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## Identifying typologies of user-innovators in the co-creation of high-technology product innovation

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### Abstract

Since 1990s, customer competence has been recognised as a key source of co-creation in new product development (NPD). In high-technology product innovation, this concept is more pivotal since firms cannot achieve fast and successful innovation without collaboration and network. However, how to identify the right customers for collaborative product innovation in high-technology industry context is an unresolved question in both marketing theory and practice. This remaining question may stem from a lack of consensus in how extant research defined the two key considerations in co-creation activities, named as ‘innovation typologies’ and ‘degree of co-creation’. To address the gap and further develop the traditional concepts in NPD, this research is aimed to gain an insight of customers’ behaviour in high-technology industry context. Within the scope of research, this paper will employ ‘user-innovator’ as the main body of knowledge to develop study on their behaviours and competence in various stages of NPD process. Participant observation and in-depth interview techniques will be conducted amongst participants in Robotics project run by researchers in the University of Birmingham and a co-creation process run by IBM. The study is expected to identify clusters of user-innovators from a holistic view, understand their competence in co-creation and gain a broader perspective in approaching innovation attempts. In addition to its originality in literature of co-creation and consumer behaviour, this study will bring valuable contributions in assisting firms to achieve a higher degree of co-creation with customers, including a generation of tacit knowledge which is widely known to be difficult to transform in high-technology context.

### Key words

Customer co-creation, user-innovator, high-technology product innovation, innovation typologies, degree of co-creation.

## 1. Introduction

Having rendered significant interest from both academics and practitioners since 1950s (Crawford & Benedetto, 2011), new product development (NPD) is strengthening its role as an important field of research in marketing. Two decades later, a phenomenon in NPD called “customer co-creation” (OHern & Rindfleisch, 2010) has become a fast growing perception amongst marketers. In high-tech industrial markets, customer co-creation is even more crucial as firms must rely on external relationships and networks to develop better and faster innovations (Castro, 2015). Extant research has recognised a primary role of customers in 70% chemical processes and process equipment development in chemical industry, 82% major functional improvements in scientific instruments, and 100% first type used commercially in semiconductor or electronic process equipment (von Hippel et al., 1999: 4). However, how to involve the ‘right’ users at the ‘right’ stage to enhance their co-creation competence still remains a question in both academia and practice (Schweitzer & Rau, 2014; Bosch-Sijtsema & Bosch, 2014). Although numerous studies on customer and their degree of co-creation in NPD process have been conducted, they are lack of consistence in criteria and factor attributes. In high-technology product innovation literature, researchers seem to have insufficient investigation into this topic. Therefore, this study will report upon the first investigation into customer typologies in co-creation in high-technology product development, from which their competence in innovation process can be significantly leveraged.

The researcher will employ an emerging concept called ‘user-innovators’ (Stock et al., 2014) as the main body of knowledge to gain insights of a specific group of customers with innate ability in innovating for self-purpose. By examining their behaviours in contributing inputs in an NPD process, the study is expected to propose a conceptual framework that explains which typologies of user-innovators can be suitable for a complete innovation process. Qualitative study will be conducted to tackle the research problem. This study will adapt participant observation as the key methodological approach, complemented by in-depth interview to generate rich content and gain thick description of the situation. With a focus on industries with high global technological intensity, this study is expected to offer valuable findings for both academicians and practitioners.

## 2. Literature on co-creation in NPD and user-innovators

The original concept of co-creation refers to co-design, co-develop, and co-produce the goods and services (Weber, 2011). Recently, ‘co-creation’ has been even used specifically for customers co-creating value in the NPD process (van Daelen, 2005). As an aspect of customer-knowledge competence, customer co-creation concerns with an understanding of how to elicit and leverage knowledge from customers (Kupiec & Leeming, 2007) and expects them to be active contributors with knowledge and skills rather than passive respondents who give basic review of their purchased products (Witell et al., 2011). Since recent research indicates that customers/ users play an important role in the development of consumer product innovations (Lüthje, 2000; Shah, 2000), ‘customer co-creation’ has received growing attention as a critical source for open innovation of a firm. It should be recognised for both knowledge intensity and scope. In high-tech industrial markets, customer co-creation is even more crucial as firms must ‘rely on external relationships and networks...[to] develop better and faster innovations’ (Castro, 2015).

Importantly, the way customers are classified for co-creation activities relies heavily on ‘innovation typologies’ and ‘degree of co-creation’. However, extant literature has little consensus in approaching these concepts (Crawford & Benedetto, 2011; Bogers et al., 2010).

