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Risk Management in New Product Development of Kombucha Cascara: A Coffee Waste-Based Local Product Case Study in Karangpring Village Jember

Manajemen Risiko New Product Development Pada Kombucha Cascara: Studi Kasus Produk Kreatif Lokal Berbasis Limbah Kopi Di Desa Karangpring Jember

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ABSTRACT

This research aims to analyze risk management in the new product development (NPD) of cascara kombucha, a fermented drink made from coffee husk waste, in Karangpring Village, Jember. Kombucha cascara is a local creative product innovation that offers health benefits and a sustainable solution by transforming waste into value-added products. The research method used is Failure Modes, Effects, and Criticality Analysis (FMECA) to identify risks and the House of Risk (HOR) to analyze and design risk mitigation strategies. The research results indicate that the main risks in NPD kombucha cascara include supply chain instability, raw material quality, and product distribution. The recommended mitigation strategies include adding alternative suppliers, utilizing adequate logistics services, and installing temperature and humidity control systems. This research significantly contributes to supporting the development of innovative products and providing sustainable solutions for the waste-based food and beverage industry. In addition, this research also provides recommendations for future NPD development, particularly in the context of locally-based creative waste products.

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Introduction

An important aspect of modern business strategy is new product development (NPD). In the ever-evolving world of the food and beverage industry today. Product innovation that involves the operational perspective of the company is called the new product development process or NPD, which integrates creative ideas with operational efficiency to produce products that meet market needs and support business sustainability (Rooderkerk & Gallino, 2019). The promising innovation is Kombucha cascara, a fermented drink that utilizes coffee husk waste. This innovation results from processing coffee husk waste located in Karangpring Village, Jember. The kombucha cascara innovation has its own uniqueness and health benefits while also providing usefulness and sustainable solutions by processing waste into value-added products. This research explores risk management in NPD for cascara kombucha products in Karangpring Village, Jember.

Desa Karangpring, located in the Sukorambi District, Jember Regency, has great potential in managing local commodities such as arabica coffee, tea, and rubber managed by PTPN XII. Most of its population, namely 1,923 people (52.3%), work as farm laborers, while others dominate the private sector and households or are still unemployed with a high population growth rate of

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more than 2% per year. Karangpring Village has become a strategic location for the development of innovative and creative products based on coffee waste (Lukman Hakim Alam Syah & Olivia, 2024). This opens up opportunities for the implementation of risk management in the process of developing new products, such as Kombucha Cascara, which utilizes coffee husk waste to create added value while supporting local economic sustainability.

Kombucha has been known as a functional drink rich in probiotics and antioxidants, which can improve digestive health and boost the immune system. The increase in demand for healthy products in Indonesia indicates a significant market potential for kombucha. According to research by Nurhayati et al. (2020), cascara kombucha contains significant phenolic compounds and a distinctive sour taste produced through the fermentation process by bacteria and yeast in SCOBY (Symbiotic Culture of Bacteria and Yeast). This indicates that cascara kombucha can be an interesting alternative for health-conscious consumers (Bentara Immanuel et al., 2020).

However, the development of new products such as cascara kombucha is not without various risks. Risks in NPD can arise from internal factors, such as the quality of raw materials and the production process, as well as external factors like market competition and government regulations (Muzaifa et al., 2022). The research emphasizes the importance of risk management in identifying and addressing potential issues that may arise during the product development process. These risks, if not managed properly, can result in product failure in the market, which in turn affects business sustainability. In this context, a systematic approach to risk management is essential. According to Dewi et al. (2015), effective risk management practices can help companies reduce the likelihood of failure in NPD projects by identifying key risks and formulating appropriate mitigation strategies. This is important to ensure that the cascara kombucha product not only meets quality standards but is also well-received by consumers.

Thus, this research will analyze various aspects of risk management in the development of cascara kombucha in Karangpring Village, Jember. The main focus will be on identifying the key risks that can affect the success of NPD and the mitigation strategies that can be applied to address these challenges. This research is expected to make a significant contribution to the development of locally-based creative products using coffee waste and to support the sustainability of the food and beverage industry in Indonesia.

