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Application of the Analytical Hierarchy Process (AHP) for Innovative Technological Projects Evaluation and Prioritization in an FMCG Company

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ABSTRACT: The FMCG industry is known for its dynamic and competitive nature. To thrive in this business sector, companies must possess the ability to swiftly adapt to the market demand changes, continuously enhance operational efficiency and drive innovation. Those abilities are crucial for maintaining competitiveness and ensuring long term viability of the company. Over the past few decades, technology along with its advancement has emerged as a factor that disrupts the ecosystem of various industries by reshaping the way businesses operate and interact with the customers. In Indonesia, many organizations including FMCG companies have continuously embraced and adopted emerging and innovative technologies within their business operations. Although it offers various benefits for the companies, the execution process has usually encountered various challenges which causing the implementation projects to experiencing delays, especially during the decision-making process. This was also the case in one of the largest FMCG companies in Indonesia due to varying interpretations of project importance, as well as the absence of clear prioritization criteria and an unorganized decision-making process. In order to address the issues, the organization plans to develop a decision-making framework that harmonizes diverse stakeholder perspectives related to project importance based on a number of key criteria while also analyze the benefit and impact provided by the implemented technologies through the application of the Multi Criteria Decision Making (MCDM) approach using the Analytical Hierarchy Process (AHP) framework. There are three technology innovation projects to be analyzed and assessed in this research: AGV Implementation, and Digital Warehouse Management System, and Universal QR for Traceability. In order to evaluate the projects, eighteen criterion which are divided into eighteen sub criteria that has been established through Secondary Data Collection and Focus Group Discussion (FGD) process. The data were processed by leveraging the systematic decision-making structure provided by the AHP framework. The research yields two primary outcomes: a structured decision-making framework and a project prioritization scheme intended for application at the organization. The findings of the research highlight the critical role of structured decision-making in navigating the complexities of evaluating and prioritizing innovative technological projects, while also proposing a scalable model that can be repeatedly utilized by the company in the project evaluation and prioritization contexts.

KEYWORDS: FMCG, Emerging and Innovative Technologies, Project Delays, Project Evaluation and Prioritization, Decision Making, Analytical Hierarchy Process

INTRODUCTION

The fast-paced nature of the FMCG sector, combined with vigorous competition, demands that companies continually innovate to stay ahead. Those characteristics are formed due to several factors that influence the industry such as customer preferences that continue to change from time to time, high volume of demand with fast product turnover and there are substitute products in the market. Therefore, the success of an FMCG company depends on their ability to adapt to the market demand, enhance their business efficiency and innovate in order to compete and maintain their existence (Olutimehin et al., 2023). In the last few decades, it must be acknowledged that technology has become a differentiating factor that disrupts various business ecosystems including the FMCG industry which makes all the companies try to adopt and adapt to it (George & George, 2023). The main objective of vast adoption of the latest technology by various FMCG companies is to reduce costs, improve product quality, eliminate waste and to have the ability to respond to market changes.

Technology does have various useful uses for the FMCG industry. However, in recent years, the rapid development of technology accompanied by the emergence of new innovations has caused companies to face various obstacles in the process of implementing the technology itself (Akhmadi & Tsakalerou, 2020), starting from high adoption costs, the need to improve worker skills and the

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difficulty to establish an effective change management process. Therefore, the existence of a robust project management practice, clear technology adoption roadmap and qualified resources are very critical in order to make the technology adoption and implementation process successful (Yordanova, 2020). A company's inability to fulfill these aspects can cause the company to allocate more of their main assets, especially money, time, and resources in order to turn the condition around. Moreover, this condition can lead into prolonged delays and even failure in the technology implementation process which is highly undesirable for all parties involved.

BUSINESS ISSUE

Staying ahead of market demand and maintaining an increasing market share in a competitive landscape that continuously changes is critical for sustainable business growth in the FMCG sector. As one of the largest FMCG company in Indonesia, the company has undertaken various initiatives to optimize their business processes through the strategic adaptation and application of technologies and made it become one of the company's main strategies which will be aligned with the vision, mission and objectives of the companies. With the aim of realizing the main objectives: reduce costs, improve product quality, eliminate waste and to have the ability to respond to market changes. Over the past four years, various key projects focusing on technological advancements have been undertaken by the organization while also exploring new technologies to be utilized in their business processes such as Automatic Guided Vehicle (AGV), ASRS racking system, and Advanced printing systems. However, the number of projects that have been scheduled for every year has been continuously rising since 2023. As an effort to balance the increasing number of projects and sudden unexpected requested projects from the management, the company has undertaken several initiatives such as hiring new employees that have the capability to support the enrolment of the projects and forming a business operations team that focuses on the smaller project and rollout process. However, the results achieved did not meet the expectations. Since the second semester of 2023, the project success rate has fallen due to numerous delays. This gap has become main concerns among the company's management, who fear the problem will continue, especially after 1 key project could not be completed by the end of 2023. Therefore, the management of the company has directed the warehouse plant team to immediately formulate a feasible and practical response to eliminate delays, minimize the time deviations, and maximize project completions. Based on the root cause analysis, three causes related to the decision-making process to evaluate and prioritize projects has been determined that are Different views on project importance, Absence of an organized approach to making decisions, and Lack of transparent criteria for prioritization. These three critical issues can be consolidated into one overarching cause that is inadequate process of evaluating and prioritizing projects in the organization which makes it is crucial for the organization to develop an integrative decision-making framework for Project Evaluation and Prioritization that aims to effectively harmonize diverse stakeholder perspectives on project importance based on a number of key criteria including the benefit and compatibility of the technology that will be implemented during the project.