Innovation can be defined broadly, from technological breakthrough to a simple new way to do things (Lee et al., 2012:818). Whilst some researchers employed the newness of product or technological disruption as criteria to distinguish innovation typologies, such as radical, incremental, or really new innovation (Garcia & Calantone, 2011, Goldenberg et al., 1999); Cooper & de Brentani, 1991), others may view it from various innovation attempts, from 'commercially attractive innovation', 'positive societal impact' to 'technology dependency' (Schweitzer et al., 2014). Similarly, the degree of customer co-creation in an NPD process is also loosely defined in terms of scope and intensity (Hoyer et al., 2010). Regarding scope of co-creation, previous studies on NPD models proposed that a process might contain seven stages (Booz et al., 1982), five, four, or three stages (Crawford & Benedetto, 2011). To introduce the potential of customer co-creation in NPD, Hoyer et al. (2010) presented their holistic view by suggesting an innovation process with four stages, namely 'idea generation (ideation)', 'product development', 'commercialisation', and 'post-launch'. In other studies relating to high-technology product innovation, researchers also shared the same mindset with Hoyer et al. but further emphasise the importance of concept testing phase (Schoormans et al., 1995), also known as 'evaluations of new product concept' (de Bont & Schoormans, 1995). In terms of intensity, researchers highlighted that firms achieve their highest level in their scope of collaboration with customers once they allow their customers to get involved in these all stages (Hoyer et al., 2010).

In accordance with the above discussion, extant literature has provided multitude ways to categorise customers in co-creation. The first and, possibly, the most dominant concept of customer in open-innovation is 'lead-user theory' (Piller et al., 2011), through which users are defined by their needs and high benefit related to innovation (von Hippel, 1986). However, recent studies have raised concern that this group is only suitable for commercially attractive innovation (Bosch-Sijtsema & Bosch, 2014). Moreover, their intensity of co-creation is recognised in the last two stages of the process, namely evaluation and commercialisation (Belz & Baumbach, 2010; Morrison et al., 2003; von Hippel, 1986) whilst co-creation should be understood in a more active approach which allows users to create solution together, even from the first stage (Piller et al., 2011: 9). The next concept is 'users with domain specific knowledge', which is widely known in developing tech-based products (Schweitzer et al., 2014; Hoffman et al., 2010; Schoormans et al., 1995). Since early 1990s, consumers with a certain level of product expertise have received good reputation from researchers in concept testing stage (de Bont & Schoorman, 1995) and ideation stage (Schweitzer et al., 2014; Hoyer et al., 2010). Some researchers even strongly recommended that 'only respondents with high product-category expertise should be used for concept tests of major innovations' (Schoormans et al., 1995). Importantly, studies on users with domain specific knowledge see them as heterogeneous groups of people, including 'high trend awareness', 'high technical skills', 'high technical innovativeness', and 'high ethical reflectiveness' (Schweitzer et al., 2014:155). However, this approach does not cover all stages in a full NPD process. Recently, researchers have focused their attention on a more holistic approach called 'user-innovators', which treats customers as heterogeneous groups and examine their competence in all innovation stages (Stock et al., 2014; Bogers et al., 2010; Franke & Shah, 2003). Distinguished from user purchasers - who are the first to move in innovation adoption (and are also called as lead-users), user innovators are the first groups of users to innovate for self-purpose, 'design for use, and test for use' (Baldwin et al., 2006). User-innovators are also portrayed in many papers as users who can innovate themselves (Bogers et al., 2010) and develop their own innovations for their own use or to help others (Stock et al., 2014). Stock et al. (2014) have further developed this concept by looking at the association between their personality traits and their co-creation potential in collaborative

NPD. More specifically, by employing the Big Five Traits, namely ‘Openness to experience’, ‘Extraversion’, ‘Conscientiousness’, ‘Agreeableness’, and ‘Neuroticism’, they presented a positive relation between the user-innovators’ traits and their successful completion in various NPD stages (Stock et al., 2014; Costa & McCrae’s, 1992). However, extant literature is calling for a more holistic study with greater nuance in traits and application since personality traits should not be the only attribute that helps to explain the competence of these groups in co-creation activities.