Material And Methods

This research uses a case study on a local creative product in Karangpring Village, Jember, namely cascara kombucha. This product is made from coffee husk waste that is fermented using bacteria called scoby. Having a fermented aroma and a slightly sour taste with a unique flavor, this product has distinctive characteristics and can be categorized as a New Product Development (NPD) product. Therefore, this research analyzes risk management in the production of cascara kombucha tea in Karangpring Village, Jember, involving three informants, namely two (R1 and R2) from the Nawasena Women's Farmers Group (KWT) and one (R3) from a kombucha beverage entrepreneur.

The House of Risk (HOR) model, which was modified from Gray and Larson (2007), and the Failure Modes, Effects, and Criticality Analysis (FMECA) model were the methodologies employed in this study. In this study, the FMECA method serves as a tool to identify risk events, generating a risk list such as the type of risk (Ei), its occurrence location, and its causes (Aj), which can affect the achievement of the company's objectives. This method helps to understand in detail the potential risks by identifying the risk agents and related risk events, thereby enabling effective preventive actions to reduce the occurrence and impact of risks (Pujawan & Geraldin, 2009). Meanwhile, the HOR method is used as a tool for risk analysis and evaluation in the HOR1 stage, as well as for designing and prioritizing risk mitigation steps in the HOR2 stage, thereby ensuring that risks can be managed effectively and efficiently.

1. HOR Phase 1

   The initial stages of risk analysis involve several key steps, namely: measuring the severity level (si), assessing the likelihood of occurrence of the risk agent, evaluating the relationship between the risk event and its causative agent through correlation values, and calculating the risk priority index or Aggregate Risk Potential (ARP). The ARP value is calculated using the following formula:

   $$ARP_j = O_j \sum S_i R_{ij} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

2. HOR Phase 2

   HOR phase 2 is the stage of designing mitigation strategies to address identified high-priority risk agents. In this phase, the steps taken include: selecting risk agents based on the highest to lowest ARP values, identifying appropriate mitigation actions (PAk) for each risk agent, measuring the correlation between risk agents and mitigation actions, calculating the total effectiveness (TEk) for each risk agent, and assessing the difficulty level of implementing mitigation actions (Dk) in reducing the likelihood of risk agents emerging. Next, the effectiveness-to-difficulty ratio (ETDk) is calculated, and prioritization is determined based on the highest to lowest ETDk values. The calculation of TEk and ETDk values can be done using the following formula:

   $$TE_k = \sum ARP_j E_{jk} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

   $$ETD_k = \frac{TE_k}{D_k} \quad \ldots\ldots\ldots\ldots\ldots (3)$$

Results And Discussions

Based on interviews with the Nawasena Women's Farmers Group (KWT) and kombucha beverage entrepreneurs, the New Product Development (NPD) process for cascara kombucha begins with the design stage, which includes production planning, technical aspects, raw material selection, production process, distribution, and marketing. Risk events and their causes in the NPD of cascara kombucha have been identified.

Based on Table 1, there are a total of 16 risk events that can affect the cascara kombucha production process at the Nawasena Women's Farmer Group (KWT). The details of the risks include 2 Risk Events in the Plan stage, 4 in the Source stage, 5 in the Make stage, 3 in the Deliver stage, and 2 in the Return stage. Next, potential risk sources (Risk agents) are identified. Occurrence refers to the frequency of risk occurrence and its impact on non-conformities that occur during the production process (Ridwan et al., 2019).

