Received: 24 May 2022 | Revised: 4 July 2022 | Accepted: 11 July 2022 | Published online: 12 July 2022

RESEARCH ARTICLE

Journal of Computational and Cognitive Engineering
2023, Vol. 2(2) 124–132
DOI: 10.47852/bonviewJCCE2202260

BON VIEW PUBLISHING

A Model for New Product Development in Business Companies Based on Grounded Theory Approach and Fuzzy Method

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Abstract: This study aims to provide a model for new product development in business companies with a grounded theory approach and fuzzy method. The present study was performed in the framework of a qualitative approach using the grounded theory method, and the required data were collected using in-depth interviews with experts. The study experts included university professors in marketing and senior executives in Beijing. The systematic method has three main stages such as open, axial, and selective coding. The obtained results demonstrate qualitative and technical improvement as the fundamental subject, brand and customer as the reason conditions, companies' marketing activities as the strategy, rules transparency and existing standards as the ruling context, managerial–promotional activities as the interfering factors, and new product and trust-building as the consequences in the paradigm model.

Keywords: new product development, business companies, grounded theory approach, fuzzy method

1. Introduction

New products are necessary for today's companies; the latest products respond to the organizations' most significant problems. Nowadays, most organizations have well felt the necessity for having an optimum process for developing new products; for this, they have made many efforts and incurred huge costs. Since acquiring new products is considered an essential part of the business, the latest products provide growth opportunities and competitive advantages for the companies.

Developing the product's service is now considered a competitive advantage for various products or service organizations. The development of new products helps the organizations to keep their competitive and exclusive position. In this way, innovation has an essential role in the growth and development of each company. The companies move toward improving their design approach to keep their competitive market and assure their survival (Cavallucci & Lutz, 2000).

The companies stop the production and present of some products or apply necessary modifications to respond well to the environmental changes. Also, due to the recognition of the needs and demands of the consumers in various markets and to satisfy these needs and continue long-term business and increase of economic boom in the company, companies try to develop new products (Parker & Brey, 2015).

The development of a new product to confront the dynamic and competitive market environment must satisfy the quality, cost, and production rate and ensure that the products have innovative value. Companies must contact the global competition challenge and improve their product development capabilities to reach long-term survival and sustainable growth. They can keep their international competition through continuous innovation in designing the new product. Prosperous companies are the ones who can make new markets by developing innovative products and dominating them (Ko, 2017).

The aim of developing the new product is to respond to the customer's needs, accommodation with the market conditions, environmental changes, benefits increase, customers' satisfaction, and confront competitive policies (Farsijani & Dehghan, 2016). The researchers believe that the design and development of new products are possible in a specified process framework and with the coordination between various parts. This process includes four steps: design, analysis, genesis, and commercial deployment. Developing the new services starts by establishing the strategy and

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objectives of the organization regarding the new services. After launching the new services strategy and purposes, the primary step of the process, i.e., the search for producing the idea evaluation, starts. The idea of new services originates from various sources. The most important sources are customers, researchers, employees, competitors, and high-level managers. Then, it is necessary to filter the ideas. In the next step (concept finding and test), it is essential to convert the attractive ideas to testable concepts. In the analysis step, the manager, to ensure the company achieves its goals, is inevitable to perform the predictions in the selling area, fixed price, profitability, and economical attraction evaluation. If the product or new services concept is justifiable economically, it is necessary to establish the project. In the product genesis or service designing services and its test, the design of the needed process and systems required for their testing, the job training of the employees, service test and preliminary implementation, and marketing tests are performed. In the commercial exploitation step, the market test will be served. The market test gives adequate information to the manager about whether the service is to be presented or not. In this step, the company offers its product to customers in a vast area (Klompaker et al., 1976).