Whilst practice has seen customer co-creation as a phenomenon that should be further developed, academia has not clearly explained its nature to enhance the collaborative activities between firms and their customers. Despite a number of studies on customers, findings of their typologies and competence in relevant innovation stage is yet conclusive. Furthermore, it is important to address the gap in this research field in high-technology innovation context. Whilst knowledge in high-technology context may be more tacit and sticky to transfer from users to producers (Bosch-Sijtsema & Bosch, 2014) and expertise knowledge of customers has been considered a dominant attribute (Schweitzer et al., 2014; Schoormans et al., 1995), the number of research in this industry is relatively modest and lack of a holistic approach. In coherence with the above discussion, this study suggests that a construction of multi factor attributes should be conducted classify customers in co-creation of high-technology innovation. This study will hence employ ‘user-innovator’ (Stock et al., 2014) as the main body of knowledge since its findings offered both intensity and relevance of outcomes. Within this research, the user-innovators will be studied during an NPD process with four stages namely: idea generation, concept testing, product development testing, and commercialisation. A qualitative approach will be employed in this study to allow generating exploratory findings in terms of user-innovators’ behaviours, the diversity in innovation attempts brought by different typologies of user-innovators, and the degree of co-creation of each user-innovator typology.

### **3. Research questions**

This research is aimed to understand user-innovators’ behaviours in co-creation of high-technology innovation to enhance the collaborative activities between firms and their customers. Accordingly, this research problem can be broken down into three sub-questions:

- What are the typologies of user-innovators in co-creation NPD?
- How each typology of user-innovator fits in each innovation stage?
- Which type(s) of innovation is each typology of user-innovator expected to contribute the most?

### **4. Research plan**

Study on behaviours should be an investigation of everyday social life in situ (Prager, 2012; Atkinson & Pugsley, 2005). To serve this methodological commitment, I will choose participant observation as the key research technique in this study (DiCicco-Bloom & Crabtree, 2006; Atkinson & Hammersley, 1994), complemented by an in-depth interview to gain insightful knowledge of the subject and the situation (Silverman, 2004; Robson, 2002).

Whilst designing the study into two phases, participant observation will take place first since it has two-fold benefits. By engaging into the same environment with participants and actually ‘performs social acts’ (Atkinson & Pugsley, 2005:231), the researcher will not only collect data but also build rapport with the respondents, which is strictly important in conducting in-depth interview (Lewis, & Ritchie, 2003). Data analysis will be run simultaneously during the NPD process whilst further analysis will be conducted once the researcher completes the data collection.

In the first phase, data collection process will be divided into three steps: screening, co-creation participation, and evaluation. First, I will recruit eligible participants, who are user-innovators, by requesting all participants to provide description of any innovation or product modification that they have done in the last three years. The anticipated number of eligible participants is around 20 for both projects. Also, in this phase, user-innovators will also be invited to complete a test to identify their personality traits, which is available on many online platforms such as [www.psychologytoday.com](http://www.psychologytoday.com). When they join the innovation process, their activities, behaviours, communication and any issues occurring during their participation will be recorded. In the last step, I will evaluate and analyse the behaviours of participants and get the results explicated by the experts.

In the second phase, data from the first phase will be examined by answers generated from an in-depth interview with respondents drawn from the same cohort. Each eligible participant will be asked to share their experience and their stories whilst co-creating in the NPD process. They are expected to describe the process, any issues, expectation and their feelings whilst taking part in the co-creation activities. They will also be profiled in terms of personality trait(s), level of education, occupation, expertise, experience, their decision-making process in buying a new innovation, and how they innovate something for themselves or conduct any activities related to innovation. Questions in this phase will be open-ended and semi-structured to allow a level of flexibility and comfort for participants in the interview. However, the theme of interview questions will be based on questions about factor attributes in research on personality traits of user-innovators, users with domain specific knowledge, and lead user theory.

Regarding the sampling, participants from two co-creation projects will be recruited. The first group will be participants involved in a co-creation project held by IBM. Well-known for its customer-centric mind-set and strategy (Chesbrough & Crowther, 2006; Prahalad & Ramaswamy, 2002), IBM is one of the market leaders in high-technology industries that has achieved much success from customer co-creation activities (Chan & Putsis, 2015; Gawer et al., 2012; Aaker, 2012). The second group will be participants recruited to join a Robotics development project run by researchers in University of Birmingham. Robotics is known as one of the fast moving high-technology innovation industries (Mohr et al., 2009; Jolly et al., 1992; Pavitt, 1990) and is also open to different innovation attempts such as ‘user-friendly’, ‘friendly patrolling’ (Shiomi et al., 2014; Lourens & Barakova, 2011) or ‘anthropomorphic innovation’ (Shea, 2014).

