Review Article
Development of innovation products by using Kano model

Eini Inha & Sofia Bohlin
School of Business and Engineering
Halmstad University
Sweden

Abstract

The aim of this review is to provide insights to the usage of Kano-model and innovation product development, and at the same time, answer to the research question "*How customer needs can be identified by using Kano-model for innovation product development?*" The research is conducted by reviewing existing literature on Kano-model and innovation product development (IPD). The relevant literature used for this research is conducted by utilizing the databases of Halmstad University and Google Scholar. A model for customer needs identification by using Kano model for Innovation Product Development (IPD) was constructed based on the reviewed theories. In addition, a general recognition for the term of IPD was acknowledged.

Keywords: Innovation product development, Kano-model, Customer needs

Introduction

Globalization and increasing competition forces companies to develop new innovative products and concepts (Hu & El-Sayed, 2016). Moreover, the structure of dynamic markets with innovative competitors and various market conditions increases the competition (Dereli, 2015). In economic sciences, Schumpeter (1934) argues that being successful in the markets requires having innovations. Thus, innovation can be considered as one important element of competitive advantage for companies (Dereli, 2015). Moreover, Kano model is an effective tool for understanding and categorizing customer needs, evaluating products quality and specific attributes as well establishing specific important criteria within a product, and in addition, it is used for measuring customer

satisfaction, and understanding product requirements in product development (Chen & Chuang, 2008; Bilgili et al., 2011). Many theories explain product development and innovation products, but there is a lack of the literature in the area of innovation product development. Therefore, we aim to conduct a review article of development of innovation products by using Kano-model. In more detail, the customer need aspect is investigated, and therefore a research question *"How customer needs can be identified by using Kano-model for innovation product development?"* is set. In this review, the research question is to be answered, and general insights to the theory of development of innovation products and the usage of Kano model from customer need aspect are provided. In the analysis part, we are going to discuss how the customer need aspect of Kano model can be used to develop innovation products. Hence, any other specific areas of development of innovation products, or Kano-model and its customer need aspect are not discussed in detail. The perspective of innovation product development to Kano model, is rather not a totally new area, but any articles within the subject using the same definition of Innovation Product Development (IPD) could not be found. Thus, we find the topic interesting and worth of investigating. Additional interest of the authors is to see if there are any differences compared to other definitions used of IPD, and maybe this research can contribute to the theoretical framework within the subject. The methodology for this research is conducted by utilizing scientific articles. The articles are selected for this review article by their reliability and they are collected from the database of Halmstad University and Google Scholar. This paper starts with literature review of innovation product development, Kano model and customer need as an aspect of Kano model. Section three discusses methodology, which is followed by analysis, and at last, we present the conclusion. We propose customer needs to be in a center of innovation product development and we propose a model for identifying customer needs by combining the theories of Kano model and innovation project management.

Theoretical framework

In this theoretical framework, general insights are provided by discussing theories of Innovation product development, Kano model, and the customer need aspect as part of Kano model.

Innovation product development

Most of the theory reviewed discusses traditional Project Management, and Innovation Project Management as a definition is not widely used term and discussed topic in the academic literature reviewed. Moreover, innovation and project management are found discussed as separate theories, or the term New Product Development is used as a definition instead of Innovation Product Development. This set some challenges to the authors to distinct Innovation Project Management from the other terms and theories, even if most of them are very closely related, or they are basically understood as the same. However, the next section provides discussion around theoretical framework of Innovation Product Development.