Table 1. Severity Assessment Risk

	Sub-Process	Risk Event	Code	Severity Value		
				R1	R2	R3
Plan	Supply planning	Uncertainty about the availability of cascara from local farmers.	E1	8	7	5
	Production planning	Inaccuracy in predicting market demand	E2	6	6	5
Source	Supplier identification	Difficulty finding a sustainable cascara supplier	E3	7	5	4
	Purchase of raw materials	The price of raw materials is fluctuating	E4	5	3	3
	Raw material quality inspection	The Cascara Kombucha drink received is of low quality or contaminated	E5	5	5	3
	Raw material logistics management	Delays in the delivery of raw materials from the supplier	E6	6	4	2
Make	Cascara cleaning	The cleaning process was not perfect, which affected the quality of the fermentation.	E7	5	3	3
	Initial fermentation	Inconsistency in temperature or fermentation time that causes the product to fail	E8	5	5	6
	Advanced fermentation	Contamination during fermentation	E9	6	4	5
	Screening	The presence of cascara residue that has not been properly filtered	E10	4	4	5
	Packaging	Broken or leaking bottles or packaging	E11	4	3	2
Delivery	Order management	Order recording error	E12	6	3	2
	Transportation of products	The product was damaged during shipping	E13	5	3	4
	Promotion and marketing strategy	Ineffective promotions reach the target market	E14	5	4	8
Return	Return of defective products	The cost of product returns is high	E15	3	4	1
	Production waste management	Production waste is not managed properly	E16	2	3	4

Table 2. Identification of Risk Agents and Assessment of Occurrence (Frequency Level) of Risk

Code	Risk Agent	Occurrence		
		R1	R2	R3
A1	The unpredictable variation in coffee harvest seasons	3	3	4
A2	Lack of market data or sales trend analysis	5	5	3
A3	The limited number of local cascara suppliers	6	5	5
A4	Dependence on a single supplier	4	5	7
A5	Storage of finished products that do not meet standards	5	4	3
A6	The lack of the supplier's logistics fleet	5	5	5
A7	The lack of adequate cleaning facilities	3	4	3
A8	Lack of precision in regulating the temperature and duration of fermentation	3	3	3
A9	Poor production environment cleanliness	3	3	3
A10	The design of the filter device is inefficient	4	3	3
A11	The low quality of the packaging materials	4	4	3
A12	Manual recording system that is prone to human error	7	5	6
A13	The inadequate quality of packaging	6	6	3
A14	Marketing strategies that are less relevant to the audience	3	4	5
A15	The absence of an efficient product return policy	7	5	6
A16	The lack of awareness among the workforce regarding waste management	3	3	2

Risk Analysis

This stage is the HOR Phase 1 (Table 3), where the severity and occurrence levels of risk events and risk agents are analyzed. Next, the correlation value between the risk event and the risk agent is calculated to determine the Aggregate Risk Potential (ARP). The purpose of this correlation analysis is to identify the risk agents that need to be prioritized in preventive actions. Based on HOR Phase 1, the highest ARP values for each respondent were recorded as follows: 524 for R1, 500 for R2, and 286 for R3, with the dominant risk agent being risk agent A3.

Table 3. HOR Phase 1

Risk Event	Risk Agent																Severity Of Risk		
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	R1	R2	R3
E1	3	1	9	1	0	1	1	0	0	0	0	0	0	1	1	0	8	7	5
E2	0	9	1	1	0	1	1	1	0	0	0	1	0	1	3	0	6	6	5
E3	1	3	9	9	0	1	0	0	0	0	0	1	0	1	1	0	7	5	4
E4	0	0	1	9	3	9	0	0	0	0	0	0	1	0	1	0	5	3	3
E5	0	1	1	1	9	3	1	0	0	1	1	3	1	1	0	0	5	5	3
E6	0	1	1	1	0	9	0	1	0	0	0	1	0	1	1	0	6	4	2
E7	0	1	0	1	1	0	9	9	0	0	1	0	0	1	1	0	5	3	3
E8	0	0	0	1	0	0	1	9	3	1	0	0	0	1	0	0	5	5	6
E9	1	1	0	0	1	1	0	9	9	0	0	1	1	0	0	0	6	4	5
E10	0	0	0	0	1	0	0	1	1	1	3	0	1	0	0	0	4	4	5
E11	1	0	0	1	1	0	0	0	1	0	1	0	1	3	0	0	4	3	2
E12	0	0	0	0	0	1	0	0	0	0	1	1	0	1	3	0	6	3	2
E13	0	1	0	0	0	0	1	0	1	0	1	0	1	0	1	3	5	3	4
E14	0	1	1	1	0	0	1	0	0	0	0	0	1	9	1	0	5	4	8
E15	1	1	0	0	1	0	1	1	0	0	0	0	3	0	9	0	3	4	1
E16	1	0	1	0	0	1	0	1	1	0	1	0	1	0	1	9	2	3	4
Oj R1	3	5	6	4	5	4	3	3	3	4	4	7	6	3	7	3			
Oj R2	3	5	5	5	5	5	4	3	3	3	4	5	6	4	5	3			
Oj R3	4	3	5	7	3	5	3	3	3	3	3	6	3	5	6	2			
ARP R1	94	150	524	176	82	173	98	165	84	14	39	46	45	121	154	33			
ARP R2	83	129	395	241	424	500	80	132	65	12	28	25	49	96	123	39			
ARP R3	76	98	286	127	52	99	69	143	78	14	33	27	37	128	88	48			
Rank ARP R1	9	6	1	2	11	3	8	4	10	16	14	12	13	7	5	15			
Rank ARP R2	9	6	3	4	2	1	10	5	11	16	14	15	12	8	7	13			
Rank ARP R3	9	6	1	4	11	5	10	2	8	16	14	15	13	3	7	12			