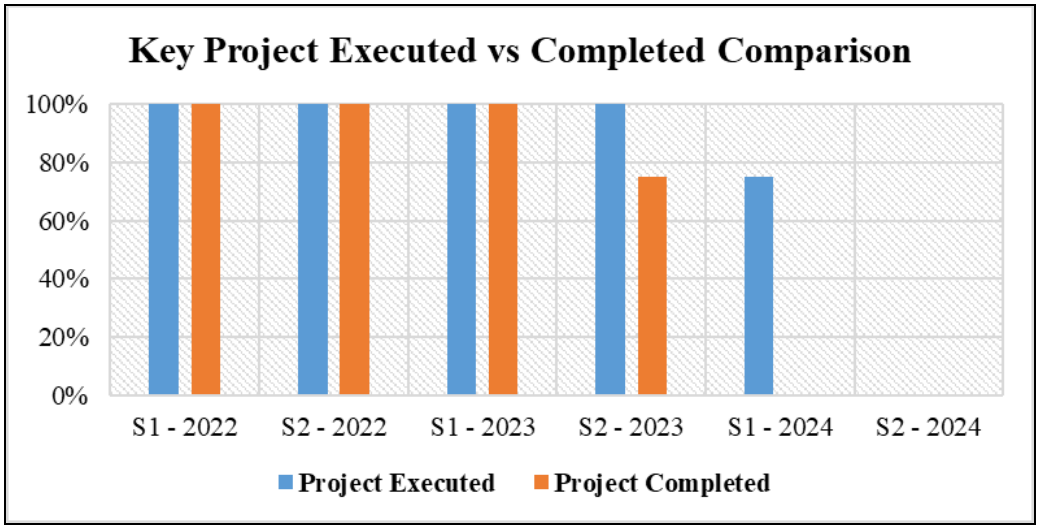

Figure 1. Project Executed vs Completed Comparison

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LITERATURE REVIEW

Organizational strategy is an organization's long-term plan to achieve its objective in a dynamic environment by managing the allocation of their resources (Abdulwase et al., 2020). Kpurunee et al. (2023) describes that the establishment and implementation of organizational strategy is important for an organization to enhance the organization performance, develop competitive advantage and help the organization to adapt to changing market conditions. In recent years, as the digitalization era is continuously changing the world, the internal and external aspects that need to be consolidated by the company during the alignment process is persistently increasing and changing. Two of the most impactful aspects are technology and the capability of the organization to use it. Those 2 aspects could affect the company adaptation process with the environmental change and uncertainties in the digital era. Al Haraisa (2022) emphasizes that to enhance the performance, organization's need to develop and enhance their information systems and technology. Recent research shows that a lot of organizations have tried to implement their organization's strategy by leveraging alignment framework through its collaboration with project implementation (Ansari et al., 2014), These frameworks are integrated into project management practices to ensure that projects are aligned with the strategic objectives of the organization. This approach facilitates better coordination, enhances strategic alignment, and improves overall project outcomes.

The Project Management Institute (2021) described project management as a practice of implementing the knowledge, information, tools and other available resources into the project activities to meet the requirements and achieve the objectives of the projects. Over the years, Project management has transformed from an operation tool into a critical business competency that drives various organizations to successful business operations especially because it provides a systematic approach to completing various tasks in an effective and efficient way (Fokina et al., 2023). Those tasks are basically referred to as a "Project", a unique and temporary process to produce specific outputs and achieve predefined objectives (Lester, 2017). The emergence of the fourth Industrial Revolution and digitalization has transformed the landscape of project management, coupled with the growing trend to integrate digital transformation principles with project management approaches to maintain and upgrade the sustainable development of the organization (Adegbite et al., 2023). Kozarkiewicz (2020) highlighted the critical role of technological automation, streamlined processes, cost efficiency, and competitive advantages generation are considered as pivotal aspects for an organization to adapt and adopt technological and innovative tools inside their project management practices. For the past few decades, project management principle has continuously evolved from a traditional perspective into an innovative methodology that provides innovative solutions (Tabassi et al., 2019). Despite providing various benefits and has become a primary approach to manage projects in the modern era, companies often encounter challenges when trying to adopt and implement project management practices inside their organization or businesses. George (2020) outlines a number of project management challenges that are restrictions related to time, cost, and quality, increased project complexity, and various factors related to manpower, legal, technology, and environment. Failure to resolve the challenges can have fatal consequences for the company. In their research, Hordieieva et al. (2024) points out that the absence of a structured decision-making approach could obstruct the success of a project. To address these issues and reduce the risk of project failures, adopting and applying a methodical and structured decision-making approach in project management is essential for an organization. One of the most prevalent decision-making approaches used by researchers to address decision making problems is the Multi Criteria Decision Making (MCDM) Approach.