To discuss innovation product development, innovation product is defined. According to Reguia (2014) innovation is defined to be a success factor for economic companies as an element to understand what customers want and to reach customer satisfaction. Innovation has also been defined as a driving force behind many successful companies today (Dereli, 2015). Product innovation is described as a product that is new or improved (Angelmar, 1990). Besides new concrete products, product innovation can also include new techniques and means in the production methods (Reguia, 2014). Moreover, product innovations reflect firm's image and the overall success of the firm is dependent on the product's success by realizing consumers needs and wants, and in that way, developing new products (Reguia, 2014). Instead of defining innovation product development separately, most of the theories distinguish innovation, innovation products and product development as separate theories. Definition of innovation product development from the scientific articles reviewed could not be found. Product development, however, is defined as "...the set of activities beginning with the perception of a market opportunity and ending with the production, sale and delivery of a product (Beauregard et al., 2016, p. 795)." Beauregard et al. (2016) propose all the project development processes requiring uncertainty in their decision-making and being found on limited knowledge under underlying situations. In summary, product development could be described as "process of eliminating the uncertainty about the product (Browning, 2000, cited by Beauregard et al., 2016, p. 795)." According to Tonnquist (2009), projects can be described as processes, which have a clear beginning, and the end, including series of continuous activities. The project lifecycle is constructed of four phases: Pre-study, Planning, Execution and Closure (Tonnquist, 2009).
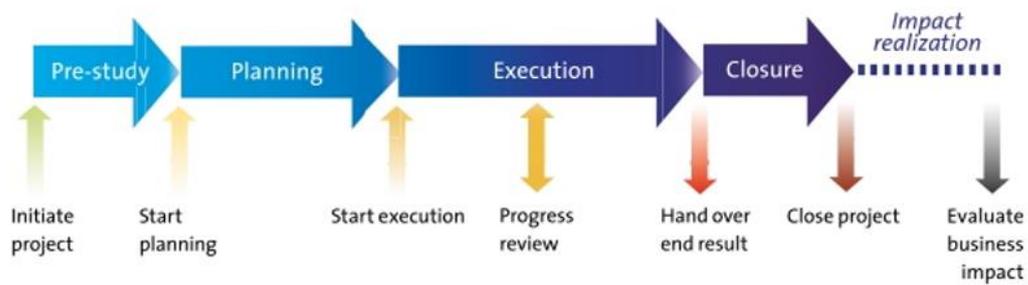
Figure 1: General project model (Tonnquist, 2009, p. 16).

The reasons for developing new products is defined by Bilgili et al. (2011) as fast growth and development of technology, increase of the expansion of the marketing environment and competition, and the limited life-span of products in the market. Also Albers et al. (2016) cite in their work Balachandra and Friar (1997) by stating that new product development (NPD), as well as R&D projects, have three dimensions, which are innovation (incremental- radical), technology (low- high) and market (new- existing). They also discuss a fourth dimension, which is called the nature of the industry (cited from Albers et al, 2016). According to Hu & Aziz (2016), there exist many studies suggesting different kind of conceptual models for the new product development process. These include idea screening, commercial launching for making a preliminary market, business or technical assessments (Hu & Aziz, 2016). The concentration on the later stages of new product development is clearly proposed to design and develop the product (Hu & Aziz, 2016). Hu & Aziz (2016) also state that a large amount of information and knowledge is needed for modern product development. Su et al. (2006) add to this that knowledge is an asset in nowadays digital economy, and carrying out knowledge management supports organizations in developing new innovative products, and also via knowledge, make strategic managerial decisions. Su et al. (2006) highlight the importance of linking technological competence to the needs of the customers in order to create product innovations by adding the "know-how" of processes or engineering, to secure market acceptance. Danneels (2002) confirms this and emphasizes that managing the knowledge is something worth of doing in order to develop new product innovations. The potential of customer knowledge management has either not been widely explored, even though the importance of knowledge management is acknowledged what comes to technological innovations (Su et al., 2006). Danneels (2002) has presented knowledge

management for innovation products and services as a must to create competitive advantage for the company. Woschke & Haase (2016) argue that as the competition on markets has increased recent years, competing against large enterprises as a small- or medium-sized enterprises (SMEs) can defend, and fight for their position by new product developments (NPDs). This is supported by Bilgili et al. (2011) stating that NPD is the strongest weapon against the growing competition. Moreover, it is strongly argued by the authors' that innovative products should not be taken for granted as the whole organisation and its employees have to be fully committed. Especially with SMEs, the skills found in the company, or limited resources might cause restrictions in improving new product development capabilities.

As a result of this review concerning innovation product development (IPD), can be stated, that most of the articles using the definition Innovation Product Development discuss high technology related studies. Also, Innovation Product development as a definition seems not to be universal, and as most of the literature discusses innovation and product development separately instead of defining IPD. Is there a need for developing a global term for IPD, or could "New Product Development" be used instead as it is widely used in the articles reviewed as two separate theories? IPD as Innovation Product Development, and not as new product development, or any other combination of innovation products and product development, is not well researched and/or defined. It seems like Innovation Product Development is more used term in new research by Bilgili et al. (2011) and Woschke & Haase (2016), for instance. Also, New Product Development is used in some newer articles such as Woschke & Haase (2016) but this is not necessarily the same than IPD as new products are not always innovation products. Therefore, we argue that not all the authors should talk about innovation product development and new product development as a same thing. Based on the theory reviewed, the authors perceive Innovation Product Development (IPD) as a creation of new or improved products that can also include new production method techniques, and uncertainty in the decision making due to the lack of information concerning the development of the product (Angelmar, 1990; Reguia, 2014; Beauregard, 2016).

