CPFR according to supply chain structures. The actual difference in mean scores between the groups was not moderate as evident from the effect size value of 0.05. Post-hoc comparison using the Tukey HSD test indicated that the mean score for structure 'S-M-W-D-R' was significantly different from structure 'S-M-R' (0.293 , $p = 0.019$) and from structure 'S-M-W-R' (0.333 , $p = 0.011$) but not from any other structures.

4.3.9.4 CPFR and Age of Organisation:

a) Descriptive Results-

The organisations which were aged less than 10 years had more inclination for CPFR with other customers (37.5 percent) as compared to suppliers (34.7 percent). There were no cases of horizontal CPFR relations for such companies. The overall CPFR initiative was nearly 44 percent in these organisations.

For organisations that were aged between 10 and 24 years, CPFR with customers and suppliers emerged to be the most commonly used strategy whereas CPFR with rest of the other partners were not common. It was found that such organisations were more inclined towards vertical CPFR as compared to horizontal CPFR. On a combined basis CPFR was very popular initiative in such organisations.

As far as organisations which aged more than 25 years were concerned, they were inclined in CPFR with suppliers (46.6) and customers (39.8 percent). The overall CPFR initiative was popular in such organisations.

The overall data responses showed more inclination for vertical CPFR and less for horizontal CPFR.

The CPFR initiative was found to be more commonly used initiative. Table 4.165 provides more details about CPFR with supply chain partners.

CPFR with:	Less than 10 yrs		10 to 24 yrs		25 and more		Total	
	F	%	F	%	F	%	F	%
Supplier	25	34.7	46	58.2	48	46.6	119	46.9
Customer	27	37.5	47	59.5	41	39.8	115	45.3
Competitor	0	0.0	0	0.0	3	2.9	3	1.2
Other Organisation	0	0.0	1	1.3	5	4.9	6	2.4
Vertical	32	44.4	55	69.6	58	56.3	145	57.1
Horizontal	0	0.0	1	1.3	6	5.8	7	2.8
Overall	32	44.4	55	69.6	59	57.3	146	57.5
Number of companies in collaborative relationship	72	100.00	79	100.00	72	100.00	79	100.00

Table 4.165: CPFR and age

In terms of average effectiveness of CPFR initiatives with respect to age, the results showed similar values for mean. However, the standard deviation and range values were different for all the three types of organisations. Moreover all the three groups had negative skewness which implied that most of the effectiveness value lies above mean. Table 4.166 provides more details:

		Average Effectiveness: CPFR			Total
		Less			
		than 10 yrs	10 to 24 yrs	25 and more	
Frequency	Yes	30	53	51	134
	No	42	26	52	120
Central Tendency & Dispersion	Mean	5.23	5.59	5.81	5.60
	Median	5.00	5.00	6.00	5.00
	Standard Deviation	1.26	1.25	1.62	1.41
	Skewness	0.42	0.53	-0.29	0.13
	Minimum	3.00	2.00	1.00	1.00
	Maximum	8.00	9.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 4.166: Average effectiveness: CPFR and age

b) Estimated Values

The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. On an overall basis, at 95% MOE the estimated percentage of SMEs in the CPFR relationship would be from 47 to 59 percentages while at 99% MOE, 45 to 61 percent of the SMEs are expected to have CPFR with their supply chain partners. At 95% MOE, the average effectiveness would range from 5.59 to 5.61 on a 10 point scale and at 99% MOE the estimated mean score will be 5.58 to 5.62. For the organisations aged between 10 and 24 years, it can be expected that CPFR relationship will be popular up to 81 percent and the mean effectiveness would be high up to 5.63. Specific details

related to the three groups are shown in the Table 4.167.

		Class Interval for Average Effectiveness: CPFR			Total
		Less than			
		10 yrs	10 to 24 yrs	25 and more	
Estimated Percentage	@95% MOE	30 to 53	57 to 77	40 to 59	47 to 59
	@99% MOE	27 to 57	53 to 81	37 to 62	45 to 61
Estimated Mean Score	@95% MOE	5.20 to 5.26	5.56 to 5.62	5.78 to 5.84	5.59 to 5.61
	@99% MOE	5.18 to 5.28	5.55 to 5.63	5.77 to 5.85	5.58 to 5.62

Table 10.167: Class interval for CPFR and age

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of age of organisation on CPFR initiative. Responses were divided into three groups: organisations aged less than 10 years, organisations aged between 10 and 24 years and organisations aged more than 25 years. Eta squared values were also used to determine the effect age of the results. The detailed results are tabulated in the Table 4.168.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	4.27	0.015	0.03	0.235* (1 & 2)	0.011
	253					
1B and 2	2	4.84	0.009	0.04	0.220* (1 & 2)	0.018
	253				0.197* (2 & 3)	0.021
1C and 2	2	2.23	0.109	-	-	-
	253					
1D and 2	2	2.48	0.086	-	-	-
	253					
1E and 2	2	5.30	0.007	0.04	0.252* (1 & 2)	0.005
	253					
1F and 2	2	3.20	0.042	0.02	-	-
	253					
1G and 2	2	5.22	0.007	0.04	0.253* (1 & 2)	0.005
	253					
1H and 2	2	1.61	0.204	-	-	-
	133					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Age of organisation;** 1- up to 10 years, 2- 10 -24 years, 3- 25 years and more.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between age of age of organisation.

Table 4.168: CPFR and age- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in the CPFR relationship

for the three respondents groups.

The value $F(2, 253) = 4.27$, $p = 0.015$ suggested significant difference between CPFR with suppliers according to age of organisation, however, the actual difference in mean scores between the groups was not high (Eta squared value of 0.03). Post-hoc comparison indicated that the mean score for organisations which were aged less than 10 years was significantly different from organisations which were aged between 10 and 24 years (0.235 , $p = 0.011$).

The value $F(2, 253) = 4.84$, $p = 0.009$ showed significant difference between CPFR with customers according to age of organisation. The actual difference in mean scores between the groups was not high (Eta squared value of 0.04). Post-hoc comparison indicated that the mean score for organisations which were aged between 10 and 24 years was significantly different from organisations which were aged less than 10 years (0.220 , $p = 0.018$) and from organisations which were aged more than 25 years (0.197 , $p = 0.021$).

The value $F(2, 253) = 5.30$, $p = 0.007$ showed significant difference between vertical CPFR according to age of organisation. The actual difference in mean scores between the groups was not high (Eta squared value of 0.04). Post-hoc comparison indicated that the mean score for organisations that were aged less than 10 years was significantly different from organisations which were aged between 10 and 24 years (0.252 , $p = 0.005$).

The value $F(2, 253) = 3.14$, $p = 0.045$ showed significant difference between horizontal CPFR according to age of organisation; however, post-hoc comparison did not indicate that the mean score was significantly different according to age of company.

The value $F(2, 253) = 5.30$, $p = 0.007$ showed significant difference between CPFR according to age of organisation. The actual difference in mean scores between the groups was not high (Eta squared value of 0.04). Post-hoc comparison indicated that the mean score for organisations that were aged less than 10 years was significantly different from organisations which were aged between 10 and 24 years (0.253 , $p = 0.005$).

4.3.9.5 Correlation of CPFR and other collaborative initiatives:

The relationship between CPFR initiatives with other types of collaborative relationship was analysed using bi-variate correlation method. Due to the restriction of a number of cases, the separate correlation analysis using country, ownership and supply chain structures as independent variables was not possible. However, the correlation analysis was possible for all the responses taken as a whole. Moreover, with the absence of any definite independent variables regression analysis was not conducted to avoid complexity of results. Spearman's rho values (non-parametric test) were used to measure the correlation as some of the variables failed the normality test. The relationship of CPFR with other

collaborative initiatives is summarised in the correlation matrix shown in Table 4.169.

Effectiveness of:		Effectiveness of CPFR with:			
		Supplier	Customer	Competitor	Other Organisation
Joint Ventures with:	Supplier	.695**	-	-	-
	Customer	.684**	-	-	-
Co-development with:	Supplier	.494*	-	-	-
	Customer	.534*	.684**	-	-
	Other Organisation	.759**	.596**	-	-
Co-design with:	Other Organisation	-	.392*	-	-
Co-manufacturing with:	Customer	.892*	-	-	-
Aggregated Purchasing with:	Customer	.785*	-	-	-
	Competitor	.347*	.481**	-	-
Co-logistics with:	Supplier	.482**	-	-	-
	Customer	.741**	.807**	-	-
	Other Organisation	.566*	.751**	-	-
Joint Problem Solving	Supplier	.269*	-	-	-
	Customer	.365*	.302*	-	-
	Other Organisation	.302**	-	-	-
Shared Resources with:	Supplier	.555*	.552*	-	-
	Customer	.890**	-	-	-
	Other Organisation	.385*	-	-	-
CPFR with:	Supplier	-	.761**	-	-

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.169: Correlation of effectiveness of CPFR with other collaborative initiatives

It was found that within CPFR initiative, CPFR with supplier was positively correlated to the CPFR with customer ($r = 0.761$). CPFR with suppliers was found to have strong relationship with: co-development with other organisations ($r = 0.759$); co-manufacturing with customers ($r = 0.892$); aggregated Purchasing with customers ($r = 0.785$); co-logistics with customers ($r = 0.741$); and Shared resources with customers ($r = 0.890$). Similarly CPFR with customers was found to be strongly related to: co-logistics with customers ($r = 0.807$); and co-logistics with other organisations ($r = 0.751$). In conclusion, CPFR emerged to have positive effect on most of the other collaborative initiatives.

Chapter 5 - Comparative Analysis

This chapter presents details of the differences of economy, demography, supply chain environment and supply chain collaboration in the UK, India and China. The comparison of economy and demography is based on the data from the Central Intelligence Agency (CIA) and World Bank Development Indicator Database, while that of supply chain environment and collaboration in the UK, India and China is based on the descriptive statistics from the survey.

5.1 Comparison of Economy and Demography

UK is located between the North Atlantic Ocean and the North Sea. UK includes Great Britain and the north-eastern part of Ireland; it is towards the north-western of France and mainland of Europe. The total area of UK is 243,610 square kilometers (km²), which is almost 7.5 percent and 2.5 percent of the total area of India and China respectively. The UK has a population of around 62.64 million with a population density of 257 persons per km².

India is located in the southern part of Asia with sea borders in Arabian Sea and the Bay of Bengal. India shares land borders with Pakistan, Afghanistan, China, Nepal, Bangladesh and Burma. It has a total area of 3,287,363 km² and ranked 7th in the world. India is ranked 2nd in terms of population (1241.49 million) with a population density of 366 persons per km².

China is located in the Eastern Asia with sea borders in East China Sea, Korean Bay, Yellow Sea and South China Sea. China ranked 4th in the world in area (9,596,961 km²) and it shares land borders with Russia, Mongolia, Kazakhstan, Kyrgyzstan, Tajikistan, India, Nepal, Bhutan, Myanmar, Laos, Vietnam and North Korea. China has the largest population in the world (1344.13 million) with a population density of 140 persons per km².

According to the Central Intelligence Agency's World Fact book (2012) and World Bank Development Indicator Database (2011):

The UK is the leading economy in Europe after Germany and France. UK's agriculture sector is: highly intensive, mechanized, very efficient, employs less than 2 percent of the labour force and produces about 60% of food needs. In the past few decades, UK's oil and natural gas reserves have declined and as a result it became a net importer of energy in 2005. The main contribution towards GDP is service sector (mainly banking, insurance and business services) whereas the industry's contribution towards GDP is declining continuously. Due to the importance of its financial sector the global financial crisis of 2008-09 hit the UK's economy particularly hard. The recession had severe impacts such as decline in home prices and higher consumer debt. As a result the government implemented a number of measures to stimulate the economy and stabilise the financial markets which included: nationalising parts of the banking system, tax cutting, and suspension of public sector borrowing rules and moving

forward public spending on capital projects. In the year 2010 the government initiated a five-year austerity program, which aimed to lower budget deficit from over 10% of GDP in 2010 to nearly 1% by 2015.

After the economic liberalisation in 1990s, India has developed into an open-market economy. The liberalisation policy included: industrial deregulation, privatisation of government-owned companies and flexibility on foreign trade and investment rules. This resulted into acceleration of the country's growth of more than 7% per year since then. India has a diverse economic structure comprising of agriculture, handicrafts, a wide range of modern industries and a variety of services. Indian agriculture is a mixture of traditional and modernised farming and it employs more than half of the labour force. Services contribute to more than half of its GDP and employs only one-third of the labour force. One important reason for this growth of services is that India has a large educated English-speaking population and as a result it has become a major exporter of information technology services and software workers. In 2010's global financial crisis, the economy rebounded robustly because of strong internal demand and growth exceeding 8 percent year-on-year in real terms. Consequently merchandise exports (account for about 15% of GDP) returned to pre-financial crisis levels. However, industrial expansion and high food prices resulting from the weak 2009 monsoon increased the inflation rate to a maximum of 11% in the first half of 2010, but it has gradually reduced to single digits following a series of central bank's (Reserve Bank of India) measures. India faces some major challenges of inadequate physical infrastructure, limited non-agricultural employment opportunities for its low educated population, limited access to higher education, and rural-to-urban migration problems.

In the past two decades, China has also moved from a closed and centrally planned economy to a more market-oriented system. The economic reforms were implemented gradually and included: liberalisation of prices, fiscal decentralisation, autonomy for government companies, diversification of banking system, development of stock markets, growth of the private sector and opening to foreign trade and investment. As a result, China became the world's largest exporter in the year 2010. "Measured on a purchasing power parity (PPP) basis that adjusts for price differences, China in 2010 stood as the second-largest economy in the world after the US, having surpassed Japan in 2001. The dollar values of China's agricultural and industrial output each exceed those of the US; China is second to the US in the value of services it produces. Still, per capita income is below the world average" (World Bank Development Indicator Database 2011). The government faces major economic challenges of: reducing its high domestic savings rate and correspondingly low domestic demand, sustaining adequate job growth for tens of millions of migrants and new entrants to the work force, reducing corruption and other economic crimes, containing environmental damage, problems related to migration of rural population in urban areas and deterioration in the environment (increased air pollution, soil erosion, and fall of the water level). Although the global financial crisis of 2009 reduced foreign demand for Chinese exports, the economy rebounded rapidly and outperformed other major economies with a growth rate

of around 10 percent in the year 2010.

Table 5.1 provides more details about the demographic and economic scenarios in the three countries.

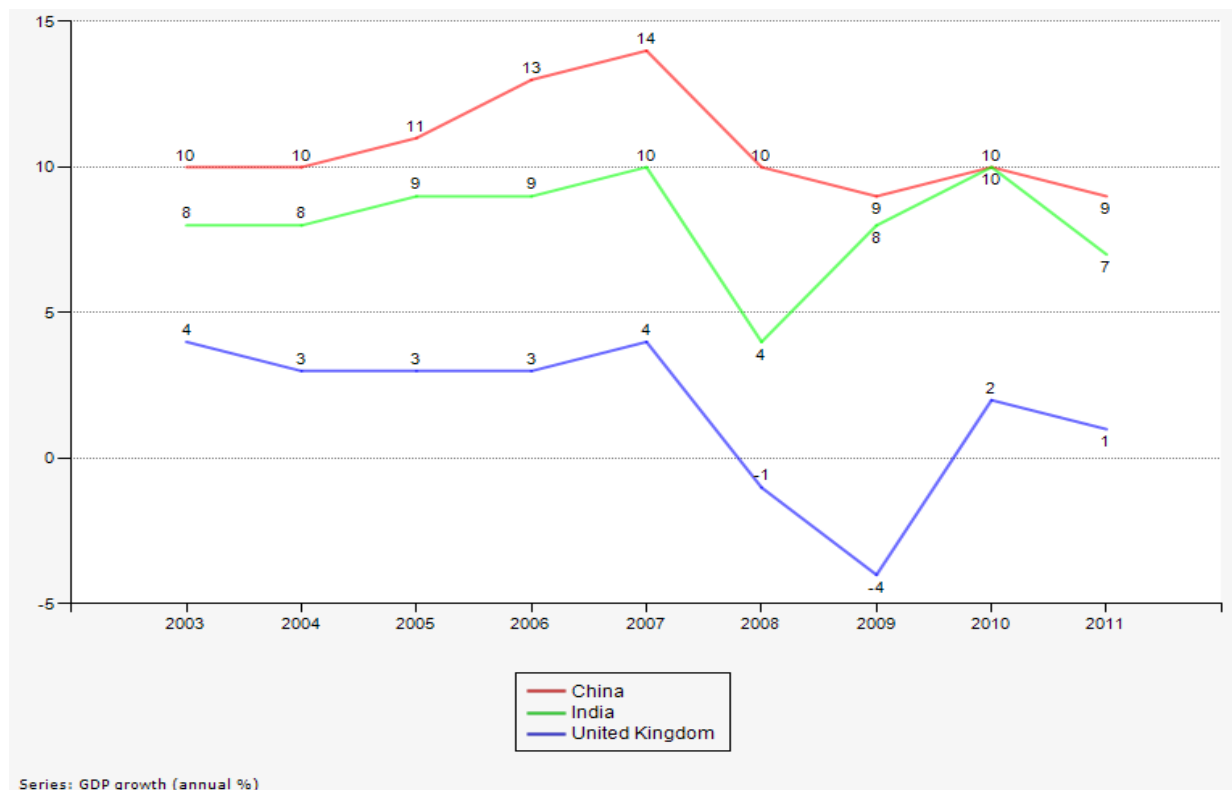
2011-12 Data	UK	India	China
Area (million sq km)	0.243	3.287	9.60
Population (million)	62.64	1,241.49	1,344.13
GDP (billions \$)	2431.59	1847.98	7318.50
GDP Growth rate (%)	0.7	6.9	9.3
Purchasing Power Parity of GDP (billions \$)	2.173	1.583	5.878
Purchasing Power Parity of GDP per capita (\$)	34,800	3,500	7,600
Exports (% of GDP)	32.0	25.3	31.0
Imports (% of GDP)	34.0	30.0	27.0
Gross Capital Formation (% of GDP)	15.0	36.0	48.0
GDP sector composition (%)			
Agriculture	0.7	19.0	10.2
Industry	21.7	26.3	46.8
Services	77.6	54.7	43.0
Investment (Gross Fixed) of GDP (%)	14.7	29.5	45.8
Direct Foreign Investment-at home (billion \$)	1,076	188.6	578.8
Inflation rate (%)	2.3	8.0	7.8
Industrial production growth rate (%)	2.1	9.7	15.7
Labour force (million)	31.52	478.3	815.3
By occupation (%)	1.4	52.0	38.0
Agriculture			
Industry	18.2	14.0	27.8
Services	80.4	34.0	34.1
Time required to start a business (days)	13	29	38

Sources: Central Intelligence Agency (2012) and World Bank Development Indicator Database (2011)

Table 5.1 Demographic and Economic data

5.1.1 GDP Growth Rate:

Figure 5.1 depicts the economical growth rate from 2003 to 2011 in the three countries. The economy of the UK has developed steadily and the economic growth was averaging around 2.75 per cent. However, in 2008 and 2009, it had a negative growth rate primarily due to a global economic crisis. The growth rate has stayed at around 1.5 per cent in years 2010 and 2011. The economy of India has also developed continuously during this period with an average growth rate of around 8 percent. In the year 2008, it suddenly dropped to 4 percent because of global recession; however, it has regained the growth rate in the following years. The growth rate of economy in China remained higher than both India and the UK, it averaged around 10 percent over this period of time. It is found that India and China regained the growth rate quickly after the global financial crisis in 2009.

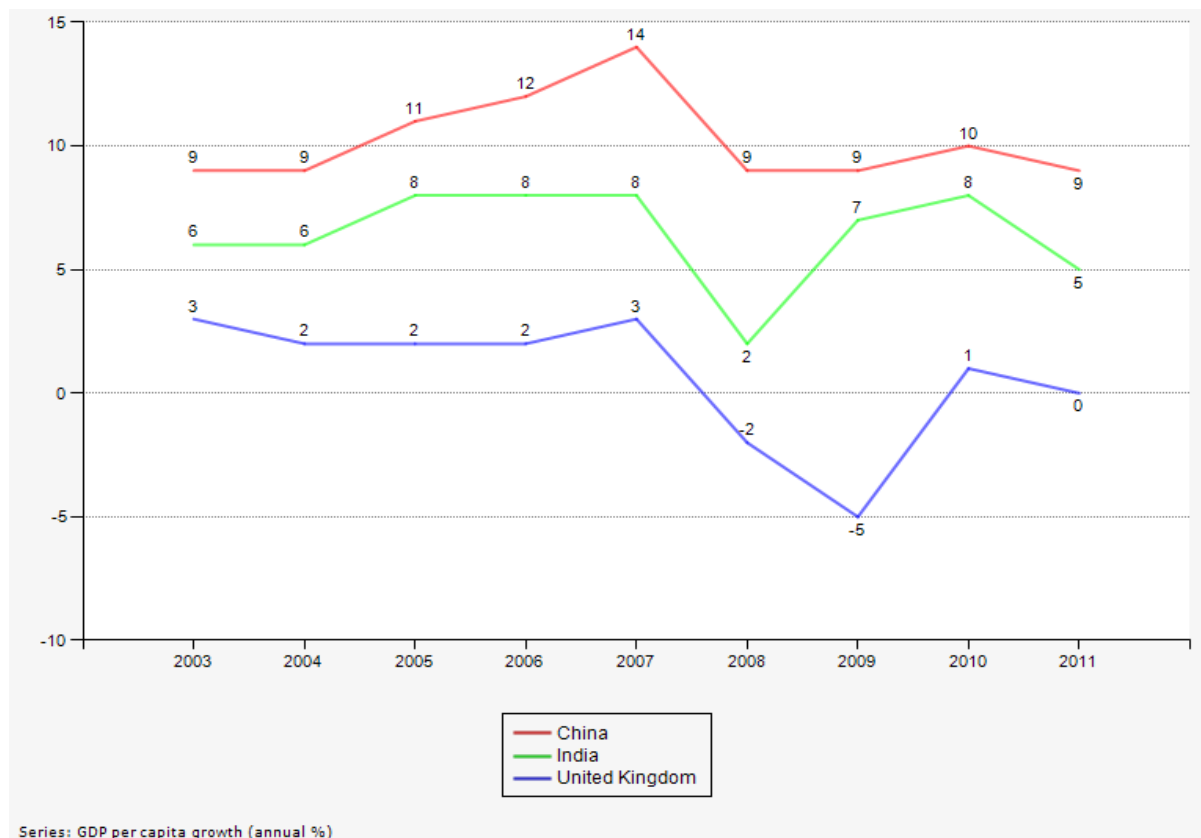


Source: World Data Bank - World Development Indicators (WDI)

Figure 55.1- GDP Growth Rate (annual %)

5.1.2 GDP per Capita Growth:

A similar trend was observed in the per capita GDP growth rate from 2003 to 2011. UK's GDP per capita growth rate averaged around 2.5 percent, India's GDP per capita growth rate was averaged around 7.6 percent while the GDP per capita growth rate in China averaged around 9 percent in the last 10 years. In the year 2008, the per capita growth rate fell down drastically in all the three countries due to global financial crunch. The GDP per capita growth rate in China remained higher than both India and the UK. It is also found that India and China regained the growth rate quickly after the global financial crisis in 2008-09. Figure 5.2 illustrates the graph for the GDP per capita growth rate in the three countries.

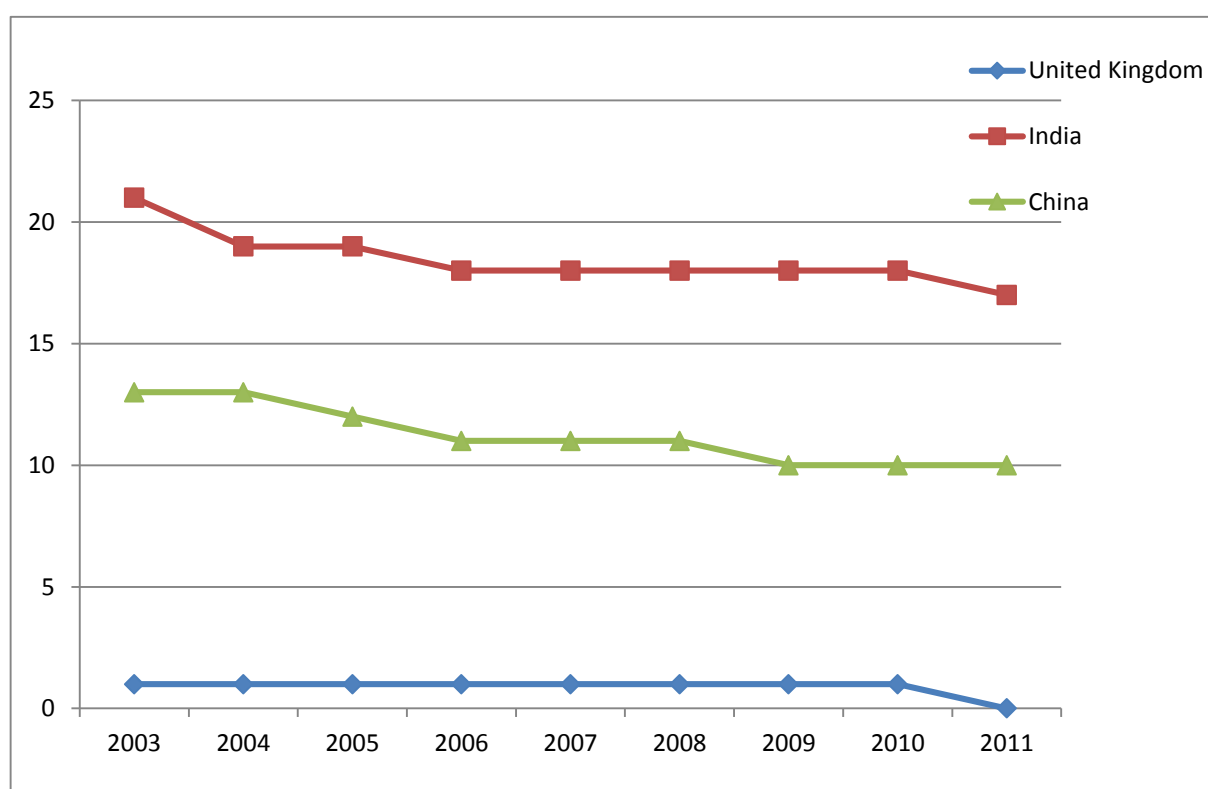


Source: World Data Bank - World Development Indicators (WDI)

Figure 5.2 - GDP per Capita Growth (annual %)

5.1.3 Agriculture, Value Added:

A dissimilar trend was observed in the agriculture, value added (expressed in terms of percentage of GDP) growth rate from 2003 to 2011. UK's agriculture, value added remained consistent up to 2010 and then dropped to 0 in the year 2011. The agriculture, value added was averaged around 1.0 percent. China's agriculture, value added growth rate has gradually decreased over this period of time and it averaged around 12 percent. Similarly India's agriculture, value added growth rate was as high as 22 percent but it gradually decreased over this period of time and fell down to 17 % in the year 2011. The agriculture, value added growth rate in India averaged around 18.5 percent. Figure 5.3 illustrates the graph for the agriculture, value added growth rate in the three countries from the year 2003 to 2011.

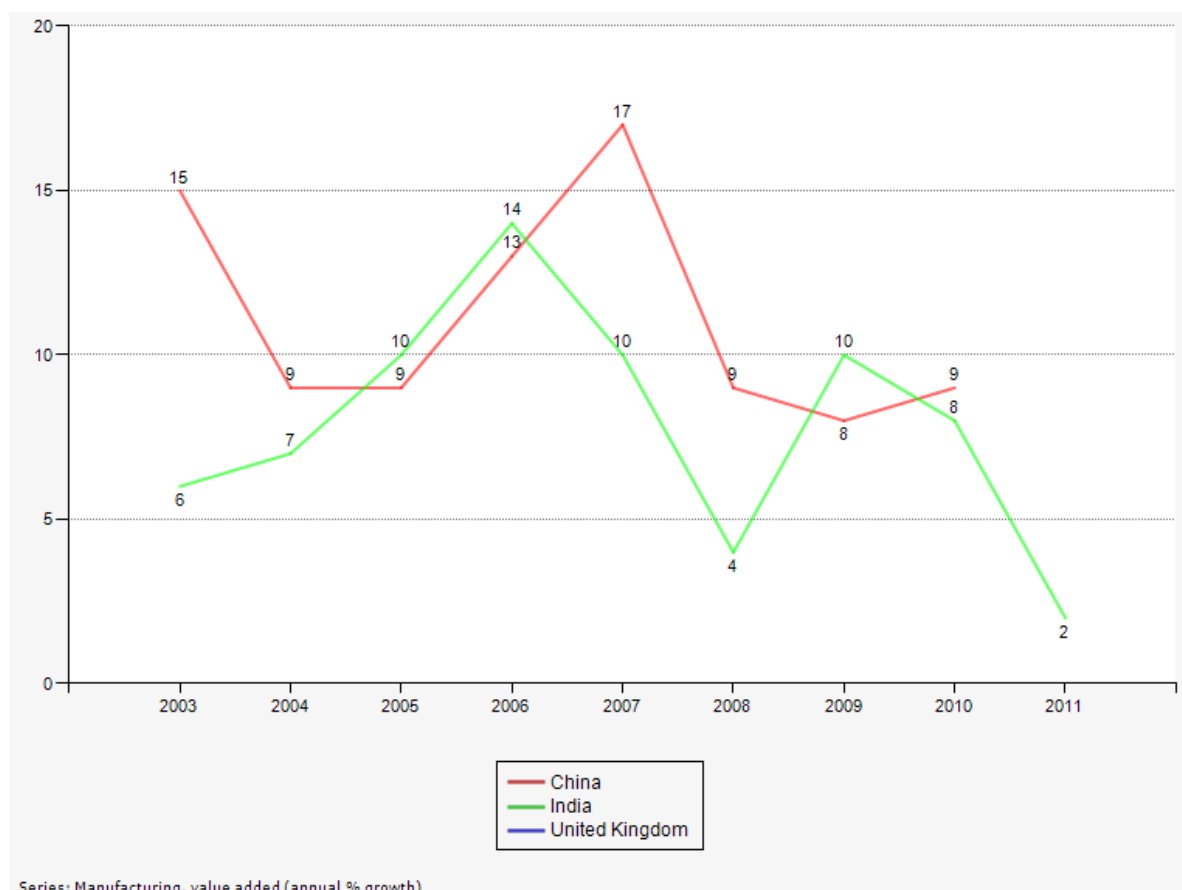


Source: World Data Bank - World Development Indicators (WDI)

Figure 5.3 - Agriculture, Value Added (% of GDP)

5.1.4 Manufacturing, Value Added:

A different trend was observed in the manufacturing, value added (expressed in terms of percentage of GDP) growth rate from 2003 to 2011. China's manufacturing, value added growth rate has fluctuated significantly over this period of time and it averaged around 11 percent. Similarly India's manufacturing, value added growth rate was as high as 14 percent but it dropped down to 2 percent in the year 2011. The agriculture, value added growth rate in India averaged around 8.8 percent. UK's manufacturing, value added data was not available and therefore a graph and comparison is not possible. Figure 5.4 illustrates the graph for the manufacturing, value added growth rate from the year 2003 to 2011.