Zhu et al. (2021) defines Multi Criteria Decision Making as a process of evaluating a situation based on various criteria in order to select the best solution or options available. Danesh, Ryan, and Abbasi (2017) highlighted that there are more than 100 MCDM methods available in academic literature, which can be utilized by researchers for studies related to decision-making problems. The diversity of MCDM methods make it difficult to decide the most suitable methodologies for a specific decision-making problem (Guarini et al., 2018) without knowing and understanding the prior usage, advantages, and disadvantages of each methodology. According to the study of Taherdoost & Madanchian (2023), AHP stands as the most MCDM methodologies being cited or used between the period of 2012 until 2022 in ScienceDirect with 15,452 results followed by DEA with 9,367 results and FST with 8730 results. Aligned Taherdoost & Madanchian study, research conducted by de Souza et al. (2021) indicates AHP as the most dominant decision-making methodology representing 22.1% of the total data population. These data confirm that AHP is the most widely utilized MCDM methodology by researchers across various fields. By leveraging the information and knowledge collected through the literature review process, the Analytic Hierarchy Process (AHP) is found to be the most suitable MCDM

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methodology or tools to address the business issue of this research. AHP is considered as an ideal solution because it connects the gap produced by the absence of formal frameworks for decision-making, including different perspectives about the importance of a project while also bringing clarity to the prioritization process.

The Analytic Hierarchy Process is a decision-making framework that breaks down complex problems into smaller components which combine quantitative and qualitative factors by quantifying and transforming opinions and judgements into quantifiable results (Liu et al., 2024). The AHP framework involves the process of converting the decision-making problems into a hierarchy of criteria and sub criterias and performing pairwise comparison analysis to define the relative importance of those elements (Abdullah & Azmael, 2023). This framework is one of the most widely used decision making techniques if it comes for selecting projects and assigning weights to various factors in the project to determine and make the best decision of the available options (Alyamani & Long, 2020). According to Shanmugasundaram & Chidhembaram (2024), AHP has 7 sequential steps as follows:

1) Define the decision problem
2) Creating Hierarchical Structure
3) Formation of Pairwise Matrix to Calculate Criteria Weight
4) Determine the Criteria Weight and Weighted Sum Value
5) Determine the Consistency Index (CI) and Consistency Ratio (CR)
6) Formation of Pairwise Matrix to Calculate Each Alternative Criterion Weight
7) Formation of Decision Matrix and Assign the Rank Based on Priority

RESEARCH METHOD

In this Research, a mixed method approach was deployed especially by utilizing Analytic Hierarchy Process (AHP) Framework to comprehensively analyze the situation and formulate a viable and effective solution for the business issues. Mazhar (2021) described data collection as the process of gathering and examining data using a specific method. The objective of the data collection process is to ensure the data used in the research are sufficient, suitable and measurable to perform the data analysis process and achieve the objective of the research (Syed & Qadri, 2021). Focus Group Discussion are chosen by the researcher to support the primary data collection process for the research. FGD is a qualitative data collection method where a few selected people are gathered to engage a detailed discussion about a specific topic (Yayeh, 2021). This method was selected for its ability to help the researcher to collect a number of detailed information based on the respondent knowledge, judgements, experience and perspective related to a topic within a limited duration (Tümen-Akyıldız & Ahmed, 2021). In this research, a Focus Group Discussion approach was deployed to collect and summarize the respondent judgements and insights about the relevant criterion and sub criteria to be used in this research and establish a quantitative threshold for each criterion and sub criteria relatively to each available alternative. The Focus Group Discussion participants were selected based on their comprehensive knowledge, robust understanding, and involvement in the projects in order to establish an efficient and effective discussion process to gathering relevant information. Each stakeholder's answer is weighted differently due to the consideration of their diversity of knowledge, experience, and competency. During the Focus Group Discussion session, the weight assigned to each participant has been determined using a range from 1 to 3. The Focus Group Discussion participants are listed in Table I.