Risk Evaluation

The next stage in this research is risk evaluation, which is conducted by assigning weights to each risk agent to determine the priority of handling the cascara kombucha production process at the Nawasena Women's Farmer Group (KWT). This weighting process uses a Pareto diagram, which helps identify the main risks based on the 80:20 principle, where most of the risk impact comes from a small number of causes. The Pareto diagrams shown in Figures 1, 2, and 3 illustrate the contribution of each risk agent to the total Aggregate Risk Potential (ARP) by the respondents. This analysis aims to determine the most crucial risk factors and develop appropriate mitigation strategies.

The analysis results show that in R1, based on the Pareto Diagram of ARP Risk agents (R1), the main risk factors that need to be prioritized are A3, with the highest ARP value of around 600, followed by A4, A6, A8, A15, and A2, which also contribute significantly. According to the 80:20 Pareto principle, the top five risk agents contribute more than 80% of the total risk, so mitigation efforts should be focused on these factors. Meanwhile, risk agents with lower ARP values still need to be monitored, but they are not the top priority. Thus, in the production of cascara kombucha at KWT Nawasena, primary attention should be given to A3, A4, and A6 to minimize the risk impact on the production process.

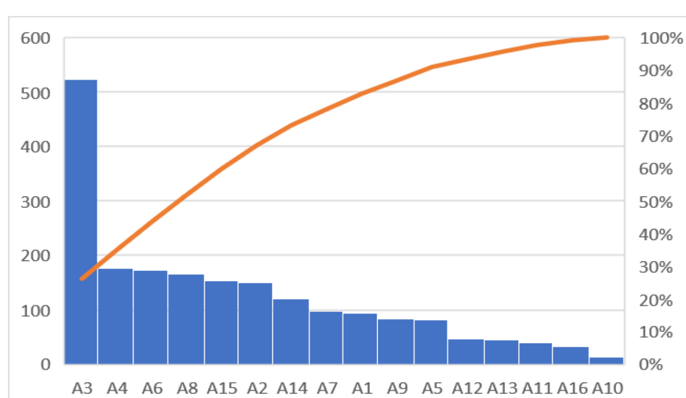

Figure 1. Pareto Diagram of ARP Risk Agent on R1

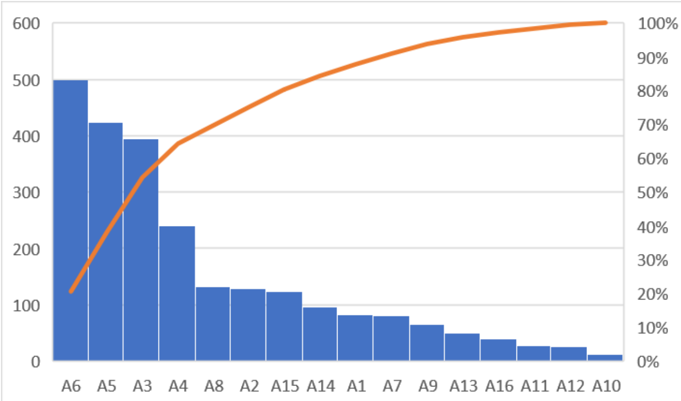

Figure 2. Pareto Diagram of ARP Risk Agent in R2

In the Pareto Diagram of ARP Risk agents in R2, the risk agents with the highest ARP values are A6 (500), A5 (424), and A3 (395), which cumulatively account for about 70% of the total risk. Just like in R1, these three factors are the top priority in risk mitigation because they have the greatest impact on cascara kombucha production. The handling strategy needs to be focused on these factors to reduce the potential risks that could hinder the production process at KWT Nawasena.

In the Pareto Diagram of ARP Risk agents in R3, the risk agent with the highest ARP value is A3 (286), which contributes approximately 35% to the total risk. This factor becomes the top priority in risk management by R3 because it has the greatest influence compared to other factors. Thus, mitigation efforts should be focused on this risk agent to improve the efficiency of cascara kombucha production and reduce obstacles in the process.