Kano model
In the next section, the theoretical framework of Kano model is presented and we aim to discuss the model by having concentration on the customer need aspect.

Kano model can be described as a two-dimensional, linear and nonlinear, quality model with purpose to address linear quality shortcomings (Chen & Chuang, 2008). It is a theory that can be applied to product development and customer satisfaction (Matzler & Hinterhuber, 1998).

The Kano model is a model used to categorize customers' needs, distinguishing from classical methods with a more simplified logic stating if a customer's demand is met, then that customer is satisfied, if not they will experience dissatisfaction (Bilgili et al., 2011). It is an effective tool used to understand customers need based upon how they affect customer satisfaction (Xu et al., 2009). Nevertheless, Xu et al. (2009) state that traditional Kano-model theory is not suited with quantitative assessment providing limited decision support for engineering design. With Kano model the customers' demands are ranked and satisfactions dimensions can be identified by use of the model (Bilgili et al., 2011). Customer should be focused on not only from the point of view of meeting customer demands but to also understand these demands and needs in pursuit of determining their differences (Bilgili et al, 2011). According to (Chen & Chuang, 2008) customers evaluate a product's quality based on several factors and dimension which makes it crucial for success to establish which product criteria or attributes are of high value and creates more satisfaction than others. Matzler and Hinterhuber (1998) identifies that the advantage of using Kano model to classify customer requirements is in fact a higher understanding of product function and requirements. Chen & Chuang (2008) argues that Kano model is useful in establishing importance of individual product criterion in multiple- criteria decision making which generates optimal advantages in product development activities.

Kano's model is often referred to as having three attributes/elements/requirements (Sauerwein, et al., 1996; Bilgili et al., 2011) something Kano himself identifies when presenting his two-dimensional model (Kano, 1984). Some, Chen & Chuang (2008), Gregory & Parsa (2013), Meng et al. (2015) argue that there are five types of requirements, adding; The indifference and reversal qualities with the argument that the Kano model most often has been used in quality improvement and product development were indifferent and reverse attributes usually are not in focus (Gregory & Parsa, 2013). While Xu et al., (2009) and Liao et al., (2015) only recognize the first four attributes, excluding; reversal qualities.

Must-be requirements: The customer will be extremely dissatisfied if these requirements are not fulfilled and the customer will lose all interest in product (Sauerwein, et al., 1996). However, customer satisfaction will neither rise or improve if provided as they are considered to be basic criteria and taken for granted (Chen & Chuang, 2008 & Bilgili et al., 2011). **One-dimensional requirements**: The customer satisfaction is directly connected to product criterion performance meaning high performance lead to high customer satisfaction (Chen & Chuang, 2008). Sauerwein, et al., (1996) states that one-dimensional requirements are often distinctly demanded by customer. **Attractive requirements**: The product criteria requirement with greatest influence on customer satisfaction of given product and are neither neither expressed nor expected by the customer (Bilgili et al., 2011). However, fulfilling these requirements leads to high satisfaction and if not met, will neither lead to dissatisfaction (Chen & Chuang, 2008 & Sauerwein, et al., 1996). **Indifferent qualities or characteristics:** Customer satisfaction or dissatisfaction are not influenced or affected based upon the presence or absence of these attributes (Gregory & Parsa, 2013). Chen & Chuang (2008) states that indifferent qualities will not affect customers' satisfaction based upon the performance of a product criterion. **Reverse qualities or characteristics:** Opposed to the must-have requirements, reverse attributes will gain satisfaction when absent and when present results in dissatisfaction Gregory & Parasa, 2013). Customers will, according to Chen & Chuang (2008), experience more dissatisfaction with the increase of a criterion performance.
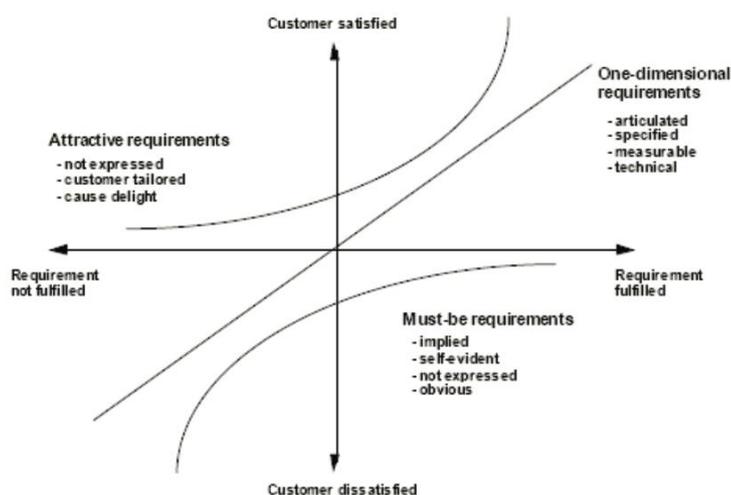

