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Scope Management in Industry 4.0 Projects: Integrating Technology with Asian Corporate Culture

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ABSTRACT

This study investigates the implementation of marketing innovations within the framework of Industry 4.0, focusing on Asian corporate culture. Companies must innovate in the rapid globalization and digital transformation era to stay competitive and meet evolving client demands. The research identifies 15 critical attributes essential for marketing innovation in Industry 4.0, including augmented reality, virtual cryptocurrencies, and the Internet of Things (IoT). These innovations represent a blend of technological and non-technological advancements companies use to enhance their marketing strategies. The study examines the impacts of these innovations through a survey of 50 companies utilizing Industry 4.0 technologies. Key findings indicate significant impacts such as increased competitiveness, improved customer communication, and enhanced work efficiency. Larger companies and those in the automotive sector rate these impacts more highly, reflecting their greater reliance on technological advancements. Additionally, the study reveals that cultural factors influence the perception of these impacts, with companies in Asian cultures exhibiting varied responses compared to those with a global business culture. The pilot study utilized qualitative and quantitative methods, including structured surveys and descriptive statistical analysis. The results underscore the importance of effective scope management in successfully implementing Industry 4.0 projects, emphasizing the need for clear goal-setting, resource allocation, and change control. The research highlights the necessity for organizations to adapt their corporate culture and develop innovative marketing strategies tailored to their specific contexts. These insights offer practical recommendations for optimizing project outcomes and maintaining competitiveness in the digital age.

Keywords: Management, Industry 4.0 Projects, Technology, Asian Corporate Culture

INTRODUCTION

Amidst globalization, organizations face rapid changes in both client needs and market conditions. To gain a competitive edge and improve their performance, companies must develop new products and systems to attract new clients and satisfy existing ones. The concept of progress, which drives organizations forward, is becoming increasingly crucial. Progress can generally be described as creating something genuinely new that does not yet exist, capable of attracting client attention (Halim et al., 2021; Koh et al., 2019; Sony & Naik, 2020).

Managing project scope effectively has become essential in Industry 4.0, which is characterized by the integration of digital technologies. It involves defining project boundaries, setting clear objectives, managing resources efficiently, and controlling changes throughout the project lifecycle (Dalmarco et al., 2019; Muscio & Ciffolilli, 2020). This study examines the processes of defining, maintaining, and managing project scope in Industry 4.0 initiatives, particularly within Asian corporate culture.

Industry 4.0, emphasizing advanced technologies such as the Internet of Things (IoT), big data, artificial intelligence (AI), and robotics, has significantly changed how projects are conceived and executed. Organizations that embrace these technologies must also adopt robust scope management practices to ensure project success. Effective scope management helps set clear goals, allocate appropriate resources, and manage changes that may arise during the project (Ajmal et al., 2020; Alvarez-Napagao et al., 2021).

Asian corporate culture, with its unique blend of traditional values and modern business practices, adds another layer of complexity to scope management. Understanding and integrating these cultural nuances with technological advancements is crucial for successfully executing Industry 4.0 projects (Cooke et al., 2020; Sony & Naik, 2020). This study investigates how companies in Asia define, plan,

control, and handle project scope within the context of Industry 4.0.

A pilot study was conducted among 50 companies utilizing Industry 4.0 technologies. Data were collected through surveys and analyzed using descriptive statistical methods. The findings highlight the importance of clear definitions and robust scope control mechanisms in achieving project success. Key impacts identified include enhanced competitiveness, improved work productivity, and shifts in corporate culture.

By examining these aspects, this paper provides valuable insights into the critical role of scope management in Industry 4.0 projects. The study offers practical recommendations for organizations seeking to optimize their project outcomes in the digital age, emphasizing the integration of technological advancements with effective scope management practices.

METHOD

The primary goal of this paper is to examine the processes of defining, controlling, and managing project scope in Industry 4.0 initiatives, particularly within Asian corporate culture. An exploratory research approach was adopted to achieve this objective, involving collecting and analyzing data from a pilot study conducted among 50 companies utilizing Industry 4.0 technologies (Swedberg, 2020). A combination of qualitative and quantitative methods was used to gather comprehensive data. Initially, a pilot survey was conducted to gain a fundamental understanding of the issue and to identify critical variables for further analysis. The survey targeted 50 companies known to implement Industry 4.0 technologies and innovations in their practices. This non-probability sampling method was chosen due to the study's exploratory nature and the need for specific insights from companies actively engaged in Industry 4.0 projects.

Data were collected through a structured survey, including open-ended and closed-ended questions. The study aimed to capture detailed information on how these companies define, plan, control, and manage the scope of their projects. The survey also included questions to assess the impact of effective scope management on various aspects such as competitiveness, work productivity, and corporate culture. The survey questions were designed to cover multiple dimensions of scope management, including how companies set objectives and outline project boundaries, the planning processes involved in managing project scope, mechanisms for controlling changes in project scope, and the effects of scope management on competitiveness, productivity, and corporate culture.