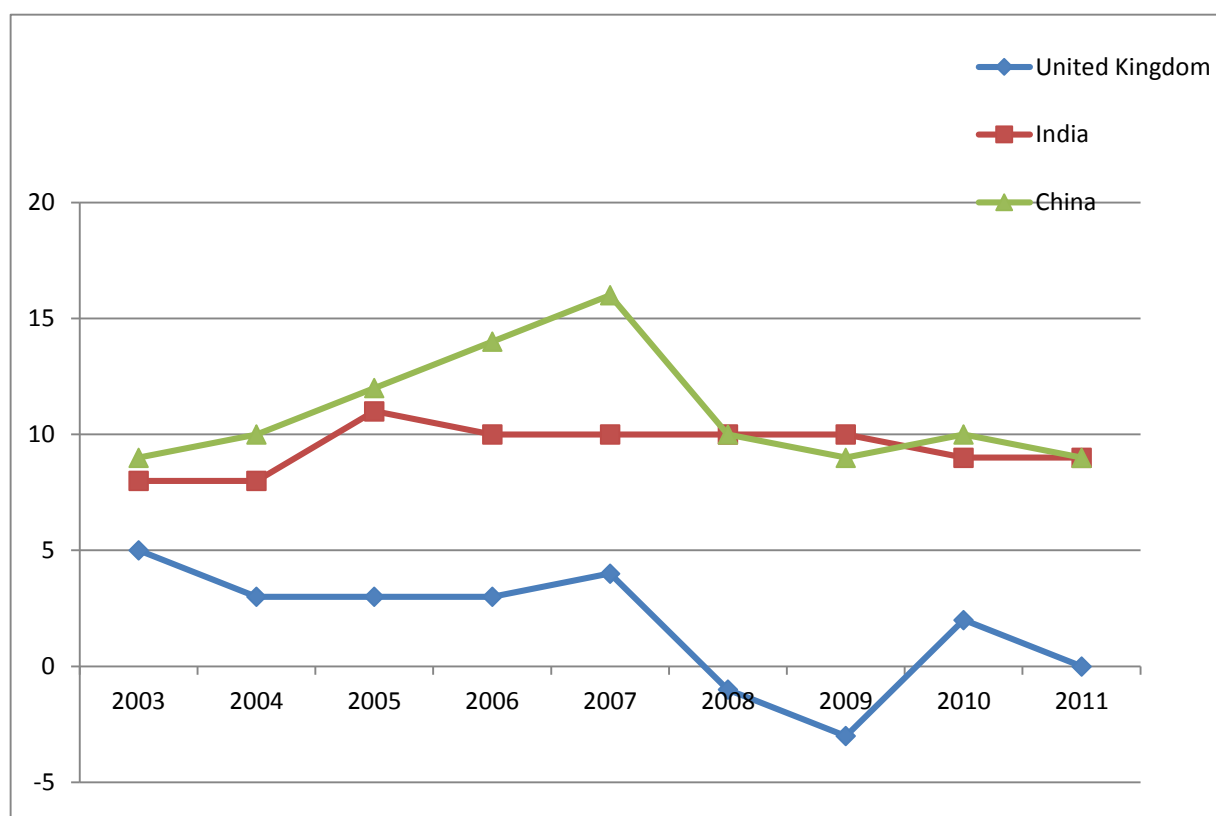


Source: World Data Bank - World Development Indicators (WDI)

Figure 5.4 - Manufacturing, Value Added (% of GDP)

5.1.5 Services, Value Added:

As compared to manufacturing value added, a relatively steady trend was observed in the services, value added (expressed in terms of percentage of GDP) growth rate from 2003 to 2011 for all the three countries. UK's services, value added remained positive until 2007 and then suddenly dropped down to negative in the years 2008 and 2009. It increased to 3 percent in the following year however reduced to zero in the year 2011. China's services, value added growth rate has increased significantly up to the year 2007 but fell down in the following years, it averaged around 11 percent over the period of 10 years. Similarly India's services, value added growth rate remained constant over this period of time and it averaged around 10 percent during this period of time. Figure 5.5 illustrates the graph for the services, value added growth rate from the year 2003 to 2011.

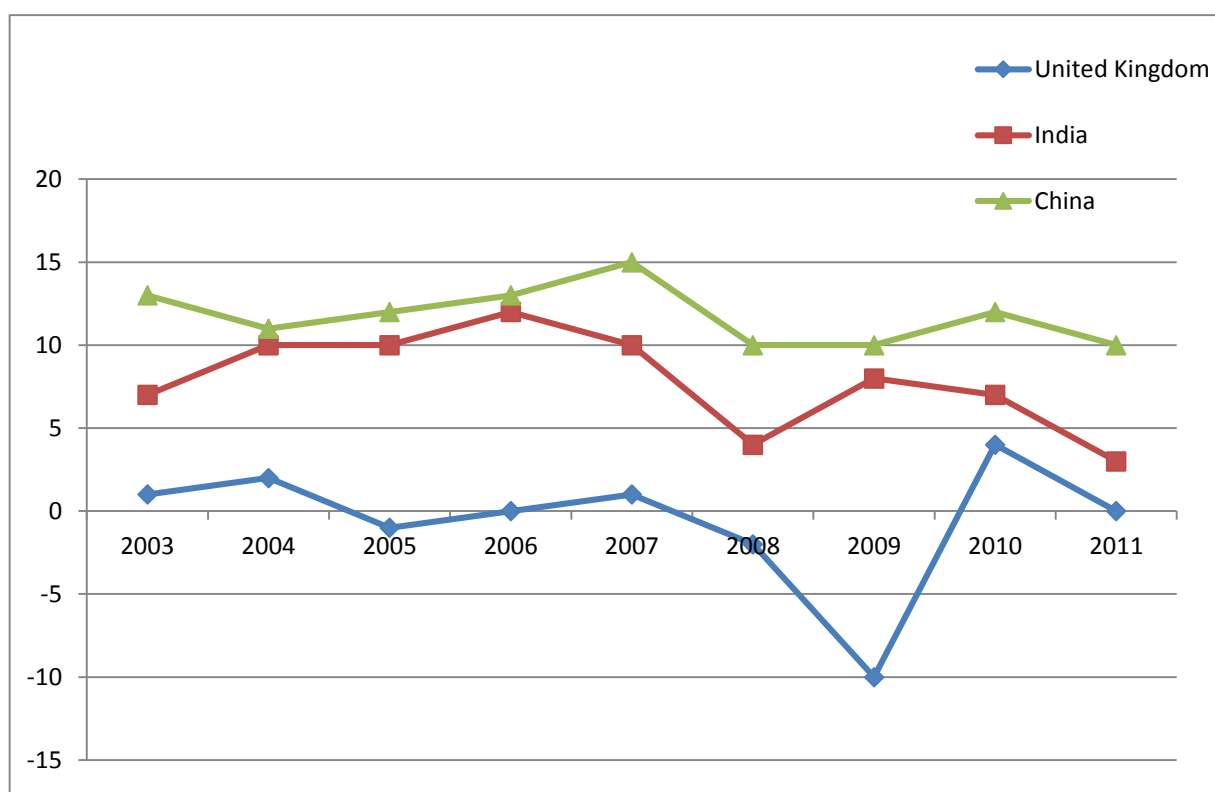


Source: World Data Bank - World Development Indicators (WDI)

Figure 5.5 - Services, Value Added (% of GDP)

5.1.6 Industry, Value Added:

As compared to services value added, a relatively similar trend was observed in the industry, value added (expressed in terms of percentage of GDP) growth rate from 2003 to 2011 for all the three countries. UK's industry, value added fluctuated on both positive and negative side until the year 2008 and then suddenly dropped down to -10 percent in the year 2009. It increased to 4 percent in the following year however again dropped to zero in the year 2011. China's industry, value added growth rate has fluctuated between 15 to 10 percent over this period of time, it averaged around 12.5 percent over the period of 10 years. India's industry, value added growth rate remained over 5 percent in this period of time except in the years 2008 and 2011 when it remained below 5 percent. Figure 5.6 illustrates the graph for the industry, value added growth rate from the year 2003 to 2011.

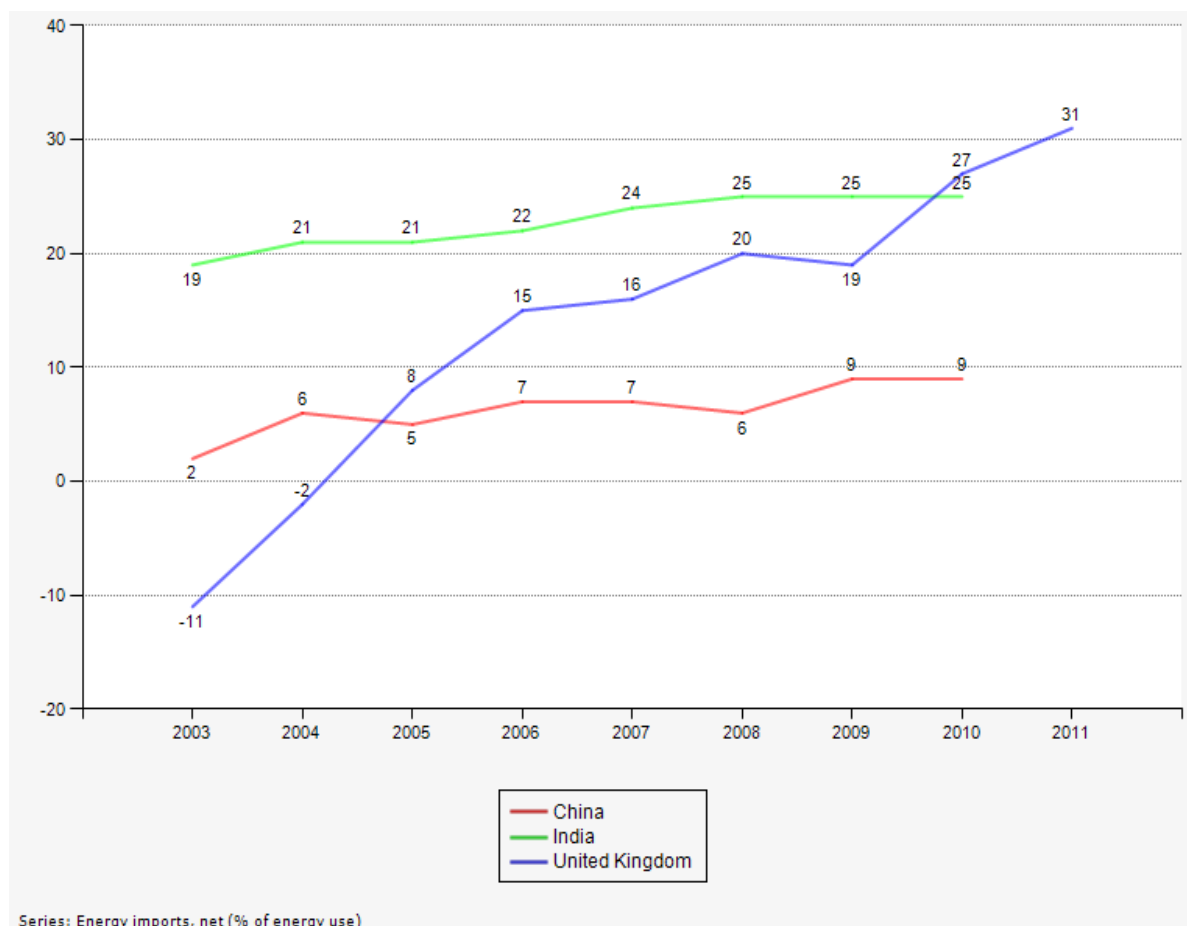


Source: World Data Bank - World Development Indicators (WDI)

Figure 5.6 - Industry, Value Added (% of GDP)

5.1.7 Energy Imports:

A relatively similar trend was observed in the energy imports (expressed in terms of percentage of net use) from 2003 to 2011 for all the three countries. UK's energy imports have continuously grown up to 31 percent in the year 2011. In the years 2003 and 2004 UK did not import any energy but in the year 2011 it became net imported of the energy. China's imports remained in the range of 2 to 9 percent and it has steadily increased over this period of time. Similarly India's energy imports have continuously increased from 19 to 25 percent in the same time period. Both India's and China's energy imports have increased steadily however UK's energy imports have increased drastically. Figure 5.7 illustrates the graph from the year 2003 to 2011.

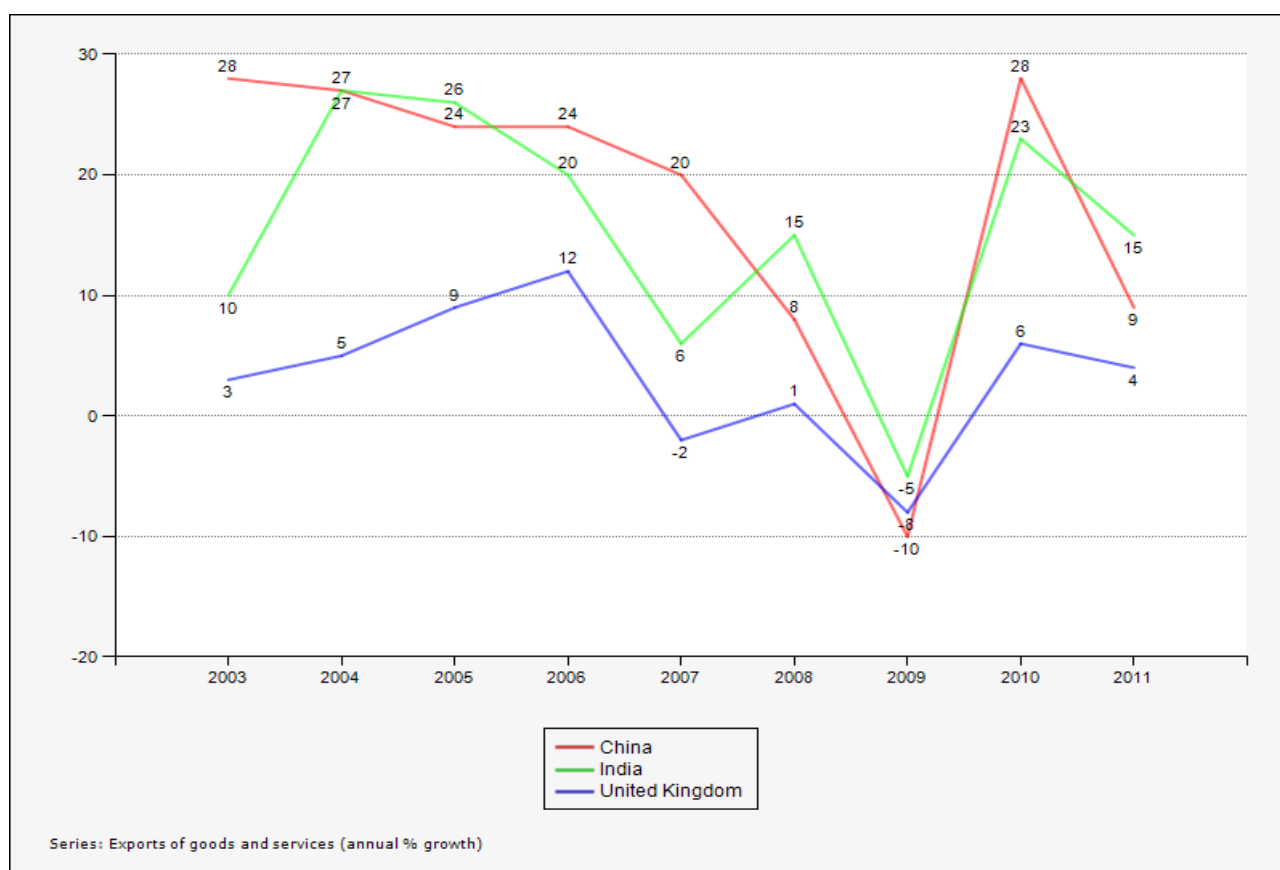


Source: World Data Bank - World Development Indicators (WDI)

Figure 5.7 – Energy Imports, net (% of energy use)

5.1.8 Exports of goods and services (annual % growth):

Figure 5.8 depicts the exports of goods and services annual growth rate from 2003 to 2011 in the three countries. The exports growth rate of the UK has developed steadily until 2006 when it reached 12 percent and since then it exhibited fluctuations and fell down minus 8 percent in the year 2009. The export growth rate in the UK averaged around 3.25 per cent. The export growth rate in India has fluctuations and it reached the highest level of 24 percent in the year 2004 and fell down to as low as minus 5 in the year 2009. The export growth rate averaged around 16 percent during the period 2003 to 2011. The exports growth rate in China steadily decreased from 28 percent in the year 2003 to minus 10 percent in the year 2009; however, it bounced back to 28 percent in the following year and again fell down to 9 percent in the year 2011. It is found that India and China regained the growth rate quickly after the global financial crisis in 2009.

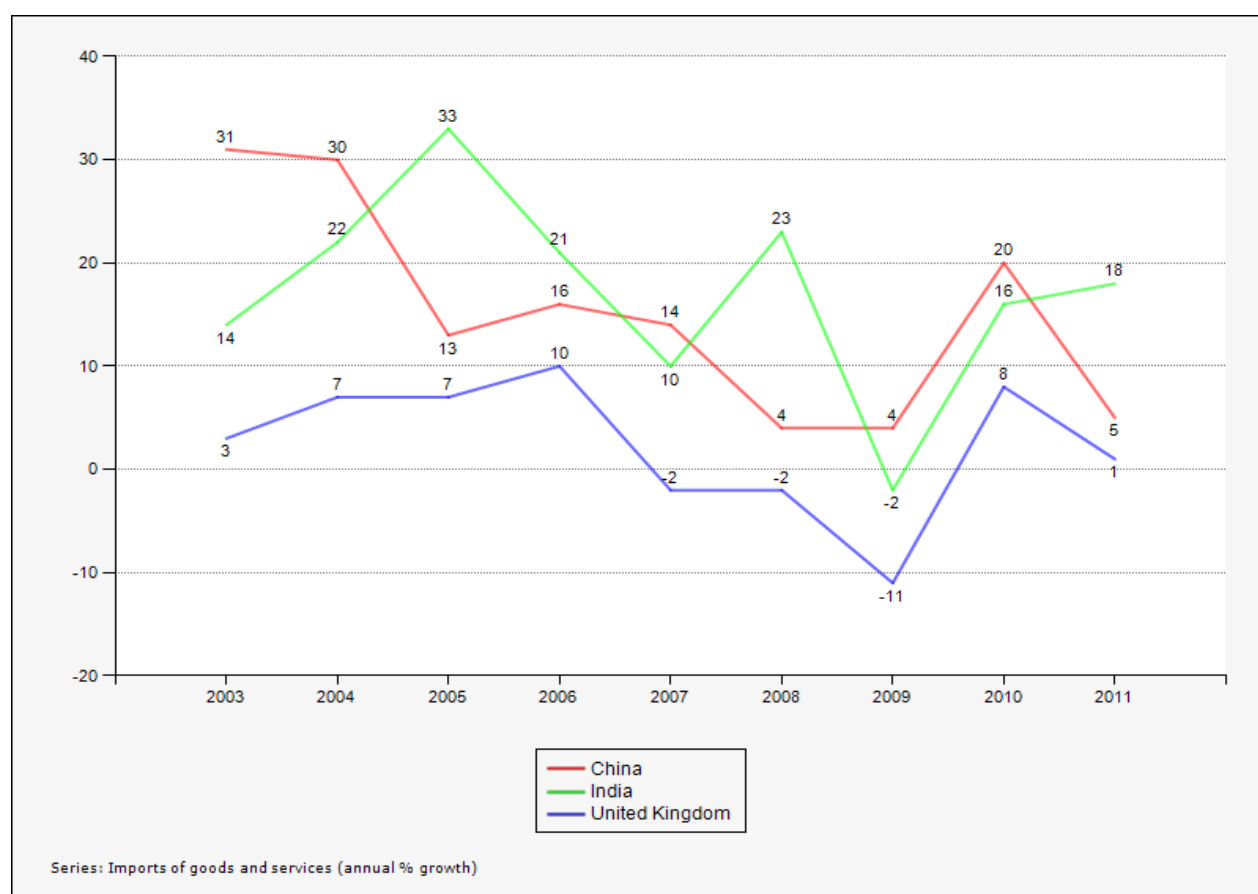


Source: World Data Bank - World Development Indicators (WDI)

Figure 5.8 - Exports of goods and services (annual % growth)

5.1.9 Imports of goods and services (annual % growth):

A similar trend of exports is found in the imports of goods and services growth rate from 2003 to 2011 in the three countries. The imports growth rate of the UK has developed steadily until 2006 when it reached 10 percent and since then it exhibited fluctuations and fell down to minus 11 percent in the year 2009. The import growth rate in the UK is averaged around 2.3 per cent. The import growth rate in India has fluctuations and it reached the highest level of 33 percent in the year 2005 and fell down to as low as minus 2 in the year 2009. The import growth rate is averaged around 17 percent during the period 2003 to 2011. The import growth rate in China decreased from 31 percent in the year 2003 to 4 percent in the years 2008 and 2009; however, it bounced back to 20 percent in the following year and again fell down to 9 percent in the year 2011. Figure 5.9 depicts the imports of goods and services annual growth rate from 2003 to 2011 in the three countries.



Source: World Data Bank - World Development Indicators (WDI)

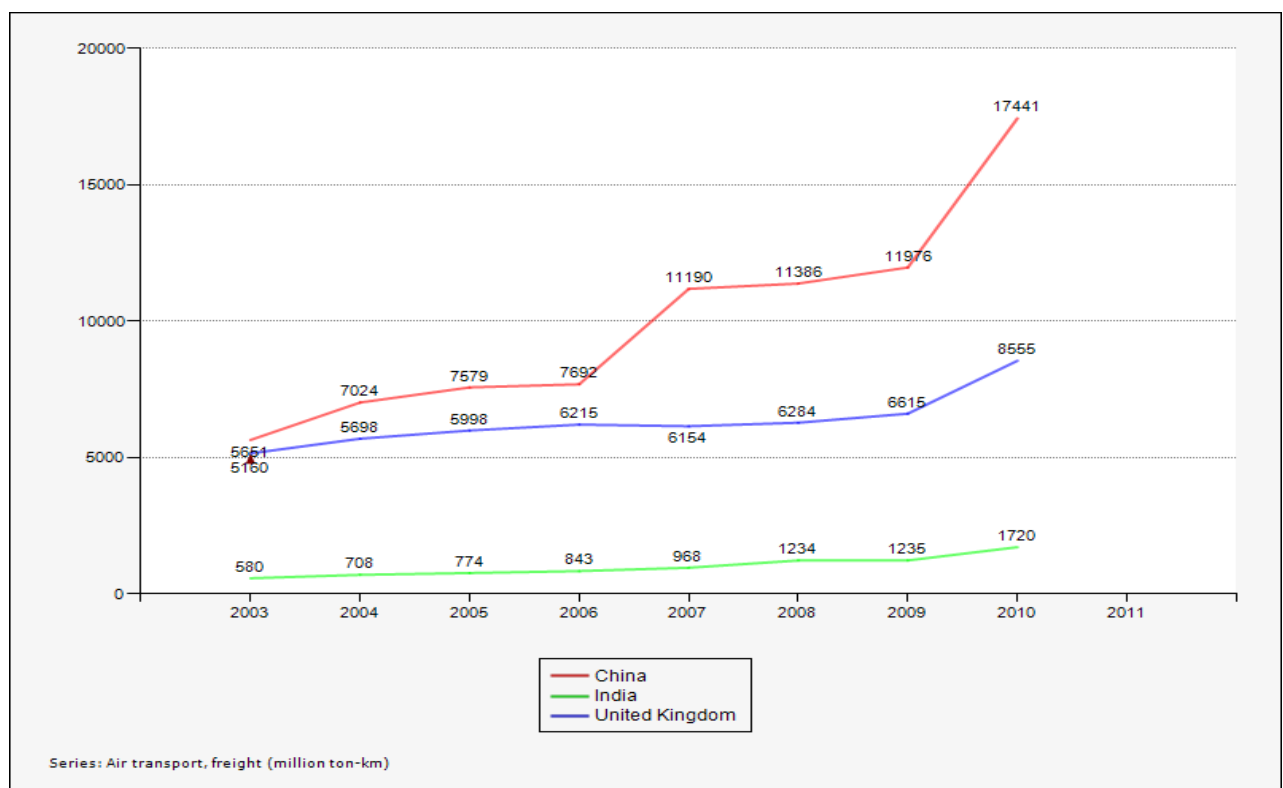
Figure 5.9 - Imports of goods and services (annual % growth)

5.2 Comparison of the logistics environment in the UK, India and China

A comparison of the transportation facility differences between the UK, India and China is depicted in figures 5.10, 5.11, 5.12 and 5.13. The transportation is sub-divided into four categories of transport: air transport, waterway transport, rail transport and road transport.

5.2.1 Air Transport:

The development of air transport (expressed in million ton-kilometer) in India is less than that of the UK and China's. The UK and India's air transport has continuously increased over the past 10 years. The air transport in China has seen some upwards fluctuation in the years 2007 and 2011. Figure 5.10 shows more details of the air transport in all the three countries.

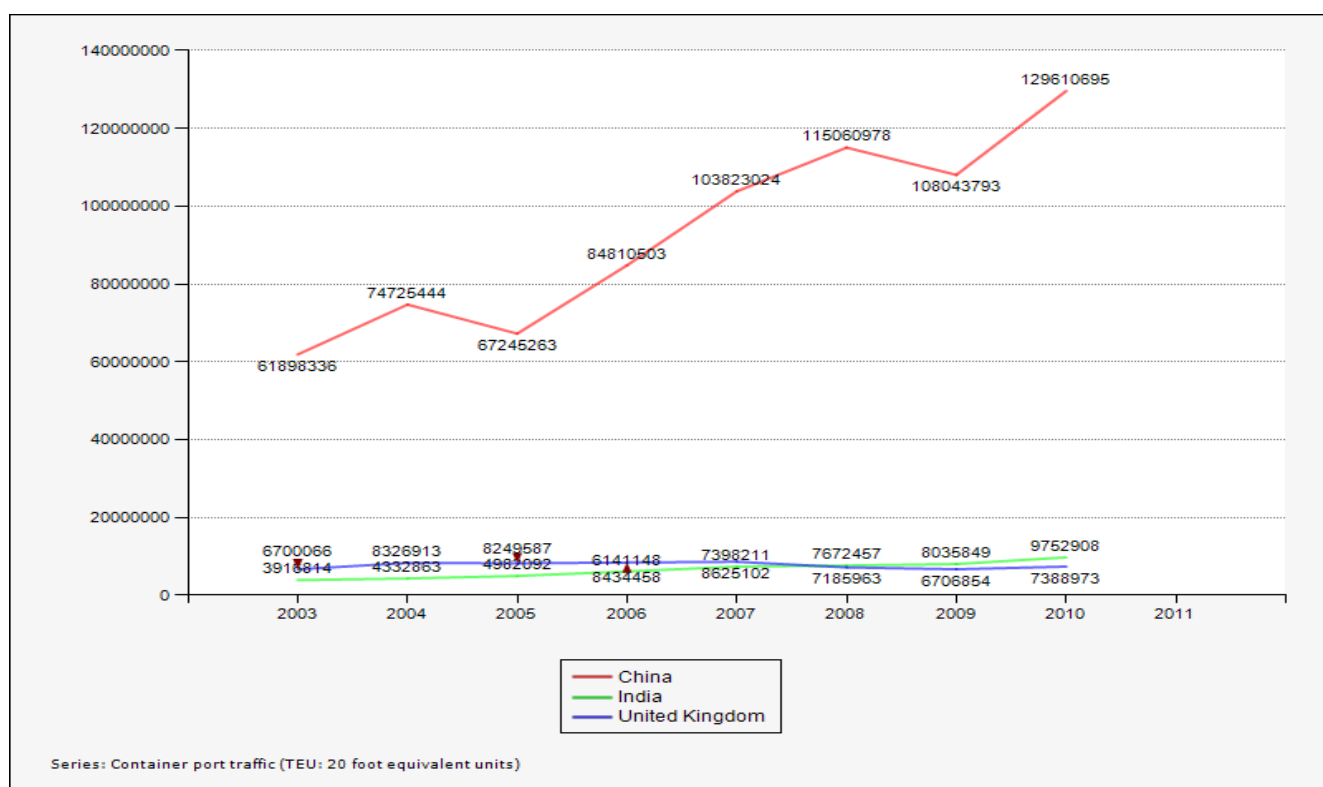


Source: World Data Bank - World Development Indicators (WDI)

Figure 5.10 - Air transport, freight (million ton-km)

5.2.2 Waterway Transport:

The development of water transport expressed in terms of container port traffic (20 foot equivalent unit) is shown in the figure 5.11 for all the three countries. The UK's and India's water transport has shown the similar trend and have steadily increased over the past 10 years. The water transport in China is substantially more than both the UK and India. The water transport in China has doubled during the same period of time.

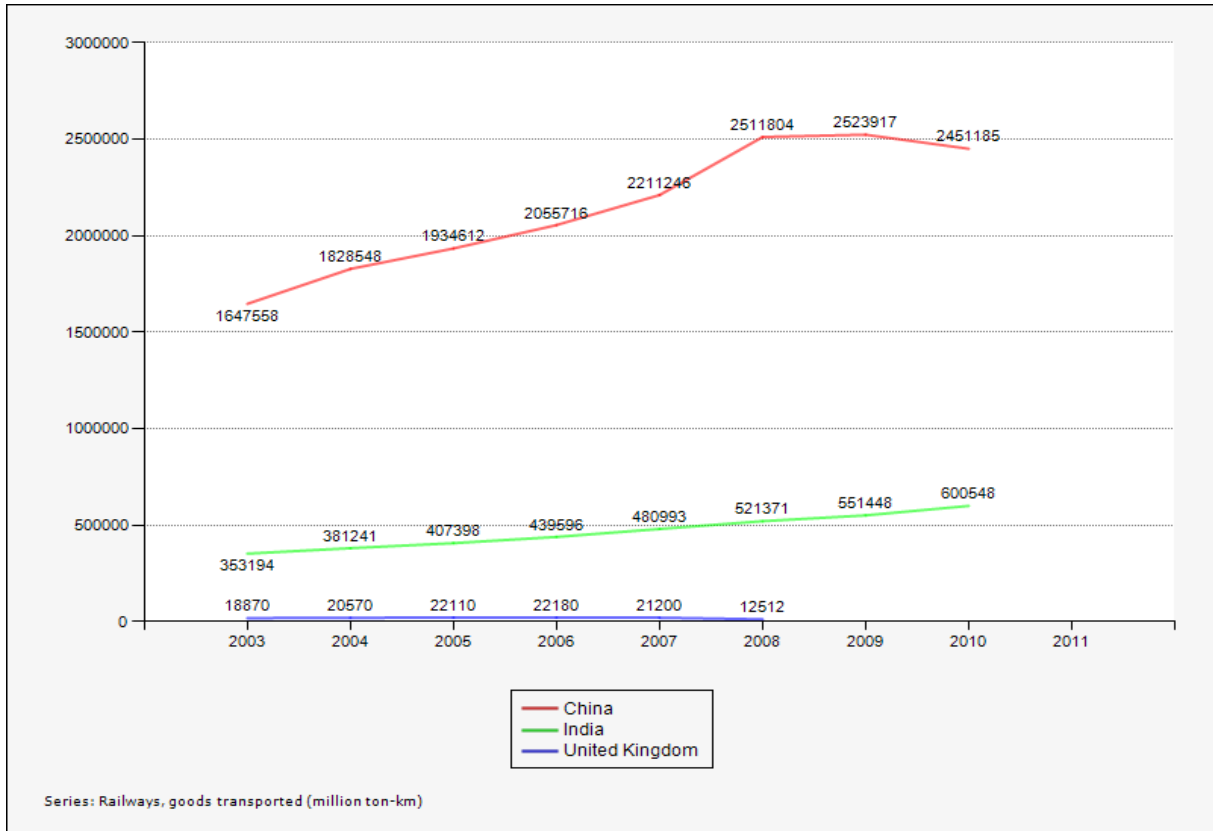


Source: World Data Bank - World Development Indicators (WDI)

Figure 5.11 - Container port traffic (TEU: 20 foot equivalent units)

5.2.3 Rail Transport:

The development of rail transport (expressed in million ton-kilometer) in the UK remained lesser than that of India and China's. The UK's rail transport has steadily increased until the year 2006 and since then it gradually decreased in the next two years. The data from the year 2009 onward is not available for the UK. Similarly India's rail transport has gradually increased over the same period of time and has nearly doubled in the past 10 years. The rail transport in China is substantially more than both the UK and India and it has also experienced sudden fluctuation in the years 2008 and 2010. Figure 5.12 shows more details of the rail transport in all the three countries.