Nowadays, most organizations need the optimum process of developing the new product and have made many efforts to have this kind of prosperous process and have undertaken high costs. In these organizations, experts and experienced persons are employed, advanced technologies are used, and in the meantime, their new product introduction may fail. Usually, the managers of this kind of organization cannot understand the reason for these failures. The research on this kind of organization has shown that the main problem is in the management type and new product production process control. The thing that is important among other factors of new products' success is the manager's rule in developing the latest developments. Because, the main problem of these organizations is the lack of correct management and proper managerial methods. To support and succeed in developing the new product, we can practically use two essential tools: organizational and designing tools. In the traditional cycle of developing the product, the design and construction steps were performed step by step and separately. At the same time, in the novel approaches, product development uses simultaneous engineering. These two steps are performed together, and the feedback of the reported faults from the design step rapidly results in the process modification. Nowadays, design tools like design by computer, engineering by computer, construction by computer, and rapid prototyping, with managerial tools like project management, product data management, and needs are well utilized in this direction.

Developing a new product is a critical strategic activity for most companies (Koufteros et al., 2005). Also, decision-making plays an essential role in real daily life. Nafei et al. (2019, 2020). The new products are, in fact, the keys to the success of the companies in the market. The managers are now under pressure to improve the performance of developing their company's new product. This needs the effectiveness and performance of most current product development processes, especially preventing ingesting resources in peripheral activities, changes, and revisions (Yeh et al., 2010).

The new product development includes various activities like design, engineering, and product tests for the products, production, and commercialization of the new product. These activities differ in many aspects like time, risk type and level, invisible ratio, distance from the market (Bassani et al., 2010). Also, in recent years, many studies have been done based on fuzzy sets and extensions. Nafei et al. (2021) proposed an optimized score function and then presented a decision-making strategy based on fuzzy neutrosophic sets. Pamucar et al. (2021) developed a multi-criteria decision-making (MCDM) methodology to prioritize the various AFVs for sustainable transport. Niksirat and Nasseri (2021) proposed a new strategy to deal with knapsack problem in fuzzy nature in which both the objective function and constraints are represented by fuzzy values.

The study's central question is, what are the most critical components of new product development for business companies? To answer this question and given the importance of the topic, the purpose of this study is to provide a model for new product development in business companies with the grounded theory approach and fuzzy method.

2. Research Methodology

The present study was performed in the framework of a qualitative approach using the grounded theory method, and the required data were collected using in-depth interviews with experts. The grounded theory is a qualitative research method by which an idea is developed using a data set. The grounded theory method is usually executed in three ways: systematic, emerging, and adaptive. The current study exploited the systematic process attributed to Strauss and Corbin (1998). The study experts included university professors in marketing and senior executives in Beijing. The systematic approach includes open, axial, and selective coding stages. Given that there are no presuppositions for presenting a new product development model in business companies, and all obtained data are unknown, using the grounded theory approach may be helpful.

2.1. Open coding

This stage of the grounded theory method is performed immediately after the first interview. In other words, after each interview, the researcher begins to find the concepts, select suitable labels for them, and combine the relevant ideas. The open coding steps in this study consisted of the following steps:

1. Analysis and coding: The researcher focused on coding all events at this stage. Numerous codes could be derived from an interview or a text; however, new data were obtained, and final regulations were specified when the data were reviewed regularly.
2. Discovery of categories: At this stage, the concepts were classified according to similar themes, referred to as the classification (theme making). The titles assigned to the categories were more abstract than the concepts forming that category. Besides, the classes had a high conceptual power as they could gather ideas around themselves. The researcher mainly chose the selected titles, which were aimed to have the highest relevancy and consistency with the data representing them. Another essential source (titles) was the expression used by the study participants, and the researcher could use it.
3. Describing the categories based on their features: The next step will be explained to clarify the types.
4. The open coding table consisted of two parts: the table of the initial codes extracted from the interviews and the table of the categories removed from the concepts with their secondary codes.