Table 1. List of FGD Participants

No	*Category*	*Position*	*Experience*	*Weight*
1	Operational	Factory Manager	19 years	3
2		Operations Manager	23 years	2
3		Warehouse Manager	15 years	1
4		Factory Manager	24 years	3
5		Operations Manager	15 years	2
6		Warehouse Manager	8 Years	1
7	Functional	Project Management Office - Senior Manager	24 years	3
8		Project Management Office - Assistant Manager	14 years	2
9		Project Management Office - Senior Lead	12 years	1
10		External Consultant	10 years	2

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The second primary data collection method utilized in this research is Questionnaires. Basically, questionnaire is a set of questions to collect data or information from the selected respondents (Taherdoost, 2020). The questionnaire serves to define the relative importance between each criterion or sub criteria used in this research based on the respondent knowledge and perspective using a pairwise comparison table that utilizes the Saaty's scale for quantifying the respondent judgements. This research utilized quantitative data analysis method to cultivate the collected data, quantitative data analysis method focused on numerical variables and mathematical calculations to provide insights and facilitate structured statistical interpretation (Ivanova, 2023). AHP method were chosen by the author to be the data analysis methods used in this research to analyze the data that has been collected and generate the required findings. In this research, there are several stages of data analysis that will be performed and the results of each stage will be used in the following stage. Therefore, sequential work is really important in this research because each process has a correlation and impact to the other. The data analysis process that will be undertaken in this research are Pairwise Comparison Matrix and Normalization, Priority Weights Calculation, Consistency Check, Determine Global Weights of each Sub Criteria, and Assess Ranking of each Alternative, all of which are steps in the Analytic Hierarchy Process (AHP) framework.

ANALYSIS

To establish a comprehensive set of criteria and sub-criteria for project evaluation and prioritization, secondary data analysis and a Focus Group Discussion (FGD) process were conducted as an initial stage. The secondary data analysis reviewed existing literature to identify key factors influencing project selection process, such as cost, ROI, and strategic alignment. Subsequently, an FGD has been conducted with the key to evaluate and identified the relevant criteria and sub-criteria, ensuring a balanced and suitable set of factors to be used for the organization. The finalized set of Criteria and Sub Criteria are shown in Table 2.

Table 2. Criteria and Sub Criteria List

Criteria	Sub Criteria	Code	Description
Financial C1	Total Investment	SC1.1	Total financial resources invested in the project
	Return of Investment (ROI)	SC1.2	Profitability of an investment relative to its cost
	Payback Period (PBP)	SC1.3	Time needed to recover the cost of an investment
	Net Present Value (NPV)	SC1.4	Positive & negative future cash flows throughout an investment life cycle
Strategic / Organizational C2	Strategic Alignment	SC2.1	Degree of alignment with organization strategic goals
	Project Influence to Organization	SC2.2	Impact range of a project to various aspects and process within the organization
	Stakeholder Satisfaction	SC2.3	Stakeholders needs and expectations fulfillment
	Resource Optimization	SC2.4	Resource utilization efficiency & effectiveness
	Drive Innovation	SC2.5	Level of novelty & change provided by the project
Technical C3	Human Resource Capability	SC3.1	Competency of the existing manpower to handle the project
	Technical Resource Availability	SC3.2	Accessibility and readiness of the required resource
	Project Complexity	SC3.3	Project's scope integration difficulty level
	Project Duration	SC3.4	Time needed to complete the project
	Interrelations with other Projects / Processes	SC3.5	Connections and dependencies between the project and other projects
Risk C4	Financial Risk	SC4.1	Potential financial losses caused by the projects
	Organizational Risk	SC4.2	The risk related to internal organizational issues such as company culture and management's direction

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Technical Risk	SC4.3	The possibility of project failure due to technical issues (Technologies or operational)
Regulatory Risk	SC4.4	Potential risks related to compliance of the projects to the industry laws and standards

To continue the analysis process of AHP methodology, a hierarchical structure needs to be developed using the goals, alternatives, criteria and sub criteria explained in the previous sections. The AHP hierarchical structure of this research is divided into four level as depicted in Figure 2. The structure briefly illustrates the relationship between each element.

