

## Conference Paper

# Business Innovation and Service Innovation: Perspective on Product Design Engineering in Term of User Experience (UX)

Khristian Edi Nugroho Soebandrija

Industrial Engineering Department, Faculty of Engineering, Program of Doctor of Research in Management (DRM). Bina Nusantara University, Jl. K H. Syahdan No. 9, Kemanggisan – Palmerah, Jakarta, Indonesia 11480

## Abstract

Business innovation is one of the factors driving a company for providing values for stakeholders toward sustainable competitive advantages. The mentioned values *vis-à-vis* not merely internal stakeholders, but also external stakeholders. Subsequently, this paper elaborates grand theory within stakeholders theory. The mentioned sustainable competitive advantages are achieved through the disruptive innovation that revamps the constellation of sustainable competitive advantages. The disruptive innovation is implemented and intertwined through industry 4.0 that covers trilogy of physical, digital, and biology. Subsequently, the mentioned implementation is geared toward benefits of Making Indonesia 4.0 through Indonesia local wisdom and setting. Precisely, it further elaborates the Product Design Engineering (PDE). This PDE discipline incorporates the concept of its evolutionary theories from cognitive psychology; human factors in product design; kansei engineering; emotional design; affective engineering; and user experience design

**Keywords:** Affective engineering; cognitive psychology; disruptive innovation; kansei engineering; user empathy

Corresponding Author:

Khristian Edi Nugroho  
Soebandrija  
Knugroho@binus.edu  
Khristian.DRM@gmail.com

Received: 16 February 2020

Accepted: 5 March 2020

Published: 10 March 2020

Publishing services provided by  
Knowledge E

© Khristian Edi Nugroho  
Soebandrija. This article is  
distributed under the terms of  
the [Creative Commons  
Attribution License](#), which  
permits unrestricted use and  
redistribution provided that the  
original author and source are  
credited.

Selection and Peer-review under  
the responsibility of the ICLBI  
(2018) Conference Committee.

## 1. Introduction

This paper provides grand theory on service innovation. This grand theory was originally initially by Schumpeter through his innovation theory [1, 2]. This service innovation theory is intertwined with the theory of capability-rigidity paradox theory [3, 4]. In this paper, business innovation constitutes a trigger point for service innovation in order to create product and service that relate to product design engineering [5].

In this paper, the grand theory on service innovation elaborates subsequently the perspectives of product design engineering, *vis-à-vis* both theoretical and empirical perspectives of business innovation, industry 4.0 and Making Indonesia 4.0. This paper elaborates the service innovation that is beneficial for managerial implementation and

 OPEN ACCESS

its implication in product design engineering. Precisely, product design engineering from concept of user experience, known as UX.

## 2. Problem statement

Problem statement in this paper refers to how tackle the managerial implementation of service innovation within the product design engineering perspective, from the concept of user experience, known as UX. Previously UX by perception has been associated with software development. Conversely, in Product Design Engineering (PDE) program; this perception is elaborated in innovated spectrum. The mentioned spectrum is intended to trigger leaping process for product design engineers the frontier of the new competencies far exceeding classical form-giving, in term of user experience (UX) dimensions.

## 3. Research questions

The principal research questions in this paper comprise two questions. The first question refers to the inquiry toward to what optimal level that the UX has evolved as compared to prior evolution from the arching theory of service innovation relates to other theories as stated in this paper. Subsequently, the second question refers to the inquiry toward to what extent the theoretical aspects in the first question can be implemented evolution of research domains related to the UX of Products, by balancing the industry 4.0. Precisely, this question relates to inquiry on how to harness the industry 4.0 with Making Indonesia 4.0's local wisdom and setting.

## 4. Purpose of the study

The objective of the study is to provide frontier on the theoretical aspect of service innovation that relates to product design engineering, from concept of UX. The mentioned frontier is subsequently explored to provide empirical benefits toward the managerial implementation within product design engineering perspectives, from concept of UX.