2.2. Axial coding

Axial coding is the process of relating the categories to subcategories and linking categories at the level of features and dimensions. At this stage, the grounded theory method theorist selects one of the categories from the open coding stage, places it at the center of the process being examined (as the "central phenomenon"), and then relates other categories to it. The other categories include "causal conditions," "strategies," "contextual and intervening conditions,"

and "consequences." This step includes plotting a graph called the "coding paradigm." The coding paradigm demonstrates the relationships among the causal conditions, strategies, contextual and intervening conditions, and consequences (Creswell & Clark, 2007).

Investigating this pattern, it can be observed that there are six boxes (categories) of information:

1. "Causal conditions": these are the categories associated with the conditions affecting the axial category;
2. "Governing context or background": it is the specific conditions affecting the strategies;
3. "Axial category": it is a mental form of the basic phenomenon of the process;
4. "Intervening conditions": these are the general contextual conditions that affect the strategies;
5. "Strategies": these are specific actions or interactions derived from the axial phenomenon;
6. "Consequences": these are outputs from employing the strategies.

2.3. Selective coding

Strauss and Corbin described selective coding and open and axial coding as follows: "In the open coding, the analyst creates the categories and their features and then attempts to determine how the categories vary along the specified dimensions. The categories are improved systematically in the axial coding, and the subcategories are linked again. However, these are not yet the main categories, and they are eventually integrated to form a larger theoretical arrangement so that the research results get the shape of theory. "Selective coding is the process of integrating and improving the categories" (Strauss & Corbin, 1998).

The statistical population study experts were university professors in marketing and new product development who were selected by the purposeful sampling method. In qualitative studies, data collection is stopped when the information about all the desired categories is saturated. This happens when the theory or topic is complete and new information is not obtained concerning the subject being studied. Thus, in qualitative studies, the sample size is considered equivalent to the data completion or data saturation. In this way, data saturation was achieved with 12 experts in this study.

Strauss and Corbin (2008) proposed the acceptability criterion instead of the validity and reliability criteria to evaluate studies based on grounded theorization. Acceptability represents the extent to which the study findings are reliable and credible in reflecting the experiences of the participants, the researcher, and the reader regarding the phenomenon under study. Several criteria have been suggested for the acceptability criterion, some of which have been exploited in this study to promote scientific accuracy, validity, and reliability. The employed criteria included methodological coherence, researcher sensitivity, sample fitting, replication of a finding, and the use of the feedback given by the informed individuals.

2.4. Fuzzy Delphi method

The experts' viewpoint was used to evaluate the indices' importance. Although the experts use their merits and mental abilities to make the comparisons, we have to note that the traditional method of people's viewpoint quantification cannot reflect the human thinking style. In other words, using fuzzy sets is more compatible with linguistic and sometimes vague human descriptions. I was considered to perform long-term predictions and decision-making in the real world using fuzzy sets (utilization of numbers) (Kahraman et al., 2006). In this study, 10 experts were used for the Delphi section, and after two rounds of Delphi, no other areas were deleted, and the survey was stopped.

3. Analyzing the Research Data

3.1. Open coding

Due to the limitations in the pages of all the text in all the interviews, the summary of an interview accompanied by the primary coding is shown in Table 1.

Table 1
A summary of an interview and primary coding

Row	Open coding (S1)	Summary of the expert's answers
2	- Process improvement - Permanent communication with customers - Processes management - Continuous quality improvement - Leadership effect - Work teams - Proper advertisements - Long-term view - Systematic planning - Marketing methods - Infrastructural methods - The necessity of the existence of good executive management - The necessity of complying the existing rules - Creativity and innovation - Market needs - The cost-effectiveness of development	In developing the product and new service for a commercial company, we have to note the process improvement issues. On the other hand, by having continuous communication with the customer, we could be informed of many issues. The processes that exist in the development of new products must be under complete control. This results that the quality to be continuously improved. We should not ignore the role of the leader. The leader should be present in all processes and decision-making. In this context, various work teams can cooperate in various sections and steps of developing the new product. In addition, one of the key factors in developing the new product is advertisement that should be performed correctly and properly. In this context, the long-term look and systematic planning should exist, so it could lead to new product success. The marketing methods that are used for new products should be completely considered. Also, the infrastructures should be correct and only proper executive management can consider all these items. Also, in all the steps, the rules must be considered and at the same time, we can observe innovation and creativity in new products. The companies should find the market need by proper study and also, for developing the new product, they have considered the economic aspects.

