

RESEARCH PAPER

A Framework of Product Attributes Analysis for Co-Creation

Faisal Rasool¹, Pisut Koomsap^{2*}, Eméranca Raharisoa³ & Abdul Qayoom⁴

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ABSTRACT

In the last decade, customers' active involvement during product development, commonly referred to as co-creation, has emerged as an effective tool to overcome barriers that keep firms from understanding customer needs. Still in its infancy, many co-creation aspects are under-researched; this may present difficulties in aligning firm goals with their co-creators, often leading to project failure. To make the co-creation process more systematic, a framework is presented in this paper that will allow firms to analyse product attributes before engaging in co-creation, concerning firm capabilities and interests and the capabilities and interests of their co-creators. The results of this analysis will help firms to align their goals with the goals of co-creators. Two exploratory case studies were conducted for illustration.

KEYWORDS: *Product innovation; Innovation management; Product development; Co-Creation; Open innovation.*

1. Introduction

Product development (PD) is a process employed by firms to utilise their resources and capabilities to develop new or improve existing offerings [1]. Successful PD not only provides a competitive advantage [2] but, in many cases, is necessary for the economic growth of the firms [3]. Moreover, shorter product life cycles, intense competition, and ever-changing customer demands have forced firms to commit more and more resources to this risky process. Nevertheless, many PD projects still fail to achieve their objectives [4, 5]. One significant reason for these failures is the firms' inability to fully understand the customers' needs [6, 7].

In the last decade, customer involvement during PD (co-creation) has been widely accepted as a successful method for capturing customer needs [8-12]. Co-creation can be defined as an active, creative, and social process adopted by a firm to directly involve customers in the design and

development of future offerings [12-15]. In other words, co-creation is a shift from firm-active PD to customer-active PD [16]. Previous studies have highlighted several benefits of co-creation, including better ideas and decision-making [17], lower development cost [17, 18], shorter time to market [19], higher customer loyalty [20-23], faster response to latent customer needs [24] and others. These will lead to a higher product success rate and greater profit with a larger market share [9, 25-29].

Realising the potential benefits of co-creation, researchers and practitioners have presented several methods and solutions to facilitate both parties' participation (customers and firm) involved in co-creation. Thus, the product failure rate has decreased, but still, many projects fail to bring desired outcomes due to failed co-creation. Literature reported several reasons for this failure, including a firm's inability to attract and sustain co-creator engagement [30, 31], goal incongruity between a firm and its co-creators [32], absence of value and culture complementarity during interaction [33], firms failing to act according to the voice of co-creators [34], co-creators feeling lack of fairness [35], and lack of common understanding between a firm and their co-creators [36]. It is argued that all of these failures result from a firm's inability to develop coordination and understanding between two parties rather than a lack of technical

* Corresponding author: *Pisut Koomsap*
pisut@ait.asia

1. *Enterprise Engineering Università degli Studi di Roma "Tor Vergata" Rome, Italy, 00133.*
2. *Industrial and Manufacturing Engineering, Asian Institute of Technology, Pathumthani, Thailand, 12120.*
3. *Università degli Studi della Campania "Luigi Vanvitelli", Caserta, Italy, 81100.*
4. *Mehran University of Engineering & Technology, Shaheed Zulfikar Ali Bhutto Campus, Khairpur Mir's, Pakistan.*

capabilities. This lack of understanding between the two parties results in a misalignment of objectives that often leads to project failure [37]. Earlier research has emphasised the need for a systematic process that the firms can adopt to align their goals and needs with their customer's goals to overcome these barriers. Surprisingly the current literature fails to provide any such systematic approach for the firms forcing them to opt for trial and error [38]. As a result, valuable resources are wasted. The co-creation project is a double-edged sword endeavour. The studies have argued that failed co-creation project results in customer dissatisfaction [39-41], and ultimately, valuable resources are needed to neutralize this negative impact. Therefore, firms need to engage in co-creation projects to have a proper plan in place. The existing trial and error approach increases the chances of failure significantly [42]. This study aims to fulfil this important gap in the literature by developing a systematic approach to identify the two parties' common interests for the co-creation project. As a result, the probability of project failure reduces significantly. This systematic approach will also help firms neutralise the negative impact in case of firms' failure to complete or act on co-creators wishes as suggested by [39] where authors argued that a higher level of customer understanding of co-creation project could significantly reduce customer dissatisfaction.

To understand a product, it can be seen as a combination of small units, called product attributes, where different combinations of these units (attributes) result in different final products. These product attributes can be considered as the characteristics that make one product different from others (e.g., colour, size, price, and quality). Product attributes can be classified into two main categories: tangible and intangible attributes [43]. Tangible or physical attributes of a product include size, colour, specification, weight, etc.; intangible or abstract attributes include perceived quality, reliability, beauty, etc. [4]. Thus, this study focuses on developing a framework to identify product attributes that both the firm and its co-creators are willing to co-create with each other.

The rest of this article is laid out as follows: The related literature is reviewed in the next section, where different dimensions of previous co-creation research are briefly discussed. In section 3, the proposed framework for the study is discussed in detail. While in section 4, the applicability of the developed framework is demonstrated by two separate exploratory case studies. Section 5 discusses the practical

implications of the study. Finally, conclusions and future recommendations are presented in the last section.

