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INDUSTRY 4.0 - SOCIAL PRODUCT DEVELOPMENT FINDS ITS WAY

SPD finds its way

Social Product Development (SPD) is a new approach to design that represents a “coalescing group of tools and technologies” described as the “tenants of social product development”^[1]. These tenants of SPD include mass collaboration, crowdsourcing, cloud-based design and manufacture (CBDM) and open innovation. By Professor **Dirk Schaefer*** and **Hannah L Forbes***

THE purpose of SPD is to “improve traditional distributed and collaborative design processes” by enhancing “communication and collaboration [...] through social computing techniques”^[2]. The tenants of SPD involve external individuals (e.g. crowdsourcing) or allow the involvement of external individuals (e.g. cloud-based design and manufacture) as an integral member of the design process^[3]. In this article, the need for SPD in industry is first presented before each tenant and its relationship with the term SPD is described. Following this, successful examples of SPD in industry are described and a case is made for an SPD framework to assist further industry adoption of SPD.

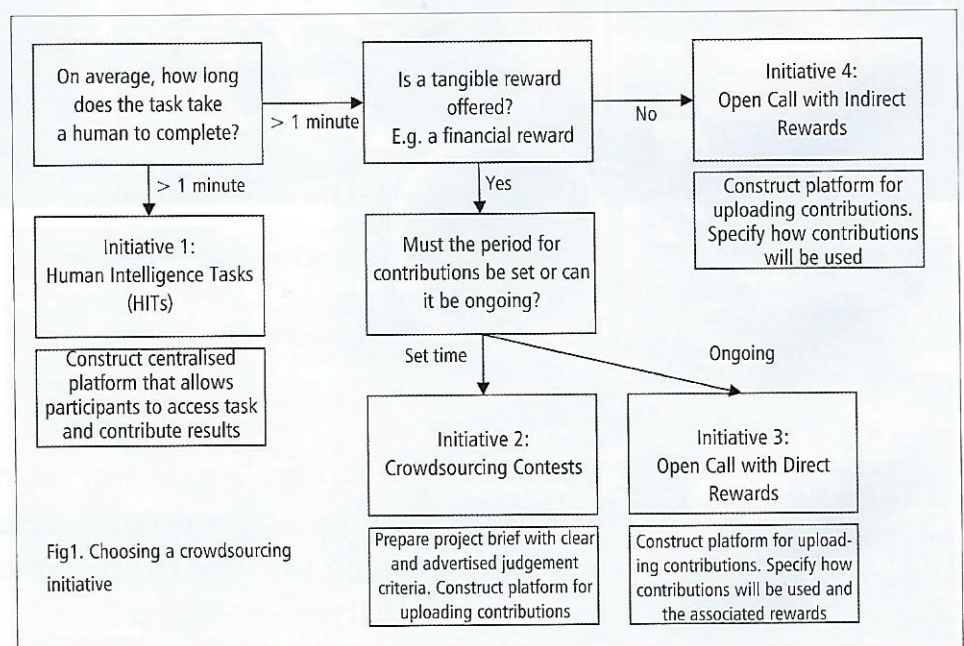
The need for SPD

The need for SPD can be expressed with three key points. First, teams in this current business environment are increasingly dispersed, which in turn creates complex projects that are difficult to manage^[4]. SPD seeks to manage this complexity by “enhancing collaboration and communication”^[2]. As Wu et al. state, “most successful product design teams have high levels of communication and collaboration”^[2] and Chui and Bughin state that a “well connected design network plays a vital role [...] in design phases”

^[5]. The introduction of SPD tenants can, therefore, address this key concern in the current business climate.