Figure 2: Kano model. (Bilgili et al., 2011, p. 831).

A Kano questionnaire can be used to determine the appropriate category for a particular attribute by using the traditional satisfaction question applied with statements connected to specific attribute or functional quality (Gregory & Parsa, 2013). In the questionnaire, customers are asked to choose a response on a scale of one (1) to seven (7), 1 representing not satisfied and 7 for satisfaction (Gregory & Parsa, 2013). The questionnaire can also be formed as expressions of feelings on the 7-point scale going from (1); I like it to (7) I dislike it (Meng, 2015).

The benefits of classifying customer need by using Kano model are according to Sauerwein, et al., (1996), Bilgili et al., (2011) and Matzler and Hinterhuber (1998): Product requirements are better understood, Kano's model of customer satisfaction can be successfully connected with quality function deployment, it also contributes with valuable assistance in adjustment situation in the product development stage and by discovering and fulfilling attractive and valued requirements creates a wide range of possibilities for variation in products.

Through the reviewed articles regarding Kano model the authors can state that Kano model is an effective tool in measuring and understanding customer satisfaction. Satisfaction is the result of fulfilling customer needs and expectations of a product's quality and/or function (Kano et al., 1984).

Kano model are not only a useful tool in measuring customer satisfaction but can also be used as a tool in product development by understanding product requirements (Matzler & Hinterhuber, 1998). By conducting Kano questionnaires followed by interviews with focus on not only on their desires but asserting the hidden needs and problems, its is possible through detailed analysis to discover instructive knowledge on promising product developments (Matzler & Hinterhuber, 1998).
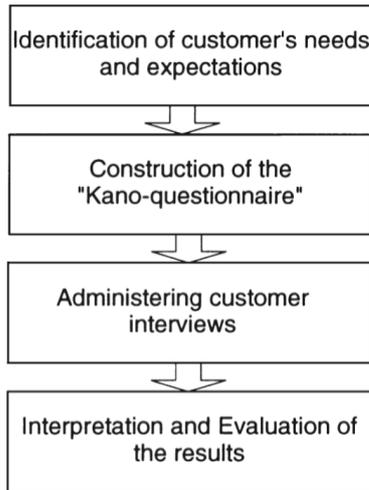
Figure 3: Individual steps Kano Project (Matzler & Hinterhuber, 1998, p. 30).

Methodology

The aim of this review article is to provide insights to Kano-model and development of innovation, and answer to a question *"How customer needs can be identified by using Kano-model for innovation product development?"* The method of investigating the topic is by reviewing literature on development of innovation products and Kano model, with specific interest on its customer need aspect. Literature for this review consists of scientific articles, which are selected by their relevance to increase the reliability of the study from the databases of Halmstad University and Google Scholar. Search words used for this research were "Kano model", "Kano product development" and "innovation product development." In total, 35 articles were reviewed, and only 19 were utilized for this study. The articles that were rejected, did not include either relevant content or they were discussing exactly the same topic but from different aspect that this research would have made use of. The articles discussing only traditional project management, for instance, do not necessarily contribute to the topic of IPD. Also, one book was added to the literature to provide additional insights to the theory found from the articles.

Analysis

The analysis is conducted by utilizing theoretical framework by trying to identify the effect of customer needs as part of Kano model to innovation product development.