2. Related Literature

With the advances in technology, product development fundamentals have shifted from manufacturer-oriented to customer-oriented [44]. The design by manufacturer has been replaced with the design by customer [45]. [46] suggest that firms must recognise that customers are no longer mere receivers of value but are becoming partners in creating value through active involvement in PD activities. Customer involvement during PD began in the 1970s, as European manufacturers introduced the concept of "participatory design," involving workers in the process of new system designs to increase productivity [47]. Ever since it has been seen as an effective strategy for product success, and in the last decade, the concept of customer involvement has received increased attention.

Several methods and guidelines have been introduced that differ in terms of application procedure and the goals and benefits perceived and received. For example, [48] provided a six-step strategy to align co-creation project goals with firm goals and described the type of relationship needed between a firm and its co-creators for specific types of co-creation projects. [49] presented seven strategies for a firm to implement co-creation successfully, focusing on the firm customer interaction before and during a co-creation project. [50] presented design principles for a firm by using customer experiences to create a vibrant co-creation platform for attracting customers to participate in firm-initiated projects. [51], with the help of a case study of "Flexifoil International," it argued that customer experience and dialogue are key components for successful co-creation and should be the top priority during co-creation projects. [29] reported on four important actors that shape customer experience in online co-creation communities.

On the other hand, co-creators willingness is as important as the firm's willingness for successful co-creation [52]. Researchers have proposed guidelines for motivating co-creators to participate and to keep them active in co-creation. For example, [49] argued that apparent benefits are key motivators for customers to engage in co-creation. [53] compiled a list of 24 motivational factors important for customers to engage in the co-creation process and underlined curiosity as the most important factor. [54] argued that the personality traits of the individual co-creator

heavily influence their decision to participate in co-creation activities. [50] concluded that four major drivers that motivate customers to engage in co-creation are the reward, curiosity, needs and intrinsic interests. [55] presented that customers seeking to engage in co-creation could be divided into unique experience seekers and unique product seekers. Memorable co-creation experience will positively affect the current co-creation project and enhance customers' interest in future projects [8]. Moreover, hedonic, cognitive, social, and personal experiences during a co-creation project are argued to influence the overall co-creation experience positively and are more likely to lead to success in co-creation activities [12, 56].

Active customer involvement in decision-making during PD is core to co-creation. Unfortunately, most of the literature has not considered this important aspect of co-creation during the planning phase of PD and has focused only on firm activities. This mindset results in a lack of understanding between the two parties on many occasions, resulting in project failure [32, 34-36]. In this study, it is argued that activities during the co-creation project should be designed to maximise the co-creators experience while keeping in view the firm's goals and capabilities. The current literature fails to provide any systematic approach for a firm to identify its co-creators capabilities and interests, forcing them to opt for a trial and error approach [38]. This study proposes a framework that will allow firms to identify their capabilities and gauge their co-creators interests at the planning phase of the PD project. This understanding will lead to project goal congruity between the two parties at later phases of PD that will result in project success.

3. The Framework

With the introduction of co-creation, success rates of commercial products have improved (as reported by P&G, [25]), but a large number of projects still fail to deliver desired outcomes. As argued earlier, poor planning and execution of a project result in misalignment of goals between a firm and its co-creators, leading to project failure. Therefore, firms need to understand their product and capabilities/limitations and their co-creators capabilities and interest regarding their product. Previous studies have suggested that it is often part of product development that causes disinterest/distrust between the firm and their co-creators, not the whole project. Therefore, there is a need to develop an understanding of PD's aspects to make the project successful. One way to develop this understanding can be to divide a

product into attributes and identify the product's attributes that both parties will be interested in co-creating. The method of dividing a product into attributes have been widely utilized in the industry. The concept of mass customization relies on product attributes to customize the product as per the needs of the customers at the time of manufacturing/assembly. This study aims to develop the understanding between firms and their co-creators by utilizing product attributes at the beginning of PD. This understanding of both parties' interests at the beginning of the project will allow a firm to prepare co-creation goals aligned with co-creators goals. As a result of this understanding, the firm can adjust its co-creation project goals and motivation at the beginning of the project. This understanding will also help firms to decide whether to proceed with the project or abandon it to avoid customer dissatisfaction due to failed co-creation project. [37] argued that this goal alignment between the two parties would lead to project success. Focusing on the firm – customer goal alignment, a framework is proposed (Figure 1) for product attribute analysis to identify the product attributes that both parties are interested in co-creating with each other.

The willingness of a firm to participate in co-creation is as important as customers' willingness. On one hand, due to the inherent complexities and technical limitations associated with PD, firms are unwilling or unable to co-create all attributes of future products with their customers. On the other hand, customers are not interested in every product attribute due to lack of motivation or lack of perceived benefits from engagement. This lack of willingness from both parties leads to undesired results in later phases of the co-creation project. The two-part framework presented in this study will analyse the product attributes for the firm and co-creator interest in PD's early stages. Part one, customer interest, identifies the product attributes which customers are not interested in co-creating with the firm. Part two, firm interest, identifies the product attributes that the firm is unwilling to co-create due to technical or managerial limitations. These two parts of the framework are connected to the development of a product through co-creation. Every attribute will be evaluated individually for both filter criteria. Attributes fulfilling the filter criteria are assigned a value of one, while the attributes failing to fulfil filter criteria are assigned a value of zero. Once co-creatable attributes for both parties have been identified, a mix-and-match process will identify and mark all attributes that satisfy both parties'

conditions as actual co-creatable attributes. These attributes will result in goal alignment between two parties that will lead to project success. The

procedure and steps taken to develop both filters are discussed in the following sub-sections.