Respondents were asked to rate the importance of various scope management practices on a six-point Likert scale, where 1 = not essential and 6 = very important. The survey also included open-ended questions to gather qualitative insights on specific challenges and best practices in scope management. Descriptive statistical methods were used to analyze the quantitative data, including calculating means, standard deviations, and coefficients of variation. This analysis helped to identify the most significant scope management practices and their impacts on project outcomes. The qualitative responses were analyzed using content analysis to identify common themes and insights related to scope management in Industry 4.0 projects.

The respondents were categorized based on three criteria: company size (organizations with up to 250 employees and those with more than 250 employees), business field (grouping companies into five categories based on their field of business activity), and geographic business culture (classifying companies according to the corporate culture predominant in their country of operation, divided into four subsets). Due to the study's exploratory nature and the non-probability sampling method, the findings cannot be generalized to all companies implementing Industry 4.0 technologies. However, the insights gained from this pilot study provide a valuable foundation for future research and quantitative studies on a larger scale.

RESULTS AND DISCUSSION

The assessment was conducted in two consecutive parts: analysis, synthesis, and descriptive statistics. The first part identifies variables related to implementing marketing innovations in the context of Industry 4.0. The second part examines the impacts resulting from these variables. The findings from the first part of the study were synthesized into a list of 15 attributes, representing essential approaches to implementing marketing innovations in Industry 4.0. These attributes are summarized in Table 1.

Table 1. Marketing Innovations Related to Industry 4.0

Innovations
Information terminal
Enormous data - data handling in the petabytes
Augmented reality
Virtual cryptocurrencies
Business vertical linking in distribution channels
Advergaming
Autonomous distribution
Additive production (3D Digital Data)
Machine-to-Machine (M2M)
Internet of Things (IoT)
Marketing to Individuals (Social Media)
Corporate Social Responsibility
Engagement Marketing
Buzz Marketing: Viral, WOM, Guerrilla Marketing

Companies currently regard these 15 factors as tools for marketing in Industry 4.0. They encompass a mix of technological and non-technological innovations, reflecting the dual nature of advancements in this field.

This research was conducted in two consecutive parts: analysis, synthesis, and descriptive statistics. The first part aims to identify the variables associated with implementing marketing innovation in the context of Industry 4.0. The second part examines the impact generated by these variables.

This study identifies 15 important attributes of implementing marketing innovation in Industry 4.0 in the first part. These attributes include information terminals, handling data on a petabyte scale, Augmented Reality, and virtual cryptocurrencies. Vertical business integrations exist in distribution channels, advergaming, autonomous distribution, and additive manufacturing using 3D digital data. Other identified innovations encompass Machine-to-Machine (M2M) communication, the Internet of Things (IoT), individual marketing through social media, and corporate social responsibility (CSR). Further marketing approaches include engagement, viral, Word of Mouth (WOM), guerrilla, and general marketing strategies. These attributes represent tools currently deemed essential by companies for marketing in Industry 4.0, encompassing a mix of technological and non-technological innovations, reflecting the dual nature of advancements in this field (El Manzani et al., 2024; Koh et al., 2019; Yoon & Kwon, 2023).

The second part of this research examines the impact of the 15 variables identified in the first part. These impacts cover various aspects, both in terms of marketing effectiveness and consumer acceptance. Innovations like Augmented Reality and the Internet of Things (IoT) have enhanced consumer interaction and engagement (Ajayi et al., 2023). Marketing supported by extensive data enables companies to perform better market segmentation and make more precise decisions based on in-depth data analysis (Gupta et al., 2021). Furthermore, innovations like social media and viral marketing can reach a broader audience relatively cheaply (Puriwat & Tripopsakul, 2021). Meanwhile, corporate social responsibility (CSR) and engagement marketing help build brand image and loyalty in the eyes of consumers (Gunawan et al., 2020).

Overall, this research emphasizes that marketing innovation in Industry 4.0 is not limited to new technologies but includes new approaches to interacting with consumers and managing supply chains. It reflects the need for more holistic and adaptive marketing strategies to face the rapid changes in the digital era. This study provides valuable insights for companies wishing to remain competitive in the Industry 4.0 era by adopting relevant and practical marketing innovations.

Impact of Marketing Innovation Implementation

The survey results were subjected to a thorough content analysis by marketing experts focusing on implementing Industry 4.0 within organizations. This analysis culminated in a list of 11 impacts arising from the execution of marketing innovations in Industry 4.0, as shown in Table 2. The number of responses indicates the number of companies reporting each effect.