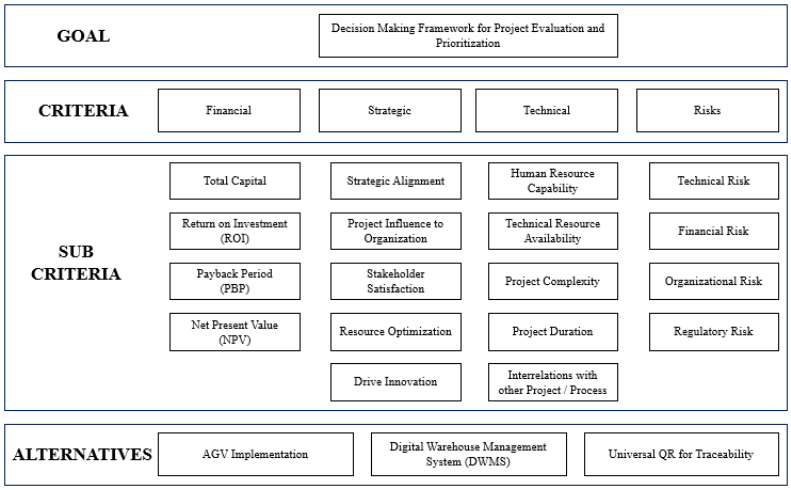

Figure 2. AHP Hierarchical Structure

The hierarchical structure is then transformed into Pairwise Comparison Matrices and distributed to all the selected stakeholders in a form of questionnaires which covering 5 pairwise comparison table including: Main Criteria, Financial Sub Criteria, Strategic Sub Criteria, Technical Sub Criteria, and Risks Sub Criteria. Later then, all of the pairwise comparison matrix that has been generated in the previous process are being consolidated and aggregated using geometric mean based on their respective hierarchical group and each participant's evaluation weight. By using those matrices, a set of calculation which includes Local Weight, Eigen Value, λ Max, Consistency Index, and Consistency Ratio are been performed. In AHP, calculating the local weight is crucial because it helps to quantifying and define the relative importance of the criteria and sub criteria within a specific hierarchy level. On the other side, the Consistency Check help the researcher to validate the judgements from the respondents is coherent and reliable. The result of the calculations is portrayed in Table 3.

Table 3. Local Weight and Consistency Check Calculation Result

Code	Matrix Sum Value	Criteria Weights	Eigen value	λ max	n	CI	RI	CR	Consistency Status
C1	0,866	**0,215**	4,028	4,028	4	0,009	0,9	0,010	**Consistent < 0.1**
C2	1,411	**0,349**	4,040						
C3	0,857	**0,213**	4,023						
C4	0,896	**0,223**	4,020						
SC1.1	0,637	**0,158**	4,026	4,035	4	0,012	0,9	0,013	**Consistent < 0.1**
SC1.2	1,608	**0,396**	4,056						
SC1.3	1,486	**0,367**	4,051						
SC1.4	0,315	**0,079**	4,008						
SC2.1	0,722	**0,144**	5,024	5,022	5	0,005	1,12	0,005	**Consistent**

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SC2.2	1,985	**0,395**	5,024						**< 0.1**
SC2.3	0,593	**0,118**	5,021						
SC2.4	0,604	**0,120**	5,013						
SC2.5	1,118	**0,222**	5,027						
SC3.1	1,758	**0,338**	5,205						
SC3.2	0,804	**0,157**	5,136						
SC3.3	0,666	**0,130**	5,119	5,138	5	0,034	1,12	0,031	**Consistent < 0.1**
SC3.4	0,364	**0,072**	5,047						
SC3.5	1,571	**0,303**	5,181						
SC4.1	1,156	**0,288**	4,013						
SC4.2	0,804	**0,200**	4,010	4,011	4	0,004	0,9	0,004	**Consistent**
SC4.3	1,005	**0,251**	4,012						**< 0.1**
SC4.4	1,047	**0,261**	4,011						

The consistency check process is performed to all 5 matrices which includes main criteria, financial sub criteria, organizational sub criteria, technical sub criteria, and risk sub criteria matrices. The respective Consistency Ratio values are 0.010, 0.013, 0.005, 0.031, and 0.004. Since all of the Consistency Ratio is below than 0.1, it proves that all of the consolidated pairwise comparison matrix along with the all the related findings are consistent and can be utilized in the following process.

In order to create a prioritization for the alternatives or projects, a calculation to define the global weight of each sub criteria is needed. The calculation is performed by multiplying the local priority weight of each sub criteria to their respective main criteria's weight. The global weight itself representing the overall importance of each sub criteria compared to other factors from all criteria used in the AHP methodology. The result of the calculation itself is shown in Table 4.

Table 4. Global Weight Calculation Result

Criteria	Criteria Weight	Sub Criteria	Local Weight	Global Weight
Financial	21,5%	Total Investment	15,8%	**3,4%**
		Return of Investment (ROI)	39,6%	**8,5%**
		Payback Period (PBP)	36,7%	**7,9%**
		Net Present Value (NPV)	7,9%	**1,7%**
Organizational	34,9%	Strategic Alignment	14,4%	**5,0%**
		Project Influence to Organization	39,5%	**13,8%**
		Stakeholder Satisfaction	11,8%	**4,1%**
		Resource Optimization	12,0%	**4,2%**
		Drive Innovation	22,2%	**7,8%**
Technical	21,3%	Human Resource Capability	33,8%	**7,2%**
		Technical Resources Availability	15,7%	**3,3%**
		Project Complexity	13,0%	**2,8%**
		Project Duration	7,2%	**1,5%**
		Interrelation with others Project	30,3%	**6,5%**
Risk	22,3%	Financial Risk	28,8%	**6,4%**
		Organizational Risk	20,0%	**4,5%**
		Technical Risk	25,1%	**5,6%**
		Regulatory Risk	26,1%	**5,8%**