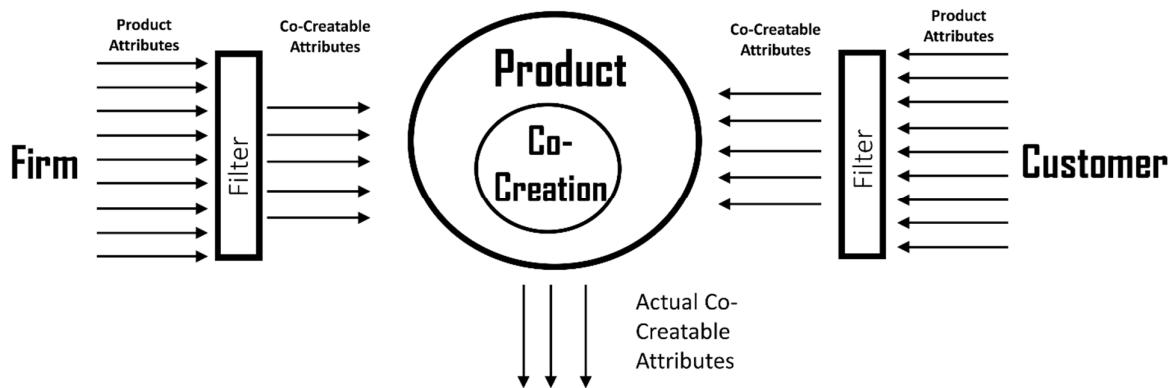


Fig. 1. The proposed framework for product attribute analysis

3.1. Customer filter

For successful co-creation, co-creators should be treated as partners, and decisions related to their activities during co-creation should be taken in consultation with them [47, 51, 57]. However, some complex products such as cars or laptops may consist of hundreds of attributes. Consulting co-creators for such a large number of attributes will lead to complexity and boredom during a co-creation project. Therefore, the attribute analysis for customer interest will be conducted in two steps to reduce boredom and increase customers' interest. In the first step, attributes will be shortlisted with the help of a customer interest filter. In the second step, shortlisted attributes will be confirmed with co-creators before finally being marked as co-creatable attributes from customers.

The co-creator experience while engaging in co-creation activities is important to its success. Memorable and joyful experiences bring positive results for co-creation projects. Hedonic, personal, social and cognitive experiences play a vital role in the co-creators decision to engage and remain active in the project [12, 56, 58]. Therefore, it can be argued that only those product attributes that enhance at least one of these experience dimensions will be of interest to the co-creators, and attributes failing to enhance these four experience dimensions will not be of

interest to co-creators. As described by [12], a brief explanation of these four experiences is given below.

Hedonic: Having a pleasurable experience

Cognitive: Gaining new skills/knowledge

Social: Connecting with other people

Personal: Gaining higher status and recognition

To identify the attributes that will enhance the co-creator experience, all attributes will be evaluated individually for all four experience dimensions (filter conditions). A value of zero or one will be assigned to every attribute depending upon its ability/inability to fulfil each criterion's requirements; criteria for evaluating attributes for co-creators experience is summarised in Table 1. For any attribute to satisfy the hedonic filter condition, it must enhance at least one of the hedonic experience components: excitement, happiness, fun, enjoyment, and pleasure [59]. The process can be conducted with the help of a template presented in Table 2. For any attribute to be shortlisted for further analysis, it must score a value for "Z" greater or equal to 1, where "Z" is the sum of four experience dimension values. Historical data of projects with similar attributes can be studied for a clearer understanding of co-creator interest. A similar process will be adopted for the remaining three filter conditions to shortlist the next step's attributes for further analysis.

Tab. 1. Criteria for evaluating product attributes against customer interest

Filter	Passing criteria	Passing condition
Hedonic	Will enhance any one of the following hedonic components: excitement, happiness, fun, enjoyment, pleasure	
Cognitive	Will make co-creators think that will enhance their problem-solving capabilities/creativity, skills or knowledge	If,
Social	Will help co-creators socialise, i.e. encourage them to discuss the ideas/options with peer/like-minded co-creators (co-creation platform will influence the experience)	$Z \geq 1 = \text{Go}$ $Z < 1 = \text{No go}$
Personal	Will provide personal benefits that can be monetary or non-monetary, i.e. key attributes of the product that may earn them respect/reward (co-creation platform will influence the experience)	Where $Z=H+C+S+P$

Tab. 2. Template for evaluating product attributes for customers interest

Attribute	Hedonic H	Cognitive C	Social S	Personal P	Z (H+C+S+P)	Result Go/no go
Attribute "A"						
Attribute "B"						
Attribute "C"						
Attribute "D"						
Attribute "E"						

Customer interest is dynamic. Interests in past product's attributes may not be translated into interest in the same or similar attributes in a new project. Therefore, once the firm has shortlisted the attributes that will enhance co-creators experiences in at least one of the four experience dimensions, they will be confirmed with co-creators for their current interest. The Kano evaluation model can be employed here, as it is useful in distinguishing between the four different types of product needs that influence customer satisfaction in different ways. Even though the Kano model was introduced in 1980s but it is still widely used by product development teams [60]. Kano model helps product development teams in identifying attributes of the product that will satisfy or even delight the customers [60, 61]. [62], in their literature review of techniques to classify product attributes, argued that the Kano questionnaire is the only available technique capable of classifying product attributes during the design stage. Their results were in line with the findings of [63] where authors argued on the dynamic capability of the technique and demonstrated its usefulness by applying it in multiple case studies. Therefore, using the Kano model for this study is appropriate to evaluate co-creator satisfaction while working on co-creation projects. In Kano's model, the attributes after the evaluation will fall under one of the four categories described below.