## 5. Conceptual models

In line with Schumpeter [2]; define service innovations as technology-based inventions, driven by the emergence of new markets or new service opportunities. Meanwhile,

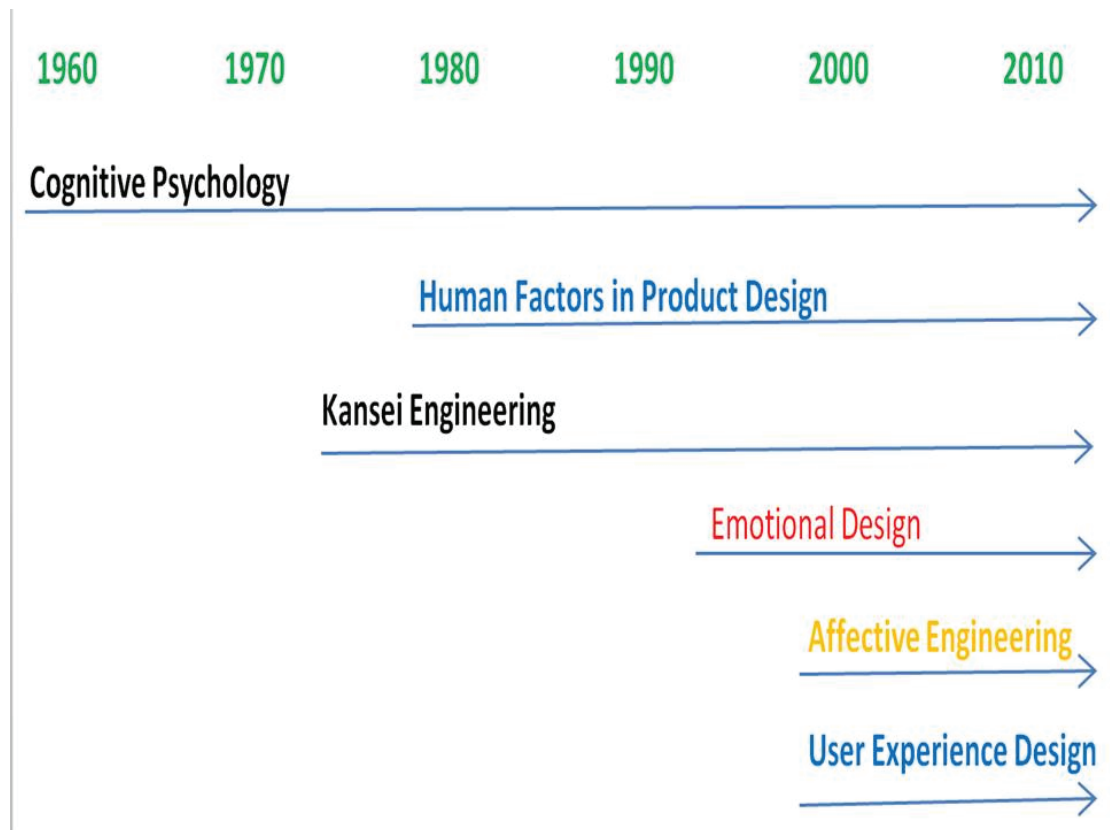
research works of this theory provide a different definition of service innovations as changes in the process of producing lines, improvements in risk assessment, in marketing and in organization [6].

The Bongard-Blanchy and Bouchard indicate user UX dimensions that potentially impact how users' experience products. These dimensions are brought together from theories of cognitive science, models of human-computer interaction and findings from design research [7]. They are presented under four categories: dimensions of human perception, dimensions of products, dimensions of the context of use and the temporal dimension. In the final part, the identified dimensions are connected into a schema, illustrating their interplay and therefore the journey of UX between a user and a product, in a certain context over a certain time.

Figure 1, depicts several evolutions of research domains in product design engineering in term of UX of Products, as the result of scholar works by Bongard-Blanchy and Bouchard [7]. First, researchers in cognitive psychology were the scholar works that embark the human perception of objects [8]. With the creation of early years for personal computers, the domain of human-computer interaction emerged as a vehicle to augment usability of graphical interfaces [9]. Second, in the product design domain, the scholar works of human factors gained significance for the same objective: that of optimizing usability [10, 11]. Third, researchers of "Kansei Engineering" [12] in Asia were the scholar works that initiate and anticipate the emotions, sensations, and semantics conveyed by product design engineering perspectives. Fourth, in the Western world, the start of the new century saw the advent of research into "Emotional Design"; the study of the emotional value of products [13]. Fifth, furthermore researcher of "Affective Engineering" investigate the sensorial experience evoked by materials and textures [14].