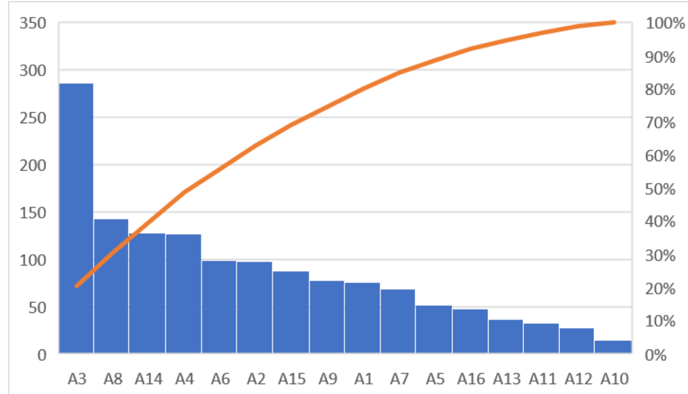

Figure 3. Pareto Diagram of ARP Risk Agent in R3

Risk Response

At this stage, the design of risk mitigation strategies in the New Product Development (NPD) of Kombucha Cascara at KWT Nawasena, Karangpring Village, Jember Regency, is carried out using the Phase 2 HOR Matrix (Table 4). Through this matrix, each identified risk agent is mapped to determine the most effective mitigation strategy (Kurniawanti, 2017). The mitigation strategies are summarized in Table 5, which will later serve as the basis for formulating concrete steps to reduce potential risks that could hinder the production and marketing processes of Kombucha Cascara. With this approach, it is hoped that the emerging risks can be addressed systematically, ensuring that product innovation remains sustainable and competitive in the market.

Table 4. HOR Phase 2

Risk Agent	Handling Strategy										ARPj		
	PA1	PA2	PA3	PA4	PA5	PA6	PA7	PA8	PA9	PA10	R1	R2	R3
A3	9	1	1	0	0	0	0	0	0	0	524	395	286
A6	0	0	0	9	1	1	0	0	0	0	173	500	99
A5	0	0	0	0	0	0	9	1	3	1	82	424	52
Tek R1	4716	524	524	1557	173	173	738	82	246	82			
Tek R2	3555	395	395	4500	500	500	3816	424	1272	424			
Tek R3	2574	286	286	891	99	99	468	52	156	52			
Dk R1	4	4	5	3	3	4	4	3	4	3			
Dk R2	3	4	4	3	4	4	4	3	3	3			
Dk R3	3	3	4	3	3	5	4	3	3	3			
ETD R1	1179	131	104,8	519	57,6	43,2	184,5	27,3	61,5	27,3			
ETD R2	1185	98,75	98,75	1500	125	125	954	141,3	424	141,3			
ETD R3	858	95,3	71,5	297	33	19,8	117	17,3	52	17,3			
Rank R1	1	4	5	2	7	8	3	9	6	9			
Rank R2	2	9	9	1	7	7	3	5	4	5			
Rank R3	1	4	5	2	7	8	3	9	6	9			

After determining various mitigation actions to reduce or prevent risks, the next step is to compile a correlation matrix between each mitigation action and each risk agent using the HOR (House of Risk) Phase 2 method. This method aims to determine the most effective mitigation strategies based on the calculation of the ETD (Effectiveness to Difficulty Ratio) value. The ranking of the generated mitigation strategies reflects the level of priority in implementation, where strategies with higher rankings should be applied first to have a more significant impact in reducing risk.

