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Optimizing New Product Development in The Hijab Industry: A House of Risk Analysis on Marketing and Design Process

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ABSTRACT

XYZ Company, a Micro, Small, and Medium Enterprise (MSME) based in Yogyakarta, specializes in producing hijabs but faces challenges in maintaining customer interest due to a misalignment between product designs and consumer preferences. To address this, the company actively engages in new product development (NPD), focusing on trend analysis and model innovation to cater to customer needs better. An essential part of minimizing risks during the NPD process involves evaluating and identifying potential pitfalls, particularly in marketing and design. This study employs the Hazard and Operability Review (HOR) method to assess risks systematically. Initial findings from HOR phase 1 reveal that inadequate competitor information (A3) leads to significant risks in competitor product identification (E3), contributing approximately 70.34% to the total Aggregate Risk Priority (ARP). Subsequently, in HOR phase 2, XYZ Company prioritizes ten mitigation actions, with conducting a comparative study of competitors' products (PA1) being the most critical, reflected by an ETDk value of 540.

Keywords: House of Risk (HOR), Hijab Fashion, Hijab Industry, New Product Development (NPD)

Introduction

Terminology of New Product Development (NPD) was introduced by Cooper and Kleinschmidt in 1986. NPD is the process of transforming new ideas related to products into products that can be sold on the market. In the NPD stage, companies often carry out several necessary steps: market study, product development, commercialization, and market analysis introduction. [1]. NPD is essential for companies because new products are continuously required to remain competitive and meet customer demand. According to customer satisfaction, this process provides products faster and better quality. [2]. The success of NPD depends on the company's ability to decide what to create during the NPD process. These decisions have a significant impact on the outcome of NPD. Information uncertainty makes measuring NPD performance during product development difficult. [3]. According to Hoppe et al [4], consumers can become an exciting source of knowledge if companies successfully attract them into the interactive NPD process. Numerous studies show that measuring NPD performance is critical during product development. A study of Fortune 500 and Japanese companies indicated that appropriate product design and market selection will influence NPD performance and emphasized that companies must understand market uncertainty. [5].

In carrying out NPD, companies create a trade-off between risks and benefits. Therefore, identifying, controlling, and managing risks is critical to the success of NPD. Risk can be defined as an undesirable condition or uncertainty that can hinder operations, cause delays, increase costs, and provide unfavorable results for the company. [6]. Thus, recognizing, optimizing, and managing risk factors is critical in NPD. [7]. Research has shown that only 60% of NPDs are successful. Some of them fail due to financial problems. [8]. Risk management can be defined as a series of activities related to risk, which includes planning, identification, assessment, analysis, handling, and monitoring of risks. Risk management improves activity performance by systematically identifying and assessing risks that may occur in an activity. [9]. One risk management method is the House of Risk (HOR) [10].

This HOR method begins with mapping supply chain activities and identifying risks, then continues with processing a matrix of risk sources and events to obtain a sequence. The priority source of risk will be given treatment. The risk source matrix will be created with preventive action, and the final result will be a priority sequence for risk mitigation as the output of the House of Risk. [11]. HOR is a risk management model that integrates models House of Quality (REMOVE) and Failure Modes and Effects Analysis (FMEA). Failure Modes and Effects Analysis (FMEA) is an approach used to identify potential failures in a process and determine the priority of corrective actions based on the severity, frequency, and detectability. [12], [13], [14]. FMEA is also used to identify potential errors when planning product development [15], FMEA in the HOR method is used to quantify risk, while HOQ is used to identify priority risk sources that need to be anticipated so that risk events arising from risk sources can be mitigated appropriately [16].