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The calculation results show the varieties of prioritization weight of each component with project influence to organization is the most critical sub criteria which representing 13.8% of the total weight. It emphasized that even though the projects are being focused on the implementation of emerging and innovative technologies in the warehouse plant's business process, their impact and benefit remain as the main consideration for the organization to define the prioritization during the project evaluation. The gap between the first and second criteria also need to be highlighted, with a span of 5.27% that underlines that how much important the project influence to organization compared to other sub criteria even to the criteria ranked second.

Return of Investment (ROI) and Payback Period (PBP) ranked second and third in the list with the global weight of 8.52% and 7.89% respectively. Almost all of the technological projects require initial investment related to the acquisition of the technologies or other related resources which makes financial assessment during the evaluation process become important especially ROI and PBP, 2 financial ratios that the organization usually used to analyze an investment in new technologies. Drive Innovation which is also one of the main objectives of the projects positioned as the fourth most important sub criteria in the list with 7.8% which aligned with the insights from the FGD process that when the company wanted to acquire and implement a new technology, it should drive innovation in a form of creativity and exploration of new solution to makes the organization stay competitive in the market competition and can meets the dynamic and continuously evolving customer demands.

From the technical criteria, human resources capabilities hold a weight of 7.2%, ranking fifth in terms of its importance that underscore the importance of the skills, knowledge and expertise of the workforce to optimizing and maximizing the potential of the technologies. On the other hand, all the risks sub criteria are ranked between 7th to 11th with the global weight are ranging from 6.42% to 4.47% which proves that risks are crucial to be evaluated. Despite there are 4 types of risks used in this research, each risk sub criteria relatively holds the same importance and significance. For the other sub criteria, their ranking and weighting provide further insight into their relative importance and impact on the overall project evaluation and decision-making process.

Once the global weights of each sub criteria have been determined, the scores of each alternative relatively to each sub criteria are need to be defined to calculate and define the final prioritization for the projects or alternatives. Following the establishment of each sub criteria score for every alternative, it needs to be normalized to ensuring fair and accurate comparison across different sub criteria and alternatives. The final step of the AHP systematic and structured process is to determining the final weight or prioritization of each alternative by multiplying the global weight of each sub criterion to its respective normalized value, this computation is performed to all of the available alternatives which are the output is displayed in Table 5.

Table 5. Alternatives or Projects Scoring Result

Criteria	Sub Criteria	Normalized			Global Weight	By Sub Criteria		
		AP1	AP2	AP3		AP1	AP2	AP3
Financial	Total Capital	10%	40%	50%	3,4%	**0,3%**	**1,4%**	**1,7%**
	Return of Investment (ROI)	45%	36%	18%	8,5%	**3,9%**	**3,1%**	**1,5%**
	Payback Period (PBP)	50%	38%	13%	7,9%	**3,9%**	**3,0%**	**1,0%**
	Net Present Value (NPV)	45%	45%	9%	1,7%	**0,8%**	**0,8%**	**0,2%**
Organizational	Strategic Alignment	33%	33%	33%	5,0%	**1,7%**	**1,7%**	**1,7%**
	Project Influence to Organization	25%	33%	42%	13,8%	**3,4%**	**4,6%**	**5,7%**
	Stakeholder Satisfaction	27%	36%	36%	4,1%	**1,1%**	**1,5%**	**1,5%**
	Resource Optimization	45%	36%	18%	4,2%	**1,9%**	**1,5%**	**0,8%**
	Drive Innovation	36%	27%	36%	7,8%	**2,8%**	**2,1%**	**2,8%**
Technical	Human Resource Capability	11%	44%	44%	7,2%	**0,8%**	**3,2%**	**3,2%**
	Technical Resources Availability	23%	38%	38%	3,3%	**0,8%**	**1,3%**	**1,3%**
	Project Complexity	22%	33%	44%	2,8%	**0,6%**	**0,9%**	**1,2%**

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	Project Duration	27%	27%	45%	1,5%	**0,4%**	**0,4%**	**0,7%**
	Interrelation with others Project	25%	33%	42%	6,5%	**1,6%**	**2,2%**	**2,7%**
Risk	Financial Risk	9%	45%	45%	6,4%	**0,6%**	**2,9%**	**2,9%**
	Organizational Risk	36%	18%	45%	4,5%	**1,6%**	**0,8%**	**2,0%**
	Technical Risk	22%	33%	44%	5,6%	**1,2%**	**1,9%**	**2,5%**
	Regulatory Risk	17%	42%	42%	5,8%	**1,0%**	**2,4%**	**2,4%**
						28,5%	**35,6%**	**35,9%**