Secondly, external input has been proven to benefit design teams and enhance the design problem-solving process. As Abhari et. al. state “essential resources for sustained innovation lie beyond an organisation boundary”^[6] and Bertoni et. al. state that “the development of technologically complex products requires

a wide range of skills, knowledge and expertise which are difficult to find within a single organisation”^[7]. As well as a need for external involvement, there is also proven benefit to looking “beyond the walls” of a single organisation. Thames and Schaefer state that “innovation projects which are largely based on external development have shortened development times and need less investment”^[4]. To support this statement, Huston and Sakkab state that



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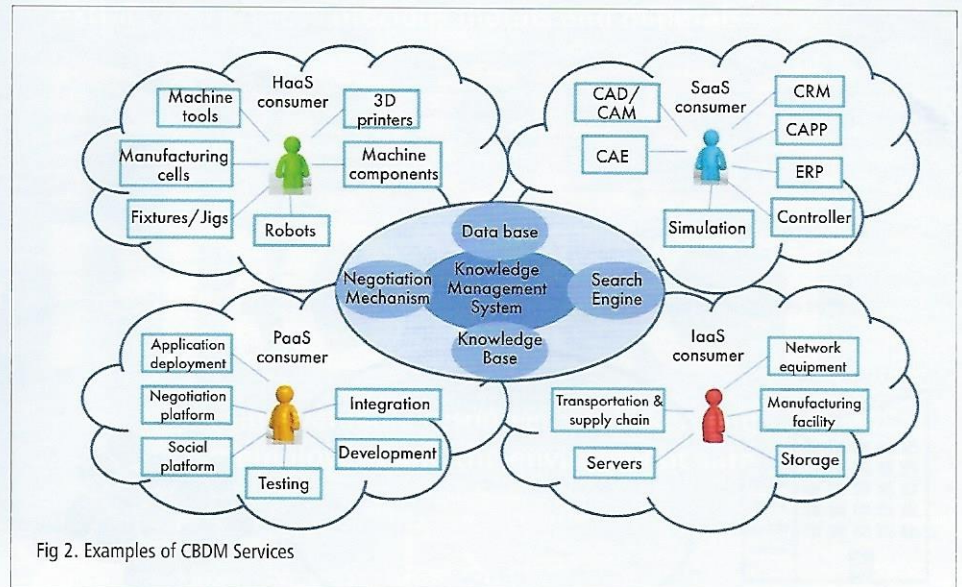


Fig 2. Examples of CBDM Services

since the introduction of an SPD initiative at Procter and Gamble “productivity has increased by almost 60%”^[8]. As described in the previous section, SPD tenants actively involve external individuals in the design process and, as a consequence, offer significant advantage to those who incorporate them.

Finally, in the current business climate competitive advantage by incremental improvement alone is no longer possible^[9]. Organisations must look for new ways to innovate to increase market share and satisfy “increasingly sophisticated customer needs”^[10]. Social Product Development is a “fundamentally new approach to innovation”^[8] that offers a route to competitive advantage for organisations. Procter and Gamble’s SPD initiative, Connect and Develop, resulted in “billions of dollars of revenue” and “35% of the company’s innovations” are credited to the initiative. SPD is, therefore, an important approach for thriving in the current business climate. In the following sections, the key tenants of SPD are outlined in more detail.

Mass collaboration: A form of SPD

Mass collaboration is defined as a “form of collective action that occurs when large numbers of people work independently on a single project, often modular in its nature”^[11].

“Any endeavour where large amounts of people come together to solve a problem or contribute to product development would be deemed Social Product Development”^[11]. Therefore, mass collaboration is a form of SPD. It should be understood, however,

that not all SPD involves mass collaboration^[11].

The application of mass collaboration in industry varies according to the project. There are, however, several principles of mass collaboration that promote effective application. These are ensuring access to the development process, defining the task concisely to all participators and setting up clear channels for communication. When planning a mass collaboration project, these three principles should first be considered. Aspects of the individual project that influence how effective collaboration can take place, should then be considered.

Crowdsourcing and CBDM: The tools of SPD

Unlike mass collaboration, other tenants of SPD are not necessarily integrated throughout the entire product development process. Crowdsourcing and cloud-based design and manufacture (CBDM) are applied as tools as part of SPD. As a consequence, the entire product development process does not need to be organised to include these tenants, they can instead be employed, when needed, during relevant design phases.