Sixth, while UX is still commonly associated with the realm of human-computer interaction, other domains such as product or service design integrates the findings of these various domains under the paradigm of UX design/experience design [15].

Figure 2, illustrates and elaborates schema of the dimension of the user-product experience, as indicated by Bongard-Blanchy and Bouchard [7]. Through this literature review, they have sought to demonstrate how UX results from the interplay of a wide range of concrete (form, colour, semantic, function) and abstract (affective and sensorial quality, semantic quality, aesthetic quality) product dimensions, together with their perception by the target user, the context in which s/he encounters the product and the temporality of the experience. The mentioned Figure 2, is further illustrated in detail in Figure 3 and Figure 4, in term of user and product, respectively.



**Figure 1:** Evolution of research domains related to the UX of products.

Subsequently, in Figure 5, Bongard-Blanchy and Bouchard indicate that nowadays product engineer has challenges to espouse a holistic view of UX *vis-à-vis* conceptual design and design evaluation [7]. That challenges construe, the conceptual design should always aim congruence between identified, and potentially evolving user goals and the product purpose.

## 6. Conclusion

A problem statement in this paper refers to how tackle the managerial implementation of service innovation within the product design engineering perspective, from concept of user experience, known as UX. Thus, this paper has already addressed this problem statement and interpreted it into research questions that have similarly been modeled.

The posed research questions refer to i) optimal level that the UX has evolved as compared to prior evolution from the arching theory of service innovation relates to other theories as stated in this paper; and ii) to what extent the theoretical aspects in the first question can be implemented Evolution of research domains related to the UX of products, by balancing the industry 4.0.

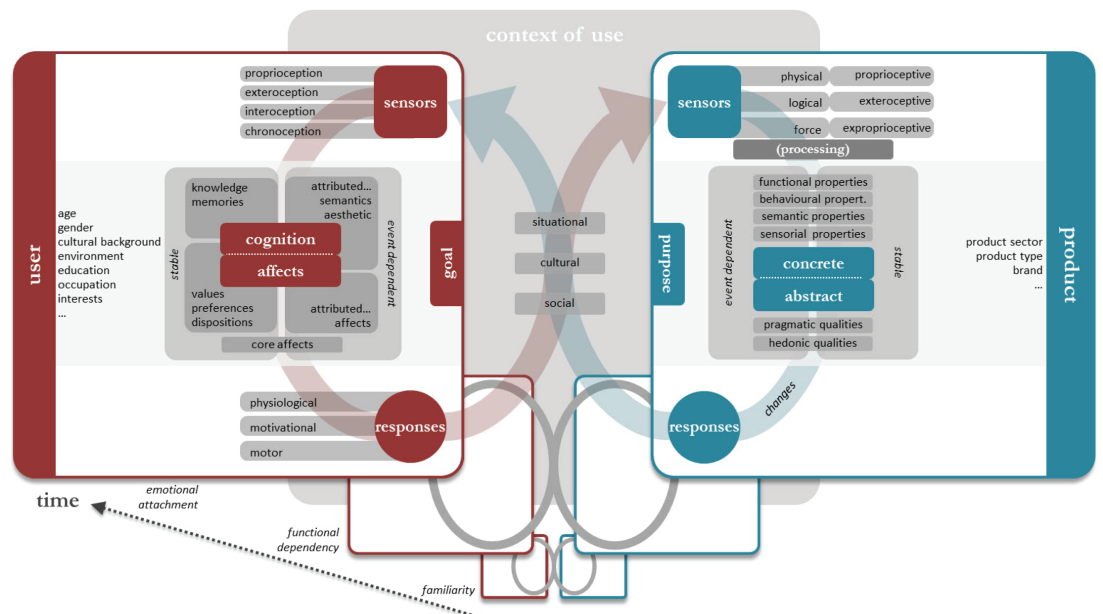


Figure 2: Schema of the dimension of the user-product experience.