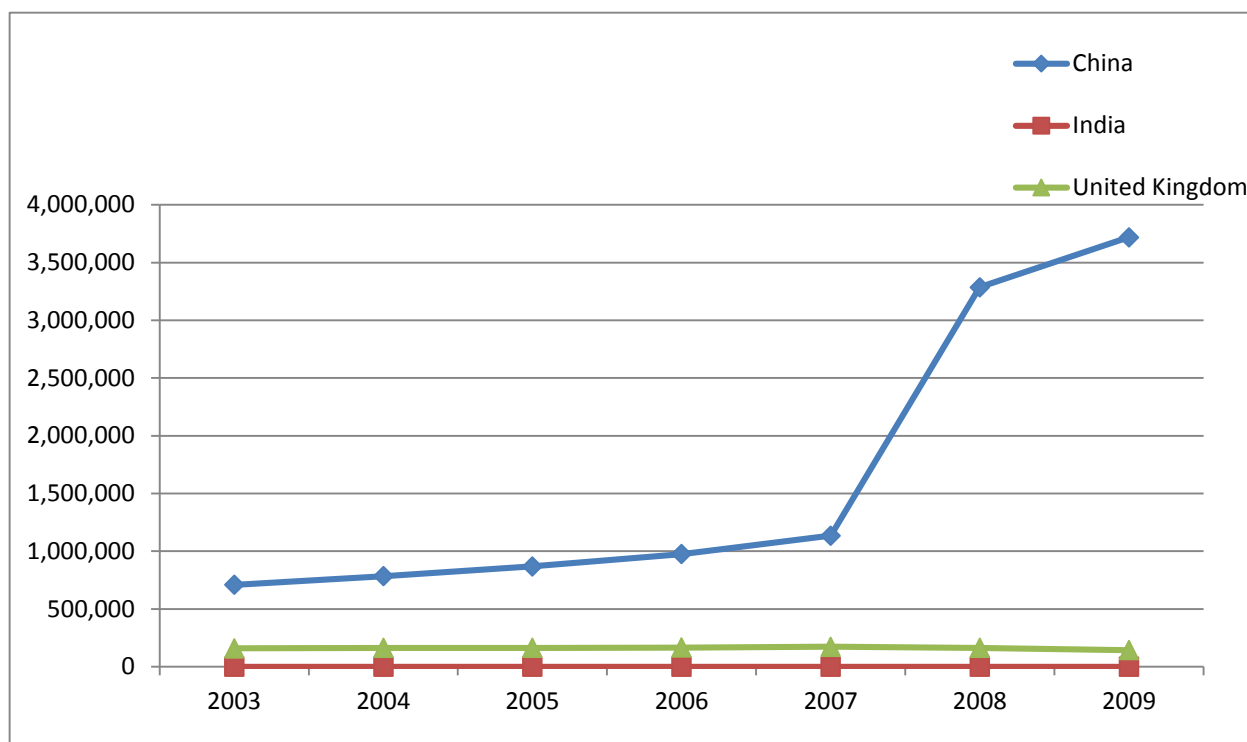


Source: World Data Bank - World Development Indicators (WDI)

Figure 5.12 - Railways, goods transported (million ton-km)

5.2.4 Road Transport:

The development of road transport (expressed in million ton-kilometer) in the UK and India remained much lesser than that of China's. The data for UK's and India's road transport was not available over the period of time. The road transport in China steadily increased until the year 2007 and then it suddenly increased by three times in the following year. Figure 5.13 shows more details of the road transport in all the three countries.



Source: World Data Bank - World Development Indicators (WDI)

Figure 65.13 - Roads, goods transported (million ton-km)

Arvis et al. (2012) analysed the short-term logistics development and policies of 150 countries in the world to provide a cross-country assessment of logistics performance. They surveyed more than 5,000 professionals trading within the countries based on a five-point scale ranging from 1 to 5 (worst to best performance). As shown in Table 5.2, this included performance indicators such as: infrastructure, shipments, quality, tracking & tracing and timeliness of the logistics services, UK achieved higher level of logistics performances as compared to both India and China.

Indicators	Country	UK		India		China	
		Rank	Score	Rank	Score	Rank	Score
Infrastructure		15	3.95	56	2.87	26	3.61
International Shipments		13	3.63	54	2.98	23	3.46
Logistics Quality		11	3.93	38	3.14	28	3.47
Tracking & Tracing		10	4.00	54	3.09	31	3.52
Timeliness		10	4.19	44	3.58	30	3.80
Overall Ranking & Scores		10	3.90	26	3.52	46	3.08

Source: Arvis et al. (2012)

Table 5.2 Rankings on the logistics performance of the UK, India and China

5.3 Comparison from the Survey Results

5.3.1 Total Sales Volume:

The total sales volume figure was completed by 117, 138 and 67 respondents from the UK, India and China respectively. The mean sales volume (in million pounds) was found to be 19.19, 12.95 and 12.25 for the SMEs in the UK, India and China respectively. Similarly the median value (in million pounds) was found to be 22.00, 11.40 and 10.00 for the UK, India and Chinese SMEs respectively. It was found that SMEs in the UK had higher sales volume as compared to SMEs in India and China. Figure 5.12 depicts more details about the dispersion of sales volume. It was found that overall sales volume for the SMEs in the UK, India and China was positively skewed.

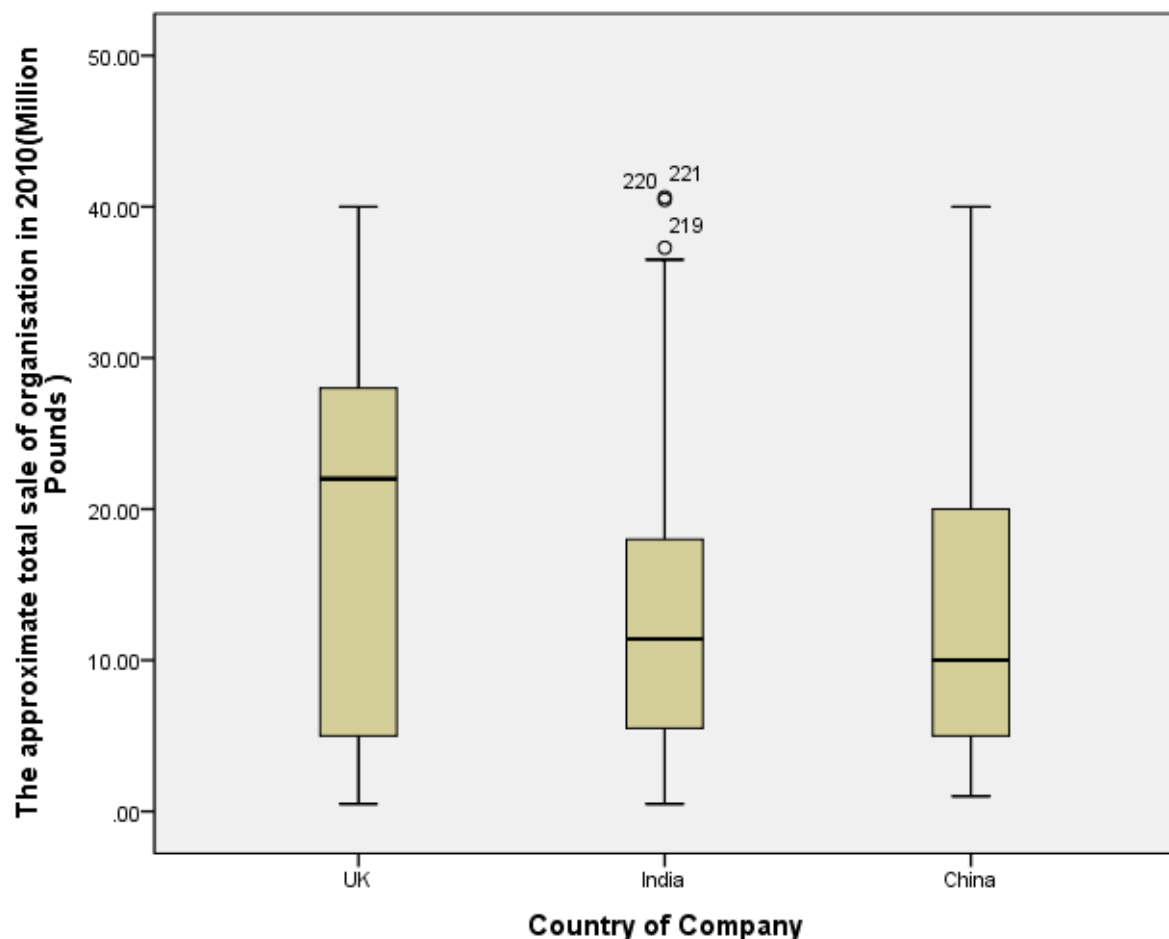


Figure 5.12: Box Plot for annual sales volume

5.3.2 Age of Organisation:

The years of establishment values were completed by 117, 175 and 71 respondents from the UK, India and China respectively. The mean age (in years) was found to be 49.05, 15.61 and 12.76 for the SMEs

in the UK, India and China respectively. The median value (in million pounds) was found to be 45.00, 14.00 and 10.00 for the UK, India and Chinese SMEs respectively. It was found that SMEs in the UK had more business experience in years as compared to SMEs in India and China. SMEs in India and China were found to be younger (less in age) than that of the UK. Figure 5.13 depicts more details about the dispersion of age of organisation.

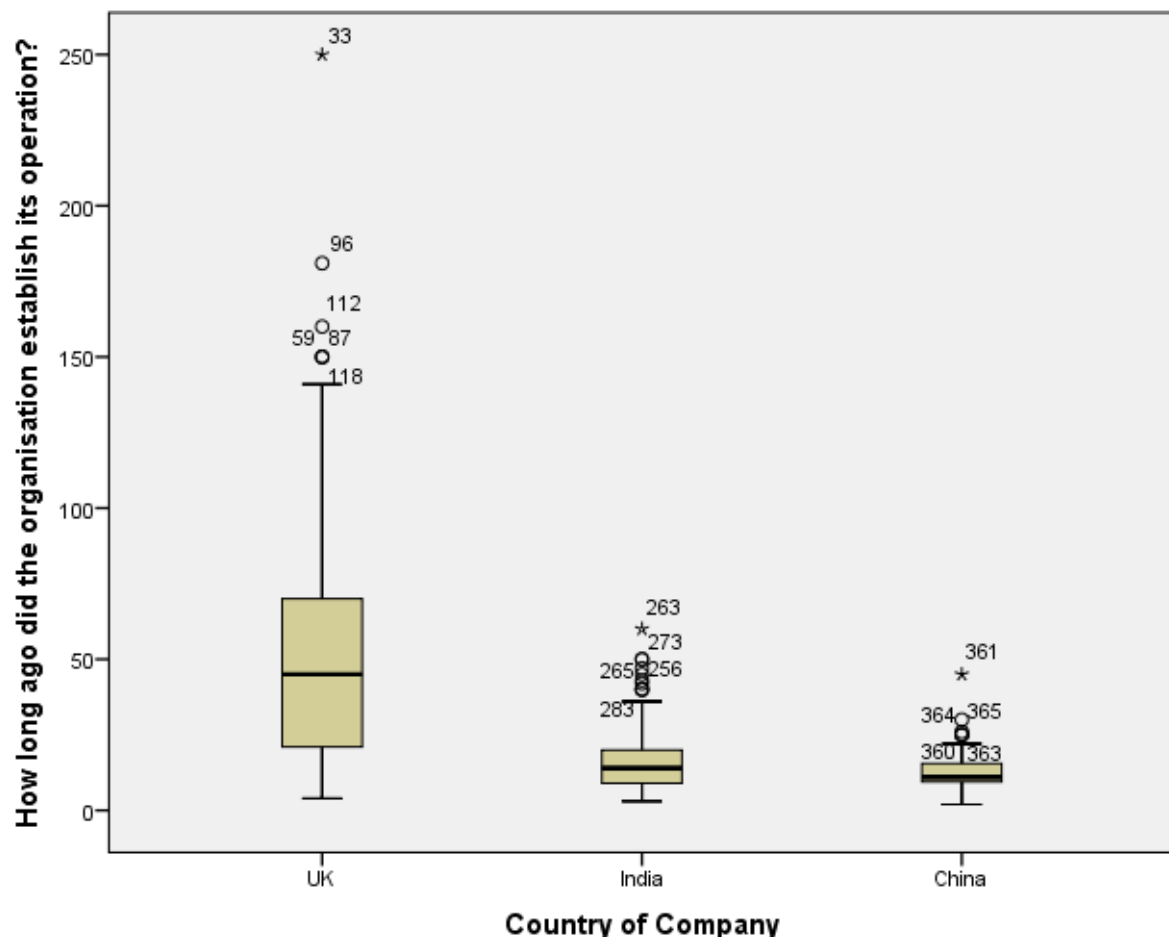


Figure 5.13: Box Plot for age of organisation

5.3.3 R&D Expenses:

The R&D expenses (% of sales volume) figure was completed by 99, 167 and 57 respondents from the UK, India and China respectively. The mean R&D expense was found to be 4.25, 2.14 and 10.71 for the SMEs in the UK, India and China respectively. Similarly the median value was found to be 3.00, 2.00 and 8.00 for the UK, India and Chinese SMEs respectively. It was found that SMEs in the China spent higher percent in R&D activities as compared to SMEs in the UK and India. Figure 5.14 depicts more details about the dispersion of R&D expenses. It was found that overall R&D expenses for the

three countries were skewed towards positive side.

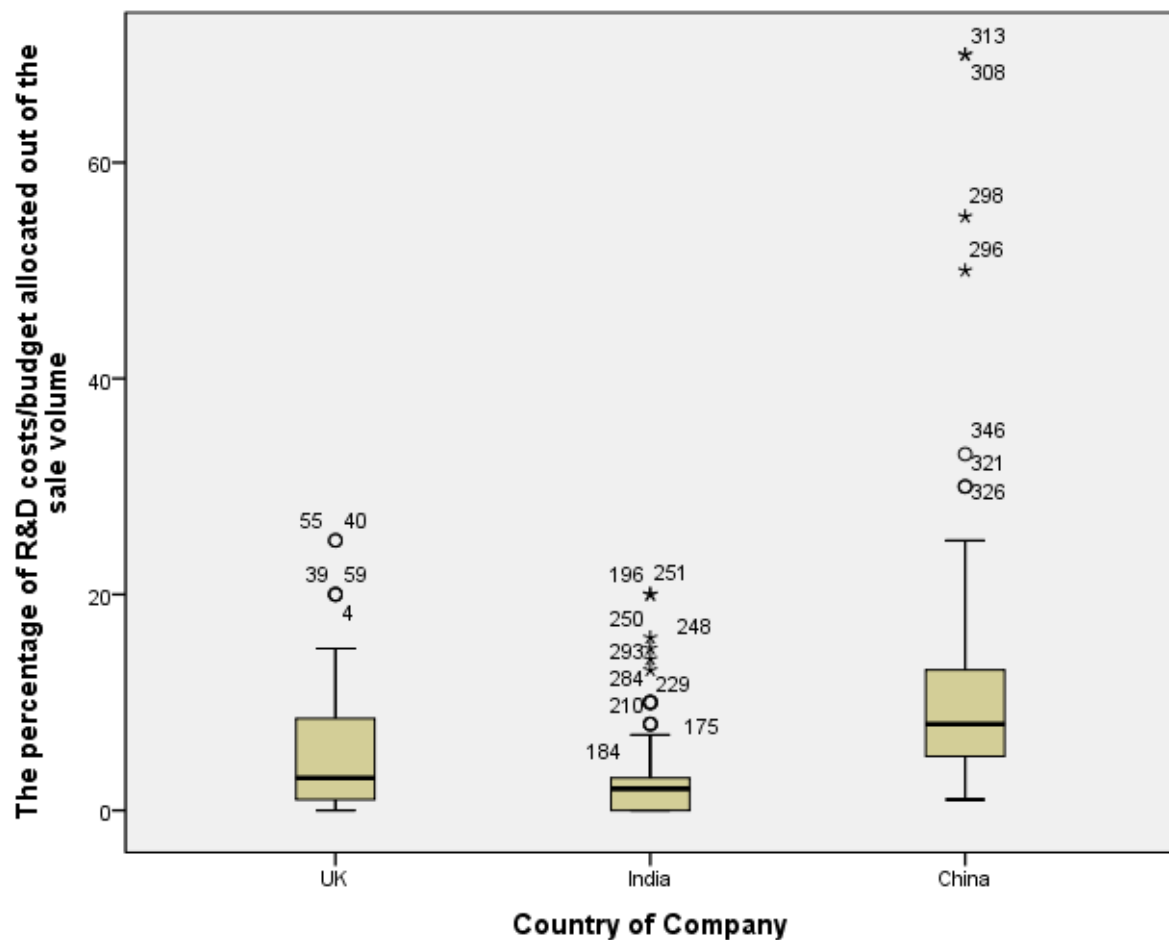


Figure 5.14: Box Plot for percentage of R&D cost

5.3.4 Logistics Expenses:

The logistics expenses (% of sales volume) figure was completed by 103, 167 and 61 respondents from the UK, India and China respectively. The mean logistics expense was found to be 5.64, 16.92 and 11.65 for the SMEs in the UK, India and China respectively. Similarly the median value was found to be 5.00, 16.00 and 10.00 for the UK, India and Chinese SMEs respectively. It was found that SMEs in India and China spent higher in logistics activities as compared to SMEs in the UK. Figure 5.15 depicts more details about the dispersion of logistics expenses.

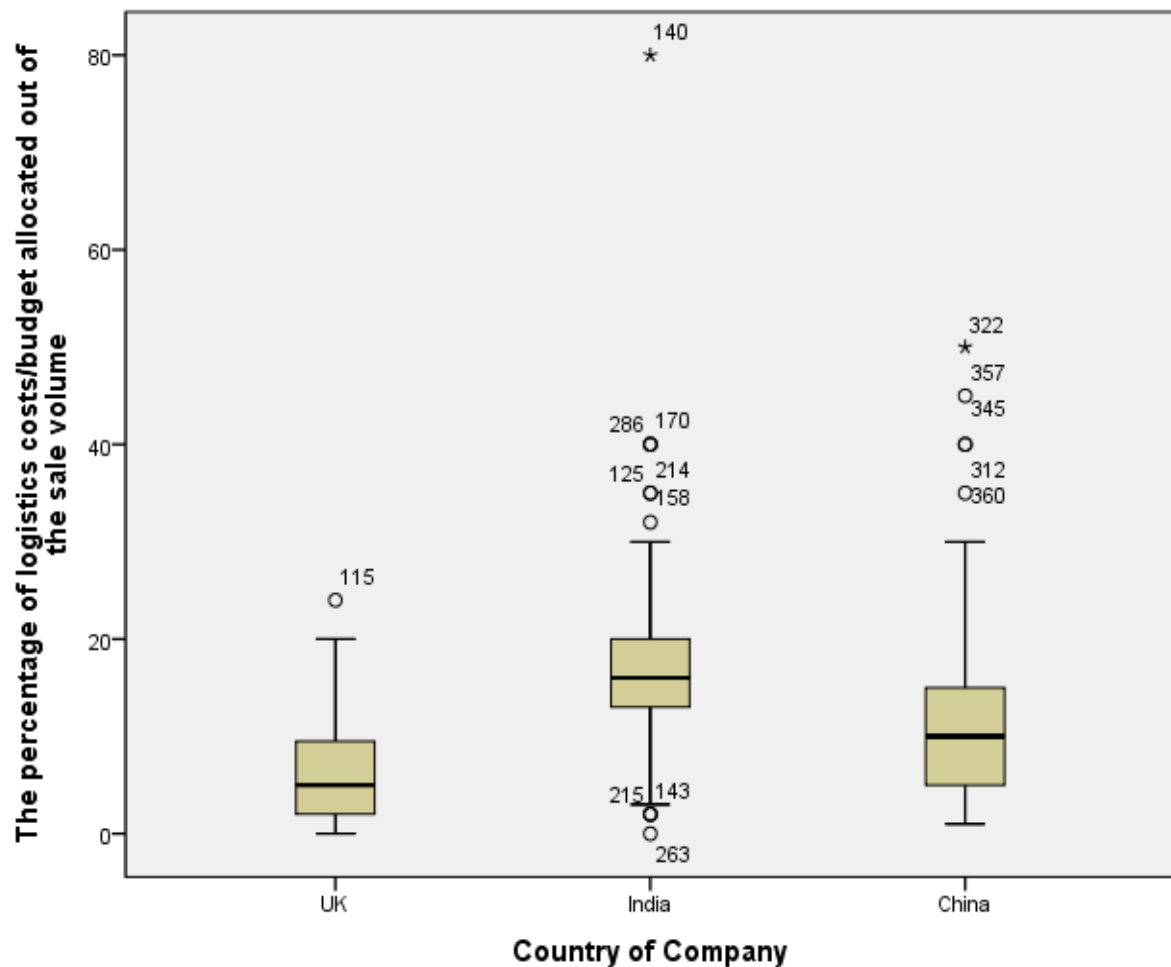


Figure 75.15: Box Plot for percentage of logistics cost

5.3.5 Production Expenses:

The production expenses (% of sales volume) figure was completed by 99, 166 and 54 respondents from the UK, India and China respectively. The mean production expense was found to be 43.19, 31.54 and 51.31 for the SMEs in the UK, India and China respectively. Similarly the median value was found to be 40.00, 35.00 and 50.00 for the UK, India and Chinese SMEs respectively. It was found that SMEs in India spent lower in production activities as compared to SMEs in the UK and China. Figure 5.16 depicts more details about the dispersion of production expenses. It was found that overall production expenses for the three countries were skewed towards negative side.

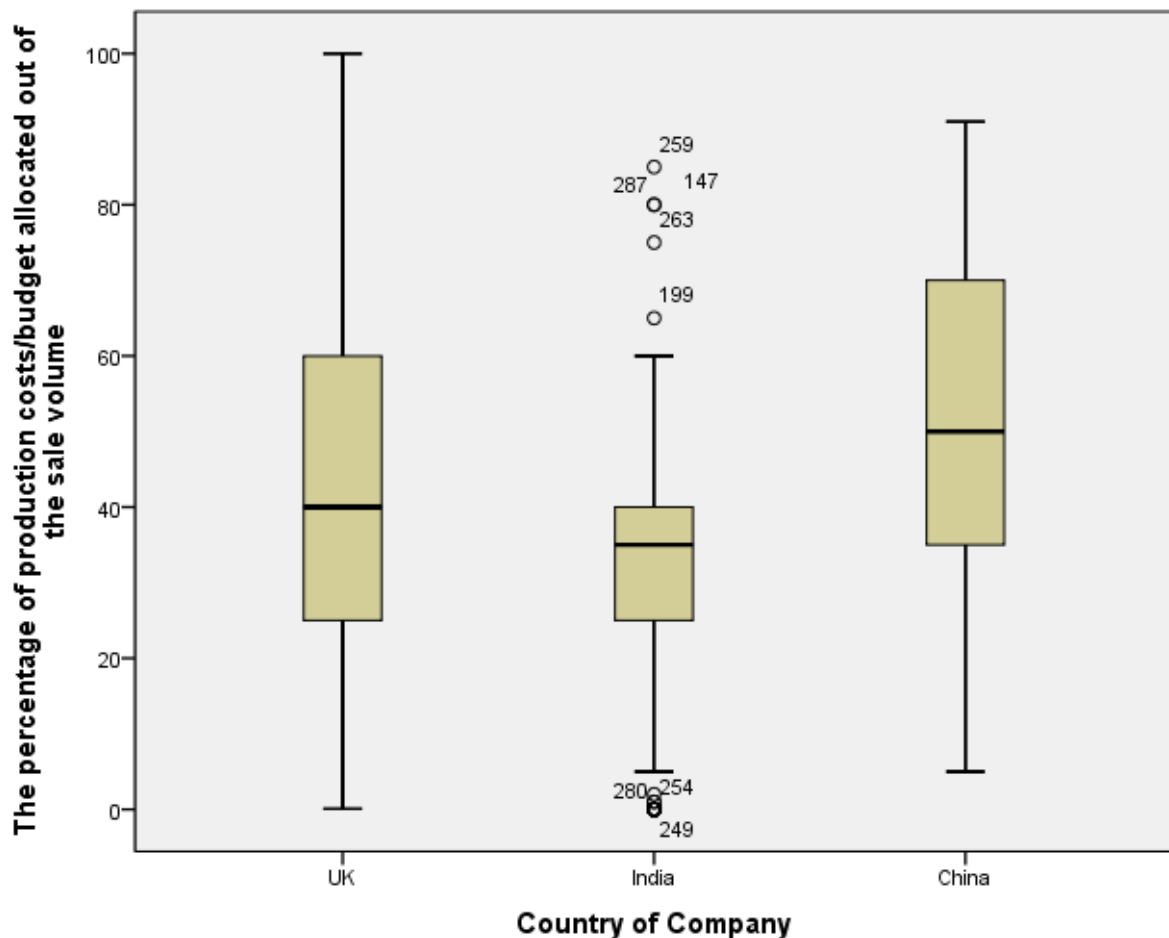


Figure 5.16: Box Plot for percentage of production cost

5.4 Comparison of Supply Chain Collaborations

5.4.1 Joint Venture

1) Descriptive Results-

In the UK, joint venture with supplier was the most popular collaborative initiative (35.6 percent) whereas 28.7 percent of SMEs had joint ventures with their customers. However joint venture with competitors was less popular with only 10.3 percent of SMEs involved in such initiatives. Vertical joint ventures (with suppliers and/or customers) were more common as compared to horizontal joint venture (with competitors and/or other organisations). The overall joint venture initiative is nearly 60 percent.

In India, joint venture with other organisations seemed to be a very popular strategy with a percentage of 41.6 and joint ventures with the rest of other partners not a popular strategy at all. It seems Indian SMEs paid more focus on horizontal (44.25 percent) joint ventures as opposed to vertical (4.42 percent) joint ventures. However on an overall basis joint venture was a common initiative in India.

As far as Chinese SMEs were concerned, they were more inclined in joint ventures with other organisations (35.2 percent) and suppliers (27.8 percent) than with customers and other organisations.

They were equally involved in both the vertical and the horizontal joint ventures. The overall joint venture initiative was very popular in China.

The overall data responses showed more inclination for joint ventures with other organisations (33.1 percent) and less with competitors (5.5 percent). The horizontal joint venture was nearly 13 percent more as compared to vertical joint ventures. Table 5.3 provides more details about joint venture with supply chain partners.

Joint Venture with:	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Supplier	31	35.6	4	3.5	15	27.8	50	19.7
Customer	25	28.7	2	1.8	8	14.8	35	13.8
Competitor	9	10.3	4	3.5	1	1.9	14	5.5
Other Organisation	18	20.7	47	41.6	19	35.2	84	33.1
Vertical	38	43.7	5	4.4	20	37.0	63	24.8
Horizontal	22	25.3	50	44.2	20	37.0	92	36.2
Overall	52	59.8	53	46.9	38	70.4	143	56.3
Number of companies in collaborative relationship	87	100.0	113	100.0	54	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 5.3: Joint venture and country

In terms of average effectiveness of joint venture initiatives with respect to country, the results showed similar values for mean and median. However the standard deviation and range values were different for all the three countries. Moreover all the three countries had negative skewness which implies that most of the effectiveness value lies above mean. Table 5.4 provides more details:

		Average Effectiveness: Joint Venture			
		UK	India	China	Total
Frequency	Yes	42	52	37	131
	No	45	61	17	123
Central Tendency & Dispersion	Mean	6.88	7.10	7.19	7.06
	Median	8.00	7.00	8.00	7.00
	Standard Deviation	2.24	1.59	2.04	1.94
	Skewness	-1.18	-1.02	-0.48	-0.96
	Minimum	1.00	1.00	3.00	1.00
	Maximum	10.00	9.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 5.4: Average effectiveness: Joint venture and country

b) Estimated Values

Based on the actual proportion of SMEs entering into joint venture relationship and based on the actual mean and standard deviation values of the joint venture effectiveness, the estimated values for the SMEs population were predicted using estimation theory. The class interval for the estimated percentage and the estimated mean score were calculated at 5% and 1% significance level. On an overall basis, at 95% Margin of Error (MOE) the estimated percentage of SMEs in the joint venture relationship will be from 45 to 58 percentage while at 99% MOE, 43 to 60 percent of the SMEs will have joint ventures with their supply chain partners. At 95% MOE, the average effectiveness will range from 6.82 to 7.29 on a 10 point scale and at 99% MOE the estimated mean score will be 6.74 to 7.37. It can be expected that joint venture relationship will be popular up to 60 percent in the SME populations and the mean effectiveness will be high up to 7.29. Specific details related to the three countries are shown in the table 5.5.

Class Interval for Average Effectiveness: Joint Venture					
		UK	India	China	Total
Estimated Percentage	@95% MOE	38 to 59	37 to 55	56 to 81	45 to 58
	@99% MOE	34 to 62	34 to 58	52 to 85	43 to 60
Estimated Mean Score	@95% MOE	6.41 to 7.35	6.81 to 7.40	6.65 to 7.73	6.82 to 7.29
	@99% MOE	6.26 to 7.50	6.72 to 7.49	6.47 to 7.90	6.74 to 7.37

Table 5.5: Class interval for joint venture and country

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of country on joint venture initiative. Responses were divided into three groups: UK, India and China. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the table 5.6.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	19.96	0.000	0.137	0.321* (1 & 2)	0.000
	253				0.242* (2 & 3)	0.000
1B and 2	2	16.90	0.000	0.118	0.270* (1 & 2)	0.000
	253				0.139* (1 & 3)	0.000
					0.130* (2 & 3)	0.038
1C and 2	2	3.10	0.047	0.023	-	-
	253				-	-
1D and 2	2	5.05	0.007	0.041	0.201 (1 & 2)	0.005
	253				-	-
1E and 2	2	27.83	0.000	0.170	0.393* (1 & 2)	0.000
	253				0.326* (2 & 3)	0.000
1F and 2	2	3.90	0.021	0.031	0.190* (1 & 2)	0.016
	253				-	-
1G and 2	2	4.51	0.012	0.034	0.235* (2 & 3)	0.012
	253				-	-
1H and 2	2	0.271	0.761	-	-	-
	130				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Country;** 1- UK, 2-India, 3-China.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between countries.

Table 5.6: Joint venture and country- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in joint venture initiative for the three respondents groups. The results are:

- Joint Venture with supplier: $F(2, 253) = 19.96$, $p = 0.000$ showed significant difference between joint venture with suppliers according to countries. In addition to this, the actual difference in mean scores between the groups was very high. The effect size, calculates using Eta squared, was 0.137. Post-hoc comparison using the Tukey HSD test indicated that the mean score for India was significantly different from UK (0.321, $p = 0.000$) and China (0.242, $p = 0.000$). However UK and China did not significantly differ from each other.
- Joint Venture with customer: $F(2, 253) = 16.90$, $p = 0.000$ showed significant difference between joint venture with customers according to countries. Moreover, the actual difference in mean scores between the groups was quite high. The effect size, calculates using Eta squared, was 0.118. Post-hoc comparison using the Tukey HSD test indicated that the mean score for India

was significantly different from UK (0.270, $p = 0.000$) and China (0.139, $p = 0.000$). Also UK and China were also significantly different (0.130, $p = 0.038$) from each other.