Must-be attributes: Without these attributes, the co-creators will not be interested in engaging in the co-creation project.

One-dimensional attributes: The presence of these attributes will result in co-creator satisfaction, while the absence of these attributes will lead to co-creator dissatisfaction.

Indifferent attributes: The presence or absence of these attributes will not affect co-creators satisfaction.

Attractive attributes: The presence of these attributes will lead to the highest co-creator satisfaction level, but the absence of these will not negatively impact co-creator satisfaction.

A close-ended questionnaire survey was conducted following Kano's model guidelines to evaluate the co-creators interest. After evaluation of the survey responses, the attributes that fall under "must-be," "attractive," and "one-dimensional" were considered for co-creation. In contrast, indifferent attributes were not considered, as co-creators have lost interest in them. The obtained attributes were then marked available for co-creation from the customers; however, the final decision regarding attributes was made after analysing the attributes for the firm interest as well. The complete developed model of the proposed framework is presented in Figure 2.

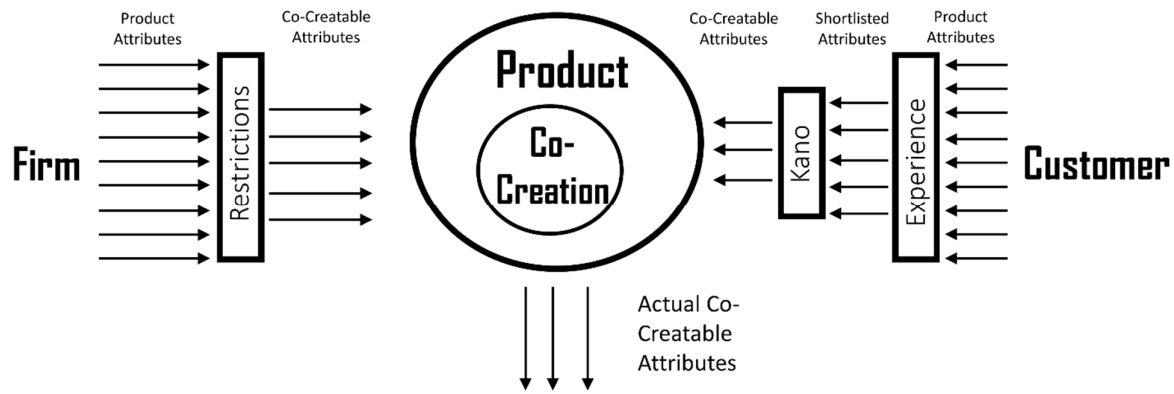


Fig. 2. The developed model of the study

3.2. Firm filter

Previous literature fails to provide actionable guidelines that a firm can follow to determine what it can and cannot co-create with its customers. As a result, the firms opt for a trial and error method often results in project failure [38]. To overcome this limitation of literature, an alternative case study approach was adopted in this study. The dataset was collected from 223 publicly available projects posted on a well-known co-creation website/platform “www.eyeka.com” between August 2012 and July 2015. The platform has more than 324,000 registered users from 164 countries to help firms innovate and solve their problems. Some firms that have used the platform include Nestle, Samsung, Coca Cola, Unilever, Microsoft, eBay, Toyota, and Adidas. As of July 2015, more than 93,000 ideas have been submitted for 480

completed projects on the platform. Firms interested in co-creation can provide descriptions of their problems on the platform and invite users to generate ideas and solutions for predefined rewards. While providing project guidelines, some firms fully rely on the co-creators imaginations, while others restrict them from wandering by providing specific guidelines (restrictions). It was observed from the data collected that participating firms have mainly used four restrictions: target price, manufacturability, implementation cost, and brand image, as shown in Table 3, to limit their co-creators from engaging with aspects and attributes of the product that firms do not want the cocreators to alter. Out of 223 projects studied, 63 of them used at least one of these restrictions.

Tab. 3. Restrictions used by the firms with the given explanation

Restriction	Explanation	The explanation given at www.eyeka.com
Target Price	The final product price is in a defined range, so the new product is affordable/represents their target customers' class.	<i>“The product costs US\$ 0,60. The future pack should not necessitate a price increase for the product”</i>
Manufacturability	Solutions generated/proposed are technically feasible and can be manufactured with current or near-future technologies.	<i>“Don’t go too wild either. Keep in mind that your idea should be that something can be developed within 5 years”.</i>
Implementation Cost	The solution's implementation cost should be within the project's budget to complete the project effectively.	<i>“You may not change the shape of the packaging. Only create graphic designs”</i>
Brand Image	Idea generated should not damage the firm's current reputation or make their current/loyal customers less interested in their new products. They may perceive that firm preferences have changed.	<i>“your idea should be in line with Aptamil’s brand personality which is: scientific, serene, reassuring and high-end.”</i>

These restrictions can be used in the proposed framework to filter the firm interest as described in Table 4, where “Y” is the sum of all four restriction values. The template provided in Table 5 can be used to perform analysis. The firm cannot relax these restrictions during co-creation; therefore, it will be necessary for qualified

attributes to satisfy all four restrictions to be eligible for co-creation ($Y = 4$). Attributes failing to fulfil all restriction criteria will be marked as unavailable for co-creation ($Y < 4$). The final developed model using the framework is presented in Figure 2.