According to Su et al. (2006), knowledge is an asset in nowadays digital economy and it supports organizations in developing new innovative products also via knowledge, and to make strategic managerial decisions. Also, Kano model can be used to classify customer requirements and thus, help to research the needs of the customers and understanding the of product functions and requirements for new innovative products (Hinterhuber, 1998). Therefore, investigating customer needs can be seen as one way to create knowledge for the companies. Based on Bilgili et al. (2011), there is a great importance in measuring and understanding customers' satisfaction, and therefore the authors of this review, believe that there is a clear linkage between understanding customer satisfaction and understanding customer needs. The authors believe that in order to reach satisfaction, the needs of the customer have to be fulfilled, and therefore, by reaching customer satisfaction, also the customer needs are understood. Moreover, the authors also believe that just like in product development, also in some of the innovation product development, the process is about eliminating the uncertainty about the product, and thus, Kano model can help in the product development by classifying the customer needs so that the product requirements can be better understood (Browning, 2000, cited by Beauregard et al., 2016; Sauerwein, et al., 1996; Bilgili et al., 2011; Matzler & Hinterhuber, 1998).
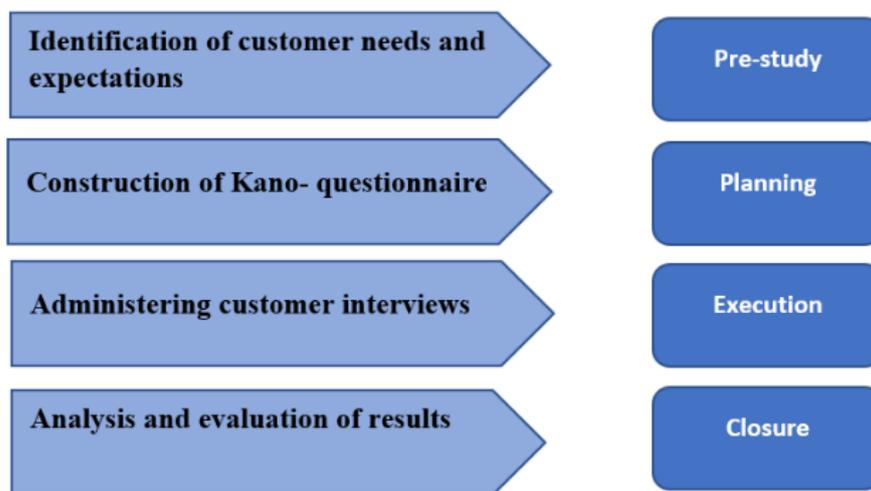

Figure 4: Customer needs identification by using Kano model for Innovation Product Development.

To identify customer needs, certain research must be done. A model for Customer needs identification by using Kano model for Innovation Product Development was developed

by utilizing the theoretical framework created for this review article. In the model, the project phases of Tonnquist (2009) are taken into consideration by including the individual steps of Kano model to it. Based on the literature review, we argue IPD projects to be formed as other projects, including series of continuous activities, and also, having a clear beginning and the end (Tonnquist, 2009). The first phase, Pre-study of IPD, includes identification of customer needs and expectations. In this sense, Kano model can help IPD by understanding product requirements from consumer perspective (Matzler & Hinterhuber, 1998). The second phase, Planning, includes constructing Kano-questionnaire, and the third phase of IPD is Execution. When applying Kano model to IPD, customer interviews are being administered. By conducting Kano- questionnaires followed by the interviews, the focus is not only on consumers' desires, but also in asserting the hidden needs and problems (Matzler & Hinterhuber, 1998). The last phase, Closure, emphasizes the analysis and evaluation of results meaning, as argued previously, the questionnaires aims to bring up the needs of customers, and therefore, it is possible through detailed analysis discover instructive knowledge on promising innovation product developments (Matzler & Hinterhuber, 1998).

Conclusion

This review article provided insights on general level to the topic of innovation product development and the customer need aspect of Kano model. The research question was answered by creating a model to help recognize hidden needs and problems in current innovation product development, analyses them, and by the analysis, utilize the discovered knowledge gained on the promising innovation product developments. The theoretical unclearance on the definition of Innovation Product Development (IPD) was clarified by arguing IPD to be perceived as a creation of new or improved products that can also include new production method techniques, and uncertainty in the decision making due to the lack of information concerning the development of the product (Angelmar, 1990; Reguia, 2014; Beauregard, 2016).