- iii. Joint Venture with competitors: Although $F(2, 253) = 3.10$, $p = 0.047$ showed significant difference between joint venture with competitors according to countries. However the actual difference in mean scores between the groups was low. The effect size, calculates using Eta squared, was 0.023. Post-hoc comparison using the Tukey HSD test also supported that the mean score for India, UK and China did not significantly differ from each other.
- iv. Joint Venture with other organisation: $F(2, 253) = 5.05$, $p = 0.007$ showed significant difference between joint venture with other organisation according to countries. The actual difference in mean scores between the groups was moderate. The effect size, calculates using Eta squared, was 0.041. Post-hoc comparison using the Tukey HSD test indicated that the mean score for India was significantly different from UK (0.201, $p = 0.005$) and but not from China. Also UK and China did not significantly differ from each other.
- v. Vertical Joint Venture: $F(2, 253) = 27.83$, $p = 0.000$ showed significant difference between joint venture with suppliers and/or customers according to countries. In addition to this, the actual difference in mean scores between the groups was very high. The effect size, calculates using Eta squared, was 0.17. Post-hoc comparison using the Tukey HSD test indicated that the mean score for India was significantly different from UK (0.393, $p = 0.000$) and China (0.326, $p = 0.000$). However UK and China did not significantly differ from each other.
- vi. Horizontal Joint Venture: $F(2, 253) = 3.90$, $p = 0.021$ showed significant difference between joint venture with competitors and/or other organisation according to countries. The actual difference in mean scores between the groups was not moderate. The effect size, calculates using Eta squared, was 0.031. Post-hoc comparison using the Tukey HSD test indicated that the mean score for India was significantly different from UK (0.190, $p = 0.016$) and but not from China. Also UK and China did not significantly differ from each other.
- vii. Overall Joint Venture: $F(2, 253) = 4.51$, $p = 0.012$ showed significant difference between joint venture with any of the supply chain partners according to countries. The actual difference in mean scores between the groups was not moderate. The effect size, calculates using Eta squared, was 0.034. Post-hoc comparison using the Tukey HSD test indicated that the mean score for India was significantly different from china (0.235, $p = 0.012$) and but not from UK. Also UK and China did not significantly differ from each other.

5.4.2 Co-development

a) Descriptive Results-

In the UK, co-development with supplier was the most popular collaborative initiative (40.2 percent)

whereas 26.4 percent of SMEs had co-developments with their customers. However co-development with competitors was less popular with only 8.0 percent of SMEs involved in such initiatives. Vertical co-developments were more popular (50.6 percent) as compared to horizontal co-development (18.4 percent). The overall co-development initiative was nearly 59 percent.

In India, co-development with other organisations seemed to be a popular strategy with a percentage of 15.9 and co-developments with the rest of other partners was not a popular strategy at all. It seemed Indian SMEs paid more focus on horizontal (16.8 percent) co-developments as opposed to vertical (8 percent) co-developments. However on an overall basis co-development was not a very common collaborative initiative in Indian SMEs.

As far as Chinese SMEs were concerned, they were more inclined in co-developments with customers and other organisations than with competitors. They were more involved in the vertical as opposed to the horizontal co-developments. The overall co-development initiative was highly popular in China.

The overall data responses for co-development showed more or less equal inclination towards customers, suppliers and other organisations and less towards competitors (4.3 percent). The vertical co-development was nearly 14 percent more as compared to horizontal co-developments. Table 5.7 provides more details about co-development with supply chain partners.

Co-development with:	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Supplier	35	40.2	5	4.4	12	22.2	52	20.5
Customer	23	26.4	7	6.2	21	38.9	51	20.1
Competitor	7	8.0	1	0.9	3	5.6	11	4.3
Other Organisation	12	13.8	18	15.9	17	31.5	47	18.5
Vertical	44	50.6	9	8.0	37	68.5	90	35.4
Horizontal	16	18.4	19	16.8	20	37.0	55	21.7
Overall	51	58.6	27	23.9	41	75.9	119	46.9
Number of companies in collaborative relationship	87	100.0	113	100.0	54	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 5.7: Co-development and country

In terms of average effectiveness of co-development initiatives with respect to country, the results showed similar values for mean and median. However the standard deviation and range values were different for all the three countries. UK and Chinese SMEs had negative skewness which implied that most of the effectiveness value lied above mean whereas for Indian SMEs the skewness is positive. The effectiveness of co-development initiative is found to be higher in the SMEs in the UK and China as compared to Indian SMEs. Table 5.8 provides more details:

		Average Effectiveness: Co-development			
		UK	India	China	Total
Frequency	Yes	41	26	40	107
	No	46	87	14	147
Central Tendency & Dispersion	Mean	6.55	5.94	6.90	6.54
	Median	7.00	6.00	7.00	7.00
	Standard Deviation	1.86	1.30	2.10	1.86
	Skewness	-0.42	0.91	-1.23	-0.54
	Minimum	2.00	4.00	1.00	1.00
	Maximum	10.00	9.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 5.8: Average effectiveness: Co-development and country

b) Estimated Values

For Chinese SMEs, at 95% MOE the estimated percentage of SMEs in the co-development relationship will be from 62 to 86 percent while at 99% MOE, 59 to 89 percent of the Chinese SMEs will have co-development relationship with their supply chain partners. At 95% MOE, the average effectiveness of SMEs in China will vary from 6.34 to 7.46 on a 10 point scale and at 99% MOE the estimated mean score will be in between 6.34 and 7.46. It can be expected that co-developments will be common up to 50 percent in the SME populations and the mean effectiveness will be up to 6.76. Specific details related to the three countries were shown in the table 5.9.

		Class Interval for Average Effectiveness: Co-development			
		UK	India	China	Total
Estimated Percentage	@95% MOE	37 to 58	15 to 31	62 to 86	36 to 48
	@99% MOE	33 to 61	13 to 33	59 to 89	34 to 50
Estimated Mean Score	@95% MOE	6.16 to 6.95	5.70 to 6.18	6.34 to 7.46	6.31 to 6.76
	@99% MOE	6.04 to 7.07	5.63 to 6.26	6.16 to 7.64	6.23 to 6.84

Table 5.9: Class interval for co-development and country

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of country on co-development initiative. Responses were divided into three groups: UK, India and China. Eta squared values were also used to determine the effect size of the results. Statisticians classify 0.01 as a small effect, 0.06 as a medium effect and 0.14 as a large effect. The detailed results are tabulated in the table 5.10.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	22.65	0.000	0.15	0.358* (1 & 2)	0.000
	253				0.178* (2 & 3)	0.012
					0.180* (1 & 3)	0.016
1B and 2	2	15.34	0.000	0.10	0.202* (1 & 2)	0.001
	253				0.327* (2 & 3)	0.000
1C and 2	2	3.20	0.042	0.02	0.072* (1 & 2)	0.036
	253				-	-
1D and 2	2	3.98	0.020	0.03	0.177* (1 & 3)	0.023
	253				0.156* (2 & 3)	0.040
1E and 2	2	32.50	0.000	0.20	0.426* (1 & 2)	0.000
	253				0.420* (2 & 3)	0.000
1F and 2	2	4.95	0.008	0.03	0.186* (1 & 3)	0.023
	253				0.202* (2 & 3)	0.008
1G and 2	2	28.56	0.000	0.18	0.347* (1 & 2)	0.000
	253				0.520* (2 & 3)	0.000
1H and 2	2	2.13	0.123	-	-	-
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Country;** 1- UK, 2-India, 3-China.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between countries.

Table 5.10: Co-development and country- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-development initiative for the three respondents groups. The results are:

- Co-development with supplier: $F(2, 253) = 22.65$, $p = 0.000$ showed significant difference between co-development with suppliers according to countries. In addition to this, the actual difference in mean scores between the groups was very high (Eta squared value of 0.15). Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.358, $p = 0.000$) and China (0.178, $p = 0.012$). SMEs in the UK and China also significantly differ from each other (0.180, $p = 0.016$).
- Co-development with customer: $F(2, 253) = 15.34$, $p = 0.000$ showed significant difference between co-development with customers according to countries. Moreover, the actual difference in mean scores between the groups was also high. The effect size, calculated using Eta squared, was 0.118. Tukey HSD test indicated that the mean score for India was significantly different from UK (0.202, $p = 0.001$) and China (0.327, $p = 0.000$). However UK and China were not significantly different from each other.

- iii. Co-development with competitors: Although $F(2, 253) = 3.20$, $p = 0.042$ showed significant difference between co-development with competitors according to countries. However the actual difference in mean scores between the groups was low (Eta squared value of 0.02). Post-hoc comparison supported that the mean score for India and UK were significantly different (0.072, $p = 0.036$) which is considered as low difference while India and China and UK and China did not showed any significant difference between them.
- iv. Co-development with other organisation: $F(2, 253) = 3.98$, $p = 0.020$ showed significant difference between co-development with other organisation according to countries. The Eta squared value of 0.03 indicated that the actual difference in mean scores between the groups was low. Post-hoc comparison using the Tukey HSD test indicated that the mean score for China was significantly different from UK (0.177, $p = 0.023$) and from India (0.156, $p = 0.040$). Whereas UK and India did not significantly differ from each other.
- v. Vertical Co-development: $F(2, 253) = 32.50$, $p = 0.000$ showed significant difference between co-development with suppliers and or customers according to countries. In addition to this, the actual difference in mean scores between the groups was very high with Eta square value of 0.20. Tukey HSD test indicated that the mean score for India was significantly different from UK (0.426, $p = 0.000$) and China (0.420, $p = 0.000$). However UK and China did not significantly differ from each other.
- vi. Horizontal Co-development: $F(2, 253) = 4.95$, $p = 0.008$ showed significant difference between co-development with competitors and or other organisation according to countries. The actual difference in mean scores between the groups was not moderate. The effect size, calculates using Eta squared, was 0.03. Post-hoc comparison using the Tukey HSD test indicated that the mean score for China was significantly different from UK (0.186, $p = 0.023$) and India (0.202, $p = 0.008$) China. On the other hand UK and Indian SMEs did not significantly differ from each other in terms of horizontal co-development initiative.
- vii. Overall Co-development: $F(2, 253) = 28.56$, $p = 0.000$ showed significant difference between co-development with competitors and or other organisation according to countries. Eta square value of 0.18 implied that the actual difference in mean scores between the groups was very high. Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.347, $p = 0.000$) and China (0.520, $p = 0.000$). On the contrary, UK and China did not significantly differ from each other.

5.4.3 Co-design

a) Descriptive Results-

In the UK, co-design with supplier was the most popular collaborative initiative (35.6 percent) whereas 29.9 percent of SMEs had co-designs with their customers. However co-design with competitors was less popular with only 4.6 percent of SMEs were involved in such initiatives. Nearly half of the UK SMEs were involved in the vertical co-designs whereas only 11.5 percent SMEs had horizontal co-design with their competitors and/or other organisations. The overall co-design initiative was nearly 55 percent.

In India, nearly one fourth of the SMEs had co-design with other organisations while co-design with other supply chain partners seemed to be a less popular strategy. It was found that Indian SMEs pay more focus on horizontal co-design relations as opposed to vertical co-design relations. However on an overall basis co-design was found to be present in 46 percent of Indian SMEs.

As far as Chinese SMEs were concerned, they were more inclined in co-designs with customers (29.6 percent) and suppliers (24.1 percent) than with competitors and other organisations. They were more involved in the vertical co-design rather than the horizontal co-designs. The overall co-design initiative was very popular (68.5 percent) in China.

The overall data responses showed more inclination for co-designs with customers (23.6 percent) and less with competitors (3.5 percent). The vertical co-design was nearly double of the horizontal co-design relationship. Table 5.11 provides more details about co-design with supply chain partners.

Co-design with:	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Supplier	31	35.6	6	5.3	13	24.1	50	19.7
Customer	26	29.9	18	15.9	16	29.6	60	23.6
Competitor	4	4.6	3	2.7	2	3.7	9	3.5
Other Organisation	8	9.2	29	25.7	10	18.5	47	18.5
Vertical	44	50.6	22	19.5	27	50.0	93	36.6
Horizontal	10	11.5	31	27.4	12	22.2	53	20.9
Overall	47	54.0	52	46.0	37	68.5	136	53.5
Number of companies in collaborative relationship	87	100.0	113	100.0	54	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 5.11: Co-design and country

In terms of average effectiveness of co-design initiatives with respect to country, the results showed similar values for mean scores. However the standard deviation, skewness and range values suggest higher variation in the UK and Chinese SMEs as compared to Indian SMEs. However all the three countries were negatively skewed which implied that most of the effectiveness value laid above mean.

Table 5.12 provides more details:

		Average Effectiveness: Co-design			
		UK	India	China	Total
Frequency	Yes	38	51	36	125
	No	49	62	18	129
Central Tendency & Dispersion	Mean	6.55	6.20	6.61	6.42
	Median	7.00	6.00	7.00	7.00
	Standard Deviation	2.00	1.28	2.11	1.77
	Skewness	-0.50	-0.20	-0.78	-0.46
	Minimum	2.00	4.00	1.00	1.00
	Maximum	10.00	9.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 5.12: Average effectiveness: Co-design and country

b) Estimated Values

For the UK SMEs, at 95% MOE the estimated percentage of SMEs in the co-design relationship will be from 33 to 54 percent while at 99% MOE, 30 to 57 percent of the SMEs in the UK will have a co-design with their supply chain partners. At 95% MOE, the average effectiveness for all the SMEs will range from 6.21 to 6.64 on a 10 point scale and at 99% MOE the estimated mean score will be expected between 6.14 and 6.71. It can be expected that the co-design relationship in China will be popular up to 83 percent while their mean effectiveness will be as high as 7.35. Specific details related to the three countries are shown in the table 5.13.

		Class Interval for Average Effectiveness: Co-design			
		UK	India	China	Total
Estimated	@95% MOE	33 to 54	36 to 54	54 to 79	43 to 55
Percentage	@99% MOE	30 to 57	33 to 57	50 to 83	41 to 57
Estimated Mean Score	@95% MOE	6.13 to 6.97	5.96 to 6.43	6.05 to 7.18	6.21 to 6.64
	@99% MOE	6.00 to 7.10	5.89 to 6.51	5.87 to 7.35	6.14 to 6.71

Table 5.13: Class interval for co-design and country

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of country on co-design initiative. The detailed results are tabulated in the table 5.14.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	16.42	0.000	0.11	0.303* (1 & 2)	0.000
	253				0.188* (2 & 3)	0.008
1B and 2	2	3.39	0.035	0.02	-	-
	253				-	-
1C and 2	2	0.27	0.763	-	-	-
	253				-	-
1D and 2	2	4.52	0.012	0.04	0.165* (1 & 2)	0.008
	253				-	-
1E and 2	2	14.18	0.000	0.10	0.311* (1 & 2)	0.000
	253				0.375* (2 & 3)	0.000
1F and 2	2	3.89	0.022	0.03	0.159* (1 & 2)	0.016
	253				-	-
1G and 2	2	3.79	0.024	0.03	0.225* (2 & 3)	0.017
	253				-	-
1H and 2	2	0.717	0.490	-	-	-
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Country;** 1- UK, 2-India, 3-China.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between countries.

Table 5.14: Co-design and country- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-design initiative for the three respondents groups. The results are:

- Co-design with supplier: $F(2, 253) = 16.42$, $p = 0.000$ showed significant difference between co-design with suppliers according to countries. In addition to this, the actual difference in mean scores between the groups was very high (Eta squared value of 0.11). Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.303, $p = 0.000$) and China (0.188, $p = 0.008$). However UK and China did not significantly differ from each other.
- Co-design with customer: Although $F(2, 253) = 3.39$, $p = 0.035$ showed significant difference between co-design with customers according to countries but the actual difference in mean scores between the groups was quite low. The Tukey HSD test could not indicate any significant differences in the score for India, UK and China.
- Co-design with other organisations: $F(2, 253) = 4.52$, $p = 0.012$ showed significant difference between co-design with other organisation according to countries. The actual difference in mean scores between the groups was moderate with Eta squared value of 0.04. Post-hoc

comparison using the Tukey HSD test indicated that the mean score for India was significantly different from UK (0.165, $p = 0.008$) but not from China. Also UK and China did not significantly differ from each other.

- iv. Vertical Co-design: $F(2, 253) = 14.18$, $p = 0.000$ showed significant difference between co-design with suppliers and/or customers according to countries. In addition to this, the actual difference in mean scores between the groups was very high (Eta squared value as 0.10). Tukey HSD test indicated that the mean score for India was significantly different from UK (0.311, $p = 0.000$) and China (0.375, $p = 0.000$). However UK and China did not significantly differ from each other.
- v. Horizontal Co-design: $F(2, 253) = 3.89$, $p = 0.022$ showed significant difference between co-design with competitors and/or other organisation according to countries. The actual difference in mean scores between the groups was not moderate (Eta squared value of 0.03). Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.159, $p = 0.016$) but not from China. However UK and China did not significantly differ from each other.
- vi. Overall Co-design: $F(2, 253) = 3.79$, $p = 0.024$ showed significant difference between co-design with any of the supply chain partner according to countries. The actual difference in mean scores between the groups was not moderate as indicated by the Eta squared value of 0.034. Further Tukey HSD test identified significant differences of score between India and China (0.225, $p = 0.017$). No other differences were identified between India and UK and between UK and China.

5.4.4 Co-manufacturing

a) Descriptive Results-

In the UK, co-manufacturing with supplier was the most common collaborative initiative (20.7 percent) whereas 10.3 percent of SMEs had co-manufacturing with their customers. However co-manufacturing with other organisations was less popular with only 6.9 percent of SMEs were involved in such initiatives. Vertical co-manufacturing initiative was more in percentage as compared to horizontal co-manufacturing initiative. The overall co-manufacturing initiative was nearly 32 percent.

On the contrary, in India co-manufacturing with other organisations seemed to be a very popular strategy with a percentage of 41.6 and co-manufacturing with rest of the other partners was not at all a common strategy. It seems Indian SMEs paid more focus on horizontal (42.5 percent) co-manufacturing as opposed to vertical (13.3 percent) co-manufacturing. However on an overall basis co-manufacturing was a very common initiative in India.

As far as the Chinese SMEs were concerned, they were more inclined in co-manufacturing with suppliers (31.5 percent) than with the rest of the partners. They were more involved in the vertical

relationship as compared to the horizontal co-manufacturing relationship. The overall co-manufacturing initiative was popular in China.

The overall data responses showed more inclination for co-manufacturing with other organisations (24 percent) and less with customers (5.5 percent). The horizontal co-manufacturing was nearly 4 percent more as compared to vertical co-manufacturing. Table 5.15 provides more details about co-manufacturing with supply chain partners.

Co-manufacturing with:	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Supplier	18	20.7	14	12.4	17	31.5	49	19.3
Customer	9	10.3	1	0.9	4	7.4	14	5.5
Competitor	7	8.0	8	7.1	1	1.9	16	6.3
Other Organisation	6	6.9	47	41.6	8	14.8	61	24.0
Vertical	22	25.3	15	13.3	20	37.0	57	22.4
Horizontal	11	12.6	48	42.5	9	16.7	68	26.8
Overall	28	32.2	58	51.3	28	51.9	114	44.9
Number of companies in collaborative relationship	87	100.0	113	100.0	54	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 5.15: Co-manufacturing and country

In terms of average effectiveness of co-manufacturing initiatives with respect to country, the results showed similar values for both the mean and median. However, the standard deviation and range values were different for all the three countries. India was positively skewed whereas the rest of the other two countries were negatively skewed. Table 5.16 provides more details:

		Average Effectiveness: Co-manufacturing			
		UK	India	China	Total
Frequency	Yes	18	57	27	102
	No	69	56	27	152
Central Tendency & Dispersion	Mean	6.90	6.22	6.70	6.47
	Median	7.00	6.00	6.00	6.00
	Standard Deviation	1.81	1.29	1.71	1.52
	Skewness	-1.41	0.51	-0.25	-0.11
	Minimum	1.00	4.00	2.00	1.00
	Maximum	9.00	9.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 5.16: Average effectiveness: Co-manufacturing and country

b) Estimated Values

For Indian SMEs, at 95% MOE the estimated percentage of SMEs in the co-manufacturing relationship will be from 41 to 60 percent while at 99% MOE, 38 to 63 percent of the Indian SMEs will have co-manufacturing with their supply chain partners. For the UK SMEs, at 95% MOE, the average effectiveness will range from 6.58 to 7.28 on a 10 point scale and at 99% MOE the estimated mean

score will be 6.40 to 7.40. It can be expected that co-manufacturing relationship will be popular up to 48 percent in the overall SME population and the mean effectiveness will be high up to 6.71. Specific details related to the three countries were shown in the table 5.17.

Class Interval for Average Effectiveness: Co-manufacturing					
		UK	India	China	Total
Estimated	@95% MOE	12 to 29	41 to 60	37 to 63	34 to 46
Percentage	@99% MOE	09 to 32	38 to 63	32 to 68	32 to 48
Estimated Mean Score	@95% MOE	6.58 to 7.28	5.98 to 6.46	6.25 to 7.16	6.28 to 6.65
	@99% MOE	6.40 to 7.40	5.91 to 6.53	6.11 to 7.30	6.22 to 6.71

Table 5.17: Class interval for co-manufacturing and country

b) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of country on co-manufacturing initiative. The detailed results are tabulated in the table 5.18.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	4.46	0.012	0.03	0.191* (2 & 3)	0.009
	253				-	-
1B and 2	2	4.56	0.011	0.13	0.195* (1 & 2)	0.010
	253				-	-
1C and 2	2	1.18	0.307	-	-	-
	253				-	-
1D and 2	2	20.46	0.000	0.14	0.347* (1 & 2)	0.000
	253				0.266* (2 & 3)	0.000
1E and 2	2	4.41	0.013	0.03	0.238* (2 & 3)	0.002
	253				-	-
1F and 2	2	6.48	0.002	0.05	0.298* (1 & 2)	0.000
	253				0.258* (2 & 3)	0.001
1G and 2	2	14.24	0.000	0.11	0.191* (1 & 2)	0.019
	253				-	-
1H and 2	2	1.19	0.304	-	-	-
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Country;** 1- UK, 2-India, 3-China.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between countries.

Table 5.18: Co-manufacturing and country- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-manufacturing initiative for the three respondents groups. The results are:

- i. Co-manufacturing with supplier: $F(2, 253) = 4.46$, $p = 0.012$ showed significant difference between co-manufacturing with suppliers according to countries but the actual difference in mean scores between the groups was not moderate (Eta squared value is 0.03). Tukey HSD test indicated that the mean score for India was significantly different from China (0.191, $p = 0.009$). However India & UK and UK & China did not significantly differ from each other.
- ii. Co-manufacturing with customer: $F(2, 253) = 4.56$, $p = 0.011$ showed significant difference between co-manufacturing with customers according to countries. Moreover, the actual difference in mean scores between the groups was quite high. The effect size is 0.13. Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.195, $p = 0.010$) but not from China. The UK and China were also not significantly different from each other.
- iii. Co-manufacturing with other organisation: $F(2, 253) = 20.46$, $p = 0.000$ showed significant difference between co-manufacturing with other organisation according to countries. The actual difference in mean scores between the groups was very high (Eta squared value is 0.14). Post-hoc comparison using the Tukey HSD test indicated that the mean score for India was significantly different from UK (0.347, $p = 0.000$) and China (0.266, $p = 0.000$). However UK and China did not significantly differ from each other.
- iv. Vertical Co-manufacturing: Although $F(2, 253) = 4.41$, $p = 0.013$ showed significant difference between co-manufacturing with suppliers and/or customers according to countries but the actual difference in mean scores between the groups is not moderate. The effect size, calculates using Eta squared, was 0.03. Tukey HSD test indicated that the mean score for India was significantly different from China (0.238, $p = 0.002$) but not from UK. Whereas UK and China did not significantly differ from each other.
- v. Horizontal Co-manufacturing: $F(2, 253) = 6.48$, $p = 0.021$ showed significant difference between co-manufacturing with competitors and/or other organisation according to countries. The actual difference in mean scores between the groups was moderate. The effect size, calculated using Eta squared, was 0.05. Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.298, $p = 0.000$) and from China (0.258, $p = 0.001$). However, UK and China did not significantly differ from each other.
- vi. Overall Co-manufacturing: $F(2, 253) = 14.24$, $p = 0.000$ showed significant difference between co-manufacturing with competitors and or other organisation according to countries. The actual difference in mean scores between the groups was very high (Eta squared is 0.11). Tukey HSD test indicated that the mean score for India was significantly different from UK (0.191, $p = 0.019$) but not from China. UK and China did not significantly differ from each other.

5.4.5 Aggregated purchasing

a) Descriptive Results-

In the UK, aggregated purchasing with supplier and customers seemed to be the common collaborative initiative. However, aggregated purchasing with competitors and other organisation were less popular within SMEs in the UK. Vertical aggregated purchasing was more common as compared to horizontal aggregated purchasing. The overall aggregated purchasing initiative was nearly one fourth.

In India, aggregated purchasing with competitors and other organisations seemed to be a very popular strategy with a percentage of 37.2 and 44.2 respectively. Aggregated purchasing with suppliers and customers is not at all a popular strategy. It seems Indian SMEs paid more focus on horizontal (65.5 percent) aggregated purchasing as opposed to vertical (8.8 percent) aggregated purchasing. However on an overall basis, aggregated purchasing was a very popular initiative in India.

As far as Chinese SMEs were concerned, they were equally inclined in aggregated purchasing with other organisations and the suppliers. Chinese SMEs were less involved with competitors for the aggregated purchasing. They had nearly similar involvement for both the vertical and the horizontal aggregated purchasing. The overall aggregated purchasing initiative was nearly 46 percent in China.

The overall data responses showed more inclination for aggregated purchasing with other organisations (25.6 percent) and less with customers (7.5 percent). The horizontal aggregated purchasing was nearly two times percent more as compared to vertical aggregated purchasing. Table 5.19 provides more details about aggregated purchasing with the supply chain partners.

Aggregated purchasing with:	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Supplier	12	13.8	9	8.0	9	16.7	30	11.8
Customer	10	11.5	2	1.8	7	13.0	19	7.5
Competitor	4	4.6	42	37.2	4	7.4	50	19.7
Other Organisation	6	6.9	50	44.2	9	16.7	65	25.6
Vertical	17	19.5	10	8.8	15	27.8	42	16.5
Horizontal	8	9.2	74	65.5	13	24.1	95	37.4
Overall	21	24.1	82	72.6	25	46.3	128	50.4
Number of companies in collaborative relationship	87	100.0	113	100.0	54	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 5.19: Aggregated purchasing and country

In terms of average effectiveness of aggregated purchasing initiatives with respect to country, the results showed different values for mean and standard deviation. Moreover all the three countries had different values of skewness. Table 5.20 provides more details:

		Average Effectiveness: Aggregated Purchasing			
		UK	India	China	Total
Frequency	Yes	13	81	24	118
	No	74	32	30	136
Central Tendency & Dispersion	Mean	5.85	6.20	7.13	6.35
	Median	6.00	6.00	8.00	6.00
	Standard Deviation	2.67	1.33	1.92	1.68
	Skewness	0.01	0.25	-1.81	-0.38
	Minimum	1.00	4.00	1.00	1.00
	Maximum	10.00	9.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 5.20: Average effectiveness: Aggregated purchasing and country

b) Estimated Values

For SMEs in India, at 95% MOE the estimated percentage of SMEs in the aggregated purchasing relationship will be from 63 to 80 percent while at 99% MOE, 61 to 83 percent of the SMEs will have aggregated purchasing with their supply chain partners. For the UK SMEs, at 95% MOE, the average effectiveness will range from 5.28 to 6.41 on a 10 point scale and at 99% MOE the estimated mean score will be 5.11 to 6.58. It can be expected that aggregated purchasing relationship will be popular up to 55 percent in the overall SME populations and the mean effectiveness will be high up to 6.62. Specific details related to the three countries are shown in the table 5.21.

		Class Interval for Average Effectiveness: Aggregated Purchasing			
		UK	India	China	Total
Estimated	@95% MOE	07 to 22	63 to 80	31 to 58	40 to 53
Percentage	@99% MOE	05 to 25	61 to 83	27 to 62	38 to 55
Estimated Mean Score	@95% MOE	5.28 to 6.41	5.95 to 6.44	6.61 to 7.64	6.14 to 6.55
	@99% MOE	5.11 to 6.58	5.88 to 6.52	6.45 to 7.80	6.08 to 6.62

Table 5.21: Class interval for aggregated purchasing and country

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of country on aggregated purchasing initiative. Responses were divided into three groups: UK, India and China. Eta squared values were also used to determine the effect size of the results. Statisticians classify 0.01 as a small effect, 0.06 as a medium effect and 0.14 as a large effect. The detailed results are tabulated in the table 5.22.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	1.58	0.208	-	-	-
	253				-	-
1B and 2	2	4.98	0.008	0.04	0.097* (1 & 2)	0.025
	253				0.112* (2 & 3)	0.026
1C and 2	2	23.12	0.000	0.16	0.326* (1 & 2)	0.000
	253				0.298* (2 & 3)	0.000
1D and 2	2	22.68	0.000	0.15	0.374* (1 & 2)	0.000
	253				0.276* (2 & 3)	0.000
1E and 2	2	5.33	0.005	0.05	0.189* (2 & 3)	0.006
	253				-	-
1F and 2	2	49.38	0.000	0.28	0.563* (1 & 2)	0.000
	253				0.414* (2 & 3)	0.000
1G and 2	2	28.19	0.000	0.18	0.484* (1 & 2)	0.000
	253				0.263* (2 & 3)	0.002
1H and 2	2	3.61	0.030	0.05	0.222* (1 & 3)	0.015
	253				0.927* (2 & 3)	0.044
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Country;** 1- UK, 2-India, 3-China.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between countries.

Table 5.22: Aggregated purchasing and country- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in aggregated purchasing initiative for the three respondent groups. The results are:

- Aggregated purchasing with customer: $F(2, 253) = 4.98$, $p = 0.008$ showed significant difference between aggregated purchasing with customers according to countries. However, the actual difference in mean scores between the groups was not quite high. The effect size, calculates was 0.04. Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.097, $p = 0.025$) and China (0.122, $p = 0.026$). However, UK and China did not significantly differ from each other.
- Aggregated purchasing with competitors: Although $F(2, 253) = 23.12$, $p = 0.000$ showed significant difference between aggregated purchasing with competitors according to countries. The actual difference in mean scores between the groups was quite high as indicated by the Eta squared value of 0.16. Post-hoc comparison using the Tukey HSD test also supported that the mean score for India was significantly different from UK (0.326, $p = 0.000$) and China (0.298, $p = 0.000$).

- iii. Aggregated purchasing with other organisation: $F(2, 253) = 22.68, p = 0.000$ showed significant difference between aggregated purchasing with other organisation according to countries. The actual difference in mean scores between the groups was very high (Eta squared value of 0.15). Tukey HSD test indicated that the mean score for India was significantly different from UK (0.374, $p = 0.000$) and from China (0.276, $p = 0.000$). However, UK and China did not significantly differ from each other.
- iv. Vertical Aggregated purchasing: $F(2, 253) = 5.33, p = 0.005$ showed significant difference between aggregated purchasing with suppliers and/or customers according to countries. In addition to this, the actual difference in mean scores between the groups was moderate. The effect size was 0.5. Post-hoc comparison indicated that the mean score for India was significantly different from China (0.189, $p = 0.006$) but not from the UK. Also UK and China did not significantly differ from each other.
- v. Horizontal Aggregated purchasing: $F(2, 253) = 49.38, p = 0.000$ showed significant difference between aggregated purchasing with competitors and/or other organisation according to countries. The actual difference in mean scores between the groups was very high (Eta squared was 0.28). Post-hoc comparison test indicated that the mean score for India was significantly different from UK (0.563, $p = 0.000$) and from China (0.414, $p = 0.000$). However, UK and China did not significantly differ from each other.
- vi. Overall Aggregated purchasing: $F(2, 253) = 28.19, p = 0.000$ showed significant difference between overall aggregated purchasing with according to countries. The actual difference in mean scores between the groups was quite high (Eta squared value of 0.18). Tukey HSD test indicated that the mean score for India was significantly different from UK (0.484, $p = 0.000$) and from China (0.263, $p = 0.002$). Moreover UK and China did significantly differ from each other (0.222, $p = 0.015$).
- vii. Average Effectiveness: $F(2, 106) = 3.61, p = 0.030$ showed significant difference between average effectiveness of aggregated purchasing according to countries. The actual difference in mean scores between the groups was not quite high (Eta squared value of 0.05). Tukey HSD test indicated that the mean score for India was significantly different from China (0.927, $p = 0.044$) and but not from China. Additionally UK and China did not significantly differ from each other.