Tab. 4. Criteria for evaluating product attributes against the firm filter

Filter	Passing criteria	Passing condition
Target Price	Will not drive the price of the product out of the targeted range	If
Manufacturability	The firm has or can acquire the capability to manufacture the altered attribute	$Y = 4 = \text{Go}$
Implementation Cost	Will not require investment beyond project budget or extensive R&D for altered attribute	$Y < 4 = \text{No go}$
Brand Image	Altering attribute will not damage the firm’s existing reputation or brand value	Where $Y = T + M + I + B$

Tab. 5. Template for evaluating product attributes –firm side

Attribute	Target Price T	Manufacturability M	Implementation Cost I	Brand Image B	Y (T+M+I+B)	Result Go/no go
Attribute “A”						
Attribute “B”						
Attribute “C”						
Attribute “D”						
Attribute “E”						

4. Case Studies

The applicability of the developed framework was demonstrated using two separate case studies. Due to limited time and access to product data, only tangible product attributes were analysed. The analysis of intangible attributes can be conducted using the same principle, as demonstrated in the case studies when sufficient data were available. For the second step, the customer interest filter, the questionnaire was distributed among international students of the Asian Institute of Technology (AIT), Thailand, while information for the firm interest filter was gathered from different sources on the internet. The following sub-sections report the procedure of analysis and results of the case studies.

4.1. Jeans

For the first case study, a pair of jeans, a common, everyday product, was selected. For this exploratory case study, it was assumed that

the initiator firm is engaged in manufacturing and selling luxury apparel products, including jeans. The attributes presented in Table 6 were obtained from the previous study of [64]. The researchers highlighted the attributes to which customers pay attention to while making purchase decisions. These attributes were analysed first for firm interest, and the results are shown in Table 7. Attribute length, for instance, met all the criteria of the firm interest filter. Varying the length of the jeans did not produce any price concerns for the firm. Also, the jeans' length was not a concern for the firm in terms of manufacturability and implementation cost and showed no threat to its brand image. Similarly, all remaining attributes of the product were analysed using the provided template. After evaluating all the attributes, it was observed that the attributes of price, brand, and material could not satisfy the firm interest. Therefore, would not be available for co-creation from the firm side.

Tab. 6. List of attributes for the jeans

Attribute	Brief Explanation
Length	Length of the jeans
Pockets	Number and types of pockets
Cut	Shape of the jeans at the bottom, i.e. straight, skinny, boot cut
Design	Fashion or trend
Durable	The quality of the jeans
Stitching	The quality of the stitching
Price	Price of the jeans
Brand	Brand image of the manufacturer
Colour	Colour options for the jeans
Material	Material type of jeans
Fit	Type of fit, i.e. slim fit, relax fit
Belt Loop	Number and types of loops

Tab. 7. Summary of the results on the firm side for a pair of jeans

Attribute	Target Price T	Manufacturability M	Implementation Cost I	Brand Image B	Z	Results
Length	1	1	1	1	4	Pass
Pockets	1	1	1	1	4	Pass
Cut	1	1	1	1	4	Pass
Design	1	1	1	1	4	Pass
Durable	1	1	1	1	4	Pass
Stitching	1	1	1	1	4	Pass
Price	0	1	1	1	3	Fail
Brand	1	1	1	0	3	Fail
Color	1	1	1	1	4	Pass
Material	1	0	0	1	2	Fail
Fit	1	1	1	1	4	Pass
Belt Loop	1	1	1	1	4	Pass

Next, the interest of customers was analysed in two steps. In the first step, the attributes were shortlisted using the co-creators experience dimensions. The results are summarised in Table 8. In the second step, the Kano model was used for shortlisted attributes to re-confirm the co-creators interest. The Kano questionnaire was distributed among the students of AIT using a Google form. Sample questions from the questionnaire are presented in Figure 3. In total, 67 responses were received and were analysed using the Kano evaluation table. The evaluation resulted in all the attributes being indifferent. The results of the evaluation are presented in Table 9. Further analysis of these responses revealed that even though most respondents would be happy if

the firm involved them in designing and developing the jeans, they would not mind if they were not involved. This lack of interest in co-creation could be from the nature of the product, as jeans are generally considered as designer product, and the respondents may have felt that they did not possess the required skills and knowledge to be part of the process. Also, the level of dissatisfaction with the current offering and apparent benefits are the major drivers of customer participation in co-creation [49, 53] and were not available in the current product. From these factors, it can be concluded that jeans are not a desirable product for co-creation for co-creators without introducing rewards that can increase co-creator interest. Therefore, any firm

willing to co-create a pair of jeans must pay attention to the co-creation platform and reward system for co-creators to enhance their

experience in the social and personal dimensions. The results of the complete attribute analysis for jeans is shown in Figure 4.