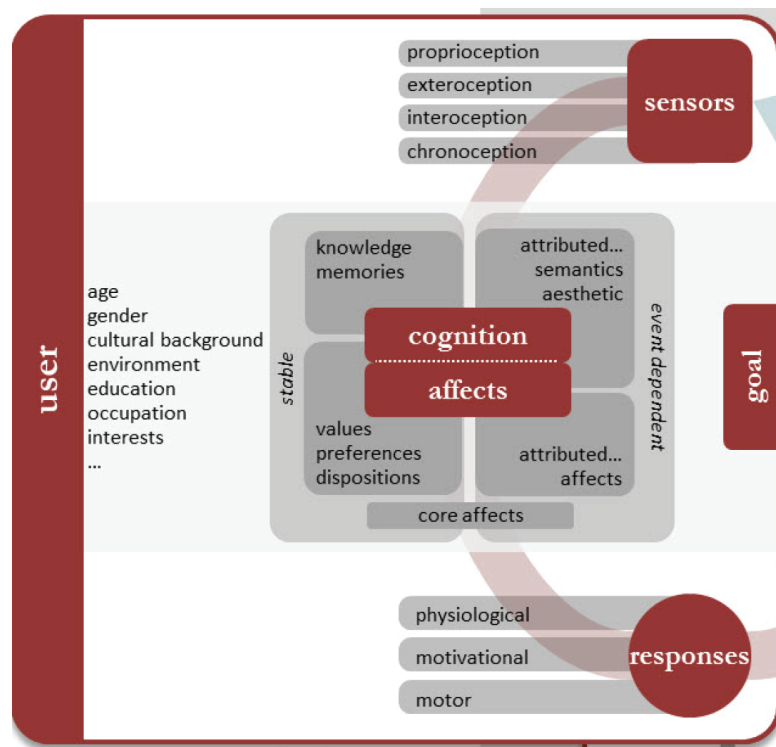


Figure 3: Schema of the dimension of the user experience.

Ultimately, the objective of the study has been achieved. Precisely, this paper has its objective to provide frontier on the theoretical aspect of service innovation that relate to product design engineering, from concept of UX.

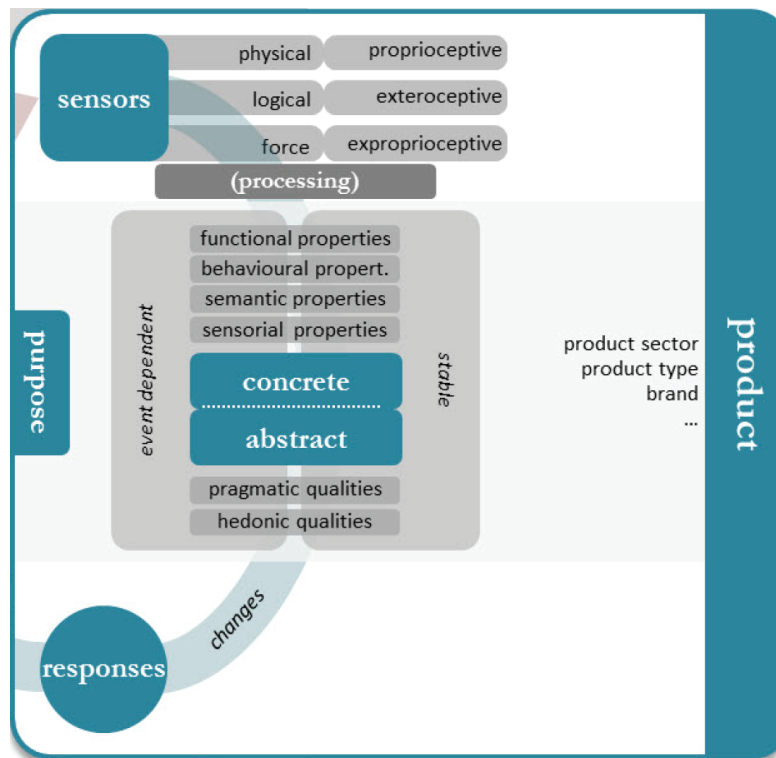


Figure 4: Schema of the dimension of the product experience.