In recent years, the growth rate of the fashion industry in Indonesia, including the Muslim fashion industry, has been speedy. According to the State Global Islamic Economic (SGIE), Muslim fashion consumption in Indonesia is USD 20 billion, with a growth rate of 18.2% annually. [17]. Indonesia occupies 3rd position in the Top 10 Modest Fashion and Top 10 Fashion Muslim Consumer Markets, with total spending amounting to USD 21 billion. [18]. Specifically, the hijab industry in Indonesia is growing by 15% -20% per year, driven by increasing market demand both domestically and abroad. One of the factors driving the growth of the hijab industry is the increasing number of Muslim women who wear the hijab. Based on data from the Central Statistics Agency (BPS), in 2022, the number of Muslim women in Indonesia reached 90.9% of the total female population. [19]. With a large number of Muslim women, of course, the hijab market has great potential to be exploited. Likewise, in Yogyakarta, 3.43 million, or 92.94% of the population, are Muslim [20]. Meanwhile, according to gender, as of 2022, 1.98 million or 49.33% of the population will be male, and the remaining 2.03 million or 50.66% will be female. [21]. Referring to these data, Muslim fashion business opportunities in Yogyakarta have great potential, especially for hijab products. Muslim women, nowadays, wear hijabs more fashionably. With so many models and styles available, the hijab is sought after by Muslim women in Yogyakarta. In Yogyakarta itself, the trend of wearing fashionable hijab is increasing, which creates a huge market opportunity for hijab fashion MSMEs in Yogyakarta. Therefore, the Hijab Industry must carry out New Product Development (NPD) to produce hijab products based on the latest trends and models. Thus, hijab fashion MSMEs in Yogyakarta can increase customer interest in the hijab products produced.

However, implementing NPD by looking at the vast potential of the hijab market is not without risks. Competition in marketing and new product design has increased, with new competitors owning their market segments. The need to effectively manage NPDs is becoming increasingly urgent in the Muslim fashion business environment. In many cases, assessing whether a product meets its intended purpose can only be done when it is competitive. In addition, the success of a product in the market depends mainly on designing the product according to specifications and the ability to translate customer needs into product specifications. [22]. There needs to be a process of identifying and mitigating risks that will arise in the design and marketing process to increase the success of NPD carried out by hijab MSMEs.

XYZ Company is one of the MSMEs that produces hijab fashion in Yogyakarta. In producing hijabs, MSME XYZ always carries out an NPD process to meet the hijab fashion needs of its customers, regularly following developing trends and fashions. In carrying out the NPD process, various possible risks will arise and need to be managed well by the company to reduce the impact that may arise from these risks, which can disrupt the company's goals. The problem currently being faced by UMKM XYZ is that the products it produces have experienced a decline in buying interest from customers. According to business owners, one of the reasons is the increasing number of competing companies producing similar products with more attractive styles and prices. Companies' current problems show that proper marketing and product design will influence the company's performance in generating profits and reduce uncertainty in carrying out the NPD process, especially at the marketing and design stages, to face market uncertainty. NPD is a way to win the competition but requires a long and challenging time. It is stated that the failure rate for new products starts at 40%. In addition, the average company takes 27 months to develop the most innovative product. [23].

Studies examining NPD in the Muslim fashion industry are still rare. Research on NPD in the hijab fashion industry has been carried out by Dewi et al. [24] by analyzing risks and developing risk mitigation strategies covering the entire NPD process. The methods used in the research are the FMEA and HOR methods. Research conducted by Annisa et al. [25] identified, analyzed, and mitigated operational risks in NPD hijab fashion at the Yeppushop company. Operational risks in this research include quality risks, production costs, development time, resources, and productivity. Risk management in this study uses an integration model between FMEA and HOR. In the two studies conducted, risk

identification and analysis at the marketing and design stages of NPD hijab fashion were not carried out separately but were combined in one NPD stage. Meanwhile, research conducted at XYZ MSMEs focuses on identifying and analyzing risks that may arise at the marketing and design stages in the field of NPD hijab fashion and determining the right risk mitigation strategy. The NPD process in MSMEs is carried out due to a lack of customer interest and understanding of consumer needs and preferences for hijab products. This study uses the HOR method to identify, analyze, and determine appropriate mitigation strategies. Implementing this HOR method can help evaluate the potential risks that may occur at the NPD design and marketing stage so that MSMEs can know the proper steps to reduce or overcome the risks that will occur. Therefore, this study will address the gap by exploring how hijab fashion companies consider risks at the NPD marketing and design stage.