Tab. 8. Summary of the results on the customer side for a jeans

Attribute	Hedonic H	Cognitive C	Social S	Personal P	Z	Results
Length	1	1	0	0	2	Pass
Pockets	1	1	0	0	2	Pass
Cut	1	1	0	0	2	Pass
Design	1	1	1	1	4	Pass
Durable	0	0	0	0	0	Fail
Stitching	0	0	0	0	0	Fail
Price	0	0	0	1	1	Pass
Brand	1	1	1	1	4	Pass
Color	1	1	0	0	2	Pass
Material	0	1	1	1	3	Pass
Fit	1	1	0	0	2	Pass
Belt Loop	1	1	0	0	2	Pass

How do You Feel	I like it that way	It must be that way	I am neutral	I can live with that way	I dislike it that way
If you are involved in designing length of Jeans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are involved in designing cut type (shape at bottom part) of Jeans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are not involved in choosing color for jeans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are involved in designing belt loop of jeans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are not involved in deciding material of jeans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are not involved in fixing price of jeans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are not involved in designing pockets of jeans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are involved in choosing color for jeans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are involved in designing fit type (relax, loose, slim) for jeans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are involved in developing new design for jeans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are not involved in designing length of the jeans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are involved in shaping Brand image of jeans line (tough, trendy, urban etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Fig. 3. Sample questions from the questionnaire for a pair of jeans

Tab. 9. Kano evaluation results for a pair of jeans

Attribute	One dimensional	Must be	Attractive	Indifferent	Reverse	Questionable	Result
Length	4		6	54	1	0	Indifferent
Pockets	13		3	42	0	0	Indifferent
Cut	4		9	53	0	0	Indifferent
Design	11		13	39	2	0	Indifferent
Price	6		9	49	0	3	Indifferent
Brand	7		10	46	2	0	Indifferent
Color	4		13	50	0	0	Indifferent
Material	9		0	58	0	0	Indifferent
Fit	7		11	43	1	2	Indifferent
Belt Loop	3		2	59	1	1	Indifferent

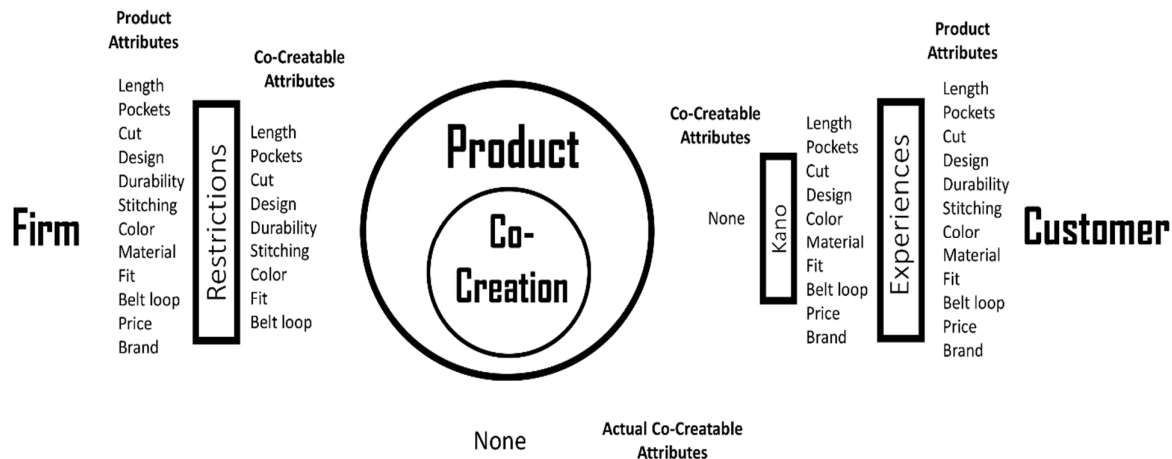


Fig. 4. Product attribute analysis for a pair of jeans

4.2. Smartphone

A second exploratory case study was conducted to demonstrate the applicability of the developed framework further. This time, a smartphone (a relatively complex but more interesting product) was selected. For this exploratory case study, it was assumed that the initiator firm is a world leader in Android smartphones. The smartphone attributes were obtained by analysis of the latest model of the selected firm's flagship smartphone. The focus while identifying the attributes was kept on the attributes that the firm emphasises during their marketing campaigns, as presented in Table 10. Data regarding the firm's capabilities and interests were gathered from different sources on the internet and presented in Table 11. The evaluation of customer interest was conducted in two steps, as explained in the previous case study. First, the attributes were shortlisted using co-creators experience, and the results are presented in Table 12. The shortlisted

attributes were confirmed by co-creators using the Kano questionnaire, from which sample questions are shown in Figure 5. The questionnaire was circulated among the same population of AIT students; a total of 27 responses were received, and the results of the evaluation are presented in Table 13. Although most of the attributes were indifferent according to the results, two attributes emerged as one-dimensional and six as attractive. The respondents did not expect any reward for their time and efforts (participation) that may have resulted in a lack of interest in the product attributes that are not very important. Therefore, attention should be paid while selecting co-creators and designing the platform and reward system for co-creators to enhance their experience in social and personal dimensions. The results of the analysis for the smartphone are presented in Figure 6.