Future research

The reliability of the research could be increased by having a bigger selection of literature reviewed. This could have be done by using wider range of search words, which would probably not give so narrow selection of articles for the research. Conducting a new review article with these settings might give more insights to the topic and strengthen the

current knowledge within the topic. This could also be used to confirm the model created for customer needs identification for IPD. Research gaps presented based on this review article suggest taking further interest on IPD studies and as discussed previously, the definitions in the field of IPD as one clear definition for Innovation Product Development could not be found. Moreover, the literature on IPD is not truly investigated, or available. The authors of this review also think over, if the results of research about IPD would be the same if its theoretical framework in the academic literature would not be constructed from the parts of product development and innovation products, but there would exist a clear theory for IPD instead. In addition, Agile projects raise questions about the reliability of traditional project development models as not all the projects follow the same project phases. In short, further research on the model created as a result of this study is recommend, and the development, or adaption of Kano model could be improved to innovation product development; in order to be more clear and predictable in IPD. Moreover, even Kano model could be developed to be more clear and secure when applied to IPD in practice, as at the moment the theory is limited in the way of gaining deeper knowledge of existing products on the markets. However, it has to be stated that the results of this research might not be applicable for all the situations.

References

Albers, A., Gladysz, B., Heitger, N., Wilmsen, M. (2016). Categories of product innovations – A prospective categorization framework for innovation projects in early development phases based on empirical data. 26th CIRP Design Conference. IPEK - Institute of Product Engineering (Karlsruhe Institute of Technology).

Angelmar, R. (1990). Product innovation: A tool for competitive advantage. European Journal of Operational Research. Elsevier.

Beauregard, Y., Polotski, V., Bhuiyan, N. & Thomson, V. (2017). Optimal utilisation level for lean product development in a multitasking context. International Journal of Production Research. p. 795-818.

Bilgili, B., Ercis, A. & Ünal, S. (2011). Kano model application in new product development and customer satisfaction (adaptation of traditional art of tile making to jewelries). Procedia Social and Behavioral Sciences. p. 829-846.

Chen, C-C. & Chuang, M-C. (2008). Integrating the Kano model into a robust design approach to enhance customer satisfaction with product design. Int. J. Production Economics. p. 667-681.

Danneels, E. (2002). The dynamics of product innovation and firm competences. Strategic Management Journal 23. p. 1095–1121.

Dereli, D. (2015). Innovation Management in Global Competition and Competitive Advantage. Procedia - Social and Behavioral Sciences. Vol. 195. p. 1365-1370.

Gregory, A.M. & Parsa, H.G. (2013) Kano's Model: An Integrative Review of Theory and Applications to the Field of Hospitality and Tourism, Journal of Hospitality Marketing & Management. p. 25-46.

Hu, Y. & Aziz. E-S. S. (2016). Creativity-based design innovation environment in support of robust product development. International Journal on Interactive Design and Manufacturing (IJIDeM). Vol. 10. p. 335–353.

Kano, H.K., Hinterhuber, H.H., Bailon, F., Sauerwein, E., 1984. How to delight your customers. Journal of Product and Brand Management. p. 6–17.

Liao, Y., Yang, C. & Li, W. (2015). Extension Innovation Design of Product family based on Kano requirement model. Procedia Computer Science. Vol 55. p 268 - 277.

Matzler, K. & Hinterhuber, H. H. (1998). How to make product development projects more successful by integrating Kano's model of customer satisfaction into quality function deployment.Technovation. Vol. 18. p. 25- 38.

Meng, Q., Jiang, X., He, L. & Guo, X. (2015). Integrating Fuzzy Theory into Kano Model for Classification of Service Quality Elements: A Case Study of Machinery Industry in China. Journal of Industrial Engineering and Management.

Reguia, C. (2014). Product innovation and the competitive advantage. European Scientific Journal. Vol.1. p. 1857- 7881.

Sauerwein, E., Bailom, F., Matzler, K. & Hinterhuber, H.H. (1996). The Kano model: How to delight your customers. Preprints. Vol. 1. p. 313-327. Austria.

Schumpeter, J.A. (1934). The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle. Transactions publishers. New Brunswick, USA.

Su, C., Chen, Y. & Sha, D. Y. (2006). Linking innovative product development with customer knowledge: a data-mining approach. Technovation. Vol 26. p. 784–795.

Tonnquist, B. (2009). Project Management: A Complete Guide. Academica.
Woschke, T. & Haase, H. (2016). Enhancing new product development capabilities of small- and medium-sized enterprises through managerial innovations. The Journal of High Technology Management Research. Vol. 27. p. 53–64.

Xu, Q., Jiao, R.J., Yang, X,. Helander, M., Khalid, H. M. & Opperud, A. (2008). An analytical Kano model for customer need analysis. Design Studies. Vol. 30.