3.2. Secondary coding

In this step, the primary codes (due to their large number) are changed to secondary codes.
Some secondary codes are transferred to a conceptual code, and abstract principles make the categories (Table 2).

Table 2
Forming the concept and categories

Frequency	Secondary codes	Concept	Categories
7	- The support of governmental organizations to the development of product marketing of the new products - Resolving some legal obstacles - Bank support	Government	Support of responsible organizations
8	- Considering the facilities for developing the infrastructures - The support of responsible organizations Attracting the continuous support of the organizations	The supporting and responsible organizations	
8	- Learning the social medial modern marketing methods - Study and research for new methods - Studying the up-to-date methods in the world - Utilization of experience of prosperous companies in this context - The importance of new marketing methods - Continuous improvement of the quality	Bing up to date	Improving the agents and equipment
8	- The utilization of the latest hardware and software - The necessity of increasing the capacity and equipment ability - Teaching the correct utilization of the programs by the employees	The equipment development	
6	- Certificate for services and products - Certificate by special organizations - Certificates of control and supervision organizations	Control and supervision	Obtaining necessary certificates
7	- Obtaining national and international standards - Accommodation with recent standards - Updating the structure	Standardization	
7	- The necessity to meet the regulations - Supervisions of control organizations - Setting the preventive rules for profitable people - The necessity to make the existing rules about the production and distribution	Making the rules	Rules and performance
8	- Evaluating the performance - A long-term look at the relationship with the customer - Innovation in developing the new product - Systematic planning	Innovation and performance	
7	- Proper advertisement - Persuasion to buy with promotional programs - Holding exhibitions for awareness	Innovation in advertisement	Correct advertisement
9	- Utilization of information and communicational technology in social media marketing - Patterning from advanced countries	Utilization of information technology tools	
8	- New marketing methods - Making private markets - Attracting the customer's trust - The existence of market regulators - Period evaluations	Market regulation	Directing the market
8	- Proper marketing management - The necessity to use marketing tools - The sufficient amount of products and services - Proper distribution in districts	Market share	

(*Continued*)

Table 2
(*Continued*)

Frequency	Secondary codes	Concept	Categories
8	- Advice from the communication experts - Modification of infrastructural issues - Changing the viewpoint of marketing experts	Experts viewpoint	Correct planning
9	- Promotional policies - Motivating the customers - Setting long-term persuasions	Promotional plans	
9	- Correct pricing mechanism - Precise process experts - Preventing the intermediation and hoarding	Choosing correct goals	Bright landscape
7	- Cooperation with educational centers - The necessity of people support from the new product	Development goals	
8	- The importance of the existence of good executive management - Identification of development barriers - Clarification of advantages and disadvantages	Clarification in developing the new product	Managerial look
7	- Changing the marketing pattern - Obstacles removal - Synchronization of producer and consumer	Structures modification	
6	- Getting the investor - Presenting the special advantages for investors - Removing the problems in front of investors - Presenting the facilities	Making motivation for investors	Investment and social responsibility
10	- Social responsibility - Care about the environment - Supporting the product and services	The society movement toward social responsibility	
7	- Response to the customer's expectations - Observing consumer rights	Customer	Brand development
6	- Identification of better brand with new product - Brand obligation	Brand creditability	
5	- Resolving the needs - Managing communication with the customer	Customer need	Society welfare
6	- Proper price - Considering the social economic condition	Economic factors	
5	- Ease of providing products and services - Systematic planning for present	Getting access to products and services	Giving correct information about the product
9	- Long-term look for development - Innovation in production and product distribution - Removing the dealer and interface	Having long-term goals	
7	- The necessity to improve the people look - Cultivation - Making awareness - Making public trust about the new product - Taking people feedback	Cultivation	Trust-building
5	- Improving the people awareness level - Modifying the communication patterns - Trust-building - Changing the traditional habits	Regulating the communication rules	