Table 5. Risk Mitigation Strategies

Ranking	Code	Mitigation
1	PA1	Adding alternative suppliers to reduce the risk of dependency
2	PA4	Use third-party logistics services with an adequate fleet
3	PA7	Install a system to control temperature and humidity
4	PA9	Use airtight packaging and maintain the cleanliness of the storage area
5	PA2	Drafting a contract with a clear delivery schedule and penalties
6	PA3	Price negotiation or bulk purchase for a discount
7	PA5	Plan efficient deliveries and maximize fleet capacity
8	PA6	Ensure the fleet meets safe transportation standards
9	PA8	Train staff to follow storage procedures according to standards
10	PA10	Routine audits to ensure storage conditions remain optimal

Based on the results of the Phase 2 HOR analysis, the mitigation strategies of the three respondents show a tendency to prioritize technical aspects, particularly in maintaining hygiene standards. In Respondent 1, the main priority is cleanliness, followed by the implementation of waste recycling strategies (PA6) to reduce environmental impact. Next, the focus shifts to material handling, such as setting a time limit for products to be exposed to outside temperatures (PA7) to maintain product quality. Additionally, the pricing strategy with an evaluation process (PA8) has also become a priority to ensure the product's price competitiveness in the market.

Meanwhile, in Respondent 2, the order of mitigation priorities began with hygiene aspects, followed by an evaluation-based pricing strategy (PA8) to address fluctuations in raw material prices. Next, the focus is directed towards setting a time limit for products to be at outside temperatures (PA7) to maintain product quality, analyzing external factors (PA9) that can affect production, and recycling waste (PA6) as a form of resource efficiency. The final priority is the overall handling of raw materials and waste to ensure the sustainability of the production process.

In Respondent 3, the mitigation strategy prioritizes the standardization of work procedures and raw material storage methods (PA3) to maintain quality and prevent contamination. After that, structured and sustainable cleanliness management (PA1) becomes the main focus to ensure that the products continue to meet food safety standards. Next, an evaluation of raw material suppliers is conducted, along with mitigation of external disruptions such as electricity supply instability, and handling material aspects related to price fluctuations and raw material availability.

If linked to the previously compiled mitigation table, the highest-ranked mitigation strategies such as adding alternative suppliers (PA1), using logistics services with adequate fleets (PA4), and installing temperature and humidity control systems (PA7) become crucial factors supporting the sustainability of Kombucha Cascara production at KWT Nawasena, Karangpring Village, Jember. This shows that the most influential factors in mitigating production risks involve aspects of supply chain stability, storage quality control, and logistics efficiency in product distribution.

Conclusion

New Product Development (NPD) is a crucial aspect of modern business strategy, especially in the ever-evolving food and beverage industry. This research focuses on the innovation of cascara kombucha, a fermented beverage made from coffee husk waste, developed by KWT Nawasena in Karangpring Village, Jember. This innovation not only offers uniqueness and health benefits but also provides a sustainable solution by transforming waste into a value-added product. This research aims to explore risk management in the NPD process to ensure the sustainability of kombucha cascara production and distribution.

The methods used in this research are Failure Modes, Effects, and Criticality Analysis (FMECA) and House of Risk (HOR). FMECA helps identify risks, causes, and their impacts, while HOR is used to analyze the severity level, occurrence frequency, and the correlation between risks and their causes. In the second phase of HOR, risk mitigation strategies are designed, resulting in action priorities. The highest-ranked mitigation strategies include adding alternative suppliers (PA1), using logistics services with adequate fleets (PA4), and installing temperature and humidity control systems (PA7). These findings indicate that supply chain stability, storage quality control, and distribution logistics efficiency are crucial factors in supporting the sustainability of cascara kombucha production.