## 5. Expected findings

This study is expected to highlight the importance of understanding typologies of user-innovators and systematically explain their heterogeneous competence in co-creation of high-technology product innovation. The key finding of this research is the clusters of user-innovators constructed from a holistic view including personality traits, creativity, expertise and knowledge, and diffusion ability. Furthermore, by participating with observation and established participant role in the innovation process, the researcher will be able to examine the difference in the degree of co-creation of various clusters of user-innovators. This finding may serve different purposes. First, the study may provide in details the co-creation activities that customers can do in NPD process within high-technology context. Second, it can suggest relevant user-innovator group(s) for each innovation stage, which can be found in the hypothetical perceptual map in Appendix 1. Moreover, the researcher also expects to see how different user-innovator typologies will be differently predisposed to produce ideas for distinct innovation attempts, for example: user-friendly, commercially attractive, or technology feasible innovation idea. From my expectation, a particular type of user-innovator

may contribute ideas for one or many types of innovation. This expected finding is demonstrated by a conceptual framework in Appendix 2.

By conducting qualitative techniques, this study also offers other exploratory findings. The in-depth interview will evoke participants to discuss about both and challenges they have during innovation process, from which their expectation about basic and advanced assistance can be identified and explained in details. At this preliminary stage, the researcher may think that customers can suggest toolkit or communication platform to assist them in generating better ideas or help them transfer their tacit knowledge to the producers.

## **6. Contribution**

By responding to the question of how to enhance the collaborative activities between firms and their customers based on user-innovator typologies, this study is expected to provide some significant contributions into NPD literature. First, it is the first study examining customer behaviours in co-creation from a holistic approach. By employing different constructs of personal attributes, this study will provide insightful knowledge of customers' diversity in terms of personality traits, skills, and knowledge in a collaborative NPD context. Also, the findings of the research will provide taxonomy of customer co-creation phenomena in the context of high-technology product innovation, which extant literature has yet investigated in. It also may confirm or challenge the existing perception that only customers with expert knowledge can be helpful in high-technology innovation (Schweitzer et al., 2014; Hoyer et al., 2010; de Bont & Schoorman, 1995). In addition, this research also tackles the problem of transferring sticky knowledge in high-technology industry by offering methods and exploring possibilities to help firms obtain tacit knowledge from external sources. Understanding diversity of customers' clusters and how they prefer to be communicated with is also helpful in leveraging their co-creation competence and evaluating their performance. Moreover, by moving away from traditional approach to innovation identification, this study offers a pivotal contribution whilst looking at innovation attempts from a broader perspective. Provisionally, they may include: the customer-centric focus, high technical skills, or high technical innovativeness, which are the core domain in developing products with technical feasibility and of greater originality (Schweitzer et al., 2014; Grimpe & Sofka, 2009; Bilgram et al., 2008).

Not only beneficial for academicians, the research may offer a convenient tool for practitioners in understanding and interacting with their customers in co-creation innovation. The findings may act as a blueprint for firms in recruiting, engaging, guiding, interacting and tracking their user-innovators' performance. From the finding of activities in NPD process, practitioners may also transmit it into a tracking list of co-creation activities (Appendix 6) or a 'user-innovator scorecard' to evaluate the performance of individuals in each NPD stage for either better adjustment or judgement. Importantly, by recognising distinct groups of user-innovators at the early stage, the firm can strategically recruit, allocate, and manage them in accordance with innovation purpose. Thereby, the cost and risk of collaborative innovation will be controlled more effectively in this regard.

## **7. Conclusion, limitations and future research**

"Creativity is thinking up new things. Innovation is doing new things" (Theodore Levitt). With the contribution in product innovation literature about customer co-creation, the study is providing tools and blueprint for firms to engage and equip their customers to transfer their creative ideas and tacit knowledge into an assessable outcome. Business organisations, therefore, are able to generate innovation idea from their customers and provide better guidance to enhance customers' collaboration in their NPD process. This means that

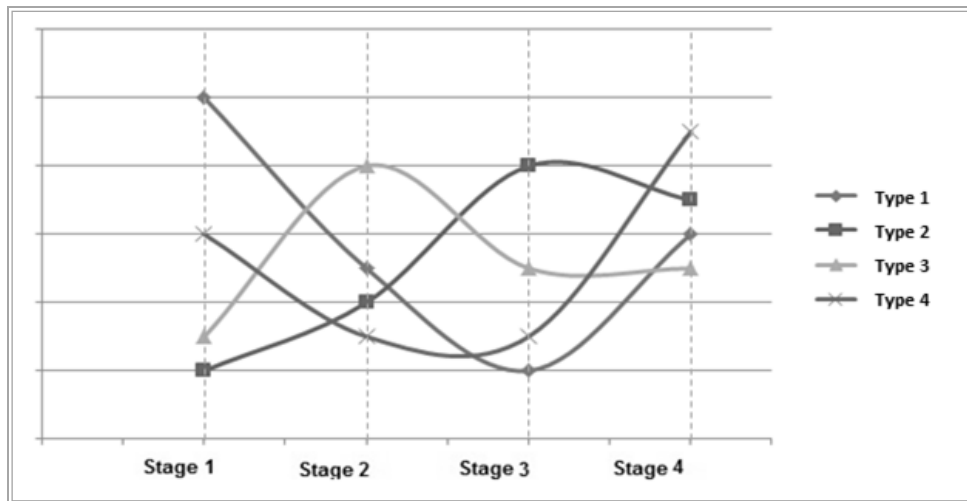
understanding of user-innovator typologies can suggest firms and researchers in approaching their customers more effectively, from an early stage of identification, to recruitment, interaction, engage, motivate, track, and evaluate their performance in collaborative innovation.