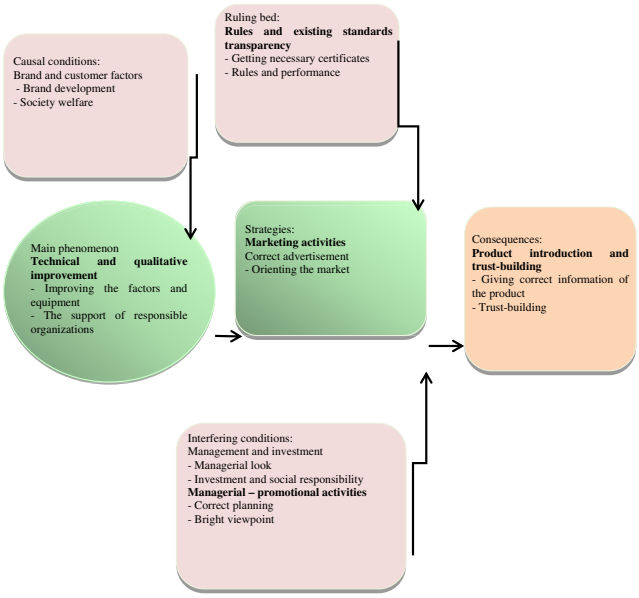
3.3. Forming the main stories

The determination of the items in the construction step of the theory is shown in Table 3.

Table 3
Determination of main stories of the items (subsidiary stories)

Items (subsidiary stories)	Main stories
- Support of the responsible organizations - Improving the factors and equipment	Technical and qualitative improvement
- Getting necessary certificates - Rules and performance	Rules and existing standards of transparency
- Proper advertisement - Orienting the market	Marketing activities
- Correct planning - Bright viewpoint	Managerial–promotional activities
- Managerial look - Investment and social responsibility	Management and investment
- Brand development - Society welfare	Brand and customer factors
- Giving correct information about the product - Trust-building	Introducing the product and trust-building

Figure 1
Paradigm model of developing the new product



3.4. Axial and selective coding

The axial coding aims to create a relationship between the generated classes (at the open coding stage). This is performed based on the paradigm model and helps the theorist conduct the theory process conveniently. The foundation of the communication process in axial coding lies in expanding one of the classes. At this point, the main steps followed by the researcher were the ones emphasized by Strauss for the axial coding stage:

- Expressing the features of a category and its dimensions that is the action that starts during the open coding.
- Identifying various conditions, actions, interactions, and outcomes associated with a phenomenon.
- Relating a category to its subcategories by phrases that specify how they relate to each other.
- Searching for clues in the data indicates the way of the relation of the main categories to each other.

At this stage, the grounded theorist chooses one category from the open coding stage, places it at the center of the process examined (as the "central phenomenon"), and then relates other categories to it. The other categories include "causal conditions," "strategies," "contextual and intervening conditions," and "consequences." This stage includes plotting a graph called the "coding paradigm."

The main stage of theorization is selective coding (based on the results of the two previous coding steps). In this way, the axial class is systematically related to other types. These relationships are presented within a narrative framework, and the classes needing further improvement and development are modified. Based on his understanding of the phenomenon under study, the researcher either presents the framework of the paradigm model in a narrative form or disarranges the paradigm model and illustrates the final theory as a plotted graph. A paradigm model of developing the new product is shown in Figure 1.