Crowdsourcing is defined as “the act of taking a job, traditionally performed by a designated agent [. . .] and outsourcing it to a [. . .] large group of people”^[3]. One of the most famous examples of crowdsourcing is Procter and Gamble’s “Connect and Develop” which allows the organisation to “partner with the world’s most innovative minds” by encouraging the crowd to submit product ideas and suggestions^[12]. The different forms of

crowdsourcing, or crowdsourcing initiatives, have been defined by Panchal^[13] and are summarised in **Table 1**.

To apply crowdsourcing as part of a product development process, one of the initiatives outlined above should be selected based on various characteristics of the task in hand. **Fig. 1** illustrates this.

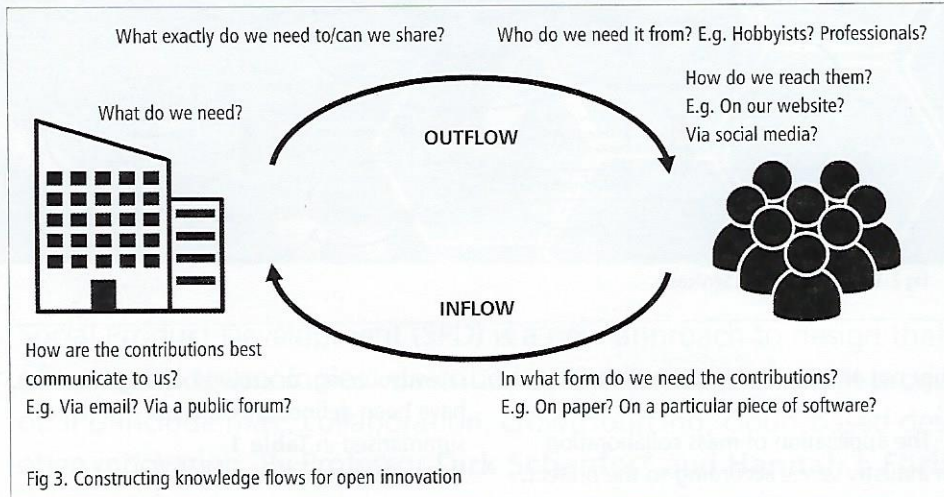
Cloud-based design and manufacture (CBDM) is “a service-oriented networked product development model in which service consumers are enabled to configure, select, and utilise customised product realisation resources and services ranging from computer-aided engineering (CAE) software to reconfigurable manufacturing systems”^[2]. The term, therefore, summarises the online software available to support organisations throughout the product development process. **Fig. 2** shows some examples of CBDM services^[14].

Open Innovation: The culture and organisational mindset for SPD

The next tenant of SPD is open innovation. Open innovation is defined by Trott et al.^[15] as a term “used to promote an information age mindset towards innovation”. This mindset encourages the sharing of data and knowledge with those external to the organisation. Open innovation can be described, in relation to SPD, as an environment or climate that allows SPD to be fostered. As a model, open innovation is “the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation”^[16]. A simplified example of the process of constructing these knowledge flows is shown in **Fig. 3**.

Crowdsourcing Initiative	Definition
Crowdsourcing contests	A contest designer poses challenge problems for the crowd. Judgement criteria and prizes available are clearly advertised E.g. Gold Corp
Open calls with direct rewards	Tasks in this class are broader. Judgement criteria not clearly advertised. E.g. Quirky
Open calls with indirect benefits	Contributors benefit indirectly from the company's implementation of the ideas in their products E.g. Connect & Develop by P&G
Micro-tasks or Human Intelligence Tasks (HITS)	Easy for humans to accomplish but difficult to automate. E.g. Amazon Mechanical Turk

Table 1. Crowdsourcing initiatives



In order to foster open innovation, an organisation must first replicate the mindset of open innovation and then implement the model of open innovation by constructing the required knowledge flows.