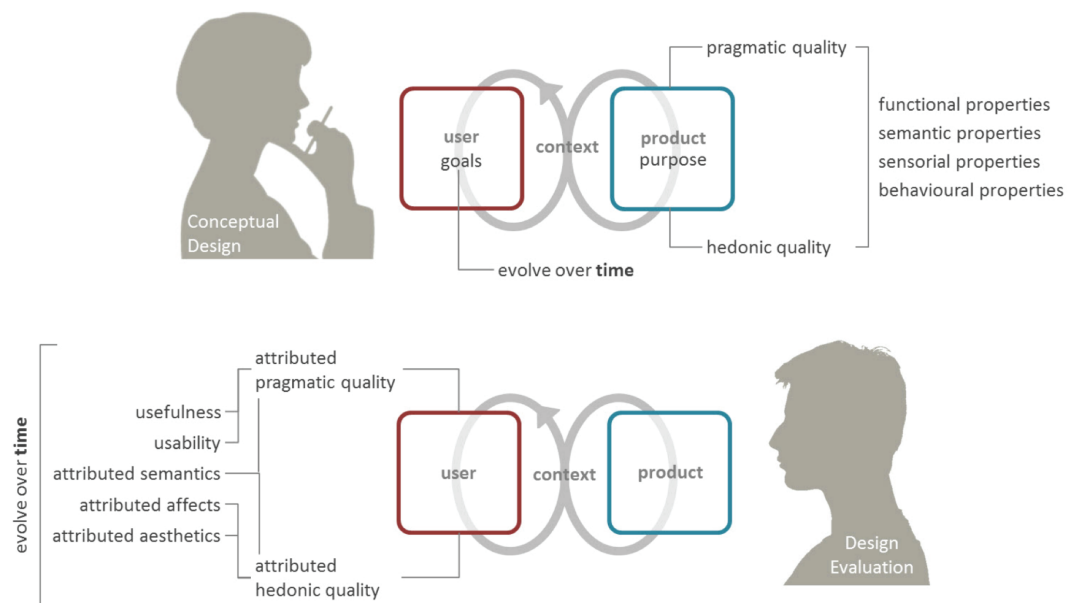


Figure 5: Dimensions of conceptual design (top) and design evaluation (bottom) when designing for UX.

The product design engineer harmonizes function, semantic, sensorial and behavioural properties *vis à vis* hedonic and pragmatic quality. To validate and improve the designed experience, concepts and prototypes should then be recurrently evaluated

through user tests. These evaluations authenticate which pragmatic and hedonic qualities the user really attributes to the designed product.

As conclusion, there are beneficial aspects in term of UX dimensions. Precisely, this perspective is applicable in product design engineering perspectives. In this situation this perspective is elaborated in innovated spectrum. The mentioned spectrum is intended to spectacle product design engineers the frontier of the new competencies far beyond classical form-giving, in term of user experience (UX) dimensions.

## References

- [1] Rong D, Ming X, Limsupanark J. The theoretical study and empirical research process of service innovation: a literature review. *International Business Research*, 2015; 8(1). <http://www.ccsenet.org/journal/index.php/ibr/article/view/38694>
- [2] Schumpeter JA. The theory of economic development. Harvard University Press, Cambridge; 2017. pp. 3--57. <https://books.google.co.id/books?id=GB8xDwAAQBAJ&printsec=frontcover&dq=the+theory+of+economic+development&hl=en&sa=X&ved=0ahUKEwiDIZPk3NrIAhVOXSsKHTHDB4YQ6AEIKTAA#v=onepage&q=the%20theory%20of%20economic%20development&f=false>
- [3] Leonard-Barton D. Core capabilities and core rigidities: a paradox in managing new product development. *Strategic Management Journal* 1992;13(S1):111--125. <https://onlinelibrary.wiley.com/doi/abs/10.1002/smj.4250131009>
- [4] Sok P, O'Cass A. Achieving service quality through service innovation exploration--exploitation: the critical role of employee empowerment and slack resources. *Journal of Service Marketing* 2015; 29(2):137--149. <https://www.emeraldinsight.com/doi/abs/10.1108/JSM-03-2014-0085>
- [5] Gustafsson A, Kristensson P, Schirr GR, Witell L. Service innovation. Business Expert Press, New York; 2016. pp. 150--169
- [6] Lee YD, Chen SH, Kuo JH. Exploring the intellectual structure of organizational learning studies. *European Journal of Research and Reflection in Management Sciences*, 2014; 2(2):76--83. [http://tweb.cjcu.edu.tw/journal\\_abstract/2015\\_01\\_15\\_04\\_48\\_52\\_976.pdf](http://tweb.cjcu.edu.tw/journal_abstract/2015_01_15_04_48_52_976.pdf).
- [7] Bongard-Blanchy K, Bouchard C. Dimensions of user experience - from the product design perspective. *Journal d'Interaction Personne-Système, Association Francophone d'Interaction Homme- Machine (AFIHM)*, 2014, 3 (1), <https://www.>