3.5. Axial phenomenon (prominent): qualitative and technical improvement

We considered qualitative and technical improvement as the axial issue. Therefore, this research's qualitative and technical improvement consists of two problems: factors improvement and responsible organization support.

3.6. Causal conditions: brand and customer factors

The reasonable conditions are the conditions that are effective on the axial issue. These are necessary but insufficient conditions to access the consequence of utilizing the strategies. In this research, the brand and customer factors are acknowledged as the causal conditions because to improve the qualitative and technical issues, in the first place, the factors related to brand and customer must be correct. The brand and customer factors are brand and social welfare development in this research.

3.7. Strategies: marketing activities

The strategy is a concept that originated in the military arena and later was used in other areas. The process, in simple terms, means an operational plan to coordinate and organize the activities to reach the objectives. Based on the organized approach of Strauss and Corbin,

the strategy is particular actions and reactions that originate from the axial issue. In this research, the techniques include the marketing activities of the company. The marketing activities of the company include the correct advertisement and market orientation.

3.8. Ruling bed (context): Rule and existing standards transparency

A unique condition that affects the strategies is named context. Due to the definition, special conditions not seen in other dimensions are needed to implement the plan. In other words, according to the paradigm model, the strategies will not reach the result till the context exists. Therefore, we cannot have proper marketing and talk about other aspects until we have defined rules and existing standards of transparency about the new product. Here, the context component or ruling context includes the management and existing measures of openness. This dimension contains getting the necessary certificate and rules and performance.

3.9. The interfering conditions: managerial–promotional activities and management and investment

The interfering conditions are the general conditions that affect the strategy. Here, the interfering state includes the managerial–promotional activities and management and investment that consists of the organizational look, investment, and social responsibility. Management and investment have the correct planning and bright viewpoint. Therefore, this can be imagined that the interfering conditions in this study (managerial–promotional activities and management and investment) are the general conditions that are generalized in other existing activities.

3.10. Consequences: Introducing the new product and trust-building

The consequence is the output resulting from the strategy utilization. It means that by correct marketing activities (correct advertisement and market orientation), we can hope to introduce the new product and its trust-building. Naturally, the other interfering factors will significantly affect this consequence.

3.11. The fuzzy Delphi sections

The reason for doing the fuzzy Delphi method is that since in the grounded theory, each expert is not aware of the overall output of the work, and maybe some of the components that have been finalized have not been approved by some experts. Therefore, the fuzzy Delphi method for verifying the final details is then done.

This study used fuzzy triangular numbers to fuzzify the experts' viewpoint. The experts' viewpoint about the importance of each index was collected with the 7° fuzzy spectrum as shown in Table 4.

Generally, an approach for Delphi's end is to compare the questions scores of the first and second rounds. If the differences between the two steps are significantly lower than the threshold limit (0.2), then the survey process will be stopped.

Table 4
The 7° fuzzy spectrum for evaluating the indices

Linguistic variables	Fuzzy number	Triangular Fuzzy number (TFN)
Totally unimportant (TL)	$\tilde{1}$	(0, 0, 0.1)
High unimportant (VL)	$\tilde{2}$	(0, 0.1, 0.3)
Low important (L)	$\tilde{3}$	(0.1, 0.3, 0.5)
Medium (M)	$\tilde{4}$	(0.3, 0.5, 0.75)
Important (I)	$\tilde{5}$	(0.5, 0.75, 0.9)
High important (VH)	$\tilde{6}$	(0.75, 0.9, 1)
Totally important (TH)	$\tilde{7}$	(0.9, 1, 1)

According to the results stated in Table 5, it was revealed that in all cases, the differences are lower than 0.2. Therefore, Delphi's approach could be ended.