5.4.6 Co-logistics

a) Descriptive Results-

In the UK, co-logistics with supplier is the popular collaborative initiative (23 percent) whereas 14.9 percent of SMEs had co-logistics with their customers. However co-logistics with competitors and other organisations were less popular initiatives. Vertical co-logistics were more as compared to horizontal co-logistics. The overall co-logistics initiative was nearly 30 percent.

In India, co-logistics with other organisations seemed to be a popular strategy with a percentage of 14.2 and co-logistics with customers is not at all a popular strategy. It seems Indian SMEs were more focussed on horizontal (23 percent) co-logistics as opposed to vertical (16.8 percent) co-logistics. However, on overall basis co-logistics was a very common initiative in India.

Chinese SMEs were more inclined in co-logistics with customers (33.3 percent) and suppliers (24.1 percent) than with competitors and other organisations. They were more involved in the vertical as compared to the horizontal co-logistics. The overall co-logistics initiative was very popular in China.

The overall data responses showed more inclination for co-logistics with suppliers (18.1 percent) and less with competitors (8.3 percent). The vertical co-logistics were nearly 10 percent more as compared to horizontal co-logistics. Table 5.23 provides more details about co-logistics with supply chain partners.

Co-logistics with:	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Supplier	20	23.0	13	11.5	13	24.1	46	18.1
Customer	13	14.9	10	8.8	18	33.3	41	16.1
Competitor	4	4.6	15	13.3	2	3.7	21	8.3
Other Organisation	5	5.7	16	14.2	8	14.8	29	11.4
Vertical	22	25.3	19	16.8	25	46.3	66	26.0
Horizontal	7	8.0	26	23.0	10	18.5	43	16.9
Overall	26	29.9	42	37.2	33	61.1	101	39.8
Number of companies in collaborative relationship	87	100.0	113	100.0	54	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 5.23: Co-logistics and country

In terms of average effectiveness of co-logistics initiatives with respect to country, the results showed dissimilar values for mean and median. Moreover the standard deviation and skewness values were also different for all the three countries. Table 5.24 provides more details:

		Average Effectiveness: Co-logistics			
		UK	India	China	Total
Frequency	Yes	16	41	32	89
	No	71	72	22	165
Central Tendency & Dispersion	Mean	6.72	5.79	7.13	6.44
	Median	7.00	6.00	7.00	6.00
	Standard Deviation	2.31	1.23	1.66	1.72
	Skewness	-0.85	0.68	-0.21	0.02
	Minimum	1.00	4.00	4.00	1.00
	Maximum	10.00	9.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 5.24: Average effectiveness: Co-logistics and country

b) Estimated Values

For Chinese SMEs, at 95% MOE the estimated percentage of SMEs in the co-logistics relationship will be from 46 to 72 percent while at 99% MOE, 42 to 77 percent of the SMEs will have co-logistics with their supply chain partners. At 95% MOE, the average effectiveness of SMEs in the UK will range from 6.23 to 7.20 on a 10 point scale and at 99% MOE the estimated mean score will be 6.08 to 7.36. It can be expected that co-logistics relationship will be popular up to 43 percent in the overall SME population and the mean effectiveness will be high up to 6.72. Specific details related to the three countries are shown in the table 5.25.

		Class Interval for Average Effectiveness: Co-logistics			
		UK	India	China	Total
Estimated	@95% MOE	10 to 27	27 to 45	46 to 72	29 to 41
Percentage	@99% MOE	08 to 29	25 to 48	42 to 77	27 to 43
Estimated Mean Score	@95% MOE	6.23 to 7.20	5.57 to 6.02	6.68 to 7.57	6.23 to 6.65
	@99% MOE	6.08 to 7.36	5.49 to 6.09	6.54 to 7.71	6.16 to 6.72

Table 5.25: Class interval for co-logistics and country

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of country on co-logistics initiative. Responses were divided into three groups: UK, India and China. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the table 5.26.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	3.04	0.059	-	-	-
	253				-	-
1B and 2	2	8.62	0.000	0.06	0.184* (1 & 3)	0.009
	253				0.245* (2 & 3)	0.000
1C and 2	2	3.43	0.054	-	-	-
	253				-	-
1D and 2	2	2.12	0.122	-	-	-
	253				-	-
1E and 2	2	8.74	0.000	0.06	0.21* (1 & 3)	0.013
	253				0.295* (2 & 3)	0.000
1F and 2	2	4.05	0.018	0.03	0.150* (1 & 2)	0.014
	253				-	-
1G and 2	2	7.39	0.001	0.06	0.312* (1 & 3)	0.001
	253				0.239* (2 & 3)	0.008
1H and 2	2	6.36	0.003	0.12	1.332* (2 & 3)	0.002
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Country;** 1- UK, 2-India, 3-China.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between countries.

Table 5.26: Co-logistics and country- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in co-logistics initiative for the three respondents groups. The results are:

- Co-logistics with customer: $F(2, 253) = 8.62$, $p = 0.000$ showed significant difference between co-logistics with customers according to countries. Moreover, the actual difference in mean scores between the groups was quite moderate as evident from the effect size value of 0.06. Post-hoc comparison indicated that the mean score for China was significantly different from UK (0.184, $p = 0.009$) and from India (0.245, $p = 0.000$). However, UK and India did not significantly differ from each other.
- Vertical Co-logistics: $F(2, 253) = 8.74$, $p = 0.000$ showed significant difference between co-logistics with suppliers and/or customers according to countries. The actual difference in mean scores between the groups was moderate (Eta squared value of 0.06). Post-hoc comparison indicated that the mean score for China was significantly different from UK (0.210, $p = 0.013$) and India (0.295, $p = 0.000$). However, UK and India did not significantly differ from each other.

- iii. Horizontal Co-logistics: $F(2, 253) = 4.05$, $p = 0.018$ showed significant difference between co-logistics with competitors and/or other organisation according to countries. The actual difference in mean scores between the groups was not moderate as evident from Eta squared value of 0.03. Post-hoc comparison using the Tukey HSD test indicated that the mean score for India was significantly different from UK (0.150, $p = 0.014$) and but not from China. Also UK and China did not significantly differ from each other.
- iv. Overall Co-logistics: $F(2, 253) = 7.39$, $p = 0.001$ showed significant difference between overall co-logistics according to countries. The actual difference in mean scores between the groups was moderate. The effect size was 0.06. Tukey HSD test indicated that the mean score for China was significantly different from UK (0.312, $p = 0.001$) and from India (0.239, $p = 0.008$). However, UK and India did not significantly differ from each other.
- v. Average Effectiveness: $F(2, 106) = 6.36$, $p = 0.003$ showed significant difference between average effectiveness of co-logistics according to countries. The actual difference in mean scores between the groups was very as evident from Eta squared value of 0.12. Post-hoc comparison using the Tukey HSD test indicated that the mean score for India was significantly different from China (1.332, $p = 0.002$) and but not from UK. Also UK and China did not significantly differ from each other.

5.4.7 Joint problem solving

a) Descriptive Results-

In the UK, joint problem solving with supplier was the most popular collaborative initiative (36.8 percent) whereas 29.9 percent of SMEs had joint problem solving relationship with their customers. However joint problem solving with competitors was very less popular with only 4.6 percent of SMEs were involved in such initiatives. Vertical joint problem solving was more common as compared to horizontal joint problem solving. The overall joint problem solving initiative was nearly 50 percent.

In India, joint problem solving with other organisations seemed to be a very popular strategy with a percentage of 54 and joint problem solving with the rest of the other partners was also a popular strategy. It seemed Indian SMEs paid nearly equal focus on horizontal (56.6 percent) joint problem solving and vertical (51.3 percent) joint problem solving. In summary, on an overall basis joint problem solving was a very popular initiative in India.

As far as Chinese SMEs were concerned, they were more inclined in joint problem solving with other customers (31.5 percent) and suppliers (22.2 percent) than with competitors and other organisations. They were more involved in the vertical as compared to the horizontal joint problem solving. The overall joint problem solving initiative was common in China.

The overall data responses showed more inclination for joint problem solving with suppliers, customers

and other organisations and less with competitors. The horizontal joint problem solving was nearly 20 percent less as compared to vertical joint problem solving. Table 5.27 provides more details about joint problem solving with supply chain partners.

Joint problem solving with:	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Supplier	32	36.8	55	48.7	12	22.2	99	39.0
Customer	26	29.9	37	32.7	17	31.5	80	31.5
Competitor	4	4.6	22	19.5	2	3.7	28	11.0
Other Organisation	6	6.9	61	54.0	5	9.3	72	28.3
Vertical	41	47.1	58	51.3	23	42.6	122	48.0
Horizontal	8	9.2	64	56.6	7	13.0	79	31.1
Overall	44	50.6	87	77.0	27	50.0	158	62.2
Number of companies in collaborative relationship	87	100.0	113	100.0	54	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 5.27: Joint problem solving and country

In terms of average effectiveness of joint problem solving initiatives with respect to countries, the results showed similar values of mean and median for India and China. However, the standard deviation and range values were different for all the three countries. Table 5.28 provides more details:

		Average Effectiveness: Joint Problem Solving			
		UK	India	China	Total
Frequency	Yes	34	86	26	146
	No	53	27	28	108
Central Tendency & Dispersion	Mean	6.63	5.97	5.85	6.11
	Median	7.00	6.00	6.00	6.00
	Standard Deviation	1.63	1.11	2.20	1.50
	Skewness	-0.47	1.14	-0.25	0.03
	Minimum	3.00	4.00	2.00	2.00
	Maximum	10.00	10.00	10.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 5.28: Average effectiveness: Joint problem solving and country

b) Estimated Values

On an overall basis, at 95% MOE the estimated percentage of SMEs in the joint problem solving relationship will be from 51 to 64 percentage while at 99% MOE, 49 to 65 percent of the SMEs will have joint problem solving with their supply chain partners. At 95% MOE, the average effectiveness will range from 5.92 to 6.29 on a 10 point scale and at 99% MOE the estimated mean score will be 5.86 to 6.35. It can be expected that joint problem solving relationship will be popular up to 53 percent in the UK SME populations and the mean effectiveness will be high up to 7.08. Specific details related to the three countries are shown in the table 5.29.

Class Interval for Average Effectiveness: Joint Problem Solving					
		UK	India	China	Total
Estimated	@95% MOE	29 to 49	68 to 84	35 to 61	51 to 64
Percentage	@99% MOE	26 to 53	66 to 86	31 to 66	49 to 65
Estimated Mean Score	@95% MOE	6.29 to 6.97	5.77 to 6.18	5.26 to 6.43	5.92 to 6.29
	@99% MOE	6.18 to 7.08	5.71 to 6.24	5.07 to 6.62	5.86 to 6.35

Table 5.29: Class interval for joint problem solving and country

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of country on joint problem solving initiative. Responses were divided into three groups: UK, India and China. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the table 5.30.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	5.69	0.004	0.04	0.265* (1 & 3)	0.003
	253				-	-
1B and 2	2	0.92	0.912	-	-	-
	253				-	-
1C and 2	2	7.78	0.001	0.06	0.149* (1 & 2)	0.002
	253				0.158* (2 & 3)	0.006
1D and 2	2	44.01	0.000	0.26	0.471* (1 & 2)	0.000
	253				0.447* (2 & 3)	0.000
1E and 2	2	0.57	0.536	-	-	-
	253				-	-
1F and 2	2	40.66	0.000	0.24	0.474* (1 & 2)	0.000
	253				0.437* (2 & 3)	0.000
1G and 2	2	10.10	0.000	0.07	0.264* (1 & 2)	0.000
	253				0.270* (2 & 3)	0.002
1H and 2	2	2.86	0.059	-	-	-
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and /or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Country;** 1- UK, 2-India, 3-China.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between countries.

Table 5.30: Joint problem solving and country- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in joint problem solving initiative for the three respondents groups. The results are:

- i. Joint problem solving with supplier: $F(2, 253) = 5.69$, $p = 0.004$ showed significant difference between joint problem solving with suppliers according to countries. The actual difference in mean scores between the groups was not moderate (Eta squared value of 0.04). Post-hoc comparison indicated that the mean score for UK was significantly different from China (0.265, $p = 0.003$) but not from India. India and China also did not significantly differ from each other.
- ii. Joint problem solving with competitors: Although $F(2, 253) = 7.78$, $p = 0.001$ showed significant difference between joint problem solving with competitors according to countries. However, the actual difference in mean scores between the groups was not moderate as evident from the effect size value of 0.06. Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.149, $p = 0.002$) and from China (0.158, $p = 0.006$). However, UK and China did not significantly differ from each other.
- iii. Joint problem solving with other organisation: $F(2, 253) = 44.01$, $p = 0.000$ showed significant difference between joint problem solving with other organisation according to countries. The actual difference in mean scores between the groups was very high (Eta squared value of 0.26). Tukey HSD test indicated that the mean score for India was significantly different from UK (0.471, $p = 0.000$) and from China (0.447, $p = 0.000$). However, UK and China did not significantly differ from each other.
- iv. Horizontal Joint problem solving: $F(2, 253) = 40.66$, $p = 0.000$ showed significant difference between horizontal joint problem solving with competitors and/or other organisation according to countries. The actual difference in mean scores between the groups was very high as evident from the effect size value of 0.24. Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.474, $p = 0.000$) and from China (0.437, $p = 0.000$). But UK and China did not significantly differ from each other.
- v. Overall Joint problem solving: $F(2, 253) = 10.10$, $p = 0.000$ showed significant difference between overall joint problem solving according to countries. The actual difference in mean scores between the groups was moderate (Eta squared value of 0.07). Post-hoc comparison using the Tukey HSD test indicated that the mean score for India was significantly different from China (0.270, $p = 0.002$) and from UK (0.264, $p = 0.000$). However, UK and China did not significantly differ from each other.

5.4.8 Shared resources and Country

a) Descriptive Results-

In the UK, shared resources with supplier were more in percentage as opposed to shared resources with the competitors. Vertical shared resources were more as compared to horizontal shared resources. The overall shared resources initiative is not a common collaborative strategy.

In India, shared resources with other organisations seemed to be a very popular strategy with a percentage of 35.4 and shared resources with rest of the other partners were not at all a popular strategy. It seems Indian SMEs paid more focus on horizontal (38.9 percent) shared resources as opposed to vertical (8.8 percent) shared resources. On an overall basis, 45.1 percent of Indian SMEs were involved in shared resources with the chain partners.

As far as Chinese SMEs were concerned, they were inclined in shared resources with suppliers (22.2 percent) and other organisations (18.5 percent). They were more involved in the vertical shared resources than the horizontal shared resources. The overall shared resources initiative was popular in China.

The overall data responses showed more inclination for shared resources with other organisations (23.6 percent) and less with competitors (4.7 percent). The horizontal shared resources were nearly 10 percent more as compared to vertical shared resources. Table 5.31 provides more details about shared resources with supply chain partners.

Shared resources with:	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Supplier	11	12.6	8	7.1	9	16.7	28	11.0
Customer	9	10.3	4	3.5	12	22.2	25	9.8
Competitor	3	3.4	7	6.2	2	3.7	12	4.7
Other Organisation	10	11.5	40	35.4	10	18.5	60	23.6
Vertical	15	17.2	10	8.8	18	33.3	43	16.9
Horizontal	11	12.6	44	38.9	12	22.2	67	26.4
Overall	22	25.3	51	45.1	28	51.9	101	39.8
Number of companies in collaborative relationship	87	100.0	113	100.0	54	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 5.31: Shared resources and country

In terms of average effectiveness of shared resources initiatives with respect to country, the results showed higher values for mean and median for UK as compared to India and China. The standard deviation and range values were different for all the three countries. Table 5.32 provides more details:

		Average Effectiveness: Shared Resources			
		UK	India	China	Total
Frequency	Yes	18	50	27	95
	No	69	63	27	159
Central Tendency & Dispersion	Mean	6.15	5.83	5.67	5.84
	Median	7.00	6.00	6.00	6.00
	Standard Deviation	2.28	1.59	1.73	1.77
	Skewness	-1.05	0.16	-0.16	-0.28
	Minimum	1.00	2.00	2.00	1.00
	Maximum	9.00	9.00	9.00	9.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 5.32: Average effectiveness: Shared resources and country

b) Estimated Values

For Indian SMEs, at 95% MOE the estimated percentage of SMEs in the shared resources relationship will be from 35 to 53 percent while at 99% MOE, 32 to 56 percent of the SMEs will have shared resources with their supply chain partners. At 95% MOE, the average effectiveness of UK SMEs will vary from 5.67 to 6.63 on a 10 point scale and at 99% MOE the estimated mean score will be 5.52 to 6.78. It can be expected that shared resources relationship will be popular up to 68 percent in the Chinese SME populations and the mean effectiveness will be high up to 6.27. Specific details related to the three countries are shown in the table 5.33.

		Class Interval for Average Effectiveness: Shared Resources			
		UK	India	China	Total
Estimated	@95% MOE	12 to 29	35 to 53	37 to 63	31 to 43
Percentage	@99% MOE	09 to 32	32 to 56	32 to 68	30 to 45
Estimated Mean Score	@95% MOE	5.67 to 6.63	5.54 to 6.12	5.20 to 6.13	5.63 to 6.06
	@99% MOE	5.52 to 6.78	5.44 to 6.22	5.06 to 6.27	5.56 to 6.13

Table 5.33: Class interval for shared resources and country

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of country on shared resources initiative. Responses were divided into three groups: UK, India and China. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the table 5.34.

Variables	ANOVA			Post Hoc Test (Tukey HSD)		
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	1.89	0.152	-	-	-
	253				-	-
1B and 2	2	7.54	0.001	0.05	0.187* (2 & 3)	0.000
	253				-	-
1C and 2	2	0.48	0.615	-	-	-
	253				-	-
1D and 2	2	8.72	0.000	0.06	0.293* (1 & 2)	0.000
	253				0.169* (2 & 3)	0.038
1E and 2	2	8.20	0.000	0.03	0.161* (1 & 3)	0.031
	253				0.245* (2 & 3)	0.000
1F and 2	2	9.63	0.000	0.06	0.263* (1 & 2)	0.000
	253				0.167* (2 & 3)	0.049
1G and 2	2	6.36	0.002	0.05	0.198* (1 & 2)	0.011
	253				0.266* (1 & 3)	0.005
1H and 2	2	0.47	0.667	-	-	-
	106				-	-

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Country;** 1- UK, 2-India, 3-China.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between countries.

Table 5.34: Shared resources and country- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in shared resources initiative for the three respondents groups. The results are:

- Shared resources with customer: $F(2, 253) = 7.54$, $p = 0.001$ showed significant difference between shared resources with customers according to countries. However, the actual difference in mean scores between the groups was not moderate as evident from the Eta squared value of 0.5. Post-hoc comparison indicated that the mean score for India was significantly different from China (0.187, $p = 0.000$) but not from UK. Also UK and China did not significantly differ from each other.
- Shared resources with other organisation: $F(2, 253) = 8.72$, $p = 0.000$ showed significant difference between shared resources with other organisation according to countries. The actual difference in mean scores between the groups was moderate (Eta squared value of 0.06). Tukey HSD test indicated that the mean score for India was significantly different from both UK (0.293, $p = 0.000$) and China (0.169, $p = 0.038$). However, UK and China did not significantly differ from each other.

- iii. Vertical Shared resources: $F(2, 253) = 8.20, p = 0.000$ showed significant difference between shared resources with suppliers and/or customers according to countries. However, the actual difference in mean scores between the groups was low (the effect size value of 0.03). Post-hoc comparison indicated that the mean score for China was significantly different from UK (0.161, $p = 0.031$) and India (0.245, $p = 0.000$). However, UK and India did not significantly differ from each other.
- iv. Horizontal Shared resources: $F(2, 253) = 9.63, p = 0.000$ showed significant difference between shared resources with competitors and/or other organisation according to countries. The actual difference in mean scores between the groups was moderate. The effect size, calculates using Eta squared, was 0.06. Tukey HSD test indicated that the mean score for India was significantly different from UK (0.263, $p = 0.000$) and from China (0.167, $p = 0.049$). However UK and China did not significantly differ from each other.
- v. Overall Shared resources: $F(2, 253) = 6.36, p = 0.002$ showed significant difference between overall shared resources according to countries. The actual difference in mean scores between the groups was not moderate (Eta squared value of 0.05). Post-hoc comparison indicated that the mean score for UK was significantly different from both India (0.198, $p = 0.011$) and China (0.266, $p = 0.005$). However, India and China did not significantly differ from each other.

5.4.9. CPFR

a) Descriptive Results-

In the UK, CPFR with supplier was the most popular collaborative initiative (34.5 percent) whereas 32.2 percent of SMEs had CPFRs with their customers. However, CPFR with competitors and other organisations were less popular initiatives. Involvement towards vertical CPFRs was more common as compared to horizontal CPFR. The overall inclination for CPFR initiative was nearly 50 percent in the UK SMEs.

Similarly in India, CPFR with suppliers and customers were very popular strategy with a percentage of 73.5 and 67.3 respectively, whereas none of the Indian SMEs was involved with competitors for the CPFR initiative. As a result of this, Indian SMEs put more emphasis on vertical relations than horizontal CPFRs. On an overall basis CPFR was a very popular initiative in India.

As far as Chinese SMEs were concerned, the emphasis was more in CPFRs with customers (20.4 percent) and suppliers (11.1 percent) than with competitors and other organisations. They were only involved in the vertical CPFRs with no involvement in the horizontal CPFRs. The overall CPFR initiative was not very popular in China.

The overall data responses showed more inclinations for CPFRs with suppliers and customers and less towards competitors and other organisations. On an overall basis CPFR seemed to be a very common collaborative strategy in the SMEs. Table 5.35 provides more details about CPFR with supply chain

partners.

CPFR with:	UK		India		China		Total	
	F	%	F	%	F	%	F	%
Supplier	30	34.5	83	73.5	6	11.1	119	46.9
Customer	28	32.2	76	67.3	11	20.4	115	45.3
Competitor	3	3.4	0	0.0	0	0.0	3	1.2
Other Organisation	5	5.7	1	0.9	0	0.0	6	2.4
Vertical	43	49.4	87	77.0	15	27.8	145	57.1
Horizontal	6	6.9	1	0.9	0	0.0	7	2.8
Overall	44	50.6	87	77.0	15	27.8	146	57.5
Number of companies in collaborative relationship	87	100.0	113	100.0	54	100.0	254	100.0

(F: Frequency, %: Valid percentage)

Table 5.35: CPFR and country

In terms of average effectiveness of CPFR initiatives with respect to country, the SMEs in UK and China had higher values for mean, median and standard deviation. On an overall basis CPFR does have an average effectiveness of 5.60. Table 5.36 provides more details:

		Average Effectiveness: CPFR			
		UK	India	China	Total
Frequency	Yes	32	87	15	134
	No	55	26	39	120
Central Tendency & Dispersion	Mean	6.03	5.36	6.07	5.60
	Median	6.00	5.00	6.00	5.50
	Standard Deviation	2.04	0.95	1.79	1.41
	Skewness	-0.68	0.47	0.06	0.13
	Minimum	1.00	3.00	3.00	1.00
	Maximum	10.00	8.00	9.00	10.00

(Effectiveness on a scale 1-10, 1 for low and 10 for high)

Table 5.36: Average effectiveness: CPFR and country

b) Estimated Values

For the UK SMEs, at 95% MOE the estimated percentage of SMEs in the CPFR relationship will be from 27 to 47 percent while at 99% MOE, 23 to 50 percent of the UK SMEs will have CPFR with their supply chain partners. At 95% MOE, the average effectiveness of Indian SMEs will range from 5.18 to 5.53 on a 10 point scale and at 99% MOE the estimated mean score will be 5.13 to 5.59. It can be expected that CPFR relationship will be popular up to 61 percent in the overall SME population and the mean effectiveness will be high up to 5.83. Specific details related to the three countries are shown in the table 5.37.

Class Interval for Average Effectiveness: CPFR					
		UK	India	China	Total
Estimated	@95% MOE	27 to 47	69 to 85	16 to 40	47 to 59
Percentage	@99% MOE	23 to 50	67 to 87	12 to 43	45 to 61
Estimated Mean Score	@95% MOE	5.60 to 6.46	5.18 to 5.53	5.59 to 5.64	5.42 to 5.77
	@99% MOE	5.47 to 6.57	5.13 to 5.59	5.44 to 6.69	5.37 to 5.83

Table 5.37: Class interval for CPFR and country

c) Statistical Results-

A one -way between -groups analysis of variance (ANOVA) and post-hoc test were conducted to explore the impact of country on CPFR initiative. Responses were divided into three groups: UK, India and China. Eta squared values were also used to determine the effect size of the results. The detailed results are tabulated in the table 5.38.

Variables	ANOVA				Post Hoc Test (Tukey HSD)	
	d.f.	F	Sig.	Eta squared	Mean Difference	Sig.
1A and 2	2	43.30	0.000	0.25	0.390* (1 & 2)	0.000
	253				0.623* (2 & 3)	0.000
					0.234* (1 & 3)	0.006
1B and 2	2	24.56	0.000	0.16	0.351* (1 & 2)	0.000
	253				0.469* (2 & 3)	0.000
1C and 2	2	2.94	0.054	-	-	-
	253				-	-
1D and 2	2	3.39	0.065	-	-	-
	253				-	-
1E and 2	2	22.96	0.000	0.15	0.276* (1 & 2)	0.000
	253				0.492* (2 & 3)	0.000
					0.216* (1 & 3)	0.019
1F and 2	2	4.38	0.063	-	-	-
	253				-	-
1G and 2	2	22.67	0.000	0.15	0.264* (1 & 2)	0.000
	253				0.492* (2 & 3)	0.000
					0.228* (1 & 3)	0.012
1H and 2	2	3.75	0.026	0.05	-	-
	106					

- **Variables: 1 Collaboration:** A-with supplier, B-with customer, C-with competitor, D-with other organisation, E- vertical (with supplier and/or customer, F-horizontal (with competitor and/or other organisation), G- combined (with any supply chain partner), H- average effectiveness , **Variable 2: Country;** 1- UK, 2-India, 3-China.
- **Mean Difference*-** The mean difference is significant at the 0.05 level. Numbers in bracket showed mean difference between countries.

Table 5.38: CPFR and country- ANOVA and Post Hoc Test

The results showed that there were statistical differences at the $p < 0.05$ level in CPFR initiative for the three respondents groups. The results are:

- i. CPFR with supplier: $F(2, 253) = 43.30, p = 0.000$ showed significant difference between CPFR with suppliers according to countries. In addition to this, the actual difference in mean scores between the groups was very high (Eta squared value of 0.25). Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.390, $p = 0.000$) and China (0.623, $p = 0.000$). Moreover UK and China did significantly differ from each other (0.234, $p = 0.006$).
- ii. CPFR with customer: $F(2, 253) = 24.56, p = 0.000$ showed significant difference between CPFR with customers according to countries. Moreover, the actual difference in mean scores between the groups was high as evident from the effect size value of 0.16. Tukey HSD test indicated that the mean score for India was significantly different from UK (0.351, $p = 0.000$) and China (0.469, $p = 0.000$). However, UK and China were not significantly different from each other.
- iii. Vertical CPFR: $F(2, 253) = 22.96, p = 0.000$ showed significant difference between CPFR with suppliers and/or customers according to countries. In addition to this, the actual difference in mean scores between the groups was very high (Eta squared value of 0.15). Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.276, $p = 0.000$) and China (0.492, $p = 0.000$). Also UK and China did significantly differ from each other (0.216, $p = 0.019$).
- iv. Overall CPFR: $F(2, 253) = 22.67, p = 0.000$ showed significant difference between overall CPFR with according to countries. The actual difference in mean scores between the groups was not moderate. In addition to this, the actual difference in mean scores between the groups was high (Eta squared value of 0.15). Post-hoc comparison indicated that the mean score for India was significantly different from UK (0.264, $p = 0.000$) and China (0.492, $p = 0.000$). Moreover UK and China did significantly differ from each other (0.228, $p = 0.012$).
- v. Average Effectiveness: Although $F(2, 253) = 3.75, p = 0.026$ showed significant difference between average effectiveness of CPFR according to countries but the actual difference between the groups was not moderate.

5.5 Essential Requirements for Collaboration:

The questionnaire included section on 'Essential Requirements for Collaboration' and the respondents were asked to tick the requirements for effective collaboration with the supply chain partners. Chi-square test was conducted to establish that statistically significant association between the requirements for collaboration and country. Additionally, Cramer's v value was used to find out the strength of the association between these variables.

5.5.1 Mutual trust:

There was a significant association between 'mutual trust' and 'country', $\chi^2(2, N = 260) = 23.96, p < .05$. The strength of the relationship was found to be .341 at $p = .000$.

85.8 percent SMEs mentioned mutual trust to be the most essential requirement for effective collaboration. Mutual trust was found to be the most essential requirement by 97.3 percent of Indian, 85.1 percent of UK and 63 percent of Chinese SMEs.

5.5.2 Mutual financial benefits and risk sharing:

An association was found between 'mutual financial benefits and risk sharing' and 'country', $\chi^2(2, N = 260) = 41.37, p < .05$. The relationship was moderate with Cramer's V value of .404 at $p = .000$.

Mutual financial benefits and risk sharing was considered as the second most essential requirement (ranked number two) for by the Indian (96.5 percent) and UK (81.6 percent) SMEs. Chinese SMEs rated it as number 4 with 51.9 percent of companies mentioned it to be an essential requirement for collaboration. On an overall basis mutual financial benefits and risk sharing was found to be the second most essential requirements for collaboration.

5.5.3 Common goals and motivation

The chi-square value (2, N = 260) of 10.48 at $p = .000$, indicated a relationship between 'common goals and motivation' and 'country', however the relationship was not found to be strong ($V = .201, p = .000$).

Common goals and motivation was mentioned by 61.8 percent of the total SMEs as an essential requirement and it emerged as sixth most popular requirement for effective collaboration on an overall basis. On country basis, Chinese SMEs considered it as the second most requirement, 5th most essential requirement by the UK SMEs and 8th most essential requirement by Indian SMEs.

5.5.4 Common performance measurement system:

An association was found between 'common performance measurement system' and 'country', $\chi^2(2,$

$N = 260$) = 5.96, $p = .05$. The relationship was found to be weak in strength with Cramer's V value of .151 at $p = .050$.

On an overall basis, common performance measurement system was considered as the 9th most essential requirement for effective collaboration. In terms of country, this was considered as one of the least important requirements by the UK, Indian and Chinese SMEs.

5.5.5 Willingness to be involved in collaboration:

Although for the Chinese SMEs, 'Willingness to be involved in collaboration' was found to be the 3rd most essential requirement for collaboration, this factor did not differ by 'country', $\chi^2(2, N = 260) = 3.33, p > .05$.

5.5.6 Willingness and openness to share information and technical expertise:

There was a significant association between 'willingness and openness to share information and technical expertise' and 'country', $\chi^2(2, N = 260) = 31.62, p = .000$. The strength of the relationship was found to be .359 at $p = .000$.

Willingness and openness to share information and technical expertise was considered as the 3rd most essential requirement by the Indian SMEs, 4th by the UK SMEs and 6th by the SMEs in China. On an overall basis, willingness and openness to share information and technical expertise was treated as the 3rd most essential requirement for effective collaboration.

5.5.7 Knowledge of benefits associated with collaboration:

The chi-square value (2, $N = 260$) of 41.47 at $p = .000$, indicated a relationship between 'knowledge of benefits associated with collaboration' and 'country', the relationship was found to be moderate ($V = .404, p = .000$).