Research Methods

General Stages of Research

This research was conducted at UMKM XYZ, which produces Muslim clothing such as hijab in Yogyakarta. The research data was taken from November to December 2023. The first step in starting this research is to identify the problem by conducting literature and field studies. The next stage is to collect data by conducting focus group discussions (FGD) and interviews. After conducting the problem identification process, including evaluating and identifying NPD risks, especially at the marketing and design stages, the data collected is analyzed using the HOR method. The House of Risk method was chosen because it is one of the most effective risk management methods for determining the priority level of potential risk agents and the mitigation actions that must be taken. Data analysis using the HOR method is carried out by determining the priority level of each risk agent to determine the most effective risk mitigation based on the priority of the risk agent that has been found.

Steps in the Preparation of HOR

The stages of preparing HOR phases 1 and 2 are as follows. [16]:

1) HOR Phase 1.
   This phase identifies potential risks that may occur in each process or activity. Each process or activity involved is mapped in detail to begin this stage. This phase focuses on determining the risk priority level or ARP, which consists of occurrence, severity, and the relationship between risk elements. This HOR phase was developed through the following stages:
   a. Identify possible occurrence risk events on each process or activity.
   b. Provide an assessment of the severity of the risk event (if it occurs) in each process or activity. In this case, a scale of 1-5 is used, where the number 5 indicates extreme impact.
   c. Identification of risk agents and assessment of the likelihood of each occurrence of risk agent. In this case, a scale of 1-5 is used, where a value of 1 indicates that the risk agent appears rarely, and a value of 5 means it occurs frequently.
   d. Develop relationships between each risk agent and every risk event, Rij (0, 1, 3, 9) where the value 0 indicates no relationship and the values 1, 3, 9 indicate low, medium, and high, respectively.
   e. Calculate the set of potential risks (*Aggregate risk priority of agent* j=ARP_j), which is determined as a result of the probability of occurrence of risk agent j and groups-severity i of each event which is caused by risk agent j as in the equation:
   $$ARP_j = O_j \sum S_i \, . \, R_{ij} \quad (1)$$
   f. Make a sequence risk agent in descending order (rank) based on value ARP_j.
2) HOR Phase 2.
   HOR phase 2 determines the first action to be taken by considering its effectiveness, difficulty level in implementation, and financial commitment. Here are the steps:
   a. Using Pareto analysis from ARPj, select several risk agents with a high priority ranking.
   b. Take into consideration relevant actions to prevent their occurrence risk agent. It is better if one action can reduce the possibility of more than one risk agent at a time.
   c. Determine the relationship of each preventive measure and risk agent, E_{jk}. Determine the relationship between each preventive measure and risk agent (E_{jk}) will be considered in determining the effectiveness of action k to reduce the probability of the event risk agent.
   $$TE_k = \sum_j ARP_j \, . \, E_{jk} \quad (2)$$

d. Estimate the degree of difficulty (D_k) in each preventive action. The degree of difficulty is indicated on a scale (3, 4, and 5) and reflects the financial and other resources required to act. After that, calculate the total effective ratio of degrees of difficulty for each preventive action using the equation:

$$ETD_k = TE_k/D_k \quad (3)$$

Table 1. Difficulty Degree Value

Weight	Information
3	Easy to implement mitigation measures
4	It isn't easy to implement mitigation measures.
5	It isn't easy to implement mitigation measures.

e. Determine the priority of each preventive action based on the highest ETD_k value, according to the priority scale.

Results and Discussion

From the marketing and design stage activities in NPD at MSME XYZ, identification was carried out for risk events and risk agents. Ten risk events and eleven risk agents were identified, as shown in Table 4. After the risk identification stage, the risk measurement stage continues. Tables 2 and 3 show the parameter's severity, occurrence, and relationship value between the risk event and agent. All of these parameters are needed to carry out risk measurements. A scale of 0, 1, 3, and 9 assesses this relationship, where each number indicates no relationship between the weak, moderate, and strong.