Examples of SPD in industry

A desire to increase the adoption of SPD in industry is fuelled by examples of its successful use. The first example is DARPA's Adaptive Vehicle Make (AVM) which is an online collaboration website used to bring participants together to find solutions to a given design challenge [17]. In addition to the online community, DARPA shared a comprehensive database to ensure contributors understood how the structural components of the system interacted with each other [18]. This initiative represented many aspects of SPD. Firstly, at its core, it is a crowdsourcing contest, with participants contributing ideas to meet a design brief. In addition, however, it is CBDM with the online collaboration tool including CAD/CAM environments. Finally, the database represents the set-up of a knowledge outflow, a component of the open innovation model. As a result of this DARPA initiative, \$1 million was awarded to a design team for the creation of an "innovative marine tank drive train" that significantly improved the efficiency of the movement of the tank [19].

Airbus has also begun embracing elements of SPD with the introduction

of their aviation open data platform, Skywise [20]. It is a crowdsourcing and open innovation initiative that inputs data from many organisations in the aviation industry. By both collecting and sharing vast amounts of data from their industry, Airbus is able to provide new insights to improve operational efficiency, operational reliability and root-cause analyses of in-service issues to current and new players in the aviation industry [20].

The data is crowdsourced and in order to provide insights and collect data, knowledge inflows and outflows have been constructed. While Skywise is a relatively recent SPD initiative, it is already providing "exciting results for early adopters" [20].

Another example of SPD in industry is the crowdsourcing process involved in the development of the Boeing 787. Boeing opened up the development of the Dreamliner to engineers from 100 different companies, including materials and manufacturing suppliers [21]. While this can be described as a relatively "controlled and low risk" form of crowdsourcing, it was a significant move from Boeing who in previous projects had a stringent and "tight" control on an internal design process [21] [22]. The success of this initiative was significant with 35% of the design supplied by external contributors, reducing the development process by one year. An external Japanese company even had a big hand in designing the coveted wings [22].

Conclusions and future work

SPD is an overarching term for a group of coalescing tools and technologies including crowdsourcing, CBDM, mass collaboration and open innovation. In this article, each tenant has been described in further detail and its relationship with SPD can be understood in more detail. The need for SPD is clear with SPD offering a way to advantage in the current competitive business environment. The benefit of SPD has also been proven by successful examples such as DARPA's AVM initiative, Airbus' Skywise initiative and the crowdsourced development of the Boeing 787.

Despite these exciting examples, the adoption of SPD is still very limited. In the Division of Industrial Design at The University of Liverpool we have collected evidence that demonstrates a great need for an SPD framework to encourage SPD adoption in industry. While the benefit of SPD is now recognised, "architectures, frameworks and models designed to tackle the associated complex management challenges need to be introduced and investigated" [4]. Requests for further information on SPD and how to implement it in industry may be addressed to the authors. ■

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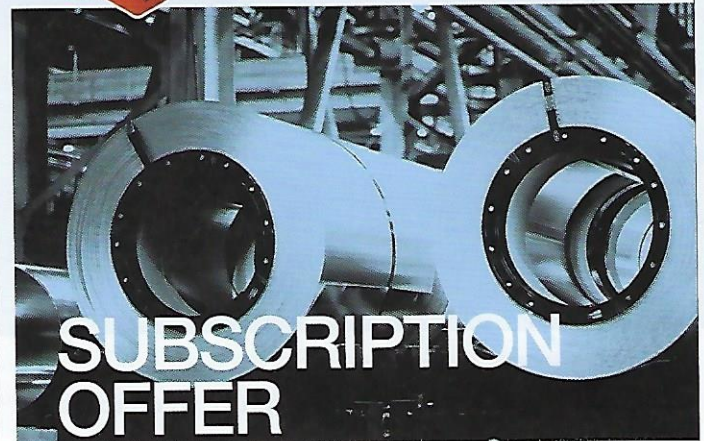
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