Knowledge of benefits associated with collaboration was considered as one of the least essential requirement for collaboration by both the UK and Chinese SMEs, however, Indian SMEs considered it to be 4th most essential requirement for collaboration.

5.5.8 Common processes structures and culture among partners:

The chi-square value (2, $N = 260$) of 10.61 at $p = .005$, indicated an association between 'common processes, structures and culture among partners' and 'country', the relationship was not found to be strong ($V = .204, p = .005$). Moreover, 'common processes, structures and culture among partners' were not considered to be an essential requirement by the SMEs in the UK, India and China.

5.5.9 Mutual commitment of the partners:

There was a significant association between ‘mutual commitment of the partners’ and ‘country’, $\chi^2(2, N = 260) = 26.58, p < .05$. The strength of the relationship was found to be .324 at $p = .000$.

Mutual commitment of the partners was considered as the 3rd most essential requirement for collaboration by the UK companies, 5th by the Indian (68.8 percent) SMEs whereas it is ranked 7th by the Chinese SMEs. On an overall basis, mutual commitment of the partners’ was treated as the 4th most essential requirement for successful supply chain collaboration.

5.5.10 Mutual adjustment to the need of other partners:

An association was found between ‘mutual adjustment to the need of other partners’ and ‘country’, $\chi^2(2, N = 260) = 11.61, p < .05$. The relationship was found to be weak in strength with Cramer’s V value of .214 at $p = .003$.

Mutual adjustment to the need of other partners was considered the 5th most essential requirement by the Chinese SMEs whereas it is equally ranked the 7th essential requirement by both the UK and Indian SMEs. On an overall basis, mutual adjustment to the need of other partners was ranked the 7th most essential requirement for effective collaboration.

In conclusion, it was found that **Mutuality** (mutual trust, mutual sharing of risk and benefits, mutual commitment) was considered as one of the key requirements for successful collaboration by the SMEs, whereas **Commonality** (common goals/motivation, common performance measurement system and common process, structure & culture) was not considered a very important requirement. **Willingness** factor (willingness to involve, willingness to share information/expertise) was also an important requirement for a successful collaboration. Table 5.39 showed more details of the requirements for collaboration.

Essential Requirement:	UK		India		China		Total		Chi-square	Cramer's v	Sig.
	F	%	F	%	F	%	F	%			
Mutual Trust	74	85.1	110	97.3	34	63.0	218	85.8	23.96	.341	.000
Mutual Financial Benefits & Risk Sharing	71	81.6	109	96.5	28	51.9	208	81.9	41.37	.404	.000
Common Goals & Motivation	64	73.6	61	54.0	32	59.3	157	61.8	10.48	.201	.005
Common Performance Measurement System	37	42.5	50	44.2	13	24.1	100	39.4	5.96	.151	.050
Willingness to be involved in collaboration	56	64.4	81	71.7	29	53.7	166	65.4	3.33	.113	.189
Willingness & Openness to share information & technical expertise	67	77.0	100	88.5	24	44.4	191	75.2	31.62	.359	.000
Knowledge of benefits associated with collaboration	32	36.8	86	76.1	15	27.8	133	52.4	41.47	.404	.000
Common Processes, structures & culture among partners	24	27.6	46	40.7	9	16.7	79	31.1	10.61	.204	.005
Mutual commitment of the partners	68	78.2	81	71.7	20	37.0	169	66.5	26.58	.324	.000
Mutual adjustment to the needs of other partners	41	47.1	78	69.0	25	46.3	144	56.7	11.61	.214	.003
Number of companies in collaborative relationship	87	100.0	119	100	54	100	260	100			

(F:Frequency, %: Valid percentage)

Table 5.39: Essential requirements for collaboration

5.6 Prime Reasons for Collaboration:

The questionnaire included a section on the prime reasons for effective collaboration in their supply chains and the respondents were asked to mention the prime reasons for entering in the collaborative relationship. Statistical significant difference was established by using Chi-square test to conclude that differences exist between respondent countries not simply because of chance error but due to other reasons. Strength of the association was found using Cramer's V value.

5.6.1 Increase sales and market share:

There was a significant association between 'increase sales and market share' and 'country', $\chi^2(2, N = 260) = 23.83, p < .05$. The strength of the relationship was found to be .306 at $p = .000$.

'Increase sales and market share' emerged as the first most prime reason for collaboration in all the

three countries. 93.7 percent of Indian SMEs, 72.4 percent of UK SMEs and 68.5 percent of Chinese companies mentioned 'increase sales and market share' to be the most important reason for effective collaboration with supply chain partners.

5.6.2 Reduce costs:

The chi-square value (2, N = 260) of 34.77 at $p < .05$, indicated a relationship between 'reduce costs' and 'country'. The strength of relationship was found to be .370 at $p = .000$.

On an overall basis, 74.8 percent of the respondent SMEs considered 'reduced costs' as the second most prime reason for collaboration. On a country basis, 86.6 percent of Indian SMEs and 72.4 percent of the UK SMEs rated reduced costs as 2nd most prime reason for entering into collaboration, whereas in China it was rated number 6 with 44.4 percent of SMEs identifying it as a prime reason for collaboration.

5.6.3 Increase utilisation of resources:

A significant association was found between 'increase utilisation of resources' and 'country', χ^2 (2, N = 260) = 24.14, $p < .05$. The relationship was not strong with Cramer's V value of .308 at $p = .000$.

On an overall basis, increase utilisation of resources (68.9 percent) emerged as the third most popular prime reason for effective collaboration. Chinese SMEs (59.3 percent) considered it to be the 2nd most popular, Indian SMEs (82.4 percent) it as 3rd most reason and the UK SMEs (51.7 percent) ranked it as the 5th most prime reason for entering in the collaborative relationship.

5.6.4 Improve customer satisfaction:

There was a significant association between 'improve customer satisfaction' and 'country', χ^2 (2, N = 260) = 14.91, $p = .001$. The strength of the association was found to be weak ($V = .240$ at $p = .001$).

Improve customer satisfaction was considered as the 4th most prime reason by the respondent SMEs on an overall basis. SMEs in the UK (67.8 percent) considered it to be 2nd most important reason for collaboration. However, SMEs in India (41.2 percent) and China (46.3 percent) mentioned it to be a less important reason for supply chain collaboration.

5.6.5 Improve forecasts:

The chi-square value (2, N = 260) of 47.13 at $p < .05$, indicated a relationship between 'improve forecasts' and 'country'. The strength of relationship was found to be .437 at $p = .000$.

Improve forecast emerged as the 5th most important reason for collaboration in all the SMEs. Indian SMEs considered it to be the 4th most important reason for effective collaborations while SMEs from

UK and China considered it to be a less important reason for entering in the collaboration.

5.6.6 Increase technical know-how or expertise:

Although increase technical know-how was considered as one of the most important reasons for supply chain collaboration by the SMEs in the UK (55.2 percent), India (42.9 percent) and China (51.9 percent), there were no associations between the ‘increase technical know-how’ and ‘country’, $\chi^2(2, N = 260) = 3.29, p > .05$.

5.6.7 Introduce new products:

No association was established between ‘introduce new products’ and ‘country’ as the chi-square value was found to be, $\chi^2(2, N = 260) = 4.93, p = .080$.

5.6.8 Improve response (lead) time:

The chi-square value, $\chi^2(2, N = 260) = 4.92, p > .05$, did not show any association between ‘improve response time’ and ‘country’.

5.6.9 Increase trust and confidence within partners:

No association was established between ‘increase trust and confidence within partners’ and ‘country’ as the chi-square value was found to be, $\chi^2(2, N = 260) = 0.14, p = .729$.

5.6.10 Reduce carbon footprint:

The chi-square value, $\chi^2(2, N = 260) = 3.13, p > .05$, showed no association between ‘reduce carbon footprint’ and ‘country’.

It is found that SMEs consider **financial factor** (increase sales, reduce costs, increase utilisation) as a very important reason for successful collaboration within supply chain partners. Whereas supply chain **performance factor** (improve customer satisfaction, improve forecasts, increase know-how) was considered as moderately important reasons for collaboration. However an **intangible** factor (increase trust and confidence, reduce carbon footprint) was not considered as important reasons for successful collaboration. Table 5.40 shows more details of the reasons for collaboration.

Prime Reason:	UK		India		China		Total		Chi-square	Cramer's v	Sig.
	F	%	F	%	F	%	F	%			
Increase sales and market share	63	72.4	111	98.2	37	68.5	211	83.1	23.83	.306	.000
Introduce new products	47	54.0	46	40.7	26	48.1	119	46.9	4.93	.137	.081
Increase technical know-how or expertise	48	55.2	51	45.1	28	51.9	127	50.0	3.29	.113	.099
Increase utilisation of resources	45	51.7	98	86.7	32	59.3	175	68.9	24.14	.308	.000
Improve response (lead) time	40	46.0	37	32.7	22	40.7	99	39.0	4.92	.138	.080
Reduce costs	63	72.4	103	91.2	24	44.4	190	74.8	34.77	.370	.000
Improve customer satisfaction	59	67.8	49	43.4	25	46.3	133	52.4	14.91	.240	.001
Increase trust and confidence within partners	29	33.3	37	32.7	18	33.3	84	33.1	0.14	.004	.729
Improve forecasts	28	32.2	87	77.0	15	27.8	130	51.2	47.13	.437	.000
Reduce carbon footprint	17	19.5	14	12.4	11	20.4	42	16.5	3.13	.114	.130
Number of companies in collaborative relationship	87	100.0	119	100	54	100	260	100			

(F:Frequency, %: Valid percentage)

Table 5.40: Prime reasons for collaboration

5.7 Major Problems of Collaboration:

The questionnaire included a section on the major problems/hurdles of collaboration and the respondents were asked to identify the hurdles of collaboration with their supply chain partners. Chi-square and Cramer's V values were used to establish statistical significance between variables.

5.7.1 Misalignment of partners' business processes, structures and culture:

The chi-square value (2, N = 260) of 23.22 at $p < .05$, indicated a relationship between 'misalignment of partners' business processes, structures and culture' and 'country'. The strength of relationship was found to be .370 at $p = .000$.

On an overall basis, 'misalignment of partners' business processes, structures and culture' (51.9 percent) was found to be the most important problem of collaboration for all the respondent SMEs. On basis of country, 69.9 percent of Indian, 41.4 percent of UK and 37 percent of Chinese SMEs mentioned it to be most significant hurdle of effective collaboration.

5.7.2 Lack of appropriate communication system:

There was a significant association between ‘lack of appropriate communication system’ and ‘country’, $\chi^2(2, N = 260) = 29.23, p = .000$. The strength of the relationship was found to be .341 at $p = .000$.

Lack of an appropriate communication system was considered to be the 1st and 2nd most significant problem associated with collaboration by the Chinese (70.4 percent) and Indian (62.2 percent) SMEs respectively, whereas, SMEs in the UK (29.9 percent) considered it to be 6th most significant hurdle of collaboration. On an overall basis, the ‘lack of appropriate communication system’ was considered the 2nd most major problem of collaboration.

5.7.3 Unwillingness to share information and technical expertise:

A significant association was found between ‘unwillingness to share information and technical expertise’ and ‘country’, $\chi^2(2, N = 260) = 11.93, p = .003$. A weak relationship was found ($V = .208$ at $p = .003$) between these two variables.

Unwillingness to share information and technical expertise was found to be the 3rd major hurdle of effective collaboration on an overall basis. SMEs in the UK (40.2 percent) rated it as the second major problem and both Indian (63.7 percent) and Chinese (38.9 percent) considered it as the third most significant problem associated with collaboration.

5.7.4 Unwillingness to share financial risks and benefits:

There was a significant association between ‘unwillingness to share financial risks and benefits’ and ‘country’, $\chi^2(2, N = 260) = 11.93, p = .003$. The strength of the association was found to be weak ($V = .214$ at $p = .003$).

Unwillingness to share financial risks and benefits was considered as the 3rd most significant problem associated with collaboration by the respondents in the three countries. Overall, this factor was considered the 4th most significant problem associated with collaborative relationships.

5.7.5 Lack of common performance measurement system:

The chi-square value (2, N = 260) of 24.28 at $p < .05$, indicated a significant relationship between ‘lack of common performance measurement system’ and ‘country’. The strength of relationship between the variables was found to be .309 at $p = .000$.

Lack of a common performance measurement system emerged as one of the least most significant problems associated with effective collaborations overall. Interestingly, both Indian (38.7 percent) and Chinese (35.2 percent) SMEs considered it the 5th most significant hurdle whereas SMEs in the UK (9.2 percent) considered it to be the least significant problem of collaborations.

5.7.6 Lack of collaborative vision:

No association was found between ‘lack of collaborative vision’ and ‘country’ as the chi-square value was found to be, $\chi^2(2, N = 260) = 2.41, p = .296$.

5.7.6 Lack of motivation and commitment towards the collaboration:

No association was found between ‘lack of motivation and commitment towards the collaboration’ and ‘country’ as the chi-square value was found to be, $\chi^2(2, N = 260) = 2.65, p > .05$.

5.7.7. Lack of trust and confidence with the partners:

Although lack of trust and confidence with the partners emerged as the 5th major problem related to collaboration on an overall basis, but no association was established between the ‘lack of trust and confidence with the partners’ and ‘country’ as the chi-square value was found to be, $\chi^2(2, N = 260) = 0.87, p = .645$.

It found that lack of **Commonality** (common process, structure & culture, communication system) has emerged as the most significant problem associated in effective collaboration. Interestingly this commonality was not perceived to be the key requirement for successful collaboration by the SMEs. It was found that commonality is the major gap between expectations and reality. SMEs need to understand that commonality play an important role in effective collaboration, otherwise the absence of commonality would lead to major hurdles or impediments which would ultimately affect the success of this relationship. Table 5.41 showed more details of the problems of collaboration.

Major Problem/Hurdle:	UK		India		China		Total		Chi-square	Cramer's v	Sig.
	F	%	F	%	F	%	F	%			
Lack of collaborative vision	22	25.3	42	37.2	18	33.3	82	32.3	2.41	.097	.296
Misalignment of partners' business processes, structures and culture	36	41.4	79	69.9	20	37.0	135	53.1	23.22	.302	.000
Lack of trust and confidence with the partners	30	34.5	48	42.5	22	40.7	100	39.4	0.87	.058	.645
Unwillingness to share information and technical expertise	35	40.2	72	63.7	21	38.9	128	50.4	11.18	.208	.004
Unwillingness to share financial risks and benefits	34	39.1	72	63.7	21	38.9	127	50.0	11.93	.214	.003
Lack or appropriate communication systems	26	29.9	74	65.5	38	70.4	138	54.3	29.23	.341	.000
Lack of motivation and commitment towards the collaboration	28	32.2	41	36.3	12	22.2	81	31.9	2.65	.101	.265
Lack of common performance measurement systems	8	9.2	46	40.7	19	35.2	73	28.7	24.28	.309	.000
Number of companies in collaborative relationship	87	100.0	119	100	54	100	260	100			

(F:Frequency, %: Valid percentage)

Table 5.41: Major problems/hurdles of collaboration

5.8 Major Benefits of Collaboration:

The questionnaire included a section on the major benefits of collaboration and the respondents were asked to identify the major benefits of effective collaboration in their supply chains. Statistical significant association was found using Chi-square and Cramer's V values.

5.8.1 Reduce costs across the supply chain:

A significant association was found between 'reduce costs across the supply chain' and 'country', $\chi^2(2, N = 260) = 20.56, p < .05$. However, the association was not strong with Cramer's V value of .294 at $p = .000$.

Reduced costs across the supply chain was found to be the most significant benefit resulting from collaboration overall. On the basis of country, 92.0 percent of Indian SMEs, 65.5 percent of UK SMEs and 59.3 percent of Chinese SMEs considered it to be the most important benefit from effective

collaboration.

5.8.2 Increased utilisation of resources:

The chi-square value (2, N = 260) of 56.76 at $p < .05$, indicated a significant relationship between ‘increased utilisation of resources’ and ‘country’. The strength of relationship was found to be .473 at $p = .000$.

Increased utilisation of resources was considered the 2nd most significant benefit (ranked number two) by the respondents overall. Both Indian SMEs (87.4 percent) and UK SMEs (47.1 percent) considered it one of the most significant benefits, whereas Chinese (37.0 percent) SMEs rated it as the 5th major benefit from collaboration.

5.8.3 Increase market share and revenue:

There was a significant relationship between ‘increase market share and revenue’ and ‘country’, χ^2 (2, N = 260) = 23.64, $p = .000$. The strength of the relationship was found to be .303 at $p = .000$.

On an overall basis, increase market share and revenue (62.3 percent) emerged as the 3rd significant benefit from effective collaboration. Indian SMEs (77.3 percent) had considered it to be the 2nd most important, UK SMEs (47.1 percent) viewed it as the 3rd most important while the Chinese SMEs (53.7 percent) considered it as the 4th most significant benefit from effective collaboration with partners.

5.8.4 Improved forecasts:

A significant association was found between ‘improved forecasts’ and ‘country’, χ^2 (2, N = 260) = 55.23, $p < .05$. The strength of association was found to be moderate (Cramer’s V value of .466 at $p = .000$) between these two variables.

On an overall basis, ‘improved forecasts’ was considered the 4th most significant benefit from effective collaboration by the respondents. Interestingly Indian (76.5 percent) SMEs considered it to be the 4th major benefit whereas UK SMEs (32.2) and Chinese SMEs (31.5 percent) considered it to be one of the less important benefits from collaboration.

5.8.5 Reduced product development costs and time:

Although ‘reduced product development costs and time’ emerged as the 5th most important benefit from collaboration, there was no association found from the chi-square value of χ^2 (2, N = 260) = 2.09, $p = .350$.

5.8.6 Increased customer satisfaction:

There was a significant relationship between ‘increase customer satisfaction’ and ‘country’, $\chi^2(2, N = 260) = 13.58, p < .05$. The strength of the relationship was found to be weak ($V = .303$ at $p = .000$) between the variables.

‘Increase customer satisfaction’ is considered to be the 2nd major benefit from supply chain collaboration by the UK (57.2 percent) SMEs. Similarly Chinese (63.0 percent) SMEs considered it the most significant (ranked first) benefit from collaboration. Indian SMEs (37.0 percent) considered it to be 6th most important benefit from successful collaboration. On an overall basis ‘increase customer satisfaction’ was mentioned as the 6th most important benefit from collaboration with supply chain partners.

5.8.7 Increased inventory turnover:

A significant association was found between ‘increased inventory turnover’ and ‘country’, $\chi^2(2, N = 260) = 47.35, p < .05$. The strength of association was found to be moderate (Cramer’s V value of .439 at $p = .000$) between these two variables.

‘Increased inventory turnover’ emerged as the 7th most important benefit from collaboration on an overall basis. On the basis of country, it is considered as the 2nd most important benefit by India SMEs, 9th by Chinese SMEs and 11th by the UK SMEs.

5.8.8 Decreased customer delivery time:

The chi-square value (2, $N = 260$) of 19.45 at $p = .000$, indicated a significant relationship between ‘decreased customer delivery time’ and ‘country’. The strength of relationship was found to be .274 at $p = .000$.

On an overall basis, decreased customer delivery time was considered as the 8th most significant benefit from collaboration. Chinese SMEs considered it the 3rd and UK SMEs considered it to be the 4th most important benefit from collaborative relationships. However, Indian SMEs considered decreased customer delivery time as one of the less important benefits from the collaboration.

5.8.9 Better product availability:

A significant relationship was found between ‘better product availability’ and ‘country’, $\chi^2(2, N = 260) = 11.73, p < .05$. The strength of association was found to be weak (Cramer’s V value of .219 at $p = .003$) between these two variables.

Better product availability was again ranked the 9th major benefit from collaboration on an overall basis.

No significant relationship was found between country and the rest of the other benefits such as:

increased product quality; improved trust and confidence; frees up time and resource to focus on core competencies; and reduced carbon footprint. Moreover these factors were considered as less important benefits resulting from the collaborative relationship.

It was found that SMEs considered **financial factor** (increase sales, reduce costs, increase utilisation) to be a very important reason for entering into collaborative relationship and this reason turned out to be a major benefit from successful collaboration within supply chain partners. No major gap between reasons of collaboration and benefits from collaborative relationship was found in this study. Table 5.42 depicts more details of the benefits from collaboration.

Major Benefit:	UK		India		China		Total		Chi-square	Cramer's v	Sig.
	F	%	F	%	F	%	F	%			
Reduced product development time and cost	38	43.7	63	55.8	29	53.7	130	51.2	2.09	.09	.350
Reduced cost across the supply chain	57	65.5	104	92.0	32	59.3	193	76.0	20.56	.294	.000
Decreased customer delivery time	39	44.8	28	24.8	30	55.6	97	38.2	19.45	.274	.000
Increased product quality	36	41.4	41	36.3	20	37.0	97	38.2	1.03	.063	.597
Increased utilisation of resources	41	47.1	104	92.0	20	37.0	165	65.0	56.76	.473	.000
Increased market share and revenues	41	47.1	92	81.4	29	53.7	162	63.8	23.64	.303	.000
Increased customer satisfaction	50	57.5	44	38.9	34	63.0	128	50.4	13.58	.229	.001
Improved forecasts	28	32.2	91	80.5	17	31.5	136	53.5	55.23	.466	.000
Increased inventory turnover	20	23.0	75	66.4	12	22.2	107	42.1	47.35	.439	.000
Better product availability	37	42.5	25	22.1	20	37.0	82	32.3	11.73	.219	.003
Improved trust and confidence	32	36.8	30	26.5	16	29.6	78	30.7	3.20	.111	.201
Frees up time and resource to focus on core competencies	23	26.4	28	24.8	18	33.3	69	27.2	1.82	.084	.400
Reduced carbon footprint	18	20.7	16	14.2	7	13.0	41	16.1	2.39	.096	.303
Number of companies in collaborative relationship	87	100.0	119	100	54	100	260	100			
(F:Frequency, %: Valid percentage)											

Table 5.42: Major benefits of collaboration

Chapter 6: Discussion

The research investigated the current supply chain practices in SMEs, the level of supply chain collaboration, scope of vertical and horizontal collaborations, the differences in the collaborative initiatives, their effectiveness and the relationship between them. As a continuation from Chapters 4 and 5, the discussion on the current level of supply chain practices in the SMEs is presented in this chapter. The purpose of this chapter is to discuss further and consolidate the findings of the empirical results covered in the previous chapters.

6.1 Non-response bias

Non-response bias was tested using two variables: sales volume and age of the company. Three methods were employed for this, one by examining 30 rejected responses (company moved or person left) versus a randomly selected 30 valid responses, the second by randomly selecting 30 companies which did not respond (no interest or company's policy) versus 30 randomly selected, valid responses (not covered in one), and the third by comparing 30 early responses and 30 late responses. We found no statistical significant difference (F value ranged from 0.09 to 1.86 at $p < 0.05$) between the groups selected. The results suggest that non-response bias appears to be negligible and not a substantive problem in the study.

6.2 Reliability and Common Method Bias

Appendix B depicts the survey items measuring the internal reliability of the scales formed by the items. Reliability in terms of internal consistency is measured by using standard Cronbach's α (O'Leary-Kelly and Vokurka, 1998; Hair et al., 2010). A construct with values of α larger than 0.60 (Nunnally, 1978) suggest that the measurement scales are reliable. Cronbach's α for the nine collaborative initiatives ranged from 0.65 to 0.89 (Appendix B), indicating that the survey instrument was reliable.

As the data set was drawn from a single respondent in each SME, the study checked the common method variance to ensure that the data had no major problems with response bias. Harmann's single-factor test was used to test the common method variance. The collaborative strategies were extracted to one factor with no rotation; only one factor emerged with 41.87 % of variance which explained that there is lot of other variance to be explained by a single factor therefore suggesting that common method bias was not a problem in the study. Data was validated in the SPSS sheets using pre-set criterions.

6.3 Supply Chain Collaboration in SMEs

The survey was carried out in three countries (UK, India and China) to identify the current status of

supply chain collaborations in the SMEs sector and to compare the key trends and differences in the collaborative initiatives employed by the SMEs. The main reasons of selecting these countries were:

- a) SMEs in developed economy and developing economy: One of the main objectives of the research work was to compare how supply chain practices of SMEs in developed countries different than those of developing countries. As the study is carried out in the UK (sixth largest economy in the world), it was the obvious selection as developed country, and the motivation to carry out this study initiated in India (developing country and fourth largest economy), it was the obvious choice. Later on during the journey of the research study, it was realised to include SMEs from China (developing country) which is the second largest economy and is increasingly playing an important and influential role in the global economy.
- b) Access to data: As the research work is carried out in the UK and the researcher had substantial work experience in India, accessing data from these two countries was relatively easier. The researcher had some Chinese colleagues and friend who helped in data collection from SMEs in China. The data was collected all across UK, central part of India (an industrial area) and southern part of China.

It was distinctly seen that majority of SMEs in India (91%) and China (94%) didn't have a separate supply chain department and most of their supply chain decisions were made by the owner or chairman or directors. In such SMEs, the supply chain strategy and related decision are often implicit and is the result of the entrepreneur's preferences alone (Huin et al, 2002; Quayle, 2003; Vaaland and Heide, 2007). This indicates that if the entrepreneur does not have knowledge of supply chain collaboration or if the entrepreneur is not willing and interested in network collaboration then the SME will not have formal collaboration. This was experienced in several in person discussion with respondents in India who did not have sufficient knowledge of supply chains and collaborative initiatives and during the discussion when the concepts of supply chain collaboration were discussed; they showed their interest to enter in formal collaboration with external organisations. It was also found after the discussion in India that in the guidance of any advisor or expert SMEs can be encouraged to enter into supply chain collaboration. Therefore SMEs in these countries need to understand and focus on the importance of the supply chain function and different collaborative strategies .

Another finding which is interesting to discuss here relates to reactive responses. When the author discussed the issues of supply chain collaboration and its benefits with the respondents in India, it was found that few respondent (owners) who had never collaborated before were interested to enter in collaboration. This indicated that SMEs are likely to behave in a reactive manner, therefore the level of formalised decision making is low. As a result, if such SMEs only react to the situation that is occurring there and then, these SMEs will not be looking into collaborative initiatives as a strategic long term plan for the future. Such SMEs can adopt the episodic nature of collaboration as suggested by researcher

(Mentzer et al, 2000; Sheu et al, 2006; Zacharia et al, 2011) who advocated for specific collaborative objectives over a short period of time with segmented approach.

6.3.1 Supply Chain Collaborations

Country Basis: The results indicated that collaboration is very popular in SMEs and more than 69% of SMEs do have some form of supply chain collaborations with external organisations. On the country basis 74 %, 65 % and 75 % of the SMES in the UK, India and China respectively did have formal supply chain collaborations with external organisations. This suggests that supply chain collaborations are highly popular in SMEs.

Ownership Type: The result indicated that it was found that 64%, 72% and 85% of local organisations, foreign organisations and local-foreign joint venture organisations collaborate with other external organisations. The test for association between ownership and external collaboration was conducted and it was found that these two variables are associated (chi square value χ^2 : 9.74, $p = 0.03$). This suggests that the type of ownership plays an important role in decision of organisation to enter into formal supply chain collaboration.

Supply chain structure: The result indicated that in the UK 100 % of SME with S-M-W-R structures collaborated externally, around 80 percent of the SMEs with S-M-D-R and S-M-W-D-R structures collaborated externally. Indian SMEs with supply chain structure S-M-W-R (77.1 %) and S-M-D-R (75.6 %) were more involved in collaboration. Chinese SMEs with S-M-D-R structures (87.6 %) and S-M-W-R (82.6 %) entered into supply chain collaboration compared to other supply chain structures. An interesting finding is that SMEs with complex supply chain structure (S-M-W-R- 82 % and S-M-D-R- 79.1 %) collaborate more as compared to relative simpler supply chain structure (S-M-R- 64.3 percent). Chi square value (χ^2 : 14.03, $p = 0.01$) suggested that there is an association between supply chain structure and external collaboration. This suggests that network structure is important when deciding about the supply chain collaborations.

6.3.2 Collaborative Initiatives in SMEs

The result of different forms of collaborative strategies employed by the SMEs considering independent variable such as country, ownership type and network structures are provided in Appendix 3, 4, 5. The chi-square test was conducted to find out any association between different the collaborative initiatives and the independent variables. On the basis of the chi-square values, it can be established that almost all collaborative initiatives are associated with the respective independent variables.

6.3.2.1 Collaborative Initiatives and Country

Each of the 45 associations between different collaborative strategies and country were tested using chi-square values and it was found that 38 collaborative strategies were associated with country. The 7

strategies which were not found to be associated were: co-design with competitor, co-manufacturing with competitor, aggregated purchasing with supplier, co-logistics with other organisation, joint problem solving with customer, shared resources with supplier and shared resources with competitor. The results in Appendix 3 also show that collaborative strategies are popular in each of the three countries.

In the UK, SMEs were found to be more inclined towards their vertical partners (suppliers and customers) for network collaborations. Joint-ventures, co-development and co-design are the subject of very popular collaborative strategies with suppliers and customers, joint problem solving and CPFR are also popular with the suppliers and customers, however, co-manufacturing, aggregated purchasing, co-logistics and shared resources were found to be less popular with SMEs in the UK.

Indian SMEs were found to be more engaged with horizontal partners, particularly with external organisations for their joint ventures, co-manufacturing, aggregated purchasing, joint problem solving and shared resources' initiatives. However, SMEs in India were less inclined towards the co-development and co-logistics forms of collaboration with their network partners. Overall, joint problem solving, CPFR and aggregated purchasing emerged as highly popular strategies.

Chinese SMEs were more focused on co-development, joint-ventures, co-design, co-logistics and shared resources as their network collaboration. These SMEs were inclined to work with their vertical partners for such collaborations. CPFR and aggregated purchasing were the initiatives which were less popular in Chinese SMEs.

6.3.3 Collaborative Initiatives and Ownership

Based on the chi-square values, it was found that 27 collaborative strategies were associated and 18 collaborative strategies were not associated with the type of ownership. The important collaborative initiatives were: joint ventures with supplier and customer; co-manufacturing with supplier, customer and competitors; co-logistics with supplier, customer and other organisation. The results in appendix 4 indicated that collaborative strategies are popular in each of the three ownership types.

Local SMEs were found to be more inclined towards joint problem solving, CPFR, co-design and aggregated purchasing initiatives, whereas co-manufacturing, joint ventures and co-developments are also popular strategies, however, co-logistics and shared resources are the collaborative strategies which were found to be less popular in the local SMEs.

Foreign SMEs, on the other hand, were more inclined towards joint ventures, co-developments and co-designs, however, such SMEs were less engaged towards co-manufacturing, aggregated purchasing and shared resources with their network partners.

Local-foreign SMEs were more focused on joint-ventures, joint problem solving, CPFR, aggregated purchasing and co-design strategies. These SMEs were also found to be involved

in co-manufacturing, co-logistics and shared resources with their supply chain partners.

6.3.4 Collaborative Initiatives and Supply Chain Structure

The chi-square test was conducted to find out an association between collaborative strategies and the supply chain structure; however it was found that only 14 collaborative strategies were associated with the type of supply chain structure as shown in the appendix 5. Co-developments with suppliers, co-design with suppliers, aggregated purchasing with suppliers, co-logistics with suppliers were the few strategies which were associated with the supply chain structure. This suggests that supply chain structure might be important in the SMEs decision to enter in formal collaboration with the suppliers only but not with other supply chain partners.

6.4 Collaborative Strategies and ANOVA and Post Hoc Test

For further analysis, one-way between groups analysis of variance (ANOVA) and a post-hoc test were conducted to explore the impact of country, ownership type and supply chain structure on different supply chain strategies. The results are tabulated in Appendix 6, 7 and 8. Based on the results, it was found that there were statistical differences at the $p < 0.05$ level in the different collaborative initiatives for the groups of respondents. The results indicated significant differences between the different supply chain strategies in terms of country and ownership. However, supply chain strategies were not found statistically different in terms of supply chain structure.