Table 2. Impact Criteria (Severity)

Value Scale	Criteria	Information
1	Insignificant	The impact on achieving company goals is negligible
2	Minor	Provides a small impact on achieving company targets
3	Moderate	Provides a moderate impact on achieving company targets
4	Major	Have a severe impact on achieving company goals
5	Catastrophic	Has a severe impact on achieving company goals

Table 3. Probability Criteria (Occurrence)

Value Scale	Criteria	Information
1	Rare	This event occurs once every three years and only occurs in extreme circumstances.
2	Unlikely	It hasn't happened yet, but it may happen once every two years
3	Possible	This event should happen and probably happens once a year
4	Likely	It's easy to happen and may happen more than five times in two years
5	Almost likely	It often occurs and most often occurs more than five times a year

Table 4. Risk Identification

Activity	Risk Event		Risk Agent
Marketing level	Mistakes in Determining Consumer Needs	→	Poor formulation of consumer needs
	Mistakes in determining market segments	→	Lack of understanding in determining market segments
	Identifying poor competitor products	→	Little information about competing products
	Errors in determining selling prices and profits	→	Company errors in analyzing production costs
	Failure in promotion	→	Product promotions are less attractive.
Design Stage	Many changes occurred during the design process.	→	Defining product concepts that are too complex
	Additional time is required for redesign.	→	Design concepts must constantly evolve.
	Underdeveloped product design	→	Weaknesses in design variations and product standards
			Lack of product innovation capabilities (Product designers do not follow trends and fashion)
	Errors in determining product specifications	→	Not having sufficient knowledge about raw materials.
	The costs of product development design exceeded budget estimates.	→	Design discrepancies due to differences in opinion from the company owner

Table 5. Risk Event Identified

Code	Risk Event	Severity (Si)
E_1	Mistakes in identifying consumer needs	5
E_2	Mistakes in determining market segments	5
E_3	Identifying poor competitor products	4
E_4	Errors in determining selling prices and profits	5
E_5	Failure in promotion	5
E_6	Many changes occurred during the design process	4
E_7	Additional time is required to redesign	3
E_8	Underdeveloped product design	4
E_9	Errors in determining product specifications	4
E_{10}	The costs of product development design exceeded budget estimates	3

Table 6. Risk Agent Identified

Code	Risk Agent	Occurrence (Oi)
A_1	Poor formulation of consumer needs	3
A_2	Lack of understanding in determining market segments	4
A_3	Little information about competing products	4
A_4	Company errors in analyzing production costs	3
A_5	Product promotions are less attractive	1
A_6	Defining product concepts that are too complex	3
A_7	Design concepts must always evolve	3

Code	Risk Agent	Occurrence (Oi)
A_8	Weaknesses in design variations and product standards	4
A_9	Lack of product innovation capabilities (Product designers do not follow trends and fashion)	4
A_{10}	Not having sufficient knowledge about raw materials	3
A_{11}	Design discrepancies due to differences in opinion from the company owner	3

After the risk event and risk agent are identified and measured, the next step is to assess the relationship between the two. This is necessary because the emergence of one or more risk agents may cause the appearance of one or more risk events and vice versa. Relationship values 0, 1, 3, and 9 are used to evaluate this relationship. The relationship assessment steps are shown in Table 7. This relationship assessment will ultimately produce an ARP_j value. Priority risk agent is based on the ARP_j value. The following example shows the ARP calculation risk agent using formula (1), namely:

$$ARP_j = O_j \sum S_i \, . \, R_{ij}$$

$$ARP_1 = 3 \times (5 \times 3) = 45$$

Table 7. Phase 1 HOR calculation

Activity	Risk Event	Risk Agent											Severity (S_i)
		A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	
Marketing Level	E_1	3	0	0	0	0	0	0	0	0	0	0	5
	E_2	0	9	0	0	0	0	0	0	0	0	0	4
	E_3	0	0	9	0	0	0	0	0	0	0	0	5
	E_4	0	0	0	9	0	0	0	0	0	0	0	5
	E_5	0	0	0	0	3	0	0	0	0	0	0	5
Design Stage	E_6	0	0	0	0	0	9	0	0	0	0	0	4
	E_7	0	0	0	0	0	0	3	0	0	0	0	3
	E_8	0	0	0	0	0	0	0	9	9	0	0	4
	E_9	0	0	0	0	0	0	0	0	0	9	0	4
	E_{10}	0	0	0	0	0	0	0	0	0	0	1	4
	Occurrence (O_i)	3	4	4	3	1	3	3	4	3	4	3	
	ARP	45	144	180	135	15	108	27	144	108	144	12	
	Ranking	**8**	**2**	**1**	**5**	**10**	**6**	**9**	**3**	**7**	**4**	**11**	