However, this research has several limitations. As a new, innovative product, information related to the production and marketing of cascara kombucha is still limited, especially for KWT Nawasena, which is still in the development stage. These limitations affect the depth of the risk analysis that can be conducted. Therefore, for future research, it is recommended to expand the scope of the analysis by involving more risk agents and developing more comprehensive mitigation strategies. Additionally, it is important to conduct further studies on consumer preferences, market potential, and the environmental impact of cascara kombucha production to ensure long-term sustainability.

This research makes an important contribution to understanding risk management in NPD, particularly in the context of waste-based product innovations such as kombucha cascara. By addressing challenges in the supply chain, quality control, and distribution, KWT Nawasela can ensure production sustainability and enhance product competitiveness in the market. Recommendations for further research include classifying case studies based on product type, business scale, or market characteristics, as well as integrating a multidisciplinary approach to optimize the NPD process and risk mitigation. Thus, this research not only supports the development of innovative products but also provides sustainable solutions for the waste-based food and beverage industry.

References

Andini, R., Abubakar, Y., Sulaiman, M. I., & Rahmi, F. (2022). Pengenalan Produk Inovasi Pengolahan Limbah Biji Kopi Melalui Proses Fermentasi Menjadi Minuman Kesehatan 'Kombucha Cascara'. *ABDIKU: Jurnal Pengabdian Masyarakat Universitas Mulawarman*, *1*(2), 12-16.

Dewi, D. S., Syairudin, B., & Nikmah, E. N. (2015). Risk Management in New Product Development Process for Fashion Industry: Case Study in Hijab Industry. *Procedia Manufacturing*, *4*, 383–391. https://doi.org/10.1016/j.promfg.2015.11.054

Gray, C.F. dan Larson, E.W., 2007, Manajemen Proyek Proses Manajerial, Andi, Yogyakarta

Immanuel, N. B., Saptari, A., Kurniawan, D., & Halim, I. (2021, January). Analysis of new product development by using quality function deployment (QFD): a study of Kombucha. In *Proceeding of the International Conference on Family Business and Entrepreneurship* (Vol. 1, No. 1).

Kurniawanti, K. (2017). MANAJEMEN RISIKO NEW PRODUCT DEVELOPMENT PADA INDUSTRI FROZEN FOOD. *Jurnal Rekavasi*, *5*(2), 108-115.

Lukman Hakim Alam Syah, M., & Olivia, Z. (2024). The Influence of Counseling on the Knowledge of PKK Women in Karangpring Village About Antioxidants in Local Mawar Tea Products. *Jurnal Abmas Negeri (JAGRI)*, *5(12)*.

Moreira, A. C., Ferreira, L. M. D. F., & Silva, P. (2021). A case study on FMEA-based improvement for managing new product development risk. International Journal of Quality and Reliability Management, 38(5). https://doi.org/10.1108/IJQRM-06-2020-0201

Nurhayati, N., Yuwanti, S., & Urbahillah, A. (2020). Karakteristik fisikokimia dan sensori kombucha cascara (kulit kopi ranum). *Jurnal teknologi dan industri pangan*, *31*(1), 38–49. Https://doi.org/10.6066/jtip.2020.31.1.38

Pujawan, i. N., & geraldin, l. H. (2009). House of risk: a model for proactive supply chain risk management. *Business Process Management Journal*, *15*(6), 953–967. Https://doi.org/10.1108/14637150911003801

Ridwan, a., lintang trenggonowati, d., & parida, v. (2019). Usulan aksi mitigasi risiko rantai pasok halal pada ikm tahu bandung sutra menggunakan metode house of risk. In *Journal Industrial Servicess* (Vol. 5, Issue 1).

Rooderkerk, R. P., & Gallino, S. (2019). *New Product Development in an Omnichannel World*.

Tosepu, Y. A. (2018). Hukum Pareto: Formula 80/20 yang dapat diterapkan dalam seluruh sendi kehidupan.

Ueasangkomsate, P., & Suksatean, S. (2024). New product development process of Thai SMEs in food industry. Procedia CIRP, 128, 393–398. https://doi.org/10.1016/j.procir.2024.06.029