On country basis: The responses were divided into three groups: UK, India and China. The results revealed that the effectiveness of different collaborative initiatives was different for different countries. Effectiveness of joint venture with suppliers and customers were different for all the countries, similarly effectiveness of co-developments with suppliers and customers were different for all the countries. This suggests that the effectiveness of collaborative strategies, especially joint ventures, co-development, aggregated purchasing, joint problem solving and CPFR depends on the location of SMEs. The differences in the effectiveness were mostly with the vertical network partners (suppliers and customers). One of the reasons which support this finding is the fact that SMEs in the UK were more involved in the vertical collaborations. The survey did not covered reasons of these differences in details, which could be the future work through more detailed research.

On ownership basis: The responses were divided into three groups: local, foreign and local-foreign joint venture. The results indicated that although there were differences in the effectiveness of different collaborative initiatives, the difference were limited to collaborative strategies such as co-manufacturing, aggregated purchasing and joint problem solving. The differences in the effectiveness of these strategies were mostly with the horizontal network partners (other organisations and competitors). One of the reasons which support this finding is the fact that SMEs in the India and China were more involved in the vertical collaborations. The survey did not explore the reasons of these

differences further research work is needed to reveal this in future.

On network structure basis: The responses were grouped into four as S-M-R, S-M-W-R, S-M-D-R and S-M-W-D-R. The results did not show any significant differences in the effectiveness of collaborative initiatives in this group. This supports the previous finding that the network structures are not associated with the supply chain collaboration and collaborative initiatives.

6.5 Relationship between Collaborative Strategies

Further analysis on the relationship between different collaborative strategies was carried out to establish a statistical relationship between them. For this purpose, the overall effectiveness of the different strategies was used to find the correlation coefficient. The relationships of different collaborative initiatives are summarised in the correlation matrix shown in table 4.10. It was found that all the different collaborative initiatives were positively related to each other at $p < 0.01$ and $p < 0.05$ level.

The results revealed that co-development strategy has a strong relationship with co-designs (.736), co-manufacturing (.668) and shared resources (.567) strategies. Similarly there were other significant correlation between co-design and co-manufacturing (.518), between co-design and joint problem solving (.516), co-manufacturing and co-logistics (.529), co-manufacturing and shared resources (.538), aggregated purchasing and co-logistics (.526), co-logistics and CPFR (.564) initiatives. There were also correlation between most of the other collaborative initiatives; however they were not very strongly related. The correlation analysis revealed that there are significant relationships between the collaborative initiatives therefore SMEs are strongly encouraged to enter in formal network collaborations. This type of analysis was not carried out in the previous literature.

Furthermore, these collaborative strategies were found to be effective in implementation. Joint venture was the most effective initiative (7.05 out of 10) while CPFR was found to be less effective (5.60 out of 10) as compared to any other collaborative initiative. This result also supports that collaborative strategies are not only related to each other but also effective in their implementation. Table 6.1 depicts the correlation between the collaborative initiatives.

	1.	2.	3.	4.	5.	6.	7.	8.	9.
Collaborative Initiatives									
1. Joint Venture	1								
2. Co-development	.448**	1							
3. Co-design	.396**	.736**	1						
4. Co-manufacturing	.368**	.668**	.518**	1					
5. Aggregated	.293*	.260*	.244**	.415**	1				
6. Co-logistics	.211**	.339*	.309*	.529**	.526**	1			
7. Joint Problem Solving	.313**	.465**	.516**	.458**	.424**	.543**	1		
8. Shared Resources	.459**	.567**	.364**	.538**	.351**	.328*	.408**	1	
9. CPFR	.231**	.459**	.274*	.477**	.383**	.564**	.378**	.347**	1
N =	131	107	125	102	118	89	146	95	134
Mean	7.05	6.54	6.42	6.45	6.34	6.43	6.09	5.84	5.60
Standard Deviation	1.93	1.86	1.78	1.54	1.58	1.72	1.52	1.78	1.41

- **Correlation is significant at the 0.01 level.
- * Correlation is significant at the 0.05 level.

Table 6.1 Correlations between Collaborative initiatives

6.5 Essential Requirements for Collaboration

The essential requirements were analysed with the help of Chi-square test and Cramer's v value. It was found that factors such as: mutual trust, mutual financial benefits and risk sharing, willingness and openness to share information and technical expertise, and mutual commitments of partners emerged out to be the key requirements for network collaborations. These finding are in line with the researchers (Simatupang and Sridharan, 2002; Demirbag et al, 2002, Berggren and Laestadius, 2003) who supported mutual trust and mutual benefits as requirement of effective collaboration. The survey result also revealed that factors such as: common process, structures and culture among partners, and common performance measure system were not considered as the most essential requirement of collaboration. The findings do not support researchers (Chang and Hong 2000; Robson and Bennett, 2000; Simatupang and Sridharan, 2002) view of common systems, structures and process of the partners to be requirements of successful collaborations. The results also supports that SMEs considered **Mutuality** (mutual trust, mutual sharing of risk and benefits, mutual commitment) as key factor which are important to collaborative relationship and SMES overlooked **Commonality** (common goals/motivation, common performance measurement system and common process, structure & culture) as key factor which are important to collaborative relationship.

6.6 Prime Reasons for Collaboration:

The results found that SMEs considered financial factors such as: increase sales and market share, reduce costs, increased utilisation of resources to be the important reasons for entering in the network collaboration. Researcher (Bolumole 2001; Thakkar et al, 2009) have also argued that financial factors are the key driver for collaborative relationships. Furthermore, performance factors such as: improve customer satisfaction, improve forecasts, increased technical know-how were also considered as reasons for networks collaborations, these factors were advocated by other researchers (Chang and Hong 2000; Thakkar et al, 2009). The survey also revealed intangible and soft issues such as; increase trust and confidence within partners, improved response time were overlooked by the SMEs as the principal reasons for entering the network relationship. This finding did not support researchers (Robson and Barnnett 2000; Piller et al 2005) who considered intangible issues to be reasons of collaboration. Interestingly majority of SMEs overlooked reducing carbon foot prints as a reason of collaborations.

6.7 Major Problems of Collaboration:

It was found that factors such as: lack or appropriate communication system, misalignment of partner's business processes, structures and culture emerged out to be the major problems in the implementation of network collaboration. Researchers (Albright 2002; Demirbag et al, 2002; Thakkar et al, 2009) have also supported that: lack of common goals, motivation towards partnership, poor cooperation, and different work culture and system, are the major hurdles in the successful collaborative relationships. Mutuality factors (trust and motivation) emerged as less problematic factor for successful collaborations. This finding is in line with the researchers (Chang and Hong, 2000; Demirbag et al, 2002; Berggren and Laestadius, 2003) who supported that mutual trust is important to successful collaborations. It is noted that majority of SMEs did not perceive the commonality as the key requirement for successful collaboration and later on they found that commonality is the major problem in collaborative relations. There is a need to bridge this gap between expectations and reality and SMEs need to understand that commonality play an important role in effective collaboration, otherwise the absence of commonality would lead to major hurdles or impediments which would ultimately affect the success of this relationship.

6.8 Major Benefits of Collaboration

The results found that SMEs considered financial factors (reduced cost across the supply chain, increased utilisation of resources and increased revenues and market share) to be the major benefits of collaboration with partners. This finding is in line with the researchers (Wagner et al, 2002; Knoppen

and Christiaanse, 2007; Power, 2005; Jain et al, 2006; Pramaturi, 2007; Soosay et al, 2008) who advocated that successful collaborations lead to financial benefits of lower costs, improved profits due to increased sales. It is also supported by other researchers (Bolumole 2001; Soosay et al 2008; Thakkar et al, 2009) who have also concluded that financial factors are the key driver for collaborative relationships.

Furthermore, performance factors (improved customer satisfaction, improved forecasts, increased product quality) were found to additional benefits of networks collaborations, these factors were supported by other researchers (Chang and Hong 2000; Power, 2005; Jain et al, 2006; Pramaturi 2007). It was found that SMEs considered **financial factors** to be important reasons for entering into collaborative relationship and these reasons turned out to be major benefits from successful collaboration. No major gap between reasons of collaboration and benefits from collaborative relationship was found in this study.

6.9 Chapter Summary

Previous literature identified the collaborative relations between supply chain network partners and different collaborative initiatives employed by SMEs, but it was limited to a primary focus on vertical collaboration with suppliers and customers, the different collaborative practices employed by organisations in general (not specific to SMEs), and no detailed study on the effectiveness of collaborative initiatives and their relationships. This study fills the gap by exploring the scope of horizontal collaboration with competitors and other organisations, the implementation of different collaborative initiatives specifically to SMEs and examining the effectiveness of different collaborative strategies and the relationship between them.

The survey results reveal that formal supply chain collaboration are very common in SMEs. Joint problem solving emerged as the most common collaborative initiative, while CPFR, joint ventures, co-design and aggregated purchasing are also popular in supply chain collaboration by SME. However, co-logistics and shared resources were found to be less-commonly used collaborative initiatives. On the basis of country, joint ventures and co-developments in the UK while CPFR, joint problem solving and aggregated purchasing in India and co-development and joint ventures in Chinese SMEs emerged as the most popular collaborative initiatives. The results suggest that SMEs understand the need and importance of supply chain collaboration and actively seek opportunities to collaborate with strategically important partners for specific collaborative initiatives, whenever it is required. These findings are in line with the views of other researchers (Barratt, 2004; Mentazer et al., 2000).

The results indicated that supply chain collaborations in SMEs are not restricted to only vertical relations with suppliers and customers but also extend to horizontal partners. SMEs are actively collaborating with their competitors and other organisations in joint ventures, co-manufacturing,

aggregated purchasing and shared resources. This suggests that competitors and other organisations are equally important partners in these collaborative initiatives as their direct supply chain partners (suppliers and customers). The results also identified that SMEs are more active in collaborating with vertical supply chain partners for co-development, co-design, co-logistics, joint problem solving and CPFR initiatives. Furthermore, different collaborative strategies were positively correlated to each other which suggest that SMEs should focus for different forms of collaboration in their supply chains and can expect to be very effective in terms of their implementations.

The study revealed that supply chain collaboration in SMEs are very common and practice and such relations have to be motivated by the mutuality of trust, sharing of risk and benefits and commitment (Demirbag et al, 2002; Simatupang and Sridharan, 2002; Berggren and Laestadius, 2003). Therefore, owners and managers of SMEs should align goals and benefits with supply chain partners for creating collaborative advantage and improving firm's performances as suggested by researchers (Bolumole 2001; Wagner et al, 2002; Knoppen and Christiaanse, 2007; Power, 2005; Jain et al, 2006; Pramatar, 2007; Soosay et al, 2008; Cao and Zhang, 2011) and evident from findings of this research work. Such collaborative relationship directly enhances the financial performance (Bolumole 2001; Soosay et al 2008; Thakkar et al, 2009) for each supply chain partner in the collaborative relationship. Supply chain collaboration can also be an effective means of transferring knowledge and new technical skills across firms (Malhotra et al., 2005).

The results of collaboration are encouraging for the SMEs, however SMEs must take more time and efforts to make it happen more effectively. Supply chain collaborations fail primarily because they are not well implemented (Lambert et al., 1999) and because of inter-firm hurdles (such as: lack or appropriate communication system, misalignment of partner's business processes, structures and culture) which are found to be the major problems in the implementation of network collaboration as suggested by researchers (Albright 2002; Demirbag et al, 2002; Thakkar et al, 2009) and found out in the study. The findings of this study revealed that collaborative relations in SMEs are based on mutuality (mutual trust, mutual sharing of risk and benefits, mutual commitment) but not commonality (common goals/motivation, common performance measurement system and common process, structure & culture) therefore managers need to strike a balance and find an optimal level of collaborative efforts for the SMEs.

The study also found that successful supply chain collaboration leads to better firm performance. The presence of both vertical and horizontal collaboration and the positive statistical relationship between various supply chain initiatives implies that SMEs must try to create a win-win situation to achieve business advantage and compete with other supply chain (Christopher.).

The model development and empirical testing presented in the study improved the understanding of supply chain collaboration in SMEs in a better way. They provide important guidance for owners and

managers of SMEs to achieve and form a better supply chain partnership, its management, and the outcomes of such relations. The understanding of supply chain, vertical and horizontal collaboration and different collaborative initiatives can help owners and managers of SMEs to identify specific actions to be taken collaboratively to improve shared supply chain processes that benefit all members (Lambert et al., 1999). This understanding can be a powerful tool to form successful supply chain collaborative partnerships. Additionally, this enhanced understanding can help managers to minimise the risk of collaboration failure before entering into any collaborative relationship.

Chapter 7: Conclusions

7.1 Introduction

In this chapter, the conclusion of the thesis is presented. This chapter provides highlights of the findings and contributions of the research work. It covers answers to the research questions, the key findings, contributions of the research and limitations of the research and future research direction.

This study is a result of review of the existing literature and the survey that was conducted in three countries. The literature provided the information, research background and other secondary data to develop a theoretical framework, whereas the survey provided empirical data to explain the theory. With the help of both the theory and empirical results, the research explained: how SMEs view the network collaborations, why do SMEs enter in such relations, and what are the different collaborative practices which are adopted by SMEs. This had provided better insights into the current status of collaborative environment of SMEs,

7.2 Research findings from research questions

The research main purpose of the research was to assess and examine the current status of supply chain collaboration in SMEs and their involvement in collaborative practices. Additionally it was to the effectiveness of collaborative initiatives and their inter-relations with each other. Further it investigated the essential requirements of collaboration, principal reasons of collaboration, major problem of collaboration and major benefits of the collaborative initiatives. From the literature review, the current level of collaborative practices was analysed and based on the theoretical framework the following research questions were derived:

- Do SMEs develop and maintain collaborative relationships with their customers, suppliers, competitors and other organisations?
- Which collaborative initiatives are popular in SMEs and do these collaborative initiatives differ in terms of country, ownership and supply chain structure?
- Are these collaborative initiatives effective and can they be statistically related to each other?
- What are the requirements of successful collaborations in SMEs?
- What are the prime reasons of collaborations in SMEs?
- What are the major hurdles of collaborations in SMEs?
- What are the major benefits of collaborations in SMEs?
- What are the requirements of supply chain collaboration in SMEs?

To answer the research questions, a survey method was employed to collect the empirical data. A sample was drawn from the available databases in the three countries and using the postal, email and personal method of data collection, a final data set of 365 responses from SMEs located in the UK, India and China was derived. A number of statistical tools (frequency tables, central tendency and dispersion, Chi-square test, ANOVA, Post-hoc analysis, T-test, f-test, correlation and theory of estimation) were used to answer the research questions.

7.2.1 SMEs and their collaborative relationships

In respect to SMEs and their network collaboration, it was found that SMEs are very active in terms of formal collaboration. It was answered that 70 % of the SMEs were involved in collaboration with their network partners (suppliers, customers, competitors and other organisation). It was found that SMEs in the UK were highly engaged in vertical collaborations (with the suppliers and/or customers) and less in horizontal collaboration (with the competitors and/or other organisations) whereas SMEs in India and China were focussed on both vertical and horizontal collaborations. A difference was noted that SMEs in India and China were more involved in horizontal collaboration as compared to the UK SMEs. There were additional finding for the difference in terms of country, type of ownership and network structure. Both the independent variables country and type of ownership were found to be statistical associated with the level of the collaboration; however the other variable network structure was not associated with the collaboration. As the research was limited in the scope, there is a scope to understand and analyse this difference of inclination towards the horizontal and vertical partners through future research work.

7.2.2 SMEs and collaborative initiatives

In respect to SMEs and collaborative initiatives, it was found that joint problem solving, joint venture and CPFR were the most common collaborative initiatives for the SMEs. On the basis of county it was further revealed that UK SMEs are engaged in joint ventures, co-development, co-design and CPFR initivates, India SMEs were more inclined for CPFR, aggregated purchasing, joint problem solving and co-manufacturing initiatives, whereas for Chinese SMEs, joint ventures, co-design and shared resources were more common collaborative strategies. Again it was revealed that UK SMEs had vertical collaboration with the suppliers and customers for these initiatives; however Indian SMEs had more collaboration with other external organisation for their collaborative relationships. Chinese SMEs were equally inclined towards vertical and horizontal partners. With the help of chi-square test and ANOVA it was further established that the country and ownership variables were associated with the type of collaboration. Furthermore, there were differences in these initiatives in terms of the variables. There was no statistical association between network structure and collaborative initiatives. The findings of

the practice of vertical collaboration were supported by the previous literature; however SME's involvement in the horizontal collaboration is an additional finding. There is further scope to investigate the difference in these associations and reasons of this in the future.

7.2.3 Effectiveness of collaborative initiatives and their relationship

For the purpose of this, statistical analysis was undertaken and it was found that collaborative initiatives are effective in implementation as most of the initiatives had a mean score more than 6 (10 was the maximum score), except for resources sharing and CPFR with mean scores of 5.8 and 5.5 respectively. It was further revealed that although CPFR emerged as the most common collaborative initiative, it was not found to be the most effective strategy. Further investigations are required for exploring the reasons, which could be the direction for future research. Joint venture was found to be most effective in terms of its benefits to the SMEs. And they were the most common collaborative initiatives in the SMEs in all the three countries.

It was further answered through correlations test that most of the collaborative initiatives were statistically correlated with each other. Collaborative initiatives such as: co-development, co-design and co-manufacturing were found to be strongly related with each other at 1% significance level. Strong coefficient of correlations were revealed in the co-design and co-development (.739), co-development and co-manufacturing (.668), co-development and shared resources (.567), co-design and co-manufacturing (.518), co-design and shared resources (.516) and co-manufacturing and co-logistics (.529). One of the possible reasons which could be assigned to this strong correlation is that most of manufacturing SMEs who are engaged in these initiatives had one or two common partners for most of these strategies. These finding were not previously available in the literature as there were limited research work on investigating the effectiveness and relationships of collaborative initiatives. A study in future is possible to examines and investigate these reasons of strong correlation.

7.2.4. Requirements of collaborations

In respect to requirements of collaborations it found out that SMEs considered factors such as: mutual trust, mutual financial benefits and risk sharing, willingness and openness to share information and technical expertise, and mutual commitments of partners to be essential requirements for the successful collaborations. For these requirements of the collaboration the Chi-square test and Cramer v value supported a moderate association between independent and dependent variables. This suggests that mutuality is associated with the country context. It was further analysed that commonality factors (common business process and structures) were not considered as essential requirements by the SMEs which later became the major problems for the successful implementation of the network collaborations. Again because of the scope of the study, detailed investigation and examination of the relationship could not be carried out.

7.2.5. Reasons for collaborations

The study disclosed that SMEs pay more importance to the monetary or financial factors as the principal reasons for entering the network relationships. It was discussed in the literature that SMEs have limited resources for managing its business activities and most of the SMEs have problems related to managing those resources. In view of this, SMEs enter into collaboration with an objective of gaining the financial benefits. Intangible benefits were not the prime focus of their network collaboration plans. Another finding was that SMEs did not focus on the environmental impact of their business activities. Furthermore, it was analysed that these reasons for collaboration are moderately associated with the location of SMEs. These findings were well supported by both the statistical measures and the literature review.

7.2.6. Major hurdles of collaborations

The study found that lack of commonness in the network partners is the major impediment to the implementation of collaboration. Factors such as: lack or appropriate communication system, misalignment of partner's business processes, structures and culture were considered as the major problems in the implementation of network collaboration. The study identified a gap in the collaborative practices. It was found that SMEs had more inclination on the mutuality and willingness aspects of the collaboration and somehow they did not realise the importance of the common systems and business process among the network partner. When they entered in the formal collaboration, it was then realised that lack of common systems and structure are the major problems. Moreover, with this gap between their expectation of requirements of collaboration and actual requirement had negative impact on their collaborative relationship. These findings were also supported by the statistical analysis.

7.2.7. Major benefits of collaborations

Financial outcome were the major benefits of the collaborative for the SMEs. It was also supported by the analysis that most SMEs entered the collaborative relationship for gaining the financial returns and they were successful in their collaborative plans. Moreover, performance factors such as: improved customer satisfaction, improved forecasts and increased product quality were proved to be additional benefits for the SMEs. It is found that these performance factors were not the prime reasons of their supply chain collaboration initiatives. The statistical results further supported a moderate association between these factors. It can be a further research area to investigate in details about the reasons of association and more details about the differences in such relationship.

7.3 Contribution to Knowledge and Future Work

Even though there is an increase in the research studies to understand the supply chain collaboration in organisational context, there has been little research on the supply chain collaboration process specifically for SME perspective which includes vertical and horizontal collaboration, effectiveness of collaborative initiatives, and relationship among different initiatives. This study unfolds important aspects of supply chain collaborative practices in SMEs by combining the research issues in three countries. Given the importance of supply chain collaboration in current dynamic environment where SMEs are continuously under pressure to improve the performance, a better understanding of the supply chain collaborative practices can contribute to our understanding of how SMEs can engage in supply chain collaborations to enhance performance and create a competitive edge.

The goal of this study was to explore and investigate the current supply chain practices employed by the SME context. This research makes several empirical contributions to the existing literature. Using multi-industry data based on 365 SMEs in three countries, the research empirically found out that supply chain collaboration are getting very common and popular in terms of acceptance and collaborative process competence. These factors affects the extent to which SMEs engage in a collaboration effort and contribute to successful collaborative outcomes. Based on the concept of supply chain collaboration developed by Mentezer et al (2000), the research has identified and validated supply chain collaboration as common and acceptable process that contributes to successful outcomes of collaborative initiative.

Second, while vertical collaborations are more common in small firms as compared to horizontal collaboration which is an important initiative in a collaborative effort (Barratt 2004), the study found that horizontal collaborations are equally common as vertical collaborations. It is also found that in some collaborative strategies horizontal collaboration predominates over the same relationship with vertical partners. This suggests that vertical and horizontal collaboration are adopted by SMEs for effective collaboration. This provides empirical support for both vertical and horizontal collaboration that can provide a competitive advantage to the SMEs.

The third contribution lies with the usage of different supply chain initiatives and their effectiveness and capabilities in a supply chain collaboration model. The study empirically validated the usage of different initiatives in the inter-firm relations. In addition to this, the research validated the effectiveness of such initiatives and the statistical relationships exists between the various supply chain initiatives which was not studied in prior research.

The fourth contribution of this research lies in the increased generalisability of the findings due to the broad scope of the sample size of 365 SMEs. The data represented countries, different industries and a

wide range of collaboration initiatives. This would suggest that the findings have implications for any SME involved in a supply chain collaborative relationship.

The broader perspectives are:

Academic perspective: Given the emergence of supply chain collaborations as a research topic, numerous researchers have emphasised the use of different supply chain strategies to enhance the competitiveness of organisations. However, there has been very little research undertaken in the area of supply chain collaborations within the context of the SMEs and the relationships of those collaborative initiatives with each other. In this research, it is found that collaborations in SMEs are becoming more popular and SMEs are engaged in different forms of collaborative initiative not only with their direct (suppliers and customers) network partners but also with their indirect (competitors and other organisations) partners. Moreover this study identified the effectiveness of different collaborative initiatives and the existence of positive relationships between them. As the study covered the ‘what’ aspect of network collaboration in the SMEs and their collaborative initiatives, further researches can be carried out to examine and investigate in questions ‘how’ and ‘why’ part of the network collaboration and the collaborative initiatives. Some of the questions such as: how the network collaboration in SMEs evolve over time, under what conditions do SMEs change their collaborative strategies and how they influence their network collaborations, how do the external and internal people influence the network decisions and other related issues can be answer through future work.

From a **managerial perspective**, this study provides a basis on which owners, managers and decision-makers in SMEs can take advantage of different forms of collaborative initiative in their business activities and strive for improved levels of performance. In addition, this study also identifies a strong association between collaborative initiatives and ownership and network structure. Furthermore, the relationships between different supply chain initiatives can be helpful in devising combinations of collaborative strategies which are highly related and effective. This research paper also provides a base for further action research in the SMEs, to examine and investigate more details of these strategies so that the role of supply chain collaboration can be better understood, leading to new research outputs and ideas.

Apart from the realising that SMEs are using more collaborative initiatives in their supply chains, this research paper also contributes to the existing research literature in terms of validating the impact of collaborative initiatives in the effectiveness. From here onwards, the researchers can work towards the alterations of the existing supply chains and current networks to achieve more fruitful business performances.

Lastly, no research is considered as successful if the researcher does not learn from the research

experience. On a personal basis, the author has gained valuable insights to the new research issue and is encouraged to do further research. While doing this research the author has interacted with many experts, academicians and other researcher who have provided valuable advises for the research work. This research experience is a value addition to the author's knowledge level.

7.4 Limitations of the study

Although the study has made important contributions to research and practice, there are limitations that need to be considered when interpreting the study findings. Because of the limited number of countries covered (3), the revalidation of constructs was not carried out with other countries in this study. This needs to be addressed in the future research. More data covering other countries may be collected to revalidate the finding.

The research findings are based on single respondent data. Even though the respondents were prequalified and had rich experience of their organisations and its supply chain, the same individual responded to all the information on all variables and measure, it could potentially bias the results. The study conducted test common method bias which was not a problem in this study. However future work, involving data from multiple respondent in the same company or supply chain, could validate the research findings. Additionally, the use of a single method to collect information of the variables covered in this study may generate some inaccuracy and more than the usual amount of random error. In the future study could use multiple or mixed method to collect data to enhance reliability of findings.

The current research work did not identify respondents in terms of successful and unsuccessful collaborations. This could lead to a potential for bias associated with respondent's experiences. Respondents might reflect to either a successful collaboration or failed collaboration to respond to the questions asked in the survey instrument used. This potential bias could be eliminated by asking specific questions on their successful collaboration and unsuccessful collaboration separately to assess the objective outcomes of the collaborative initiative.

In the current study analysis is carried out based on country, ownership and supply chain structures, future research should conduct analysis based on type of industry and level of respondents. One may test for factorial invariance across industries and respondents. An analysis of supply chain collaboration by industry would be very beneficial to examine how they are used across different industries and what are the most common level of supply chain collaboration in each industry. This could help identify any industry-specific odds against or for supply chain collaboration. Same analysis can be useful for the level of respondents as most of the respondents in this study were senior executives (i.e., owners, CEOs,

presidents, MD and managers). There might be significant differences in relationship perceptions between senior executives and mid-level and low-level managers. Further statistical test can be used to identify any major trends or differences.

Another limitation was the research did not identify the respondent's node in the supply chain (supplier or manufacturer or warehouse or distributor or retailer), more insights would be gained by collating data from different nodes rather than just from one. This research assessed the supply chain collaboration from the view point of a single organisation. There is potential that perceptions of supply chain collaboration among different supply chain partners could be different. Future research could add comparing the perception from different nodes in the same supply chain would provide different insights to this point.

Another limitation was coverage of the study. The research addressed the 'what' aspect of collaborative practices adopted by the SMEs, inclusion of case studies could address the 'how' and 'why' aspects of the research issues addressed through the questionnaire survey. This study did not include and examine other important factors such as length of collaborative relations, outcome of these relations and other relevant experience/s with individual supply chain partners. This was another limitation and it could be further area of research work in the future.

Future research could also focus on detail analysis of the sources of relational advantage in supply chain collaboration. For example if one partner or more partners have disproportionate power in the supply chain, how will it influence the collaborative relationship? Another focus could be to analyse effect of cultures on collaboration. For example, how does organisational or country culture play a role in the development of collaborative relationship and its effectiveness? Are different competencies or strategies required to collaborate successfully in such situations? How such situation will be governed?

7.5 Summary

With rapid changes in technology, customer demands, competition and globalisation, 'collaboration' is viewed as a competitive asset by many organisations. If SMEs can ensure the key collaborative practices that stimulate the production of new networks and knowledge exchange and enhancement of new forms of collaborative relationships, it will increase the competitiveness and responsiveness of SMEs in fulfilling the demands of customers and the market.

Through the exploration and analysis of survey responses, it can be concluded from this study that collaborative strategies are immensely getting popular in SMEs. The SMEs in UK, India and China have realised the importance of supply chain collaborations and thus begun to look forward and implement collaborations into their business strategy. This study evidently proposes that collaborations

in supply chain are getting increased in number and SMEs are adopting different collaborative initiatives to improve their business performances. The research also establishes the important differences in the collaborative initiatives in terms of country, ownership and supply chain structures, Furthermore; the important outcome of this study is finding of positive relationship between different supply chain initiatives, which will encourage and motivate the SMEs to adopt and implement various collaborative strategies for improved effectiveness in their supply chains. To survive and compete in the existing dynamic business environment, SMEs need to consistently improve their existing supply chain relations and/or search for new forms of collaborations. In order to do so, the present study's results support the importance of supply chain collaborations which are crucial for the SMEs to compete successfully in the business and attain growth. Through the effective networks of supply chain partners SMEs will increase their ability to reap the benefits of supply chain collaborations and become successful in the competitive business environment in the present time.

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Appendix 1: Questionnaire

The University of Liverpool Management School,
Liverpool, L69 7ZH, UK
E-mail: manish.unhale@liverpool.ac.uk

Dear Respondent,

I am a research student currently working under the supervision of Dr Andrew Lyons at the University of Liverpool Management School. My research concerns collaborative strategies in the supply chains of Small and Medium-sized Enterprises (SMEs). A key component of the research methodology is to review existing supply chain collaborative practices through this survey questionnaire.

Your experience of supply chain practices is very important for this study and your assistance is highly appreciated. This survey takes nearly 10 minutes to complete and all the responses will be kept confidential. The survey results will be used only for the academic work and will be published in the form of summaries in which individual responses cannot be identified. A copy of this summary will be provided to all respondents.

If you are unsure of a survey question, please choose the response that you believe is most suitable. Thank you once again for your valuable assistance.