- researchgate.net/publication/278828656\_Dimensions\_of\_User\_Experience\_-\_from\_the\_Product\_Design\_Perspective
- [8] Choi MW. A study on the application of user experience to ICT-based advertising. *International Journal of Pure and Applied Mathematics*, 2018; 120 (6). <https://acadpubl.eu/hub/2018-120-6/issue4.html>
- [9] Pikas, E., Oehmen, J., Koskela, L., & Thuesen, C. A new framework for construction project definition stage. 2018. In *DS92: Proceedings of the DESIGN 2018 15th International Design Conference. DESIGN METHODS*. Marjanović D, Štorga M, Škec S, Bojčetić N, Pavković N (Eds.). pp. 1301–1312. [https://orbit.dtu.dk/files/149481728/Contribution542\\_final\\_A.pdf](https://orbit.dtu.dk/files/149481728/Contribution542_final_A.pdf)
- [10] Norman DA. *The design of everyday things*. Revised and expanded edition. Basic Books, New York; 2013. Pp. 1–347. <https://www.goodreads.com/book/show/17290807-the-design-of-everyday-things>
- [11] Golightly D, Sharples S, Patel H, Ratchev S. Manufacturing in the cloud: A human factors perspective. *International Journal of Industrial Ergonomics* 2016; 55:12–21. <https://www.sciencedirect.com/science/article/pii/S0169814116300464>
- [12] Tomico O, Mizutani N, Levy P, Takahiro Y, Cho Y. Kansei physiological measurements and constructivist psychological explorations for approaching user subjective experience during and after product usage. In: *The 10<sup>th</sup> International Design Conference. DS 48: Proceedings DESIGN 2008*. Marjanovic D, Storga M, Pavkovic N, Bojcetic N (Eds.). pp. 529–536. [https://www.researchgate.net/publication/230561428-Kansei\\_physiological\\_measurements\\_and\\_constructivist\\_psychological\\_explorations\\_for\\_approaching\\_user\\_subjective\\_experience](https://www.researchgate.net/publication/230561428-Kansei_physiological_measurements_and_constructivist_psychological_explorations_for_approaching_user_subjective_experience)
- [13] Norman DA. *Emotional design: Why we love (or hate) everyday things*. Basic Books, USA; 2004. p. 161. <https://www.amazon.com/Emotional-Design-Love-Everyday-Things/dp/0465051367>
- [14] Salvia G, Rognoli V, Malvoni E, Levi M. The objectivity of users' emotional experience with textiles biological and mechanical tests for the prediction of the sensorial profile of fabrics. In: *Seventh International Conference on Design and Emotion 2010*. pp. 1–12. <https://zenodo.org/record/2596735>
- [15] Hassenzahl M. User experience: A research agenda. In: *Encyclopedia of Human-Computer Interaction*. Soegaard M, Dam RF (Eds.). The Interaction Design Foundation, Denmark; 2011. pp 1–14. [https://www.researchgate.net/publication/259823352\\_User\\_Experience\\_and\\_Experience\\_Design](https://www.researchgate.net/publication/259823352_User_Experience_and_Experience_Design)