Table 8. Phase 2 HOR calculation

Risk Agent	Mitigation Strategy										ARP_j
	PA_1	PA_2	PA_3	PA_4	PA_5	PA_6	PA_7	PA_8	PA_9	PA_{10}	
A_3	9	9									180
A_2			9	3							144
A_8					9	9					144
A_{10}							9	3			144
A_4									9	3	135
Total Effectiveness of Action (TE_k)	1620	1620	1296	432	1296	1296	1296	432	1215	405	

Difficulty of Performing Action (D_k)	3	4	3	3	4	3	3	3	3	4
Effectiveness to Difficulty Ratio of Action (ETD_k)	540	405	432	144	324	432	432	144	405	101,25
Rank of Action	**1**	**5**	**2**	**8**	**7**	**3**	**4**	**9**	**6**	**10**

The results of calculating the ARP value in Table 7 show that risk agent The highest is little information about competitors' products (A_3). Risk agent This has the highest value because it can cause risk in an event by identifying poor competitor products (E_3). The relationship between risk agent A_3 and risk event E3 is quite strong. The risk agent with the lowest ARP value has a design discrepancy due to differences of opinion from the company owner (A_{11}). Risk agents give rise to risk events in the form of costs from product development design exceeding budget estimates (E_{10}). After calculating the ARP value, risk evaluation is the next step. A risk evaluation is carried out to determine the sequence of risk agents that should be prioritized in mitigation strategies. In risk evaluation, the Pareto diagram is an analytical tool used. First, the ARP values are sorted from largest to smallest. Next, the cumulative risk agent and percentage value are calculated, as shown in Table 9.

Table 9. Calculation of ARP Percentage and Cumulative Percentage

Code	Risk Agent	ARP	%	% Cumulative
A_3	Little information about competing products	180	16,95	16,95
A_2	Lack of understanding in determining market segments	144	13,56	30,51
A_8	Weaknesses in design variations and product standards	144	13,56	44,07
A_{10}	Not having sufficient knowledge about raw materials	144	13,56	57,63
A_4	Company errors in analyzing production costs	135	12,71	70,34
A_6	Defining product concepts that are too complex	108	10,17	80,51
A_9	Lack of product innovation capabilities (Product designers do not follow trends and fashion)	108	10,17	90,68
A_1	Poor formulation of consumer needs	45	4,24	94,92
A_7	Design concepts must always evolve	27	2,54	97,46
A_5	Product promotions are less attractive	15	1,41	98,87
A_{11}	Design discrepancies due to differences in opinion from the company owner	12	1,13	100,00