Table 5
The definite value distance of the first and second rounds

Indices	Round 1	Round 2	Gap	Result
Supporting responsible organizations	0.830	0.847	0.017	Agreement
Upgrading agents and equipment	0.875	0.747	–	Disagreement
Getting the necessary approvals	0.773	0.822	0.048	Agreement
Rules and practice	0.735	0.925	0.190	Agreement
Correct advertising	0.772	0.855	0.083	Agreement
Market orientation	0.822	0.933	0.112	Agreement
Proper planning	0.917	0.917	0.000	Agreement
Bright prospects	0.578	–	–	Disagreement
Managerial look	0.755	0.775	0.020	Agreement
Investment and social responsibility	0.925	0.842	0.083	Agreement
Brand development	0.788	0.723	0.065	Agreement
Community welfare	0.892	0.925	0.033	Agreement
Providing correct product information	0.578	–	–	Disagreement
Trust-building	0.855	0.773	0.082	Agreement

4. Conclusion

In the obtained model and components for a new product, it was observed that the factors related to the brand and customer are the reason conditions. In fact, for a commercial company, the new product development is accompanied by some risks, as the brand is now famed by the customers. Therefore, brand development could be one of the essential items in this context. The same results were reported by Delavari and Sobhieh (2017). Another critical item in developing the brand and customer is related to the community welfare that should be considered by the companies that intend to build the new product. Floren et al. (2018) reported this kind of result. Here, community welfare means the easy access of all the society to the latest products and services and accurate prices.

The extracted model's central phenomenon is a qualitative and technical improvement. This component includes the improvement of factors, hardware and software equipment of the company, and the responsible companies' support. This result is consistent with the results of Cooper (2019). The equipment being up to date is very important for developing the new product, especially for commercial companies where customers expect to receive the best products and services. The support of responsible companies is essential because in creating a new product, most responsible organizations should evaluate the steps, development, and final service. Without the necessary support, it is possible that many good ideas would be diminished in the early stages despite having essential potential. The ruling context in the extracted model is the rules transparency and existing rules. This section includes getting the required certificates, and regulations and performance To develop a new product or service, some rules and standards must be met. Suppose a company could be certified to the highest level of the standards and up-to-date certificates. In that case, it can expect to have proper success in that product marketing and attracting the customer's attention.

The obtained approaches in this pattern include marketing activities. The correct advertisement and orienting of the market have the leading roles in this component. Proper advertisement's position and essential effect for introducing and marketing the new product and service is undeniable. The market and customer must be ready to accept the product, and mentally, the market would be directed toward the latest product and service. The novel marketing methods proportional to the new product or service must be utilized for this purpose.

It is observed in the model that the interfering factors are categorized into two groups. The first group is the factors related to management and investment, including managerial, investment, and social responsibility look. The same results were reported by Wen-Hsien et al. (2011). The investment could be very determinative of the products that need higher costs. How a manager can attract the attention of the investors to develop a new product is essential. Nowadays, customers have a unique look at social responsibility. Considering the environment and society must be met in all the sections of developing the new product, so it could satisfy the customers in long-term conditions. The second group of interfering factors is the managerial–promotional factors that include the correct programming and bright prospect. In the Edvardsson studies (2013), similar results were obtained. The proper programming always must be done in long-term issues, and the vision considered by the company should be defined for a definite period of years, so the forward movement for the product and service can be evaluated for concrete years.

Finally, we witness some consequences in the model that include the product introduction and trust-building, which provides correct information about the product and trust-building in society. Generally, the aim of developing a new product is to create a good view of that product for the customers in the society, and they could trust it so the product would face a proper welcome. To do so, the company must present correct information about the product's advantages and disadvantages, so the customers can make the right decision. For further research, it is suggested to propose a model for new product development in business companies based on interval-valued fuzzy sets.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

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How to Cite: Nezhadkian, M., Azimi, S. M., Ferro, A., & Nafei, A. H. (2023). A Model for New Product Development in Business Companies Based on Grounded Theory Approach and Fuzzy Method. *Journal of Computational and Cognitive Engineering* 2(2), 124–132, https://doi.org/10.47852/bonviewJCCE2202260