Tab. 10. List of the attributes for a smartphone

Attribute	Brief Explanation
Network	2G, 3G, 4G or any other option
Size	Dimensions of the mobile length, width and thickness
Weight	Weight of the mobile phone
Colour	Colour and finish type of mobile phone
Screen size	Size of the mobile screen
Screen resolution	Resolution of the mobile screen and depth per inch
Screen protection	Resistance of mobile phone screen against drops
Platform	Operating system
Chipset	Motherboard of the mobile phone
CPU	Processor of mobile phone
GPU	Graphics processing unit of mobile phone
Internal memory	Internal memory of the mobile phone
External memory	External memory option on the mobile phone
Primary camera	Back camera and its features (MP, flash, face recognition)
Secondary camera	Front camera and its features (MP, flash, beautification)
Loudspeaker	Quality of Loudspeaker of the mobile phone
Sound jack	Sound jack for connecting mobile to external speakers
Wi-Fi	Wi-Fi signal strength/speed and any other options
Bluetooth	Bluetooth signal strength/speed and any other feature
Infrared	Infrared signal strength/speed and any other feature
GPS	GPS signal strength/speed, accuracy and any other feature
Radio	Radio option available or not or any other feature
Battery	Battery power, weight and performance
Additional optional features	Any other feature (fingerprint reader, waterproof, compass)
Price	Price of mobile phone
Brand	Brand image of the manufacturer

Tab. 11. Summary of results on the firm side for a smartphone

Attribute	Target Price	Manufacturability	Implementation	Brand Image	Cost	Z	Results
	T	M	I	B			
Network	1	1	1				Pass
Mobile size	1	1	1				Pass
Weight	1	1	1				Pass
Color	1	1	1				Pass
Screen size	1	1	1				Pass
Screen resolution	1	0	0				Fail
Screen protection	1	0	0				Fail
Platform	1	1	1				Fail
Chipset	1	0	0				Fail
CPU	1	0	0				Fail
GPU	1	0	0				Fail
Internal memory	1	1	1				Pass
External memory	1	1	1				Pass
Primary camera	1	1	1				Pass
Secody camera	1	1	1				Pass
Loud speaker	1	1	1				Pass
Sound jack	1	1	1				Pass
Wi-Fi	1	1	1				Pass
Bluetooth	1	1	1				Pass

Infrared	1	1	1	1	Pass
GPS	1	1	1	1	Pass
Radio	1	1	1	1	Pass
Battery	1	0	1	1	Fail
Price	0	1	1	1	Fail
Brand	1	1	1	1	Fail
Additional optional features	1	1	1	1	Pass

Tab. 12. Summary of results on the customer side for a smartphone

Attribute	Hedonic H	Cognitive C	Social S	Personal P	Z	Results
Network	0	0	0	0	0	Fail
Mobile size	1	1	0	0	2	Pass
Weight	1	0	0	0	1	Pass
Color	1	1	0	0	2	Pass
Screen size	1	1	0	0	2	Pass
Screen resolution	1	1	0	0	2	Pass
Screen protection	1	1	0	0	2	Pass
Platform	1	1	1	1	4	Pass
Chipset	0	0	0	0	0	Fail
CPU	0	0	1	1	2	Pass
GPU	0	0	0	0	0	Fail
Internal memory	1	1	0	0	2	Pass
External memory	1	1	0	0	2	Pass
Primary camera	1	1	0	0	2	Pass
secondary camera	1	1	0	0	2	Pass
Loud speaker	0	0	0	0	0	Fail
Sound jack	0	0	0	0	0	Fail
Wi-Fi	0	1	0	0	1	Pass
Bluetooth	0	1	0	0	1	Pass
Infrared	0	0	0	0	0	Fail
GPS	0	1	0	1	2	Pass
Radio	0	0	0	0	0	Fail
Battery	1	1	0	0	2	Pass
Price	0	1	1	1	3	Pass
Brand	1	1	1	1	4	Pass
Additional optional features	1	1	1	1	4	Pass

Tab. 13. Kano evaluation results for a smartphone

Attribute	One dimensional	Must be	Attractive	Indifferent	Reverse	Questionable	Result
Screen resolution	5	2	7	11	1	1	Indifferent One dimensional
Mobile size	9	3	5	8	1	1	
Weight	4	4	8	10	0	1	Indifferent
Color	5	4	8	7	0	3	Attractive
Platform	6	3	6	9	1	2	Indifferent
Screen size	3	3	10	8	1	2	Attractive

Primary camera	3	5	10	8	0	1	Attractive
Secondary camera	5	3	10	7	0	2	Attractive
Battery	8	5	6	6	0	2	One dimensional
Brand	4	5	8	5	2	3	Attractive
Wi-Fi	4	3	4	12	2	2	Indifferent
Bluetooth	1	1	6	16	1	2	Indifferent
Price	0	2	7	13	1	4	Indifferent
GPS	2	4	8	10	1	2	Indifferent
Screen protection	2	0	10	12	1	2	Indifferent
Additional optional features	1	0	8	8	1	9	Questionable
Internal memory	2	4	9	7	0	5	Attractive
External memory	4	3	6	11	0	3	Indifferent

How would you feel	I like it that way	It must be that way	I am neutral	I can live with that way	I dislike it that way
If you can tell the firm what is ideal size for new mobile phone in your opinion.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If firm select size of new phone without involving you.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you can tell the firm what is ideal weight for new mobile phone in your opinion.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If firm finalize weight of new phone without involving you.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If firm listens to you in making decision regarding platform of new mobile phone (Android, Windows, OS or completely new)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If firm does not listens to your preferences about platform (Android, Windows, OS or completely new) in new mobile phone.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you able to communicate to the firm your camera preferences (front/Back) of new mobile phone (MP, features like geo tagging, stabilization, flash).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If firm choose camera setting (MP, features like geo tagging, stabilization, flash) for you without consulting you	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are able to tell firm what should be price of the new mobile being manufactured	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If firm decides for how much price they are willing to sell new phone.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Fig. 5. Sample questions in the questionnaire for a smartphone