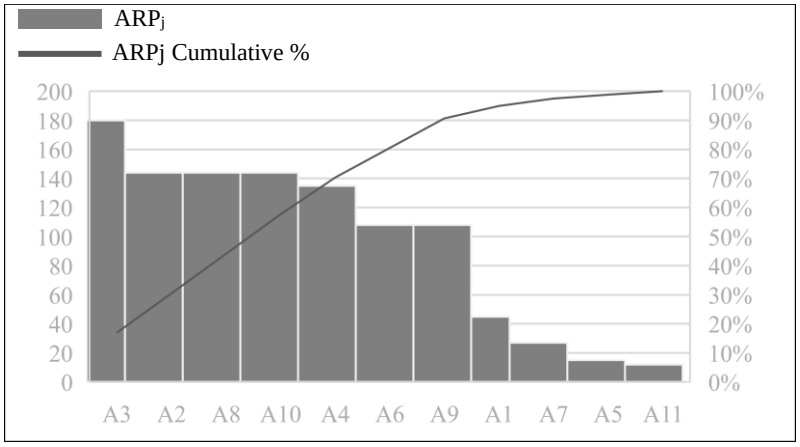

Figure 1. Pareto Diagram Risk Agent

Figure 1 shows a graph of ARP values presented in a Pareto diagram. From the diagram, MSME company XYZ chose five risk agents, contributing around 70.34% of the total ARP. Then, HOR phase 2 can be used to prioritize mitigation strategies that the company must implement to maximize the effectiveness of efforts with acceptable resources and financial commitments. HOR phase 2 presents five risk agents with the ten proposed actions in Table 10. The difficulty level in performing each action is classified into three categories: low with a value of 3, medium with a value of 4, and high with a value of 5. The difficulty level should also reflect the money and other resources required to take appropriate action. Therefore, the ratio will indicate the cost-effectiveness of each action.

Table 10. Rank of Action from Mitigation Action

Code	Mitigation Action	Rank	TE_k	DK	ETD_k
PA_1	Conduct comparative studies of competitors	1	1620	3	540
PA_3	Conduct interviews with potential consumers to gain direct insight into consumer preferences and needs	2	1296	3	432
PA_6	Establish a centralized design team that leads and coordinates all aspects of product design	3	1296	3	432
PA_7	Training employees in the production department so that they have sufficient knowledge about raw materials	4	1296	3	432
PA_2	Regular scheduling to identify and analyze competitors	5	1620	4	405
PA_9	Improve the cost analysis planning mechanism	6	1215	3	405
PA_5	Collaborate between the design team, production team, and marketing team for product development and have the same understanding	7	1296	4	324
PA_4	Conduct training for marketing employees to be able to review sales data, feedback, and purchasing behavior to identify the right market segments	8	432	3	144
PA_8	Create SOPs related to raw materials that will be used in the production process	9	432	3	144
PA_{10}	carry out regular analysis regarding fluctuations in raw material prices and selling prices	10	405	4	101,25

As shown in Table 8, HOR phase 2 assesses the relationship between risk agents and risk mitigation measures. The results show that one risk agent can be anticipated by carrying out several risk mitigation actions, and one risk mitigation action can be taken to prevent the emergence of one of the risk agents. ETD_k value is used to determine the priority order of risk mitigation actions. Table 10 shows the ranking order of mitigation actions from highest to lowest. Looking at Table 10, XYZ MSMEs can carry out ten priority mitigation actions. As an illustration, a comparative study of competitors (PA_1) is the top priority. With an ETD_k value of 540, PA mitigation actions1 can effectively minimize the occurrence risk agent little information about competitors' products (A_3).

Conclusion

Based on the research that has been done, it can be concluded that several potential risks were identified at the marketing and design stages in the NPD process at XYZ MSMEs. At the marketing stage, there are risk agents such as mistakes in identifying consumer needs (A1), market segment determination error (E2), Poor-identifying competitor products (E3), errors in determining selling prices and profits (E4), and failure in promotion (E5). In addition, at the design stage, there are several other

agent risks, such as many changes occurring during the design process (E6), additional time required in redesign (E7), underdeveloped product design (E8), errors in determining product specifications (E9), and the costs of product development design exceeded budget estimates (E10). After the analysis using a Pareto chart, it was found that five risk agent priorities (A3), (A2), (A8), (A10), and (A4) will be prioritized for mitigation actions. There are 10 risk mitigation recommendations provided, and mitigation actions a comparative study of competitors (PA1) is the top priority with an ETDk value of 540; PA mitigation actions 1 can effectively minimize the occurrence risk agent little information about competitors' products (A3). With the implementation of several risk mitigation recommendations, MSMEs can optimize the NPD process on hijab products to increase the success of the products to be produced. Suggestions that can be given for future research include identifying risks at other stages to increase the optimization of the NPD process carried out. In addition, further research was conducted on more than one or several similar companies to obtain an NPD risk management framework that can be applied as a general guide for managing risk in the NPD process.

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