Notes

- AP1 : AGV Implementation
- AP2 : Digital Warehouse Management System
- AP3 : Universal QR for Traceability

CONCLUSION

The proposed solution is synthesized from the findings and outcomes of the analysis process in the previous section. The final product of the process is a project prioritization proposal, which is defined based on the combined weight of each project, as illustrated in Table 6. It reveals "Universal QR for Traceability" project as the most viable project to be prioritized, holding 35.9% of the total weight. It holds the highest weight score for organizational, technical, and risk criteria with 12.5%, 9.1%, and 9.9% respectively. It shows that the project has a significant importance for the organization and has the potential for generating positive outcomes in various organizational business process. "Digital Warehouse Management System (DWMS)" is ranked second with 35.6% of the total weight which only had 0.3% difference with "Universal QR for Traceability", which ranked first. The slight point difference between these two projects outlines that both of the project is important to be executed and prioritized because they substantially contribute to the organization success along with the technological innovation during the process. All of the DWMS project's criteria score ranked second in the list. On the other hand, the "AGV Implementation" project ranked third on the list with 28.5% weight. This project has a low score in technical and risks criteria with only 4.2% and 4.4% of the total score which is only half of the other alternative point for those criteria.

Through the process, a decision-making analysis framework also has been established which can be used repeatedly by the organization to evaluate and define the prioritization of technological projects that are planned to be implemented in plant's warehouses. The established decision-making framework using AHP methodology already unify the difference views from the stakeholder related to importance of each project and assessing the offered benefit by implementing the technology by evaluating the projects using 4 criteria and 18 sub criteria which already includes quantitative and qualitative factors that has been defined by all of the key stakeholders. In conclusion, the findings proposed the organization to prioritize the "Universal QR for Traceability" project first, followed by "Digital Warehouse Management System (DWMS)" project and "AGV" project. Additionally, the decision-making framework also can iteratively use by the organization to evaluating and selecting project to define its prioritization.

Table 6. Project Prioritization Proposal

Alternatives or Projects	Universal QR for Traceability	Digital Warehouse Management System (DWMS)	AGV Implementation
Financial Criteria	4,4%	8,2%	8,9%
Organizational Criteria	12,5%	11,4%	11,0%
Technical Criteria	9,1%	8,0%	4,2%
Risk Criteria	9,9%	8,0%	4,4%
Total Weight	**35,9%**	**35,6%**	**28,5%**
Rank	**1**	**2**	**3**