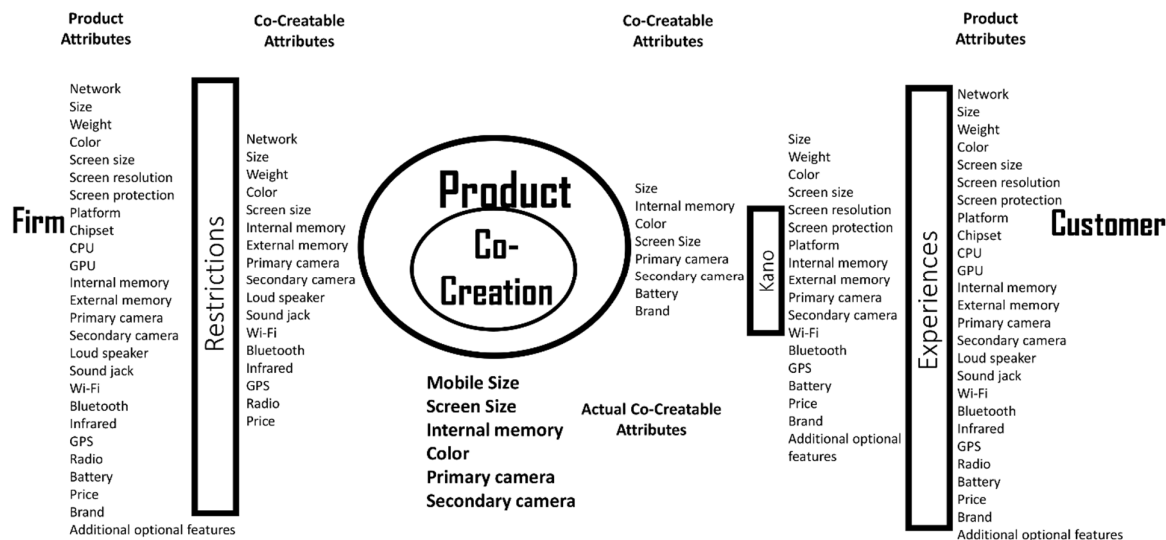


Fig. 6. Product attribute analysis for a smartphone

5. Practical Implication and Discussion

The study's objective is to develop a framework to help firms identify co-creatable attributes to make co-creation project systematic and successful. The multi-case study data analysis from the online platform suggest that firms looking to expand their existing product line or introduce incremental innovation focus on providing detailed guidelines for their co-creators. On the other hand, firms looking for disruptive ideas for future projects or ideas to introduce new to the market products refrain from providing detailed information. As a result, the ideas generated by the co-creators vary in nature and help firm look beyond their existing business models. This insight from the multi-case study analysis is very useful for practising managers. The practising managers can use this insight while preparing guidelines and description of their projects. Another insight for practitioners emerged during the analysis of two sample case studies. The lack of interest in co-creating jeans and high-level interest in co-creating mobile phone confirms that customers are not interested in co-creating every product and not even all attributes for a product of interest. This finding is in line with the multiple project analysis finding where the number of ideas submitted for personalized products was up to three times higher than the responses for other products. While the financial reward offered for these projects remained similar. This finding also confirms the argument made earlier in this study that hedonic, cognitive, personal and social experiences are more valuable for co-creators

than monetary benefits. Therefore, while designing their co-creation project, managers should pay attention to its motivation and method of engaging with the co-creators.

6. Conclusions

A framework to analyse the product attributes for the firm and their co-creators interest has been introduced that will align firm and co-creator goals during co-creation. The framework approaches the co-creation process from both firm and co-creators perspectives from the beginning of the project. It utilises co-creators experiences to shortlist product attributes by analysing the co-creators interest regarding individual attributes during the co-creation project. Future co-creators confirm these shortlisted attributes with the help of a Kano model. For determining firm interest, multiple case studies were analysed. The restrictions used by firms in these case studies utilised to analyse the attributes that a firm will be interested to co-create. Once both parties' interest has been analysed, a mix-and-match process helps identify the attributes in which both parties are interested; these are the actual co-creatable attributes that should be made available for co-creation during PD activities.

Two exploratory case studies were conducted to illustrate how the framework presented can be applied. Only tangible attributes were analysed in the exploratory case studies due to limited access to the required information. Availability of more information will further improve the evaluation results. In the first case study, the twelve attributes for the pair of jeans were tested

for customer and firm interest. The firm filter suggested that it is interested in co-creating nine attributes with co-creators. The customer side filer initially produced ten attributes that customer will be interested in co-creating. But once these ten attributes were tested using the Kano model, it was revealed that customers are not interested in co-creating any of these due to lack of interest and importance of these attributes for them. In the second case study of the smartphone, the customers showed higher interest in the co-creation project. Out of 26 attributes tested, two emerged as one dimensional and six as attractive, confirming that co-creators are more interested in personalized/less technical attributes when it comes to co-creation. In this case, the firm was willing to co-create 19 attributes with the co-creators.

It should be noted that the relationships among the attributes were not considered during this study. However, in a product, several attributes are interrelated, and altering one attribute may affect the other, as in the case of attributes weight and size. This relationship among the attributes should be further studied in future work related to the framework. The first case study results (jeans) point towards an interesting dimension of research related to what types of products and industries are suited for co-creation and what strategies will be needed to motivate co-creators to engage in products that are of no interest to them for co-creation.

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