Yours sincerely,

Manish Unhale

Survey on Collaborative Strategies	
SECTION A: Organisation Overview	
Part 1. Respondent Details	
Name:	
Position:	
Years of experience in this company/industry:	
Please attach business card Or Fill in details of business address in the blank space provided.	
Do you wish to receive the summary of the results of this study	<input type="checkbox"/> Yes <input type="checkbox"/> No
Part 2. General Information of the organisation	
2.1 How long ago did your organisation establish its operation? Years	
2.2.1 What is the approximate total sales volume of your organisation in 2009? (..... Million <input type="checkbox"/> Pounds <input type="checkbox"/> Euro , please tick as appropriate)	
2.2.2. What is the approximate percentage of costs/budget allocated out of this sales volume? R&D %; Logistics (Transportation)%; Production (Manufacturing) %	
2.3 What type of ownership has your organisation? <input type="checkbox"/> Local organisation <input type="checkbox"/> Foreign organisation <input type="checkbox"/> Foreign-local joint venture	

SECTION B. Supply Chain Overview	
Part 1. Overview of existing supply chain structure	
1.1 Which best describes your supply chain structure?	
<input type="checkbox"/> Supplier-manufacturer-retailer <input type="checkbox"/> Supplier-manufacturer-distributor-retailer	
<input type="checkbox"/> Supplier-manufacturer-wholesaler-retailer <input type="checkbox"/> Supplier-manufacturer-wholesaler- distributor-retailer	
<i>Please refer to the definitions given on the last page of the questionnaire for responding to Part 2</i>	
Part 2. Supply Chain Collaboration/Relationship/Partnership Overview	
Does your organisation collaborate externally? <input type="checkbox"/> Yes <input type="checkbox"/> No	
If yes, please answer the questions below, otherwise go to part 3	

2.1. Please ✓ if you have entered into any of the following initiatives.					
	Supplier	Customer	Competitor	Other Organisations	Effectiveness of initiative (please rate on a 1-10 scale, 1 for low and 10 for high)
Joint Venture with					

Co-Development with					
Co-Design with					
Co-Manufacturing with					
Aggregated Purchasing with ..					
Horizontal Collaboration with					
Co-Logistics with					
Joint Problem Solving with					
Shared Resources/Services with					
Collaborative Planning, Forecasting and / or Replenishment with					
Others (please specify)					

2.2 Please indicate the essential requirements for effective collaboration(tick all that apply).	
Mutual trust	
Mutual financial benefits and risk sharing	
Common goals and motivation	
Common performance measurement systems	
Willingness to be involved in supply chain collaboration (e.g. regular meetings)	
Willingness and openness to share information and technical expertise	
Knowledge of the benefits associated with collaborative supply chain practices	
Common processes, structures and culture among the partners	
Mutual commitment of the partners	
Mutual adjustment to the needs of other partners	
Any other requirements (please specify)	

2.3 Please indicate the principal reasons for entering into collaborative initiatives (tick all that apply).	
Increase sales and market share	
To introduce new products	
Increase technical know-how or expertise	
Increase utilisation of resources (e.g. capital, people, equipment)	
Improve response (lead) time	
Reduce costs (e.g. inventory, logistics, product development costs)	
Improve customer satisfaction (e.g. higher delivery time, poor quality)	
Increase trust and confidence within partners	
Improve forecasts	
Reduce carbon footprint	

Any other reasons (please specify)

2.4 Please indicate the major problems/hurdles, if any, associated with your collaborative initiatives (tick all that apply).	
Lack of collaborative vision	
Misalignment of partners' business processes, structures and culture	
Lack of trust and confidence with the partners	
Unwillingness to share information and technical expertise (with a fear of exposing weaknesses and sensitive information) among the partners	
Unwillingness to share financial risks and benefits among the partners	
Lack or appropriate communication systems (Information system and technological incompatibility)	
Lack of motivation and commitment towards the collaboration	
Lack of common performance measurement systems	
Any other problems (please specify)	

2.5 Please indicate the major benefits arising from the collaboration (tick all that apply).	
Reduced product development time and cost	
Reduced cost across the supply chain (e.g. logistics, material, labour costs)	
Decreased customer delivery time (order cycle)	
Increased product quality	
Increased utilisation of resources (e.g. capital, people, equipment)	
Increased market share and revenues	
Increased customer satisfaction	
Improved forecasts	
Increased inventory turnover	
Better product availability	
Improved trust and confidence among supply chain partners	
Frees up time and resource to focus on core competencies	
Reduced carbon footprint	
Any other benefits (please specify)	

Part 3.Reasons for non-collaboration

Please tick (✓) the reasons for non-collaboration with other organisations (tick all that apply).	
No interest in collaborative initiatives	
Lack of top management's support for collaboration	
Difficulty in finding partners	

Difficulty agreeing terms and conditions associated with the collaboration	
Lack of trust and commitment among the supply chain partners	
Unwillingness to share financial benefits and risk	
Lack of common goals (interests) among the supply chain partners	
Unwillingness to share information and technical expertise between the supply chain partners	
Lack of knowledge of the benefits of collaboration	
Absence of collaborative culture	
Any other reasons (please specify)	

Thank you for your participation in this important study.

Definitions for responding to Part 2

Co-development is a collaborative strategy for sharing technical, marketing and production information with business partners in order to acquire resources and new ideas to develop new products.

Co-design is a collaborative strategy to design products across a network of partners or to improve and add new features to existing products.

Co-manufacturing is a collaborative strategy for sharing manufacturing facilities to produce products.

Aggregated Purchasing is a collaborative strategy which involves partners forming buying groups to reduce the price of goods and services.

Collaborative Planning, Forecasting and Replenishment (CPFR) is a collaborative strategy for supply chain partners to develop and share joint plans and forecasts.

Co-logistics is the sharing of storage facilities and/or third-party transportation with outside partners.

Joint Problem Solving involves discussion, collaboration and interaction between partners in order to establish solutions to problems affected by the partners.

Joint Venture is a collaborative alliance that combines resources from more than one organisation to create a new organisational entity, which is distinct from its parent organisations.

Resource Sharing is the sharing of resources within formal or informal consortia of individuals and/or organisations(shared IT and back-office functions are examples of resource sharing).

Horizontal Collaboration is a collaboration between your organisation and other companies that produce the same or similar products and services. These companies may be direct competitors.

Appendix 2: Scale and Reliability

Scale (1 to 10)	Supplier		Customer		Competitor		Other organisation		Overall Effectiveness of Collaborative Initiatives		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Cronbach alpha	Mean	Standard Deviation
Effectiveness of Collaborative Initiatives	6.9	1.9	6.9	1.3	6.4	1.2	7.2	1.8	.71	7.0	1.9
	6.4	1.7	6.8	1.9	4.7	1.6	6.7	1.8	.73	6.5	1.8
Joint Venture Co-development	6.7	1.6	6.4	1.1	4.5	1.5	6.4	1.7	.89	6.4	1.7
Co-design	6.6	1.7	5.8	1.5	4.9	1.9	6.3	1.6	.80	6.4	1.5
Co-manufacturing	6.0	1.1	6.8	1.0	5.8	1.8	6.5	1.7	.76	6.3	1.6
Aggregated Purchasing	6.3	1.8	6.5	1.6	4.9	1.5	6.5	1.1	.85	6.4	1.7
Co-logistics	6.0	1.4	6.0	1.7	5.4	1.2	6.2	1.4	.68	6.0	1.5
Joint Problem Solving	5.5	1.8	5.3	1.6	3.8	1.0	6.0	1.7	.71	5.8	1.7
Resource Sharing	5.5	1.4	5.5	1.3	1.5	.7	5.5	1.2	.65	5.5	1.4
CPFR											

Appendix 3: Collaborative initiatives and country

Collaborative Initiatives		UK		India		China		Total		Chi-square Test
		F	%	F	%	F	%	F	%	
Joint Ventures	Supplier	31	35.6	4	3.5	15	27.8	50	19.7	34.86, $p = .000$
	Customer	25	28.7	2	1.8	8	14.8	35	13.8	30.14, $p = .000$
	Competitor	9	10.3	4	3.5	1	1.9	14	5.5	6.15, $p = .047$
	Other Organisation	18	20.7	47	41.6	19	35.2	84	33.1	9.84, $p = .007$
	Overall	52	59.8	53	46.9	38	70.4	143	56.3	8.82, $p = .012$
Co-development	Supplier	35	40.2	5	4.4	12	22.2	52	20.5	38.83, $p = .000$
	Customer	23	26.4	7	6.2	21	38.9	51	20.1	27.67, $p = .000$
	Competitor	7	8.0	1	0.9	3	5.6	11	4.3	6.32, $p = .042$
	Other Organisation	12	13.8	18	15.9	17	31.5	47	18.5	7.80, $p = .020$
	Overall	51	58.6	27	23.9	41	75.9	119	46.9	47.08, $p = .000$
Co-design	Supplier	31	35.6	6	5.3	13	24.1	50	19.7	29.42, $p = .000$
	Customer	26	29.9	18	15.9	16	29.6	60	23.6	6.67, $p = .035$
	Competitor	4	4.6	3	2.7	2	3.7	9	3.5	0.58, $p = .760$
	Other Organisation	8	9.2	29	25.7	10	18.5	47	18.5	8.80, $p = .012$
	Overall	47	54.0	52	46.0	37	68.5	136	53.5	7.44, $p = .024$
Co-manufacturing	Supplier	18	20.7	14	12.4	17	31.5	49	19.3	8.72, $p = .013$
	Customer	9	10.3	1	0.9	4	7.4	14	5.5	8.93, $p = .012$
	Competitor	7	8.0	8	7.1	1	1.9	16	6.3	2.37, $p = .305$
	Other Organisation	6	6.9	47	41.6	8	14.8	61	24.0	35.60, $p = .000$
	Overall	28	32.2	58	51.3	28	51.9	114	44.9	8.62, $p = .013$
Aggregated Purchasing	Supplier	12	13.8	9	8.0	9	16.7	30	11.8	3.15, $p = .206$
	Customer	10	11.5	2	1.8	7	13.0	19	7.5	9.69, $p = .008$
	Competitor	4	4.6	42	37.2	4	7.4	50	19.7	39.52, $p = .000$
	Other Organisation	6	6.9	50	44.2	9	16.7	65	25.6	38.82, $p = .000$
	Overall	21	24.1	82	72.6	25	46.3	128	50.4	46.57, $p = .000$
Co-logistics	Supplier	20	23.0	13	11.5	13	24.1	46	18.1	6.01, $p = .047$
	Customer	13	14.9	10	8.8	18	33.3	41	16.1	16.32, $p = .000$
	Competitor	4	4.6	15	13.3	2	3.7	21	8.3	6.76, $p = .034$
	Other Organisation	5	5.7	16	14.2	8	14.8	29	11.4	4.21, $p = .121$
	Overall	26	29.9	42	37.2	33	61.1	101	39.8	14.13, $p = .001$
Joint Problem Solving	Supplier	32	36.8	55	48.7	12	22.2	99	39.0	11.01, $p = .004$
	Customer	26	29.9	37	32.7	17	31.5	80	31.5	0.18, $p = .891$
	Competitor	4	4.6	22	19.5	2	3.7	28	11.0	14.80, $p = .001$
	Other Organisation	6	6.9	61	54.0	5	9.3	72	28.3	65.95, $p = .000$
	Overall	44	50.6	87	77.0	27	50.0	158	62.2	18.93, $p = .000$
Shared Resources	Supplier	11	12.6	8	7.1	9	16.7	28	11.0	3.77, $p = .151$
	Customer	9	10.3	4	3.5	12	22.2	25	9.8	14.40, $p = .001$
	Competitor	3	3.4	7	6.2	2	3.7	12	4.7	0.98, $p = .612$
	Other Organisation	10	11.5	40	35.4	10	18.5	60	23.6	16.55, $p = .000$
	Overall	22	25.3	51	45.1	28	51.9	101	39.8	18.93, $p = .000$
CPFR	Supplier	30	34.5	83	73.5	6	11.1	119	46.9	65.15, $p = .000$
	Customer	28	32.2	76	67.3	11	20.4	115	45.3	41.57, $p = .000$
	Competitor	3	3.4	0	0.0	0	0.0	3	1.2	5.82, $p = .050$

Other Organisation	5	5.7	1	0.9	0	0.0	6	2.4	6.69, $p = .035$
Overall	44	50.6	87	77.0	15	27.8	146	57.5	38.79, $p = .000$
Number of companies in collaborative relationship	87	100.0	113	100.0	54	100.0	254	100.0	

Appendix 4: Collaborative initiatives and ownership

Collaborative Initiatives		Local		Foreign		Local-Foreign		Total		Chi-square Test
		F	%	F	%	F	%	F	%	
Joint Ventures	Supplier	28	20.0	15	26.3	7	12.3	50	19.7	3.57, $p = .068$
	Customer	20	14.3	10	17.5	5	8.8	35	13.8	1.91, $p = .384$
	Competitor	9	6.4	4	7.0	1	1.8	14	5.5	2.09, $p = .364$
	Other Organisation	33	23.6	10	17.5	41	71.9	84	33.1	50.80, $p = .000$
	Overall	62	44.3	30	52.6	51	89.5	143	56.3	34.02, $p = .000$
Co-development	Supplier	27	19.3	18	31.6	7	12.3	52	20.5	6.78, $p = .034$
	Customer	36	25.7	9	15.8	6	10.5	51	20.1	6.65, $p = .036$
	Competitor	6	4.3	3	5.3	2	3.5	11	4.3	0.21, $p = .899$
	Other Organisation	20	14.3	10	17.5	17	29.8	47	18.5	6.53, $p = .038$
	Overall	63	45.0	29	50.9	27	47.4	119	46.9	8.57, $p = .015$
Co-design	Supplier	28	20.0	17	29.8	5	8.8	50	19.7	8.00, $p = .018$
	Customer	42	30.0	13	22.8	5	8.8	60	23.6	10.14, $p = .007$
	Competitor	5	3.6	1	1.8	3	5.3	9	3.5	1.09, $p = .596$
	Other Organisation	23	16.4	3	5.3	21	36.8	47	18.5	19.72, $p = .000$
	Overall	77	55.0	27	47.4	32	56.1	136	53.5	11.14, $p = .007$
Co-manufacturing	Supplier	29	20.7	9	15.8	11	19.3	49	19.3	0.63, $p = .729$
	Customer	6	4.3	5	8.8	3	5.3	14	5.5	1.57, $p = .455$
	Competitor	12	8.6	1	1.8	3	5.3	16	6.3	3.32, $p = .190$
	Other Organisation	39	27.9	2	3.5	20	35.1	61	24.0	18.09, $p = .000$
	Overall	69	49.3	15	26.3	30	52.6	114	44.9	10.44, $p = .007$
Aggregated	Supplier	17	12.1	6	10.5	7	12.3	30	11.8	1.17, $p = .934$
	Customer	10	7.1	5	8.8	4	7.0	19	7.5	0.17, $p = .951$
	Competitor	32	22.9	3	5.3	15	26.3	50	19.7	9.97, $p = .007$
	Other Organisation	39	27.9	4	7.0	22	38.6	65	25.6	15.76, $p = .000$
	Overall	74	52.9	16	28.1	38	66.7	128	50.4	17.71, $p = .000$
Co-logistics	Supplier	23	16.4	15	26.3	8	14.0	46	18.1	3.49, $p = .174$
	Customer	19	13.6	13	22.8	9	15.8	41	16.1	2.55, $p = .278$
	Competitor	12	8.6	1	1.8	8	14.0	21	8.3	5.70, $p = .050$
	Other Organisation	18	12.9	3	5.3	8	14.0	29	11.4	2.86, $p = .246$
	Overall	50	35.7	24	42.1	27	47.4	101	39.8	4.46, $p = .019$
Joint Problem Solving	Supplier	60	42.9	17	29.8	22	38.6	99	39.0	2.89, $p = .235$
	Customer	50	35.7	14	24.6	16	28.1	80	31.5	2.73, $p = .255$
	Competitor	21	15.0	1	1.8	6	10.5	28	11.0	7.26, $p = .026$
	Other Organisation	38	27.1	1	1.8	33	57.9	72	28.3	44.47, $p = .000$
	Overall	88	62.9	26	45.6	44	77.2	158	62.2	12.14, $p = .007$
Shared Resources	Supplier	17	12.1	5	8.8	6	10.5	28	11.0	0.48, $p = .748$
	Customer	16	11.4	9	15.8	0	0.0	25	9.8	8.89, $p = .012$
	Competitor	8	5.7	2	3.5	2	3.5	12	4.7	0.69, $p = .712$
	Other Organisation	33	23.6	5	8.8	22	38.6	60	23.6	14.05, $p = .000$
	Overall	57	40.7	17	29.8	27	47.4	101	39.8	12.14, $p = .007$
CPFR	Supplier	69	49.3	11	19.3	39	68.4	119	46.9	28.36, $p = .000$
	Customer	63	45.0	16	28.1	36	63.2	115	45.3	14.17, $p = .000$
	Competitor	3	2.1	0	0.0	0	0.0	3	1.2	2.47, $p = .291$
	Other Organisation	4	2.9	2	3.5	0	0.0	6	2.4	1.86, $p = .396$
	Overall	80	57.1	26	45.6	40	70.2	146	57.5	7.05, $p = .029$
Number of companies in collaborative relationship		140	100.0	57	100.0	57	100.0	254	100.0	

Appendix 5: Collaborative initiatives and supply chain structure

Collaborative Initiatives		S-M-R		S-M-W-R		S-M-D-R		S-M-W-		Chi-square
		F	%	F	%	F	%	F	%	
Joint Ventures	Supplier	14	18.9	12	24.0	11	15.3	11	20.0	5.96, $p = .223$
	Customer	13	17.6	6	12.0	8	11.1	6	10.9	8.90, $p = .049$
	Competitor	4	5.4	0	0.0	4	5.6	5	9.1	8.71, $p = .050$
	Other Organisation	15	20.3	19	38.0	21	29.2	27	49.1	14.43, $p = .198$
	Overall	35	47.3	32	64.0	38	52.8	36	65.5	6.01, $p = .198$
Co-development	Supplier	19	25.7	5	10.0	12	16.7	14	25.5	10.01, $p = .017$
	Customer	20	27.0	6	12.0	13	18.1	11	20.0	4.77, $p = .311$
	Competitor	3	4.1	0	0.0	3	4.2	4	7.3	9.52, $p = .043$
	Other Organisation	14	18.9	12	24.0	9	12.5	11	20.0	3.25, $p = .517$
	Overall	38	51.4	19	38.0	32	44.4	28	50.9	3.17, $p = .528$
Co-design	Supplier	19	25.7	6	12.0	18	25.0	5	9.1	12.92, $p = .001$
	Customer	21	28.4	8	16.0	16	22.2	14	25.5	2.87, $p = .579$
	Competitor	2	2.7	1	2.0	1	1.4	4	7.3	11.50, $p = .001$
	Other Organisation	13	17.6	9	18.0	14	19.4	10	18.2	0.53, $p = .970$
	Overall	43	58.1	21	42.0	44	61.1	26	47.3	6.03, $p = .197$
Co-manufacturing	Supplier	19	25.7	7	14.0	16	22.2	6	10.9	6.09, $p = .192$
	Customer	4	5.4	3	6.0	3	4.2	3	5.5	4.73, $p = .316$
	Competitor	3	4.1	4	8.0	4	5.6	4	7.3	4.74, $p = .314$
	Other Organisation	11	14.9	14	28.0	20	27.8	15	27.3	4.85, $p = .303$
	Overall	30	40.5	23	46.0	39	54.2	21	38.2	4.25, $p = .372$
Aggregated	Supplier	13	17.6	1	2.0	6	8.3	8	14.5	16.87, $p = .001$
	Customer	8	10.8	2	4.0	3	4.2	5	9.1	6.30, $p = .177$
	Competitor	12	16.2	12	24.0	14	19.4	11	20.0	1.51, $p = .825$
	Other Organisation	8	10.8	17	34.0	21	29.2	18	32.7	12.39, $p = .001$
	Overall	32	43.2	27	54.0	37	51.4	30	54.5	2.49, $p = .645$
Co-logistics	Supplier	14	18.9	5	10.0	9	12.5	14	25.5	11.13, $p = .001$
	Customer	13	17.6	6	12.0	9	12.5	12	21.8	3.41, $p = .491$
	Competitor	3	4.1	7	14.0	6	8.3	4	7.3	6.45, $p = .168$
	Other Organisation	4	5.4	12	24.0	7	9.7	5	9.1	12.39, $p = .001$
	Overall	25	33.8	26	52.0	24	33.3	24	43.6	6.72, $p = .151$
Joint Problem Solving	Supplier	31	41.9	14	28.0	34	47.2	19	34.5	5.36, $p = .253$
	Customer	22	29.7	17	34.0	20	27.8	20	36.4	1.32, $p = .858$
	Competitor	8	10.8	9	18.0	7	9.7	3	5.5	5.87, $p = .209$
	Other Organisation	16	21.6	21	42.0	16	22.2	18	32.7	8.12, $p = .057$
	Overall	48	64.9	33	66.0	44	61.1	32	58.2	2.00, $p = .734$
Shared Resources	Supplier	10	13.5	4	8.0	6	8.3	7	12.7	3.15, $p = .533$
	Customer	8	10.8	5	10.0	5	6.9	6	10.9	2.69, $p = .610$
	Competitor	6	8.1	2	4.0	2	2.8	1	1.8	9.03, $p = .045$
	Other Organisation	15	20.3	12	24.0	18	25.0	14	25.5	0.80, $p = .938$
	Overall	31	41.9	19	38.0	29	40.3	21	38.2	2.00, $p = .734$
CPFR	Supplier	29	39.2	26	52.0	31	43.1	31	56.4	5.16, $p = .271$
	Customer	27	36.5	29	58.0	28	38.9	29	52.7	8.85, $p = .063$
	Competitor	0	0.0	0	0.0	0	0.0	2	3.6	31.75, $p = .001$
	Other Organisation	3	4.1	1	2.0	0	0.0	1	1.8	15.23, $p = .001$
	Overall	42	56.8	31	62.0	38	52.8	33	60.0	1.32, $p = .856$
Number of companies in collaborative relationship		74	100.0	50	100.0	72	100.0	55	100.0	

Appendix 6: Collaborative initiatives and Country: ANOVA and Post Hoc Test

Variables		ANOVA				Post Hoc Test (Tukey HSD)
Collaboration and Country		d.f.	F	Sig.	Eta squared	Mean Difference*
Joint Venture	Supplier	2,	19.96	0.000	0.14	0.321 (1 & 2), 0.242 (2 & 3)
	Customer	2,	16.90	0.000	0.12	0.270 (1 & 2), 0.139 (1 & 3), 0.130 (2 & 3)
	Competitor	2,	3.10	0.047	0.03	-
	Other Organisation	2,	5.05	0.007	0.04	0.201 (1 & 2)
	Overall	2,	4.51	0.012	0.03	0.235 (2 & 3)
Co-development	Supplier	2,	22.65	0.000	0.15	0.358 (1 & 2), 0.178 (2 & 3), 0.180 (1 & 3)
	Customer	2,	15.34	0.000	0.10	0.202 (1 & 2), 0.327 (2 & 3)
	Competitor	2,	3.20	0.042	0.02	0.072 (1 & 2)
	Other Organisation	2,	3.98	0.020	0.03	0.177 (1 & 3), 0.156 (2 & 3)
	Overall	2,	28.56	0.000	0.18	0.347 (1 & 2), 0.520 (2 & 3)
Co-design	Supplier	2,	16.42	0.000	0.11	0.303 (1 & 2), 0.188 (2 & 3)
	Customer	2,	3.39	0.035	0.02	-
	Competitor	2,	0.27	0.763	-	-
	Other Organisation	2,	4.52	0.012	0.04	0.165 (1 & 2)
	Overall	2,	3.79	0.024	0.03	0.225 (2 & 3)
Co-manufacturing	Supplier	2,	4.46	0.012	0.03	0.191 (2 & 3)
	Customer	2,	4.56	0.011	0.13	0.195 (1 & 2)
	Competitor	2,	1.18	0.307	-	-
	Other Organisation	2,	20.46	0.000	0.14	0.347 (1 & 2), 0.266 (2 & 3)
	Overall	2,	14.24	0.000	0.11	0.191 (1 & 2)
Aggregated Purchasing	Supplier	2,	1.58	0.208	-	-
	Customer	2,	4.98	0.008	0.04	0.097 (1 & 2), 0.112 (2 & 3)
	Competitor	2,	23.12	0.000	0.16	0.326 (1 & 2), 0.298 (2 & 3)
	Other Organisation	2,	22.68	0.000	0.15	0.374 (1 & 2), 0.276 (2 & 3)
	Overall	2,	28.19	0.000	0.18	0.484 (1 & 2), 0.263 (2 & 3)
Co-logistics	Supplier	2,	3.04	0.059	-	-
	Customer	2,	8.62	0.000	0.06	0.184 (1 & 3), 0.245 (2 & 3)
	Competitor	2,	3.43	0.054	-	-
	Other Organisation	2,	2.12	0.122	-	-
	Overall	2,	7.39	0.001	0.06	0.312 (1 & 3), 0.239 (2 & 3)
Joint Problem Solving	Supplier	2,	5.69	0.004	0.04	0.265 (1 & 3)
	Customer	2,	0.92	0.912	-	-
	Competitor	2,	7.78	0.001	0.06	0.149 (1 & 2), 0.158 (2 & 3)
	Other Organisation	2,	44.01	0.000	0.26	0.471 (1 & 2), 0.447 (2 & 3)
	Overall	2,	10.10	0.000	0.07	0.264 (1 & 2), 0.270 (2 & 3)
Shared Resources	Supplier	2,	1.89	0.152	-	-
	Customer	2,	7.54	0.001	0.05	0.187 (2 & 3)
	Competitor	2,	0.48	0.615	-	-
	Other Organisation	2,	8.72	0.000	0.06	0.293 (1 & 2), 0.169 (2 & 3)
	Overall	2,	6.36	0.002	0.05	0.198 (1 & 2), 0.266 (1 & 3)
CPFR	Supplier	2,	43.30	0.000	0.25	0.390 (1 & 2), 0.623 (2 & 3), 0.234 (1 & 3)
	Customer	2,	24.56	0.000	0.16	0.351 (1 & 2), 0.469 (2 & 3)
	Competitor	2,	2.94	0.054	-	-
	Other Organisation	2,	3.39	0.065	-	-
	Overall	2,	22.67	0.000	0.15	0.264 (1 & 2), 0.492 (2 & 3), 0.228 (1 & 3)

- **Country:** 1- UK, 2-India, 3-China.
- **Mean Difference *-** Is significant at the 0.05 level. Numbers in bracket show mean difference between Countries.

Appendix 7: Collaborative initiatives and Ownership: ANOVA and Post Hoc Test

Variables		ANOVA				Post Hoc Test (Tukey HSD)	
Collaboration and Ownership		d.f.	F	Sig.	Eta squared	Mean Difference*	
Joint Venture	Supplier	2,	1.78	0.169	-		-
	Customer	2,	0.95	0.387	-		-
	Competitor	2,	1.00	0.367	-		-
	Other Organisation	2,	31.37	0.000	0.20	0.484 (1 & 3), 0.544 (2 & 3)	
	Overall	2,	19.4	0.000	0.13	0.453 (1 & 3), 0.368 (2 & 3)	
Co-development	Supplier	2,	3.44	0.033	0.02		0.193 (2 & 3)
	Customer	2,	3.38	0.036	0.02		0.152 (1 & 3)
	Competitor	2,	0.10	0.90	-		-
	Other Organisation	2,	3.31	0.038	0.02		0.155 (1 & 3)
	Overall	2,	0.28	0.754	-		-
Co-design	Supplier	2,	4.08	0.018	0.03		0.211 (2 & 3)
	Customer	2,	5.22	0.006	0.04		0.122 (1 & 3)
	Competitor	2,	0.519	0.601	-		-
	Other Organisation	2,	10.57	0.000	0.08	0.204 (1 & 3), 0.316 (2 & 3)	
	Overall	2,	0.57	0.566	-		-
Co-manufacturing	Supplier	2,	0.31	0.732	-		-
	Customer	2,	0.78	0.458	-		-
	Competitor	2,	1.16	0.192	-		-
	Other Organisation	2,	9.62	0.000	0.07	0.243 (1 & 2), 0.316 (2 & 3)	
	Overall	2,	4.65	0.010	0.07	0.316 (1 & 2), 0.351 (2 & 3)	
Aggregated Purchasing	Supplier	2,	0.58	0.944	-		-
	Customer	2,	0.08	0.916	-		-
	Competitor	2,	5.13	0.007	0.04	0.176 (1 & 2), 0.211 (2 & 3)	
	Other Organisation	2,	8.30	0.000	0.06	0.208 (1 & 2), 0.316 (2 & 3)	
	Overall	2,	9.42	0.000	0.07	0.248 (1 & 2), 0.386 (2 & 3)	
Co-logistics	Supplier	2,	1.75	0.176	-		-
	Customer	2,	1.27	0.281	-		-
	Competitor	2,	2.88	0.050	0.06	0.123 (2 & 3)	
	Other Organisation	2,	1.40	0.248	-		-
	Overall	2,	1.23	0.394	-		-
Joint Problem Solving	Supplier	2,	1.44	0.237	-		-
	Customer	2,	1.36	0.257	-		-
	Competitor	2,	3.69	0.026	0.03	0.132 (1 & 2)	
	Other Organisation	2,	26.61	0.000	0.17	0.254 (1 & 2), 0.308 (1 & 3), 0.561 (2 & 3)	
	Overall	2,	6.60	0.002	0.05	0.316 (2 & 3)	
Shared Resources	Supplier	2,	0.24	0.781	-		-
	Customer	2,	4.55	0.011	0.03	0.114 (1 & 3), 0.158 (2 & 3)	
	Competitor	2,	0.36	0.715	-		-
	Other Organisation	2,	7.35	0.001	0.05	0.298 (2 & 3)	
	Overall	2,	1.89	0.152	-		-
CPFR	Supplier	2,	15.77	0.000	0.11	0.300 (1 & 2), 0.191 (1 & 3), 0.491 (2 & 3)	
	Customer	2,	7.41	0.001	0.05	0.182 (1 & 3), 0.351 (2 & 3)	
	Competitor	2,	1.23	0.293	-		-
	Other Organisation	2,	0.99	0.399	-		-
	Overall	2,	3.58	0.029	0.02		-

- **Ownership;** 1- Local, 2-Foreign, 3-Local-foreign
- **Mean Difference*** - Is significant at the 0.05 level. Numbers in bracket show mean difference between Ownerships.

Appendix 8: Collaborative initiatives and supply chain structure: ANOVA and Post Hoc Test

Variables		ANOVA				Post Hoc Test (Tukey HSD)
Collaboration and SC Structure		d.f.	F	Sig.	Eta squared	Mean Difference*
Joint Venture	Supplier	3,	1.42	0.225	-	-
	Customer	3,	2.26	0.063	-	-
	Competitor	3,	2.21	0.068	-	-
	Other Organisation	3,	3.74	0.006	0.06	0.288 (1 & 4)
	Overall	3,	1.50	0.20	-	-
Co-development	Supplier	3,	2.55	0.040	0.03	0.33 (2 & 4)
	Customer	3,	1.19	0.315	-	-
	Competitor	3,	2.42	0.49	-	-
	Other Organisation	3,	0.80	0.522	-	-
	Overall	3,	0.78	0.533	-	-
Co-design	Supplier	3,	3.33	0.110	-	-
	Customer	3,	0.73	0.584	-	-
	Competitor	3,	2.95	0.061	-	-
	Other Organisation	3,	0.13	0.971	-	-
	Overall	3,	1.51	0.190	-	-
Co-manufacturing	Supplier	3,	1.53	0.194	-	-
	Customer	3,	1.18	0.319	-	-
	Competitor	3,	1.18	0.318	-	-
	Other Organisation	3,	1.21	0.306	-	-
	Overall	3,	1.08	0.363	-	-
Aggregated Purchasing	Supplier	3,	4.42	0.002	0.06	0.647 (2 & 4), 0.583 (3 & 4)
	Customer	3,	1.58	0.179	-	-
	Competitor	3,	0.37	0.828	-	-
	Other Organisation	3,	3.19	0.014	0.05	0.232 (1 & 2), 0.232 (1 & 4)
	Overall	3,	0.61	0.650	-	-
Co-logistics	Supplier	3,	2.85	0.054	-	-
	Customer	3,	0.84	0.496	-	-
	Competitor	3,	1.62	0.169	-	-
	Other Organisation	3,	3.19	0.014	0.05	0.186 (1 & 2)
	Overall	3,	1.69	0.152	-	-
Joint Problem Solving	Supplier	3,	1.33	0.256	-	-
	Customer	3,	0.35	0.861	-	-
	Competitor	3,	1.47	0.211	-	-
	Other Organisation	3,	2.05	0.087	-	-
	Overall	3,	0.49	0.739	-	-
Shared Resources	Supplier	3,	0.78	0.538	-	-
	Customer	3,	0.66	0.615	-	-
	Competitor	3,	2.29	0.060	-	-
	Other Organisation	3,	0.19	0.940	-	-
	Overall	3,	0.78	0.989	-	-
CPFR	Supplier	3,	1.29	0.274	-	-
	Customer	3,	2.16	0.073	-	-
	Competitor	3,	8.89	0.000	0.12	0.393 (1 & 4), 0.297 (3 & 4)
	Other Organisation	3,	3.97	0.004	0.06	0.293 (1 & 4), 0.313 (2 & 4)
	Overall	3,	0.32	0.859	-	-

- **Supply Chain Structure:** 1 S-M-R, 2 S-M-W-R, 3 S-M-D-R, 4 S-M-W-D-R.
- **Mean Difference*** - Is significant at the 0.05 level. Numbers in bracket show mean difference between SC Structures.