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REFERENCES

1. Olutimehin, D., Nwankwo, E., Ofodile, O., & Ugochukwu, C. (2024). Strategic operations management in FMCG: A comprehensive review of best practices and innovations. International Journal of Management & Entrepreneurship Research, 6(3), 780-794. https://doi.org/10.51594/ijmer.v6i3.935.
2. George, A. S., & George, A. (2023). FMCG's digital dilemma: The consequences of insufficient IT expertise in the fast-moving consumer goods industry. 01, 46-69. https://doi.org/10.5281/zenodo.8066759.
3. Akhmadi, S., & Tsakalerou, M. (2020). Obstacles to innovation – Is there a need for consensus?. https://doi.org/10.1109/TEMSCON47658.2020.9140075.
4. Yordanova, Z. (2020). Innovative technologies and learning. Springer.
5. Abdulwase, R., Ahmed, F., Nasr, F., Al-yousofi, A., & Yan, S. (2020). The role of business strategy to create a competitive advantage in the organization. Open Access Journal of Science, 4(4), 135-138. https://doi.org/10.15406/oajs.2020.04.00162.
6. Kpurunee, G., Amadi, K., & Kpurunee, K. (2023). Competitive strategies and organizational performance of corporate enterprises in Nigeria. International Journal of Entrepreneurship and Business Innovation, 6(4), 149-162. https://doi.org/10.52589/IJEBI-BZI87J3S.
7. Haraisa, Y. E. Al. (2022). The Impact of Strategic Alignment and Strategic Awareness On Strategic Performance: Evidence from Jordan. International Journal of Academic Research in Accounting Finance and Management Sciences, 12(4), 42–55.
8. Ansari, R., Shakeri, E., & Raddadi, A. (2014). Framework for aligning project management with organizational strategies. Journal of Management in Engineering, 31(3). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000249.
9. Project Management Institute. (2021). A Guide to the project management body of knowledge (PMBOK® guide) (7th ed.).
10. Fokina, O., Ivanovskaya, Z., Mottaeva, A., & Khubaev, A. (2023). The conceptual role of leadership in project management. E3S Web of Conferences, 458. https://doi.org/10.1051/e3sconf/202345804020.
11. Lester, A. (2017). Project Management, Planning and Control (7th ed.). Elsevier.
12. Adegbite, A., Adefemi, A., Ukpoju, E., Abatan, A., Adekoya, O., & Obaedo, B. (2023). Innovations in project management: Trends and best practices. Engineering Science & Technology Journal, 4(6), 509-532. https://doi.org/10.51594/estj.v4i6.670.
13. Kozarkiewicz, A. (2020). General and specific: The impact of digital transformation on project processes and management methods. Foundations of Management, 12(1), 237-248. https://doi.org/10.2478/fman-2020-0018.
14. Tabassi, A. A., Bryde, D. J., Kamal, E. M., Dowson, J., & Michaelides, R. (2019). Challenges for project management in the 21st century. The European Proceedings of Multidisciplinary Sciences. ISSN 2421-826X.
15. George, C. (2020). The use of project management skills to overcome organizational challenges. International Journal of Innovative Science and Research Technology, 5(3). ISSN 2456-2165.
16. Hordieieva, I., Omelyanenko, V., Krysovatyy, I., Oprysok, M., & Kostin, I. (2024). Project management in complex technical infrastructure projects: Challenges and strategies. AD ALTA: Journal of Interdisciplinary Research, 14(1), 88-93. https://doi.org/10.33543/1401398893.
17. Zhu, X., Meng, X., & Zhang, M. (2021). Application of multiple criteria decision making methods in construction: A systematic literature review. Journal of Civil Engineering and Management, 27(5), 372-403. https://doi.org/10.3846/jcem.2021.15260.
18. Danesh, D., Ryan, M., & Abbasi, A. (2017). A systematic comparison of multi-criteria decision making methods for the improvement of project portfolio management in complex organisations. International Journal of Management and Decision Making, 16(1), 1. https://doi.org/10.1504/IJMDM.2017.10005690.
19. Guarini, M., Battisti, F., & Chiovitti, A. (2018). A methodology for the selection of multi-criteria decision analysis methods in real estate and land management processes. Sustainability, 10(2), 507. https://doi.org/10.3390/su10020507.
20. Taherdoost, H., & Madanchian, M. (2023). Multi-criteria decision making (MCDM) methods and concepts. Encyclopedia, 3(1), 77-87. https://doi.org/10.3390/encyclopedia3010006.

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www.ijcsrr.org

21. Souza, D., Santos, E., Soma, N., & Silva, C. (2021). MCDM-based R&D project selection: A systematic literature review. Sustainability, 13(21), 11626. https://doi.org/10.3390/su132111626.
22. Liu, X., Shao, S., & Shao, S. (2024). Landslide susceptibility zonation using the analytical hierarchy process (AHP) in the Great Xi'an Region, China. Scientific Reports, 14. https://doi.org/10.1038/s41598-024-53630-y.
23. Abdullah, M., & Asmael, N. (2023). Analytic hierarchy process for evaluation of transportation alternatives on the Karkh side of Baghdad. Journal of Engineering and Sustainable Development, 27(6). https://doi.org/10.31272/jeasd.27.6.8.
24. Alyamani, R., & Long, S. (2020). The application of fuzzy analytic hierarchy process in sustainable project selection. Sustainability, 12(20). https://doi.org/10.3390/su12208314.
25. Shanmugasundaram, S., & Raja Muthaiah, M. C. (2024). Selection of robot for contour crafting using analytical hierarchy process. Civil and Environmental Engineering Reports, 33(1), 123-150. https://doi.org/10.59440/ceer/177605.
26. Mazhar, S. A. (2021). Methods of data collection: A fundamental tool of research. Journal of Integrated Community Health, 10(1), 6-10. https://doi.org/10.24321/2319.9113.202101.
27. Syed, S., & Qadri, S. (2021). Data Collection Methods: Advanced Research Methodology. Department of Business Administration, Greenwich University, Pakistan Campus-Karachi.
28. Yayeh, F. A. (2021). Focus Group Discussion as a data collection tool in Economics. Daagu International Journal of Basic & Applied Research-DIJBAR, 3(1), 52-61.
29. Tümen Akyıldız, S., & Ahmed, K. (2021). An overview of qualitative research and focus group discussion. International Journal of Academic Research in Education, 7(1), 1-15. https://doi.org/10.17985/ijare.866762.
30. Taherdoost, H. (2020). Different types of data analysis; Data analysis methods and techniques in research projects. International Journal of Academic Research in Management (IJARM), 9(1), 1-9. https://doi.org/10.5376/ijarm.2020.0901.0001. ISSN: 2296-1747.
31. Ivanova, N. (2023). Classification of basic methods for data analysis in industry. Annual of the University of Mining and Geology "St. Ivan Rilski", Vol. 66/2023. https://doi.org/10.5281/zenodo.8335379.

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