Since this study is still in its infancy, it may have certain limit in research plan. First, the participant observation technique may get questioned of its subjective approach as with any piece of research (Madison, 2011; Huspek, 1994). Furthermore, the findings may be influenced by my background and experience as a product developer for years. However, I would propose that experience should be considered as an advantage rather than a drawback since it allows me to immerse into the field quickly and more effectively. In addition, the outcome will not be affected by my own standpoint as the findings will be reviewed by experts in the field (the Robotics project leader and IBM representatives). In the future, when I can a better network to recruit a larger sample of participants, I will complement this qualitative study with a cross-sectional study (or repeated cross-sectional study) for triangulation purpose (Mason, 2006; Bechhofer & Paterson, 2000; Brannen, 1992) to strengthen my proposal of the conceptual framework and the perceptual map.

It is important to recognise that the challenge in research implementation should be outweighed by the contribution and the direction of future research. Besides significant contribution which has been presented above, engaging customers in a real NPD process may provoke new concept in innovation. Possibly, this study may open a propensity towards experiential innovation. If focusing on personal development, the findings of user-innovator behaviours may even suggest a new research angle on 'individual innovative ability' to help people discover their innate ability and characteristics to gain confidence in innovating new things and developing their creative potential in different stratifications.

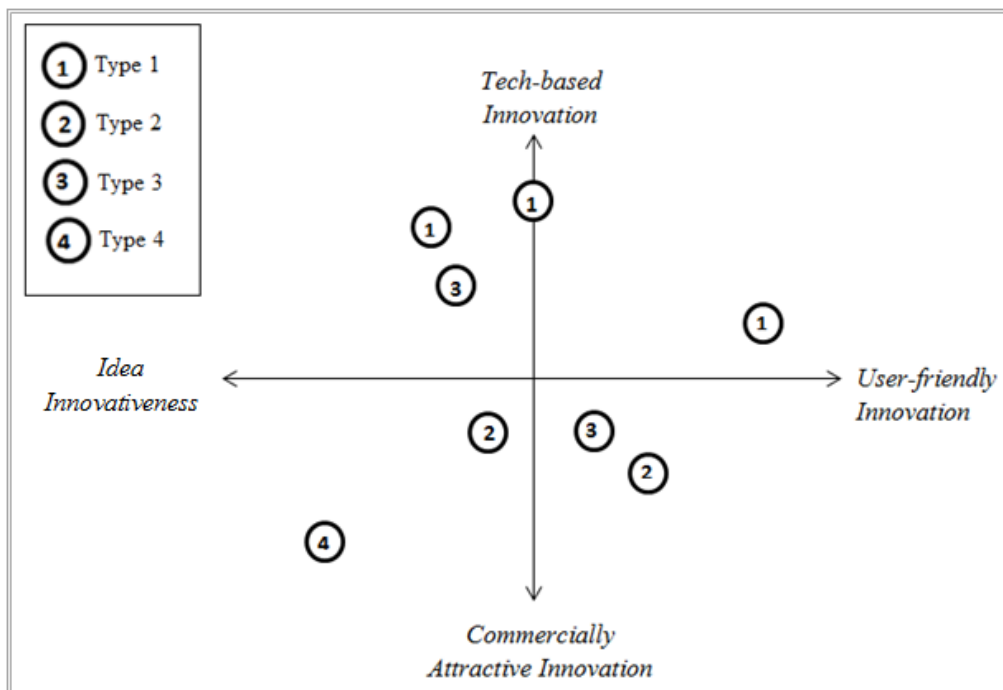
## Appendix

**Appendix 1:** Hypothetical perceptual map of user-innovators' involvement in different NPD stages



Source: The authors (2015)

**Appendix 2:** Conceptual framework of competence of different user-innovator types



Source: The authors (2015) and adapted from Schweitzer et al. (2014); Lettl et al. (2006); Schoormans (1995)



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