Table 2. Influences Related to the Implementation of Marketing Innovations in Organizations

Impact	Number of Responses
Building Advertising and Branding	23
Greater Demands on Employees	21
Improved Communication with Customers	21
Increased Competitiveness	21
Changes in Total Costs	20
Entering New Markets	15
Improving Work Effectiveness	15
Changing Distribution Channels	14
Improving Product Quality	12
Changes in Strategic Planning	10
Changing Corporate Culture	10

Introducing Industry 4.0 and marketing innovations into an organization typically results in improved public relations and enhanced business reputation. This implementation is generally associated with capital investments, which increase costs and improve the business's image and value. Additionally, marketing innovations lead to greater employee demands, necessitating a shift towards a more educated workforce (Pozzi et al., 2023; Veile et al., 2020).

Enhanced communication with customers is another significant impact. Marketing innovations enable better understanding and interaction with customers, improving customer satisfaction and acquiring new clients. Using big data and social media allows organizations to effectively tailor their communication strategies (Alzoubi et al., 2022; Kurdi et al., 2020).

Increased competitiveness is critical, as marketing innovations give organizations a competitive edge. These innovations often lead to changes in total costs, with initial increases due to investment in new technologies, followed by long-term cost reductions (Na et al., 2019). Entering new markets is another notable impact, facilitated by innovative marketing strategies that drive internationalization and expansion into new segments (Deng et al., 2020).

Work efficiency improvements are driven by introducing advanced technologies, which increase overall productivity. Changes in distribution channels result from vertical integration and automation, leading to more efficient and autonomous distribution systems (Chowdhury et al., 2019; Na et al., 2019).

Improving product quality is another critical impact, as new materials and precision manufacturing techniques enhance product offerings. Strategic planning changes are necessitated by the digitization and data processing capabilities of Industry 4.0, which provide organizations with comprehensive insights for long-term planning (Javaid et al., 2021). Lastly, changes in corporate culture are essential to adapt to the evolving business landscape and customer needs brought about by Industry 4.0 (Durana et al., 2019).

Evaluation of the Impact of Marketing Innovation Implementation

A pilot study involving 50 respondents assigned importance ratings to the proposed impacts of marketing innovations on a scale from 1 (not necessary) to 6 (very important). The arithmetic mean, standard deviation and coefficient of variation were calculated from the responses, as shown in Table 3. The results indicate that respondents regard all the listed impacts as significant, with mean ratings ranging from 4.0 to 5.1.

Table 3. Evaluating the Impact of Marketing Innovation Implementation

Impact	Mean	Median	Standard deviation	Coefficient of variation
Increase competitiveness	5.1	6	1.15	0.23
Increase work productivity	5.07	5	0.88	0.17

Impact	Mean	Median	Standard deviation	Coefficient of variation
Changing corporate culture	5	5	1.05	0.21
Building PR, business value growth	4.91	5	1.21	0.25
Higher demands on employees	4.9	5	0.97	0.2
Improve communication with customers	4.76	5	1.38	0.29
Entering new markets	4.67	5	1.45	0.31
Changes in total costs	4.4	5	1.31	0.3
Improving product quality	4.4	4	0.92	0.21
Changes in strategic planning	4.2	4	1.4	0.33
Changing distribution channels	4	3	1.53	0.38

The research results indicate that respondents consider all proposed impacts of marketing innovation implementation significant, with average ratings ranging from 4.0 to 5.1 on a 1 to 6 scale. This high average rating suggests that respondents understand the importance of marketing innovation in achieving organizational success in the Industry 4.0 era.

The most significant impact identified is the increase in competitiveness, with an average rating of 5.1 and a coefficient of variation (CV) of 0.23, indicating a uniform perception among respondents. It implies that marketing innovation provides a tangible competitive advantage for companies, enabling them to remain relevant and competitive in a constantly changing market. Increased work productivity is also rated highly (mean 5.07, CV 0.17), reflecting the efficiency of implementing new technologies and strategies in business operations.

Changes in corporate culture (mean 5, CV 0.21) and business value growth through public relations (mean 4.91, CV 0.25) are also considered significant impacts. Marketing innovation requires corporate cultural adaptation to support technological and operational changes and enhances the business's image and reputation in the eyes of the public (Kumar, 2019). It is crucial for attracting new customers, retaining existing ones, and increasing customer loyalty and satisfaction.

Other significant impacts include increased demands on employees (mean 4.9, CV 0.2) and better communication with customers (mean 4.76, CV 0.29). Implementing new technologies requires a more skilled and educated workforce and effective communication strategies to understand and meet customer needs (Sima et al., 2020). Using big data and social media allows companies to tailor their communication strategies more accurately and efficiently.

Entering new markets (mean 4.67, CV 0.31) and changes in total costs (mean 4.4, CV 0.3) are also important. Innovative marketing strategies drive internationalization and expansion into new market segments, although they initially require significant capital investment (Ciravegna et al., 2019). However, these innovations can reduce costs in the long term through operational efficiency and automation.

Improving product quality (mean 4.4, CV 0.21) and changes in strategic planning (mean 4.2, CV 0.33) indicate that marketing innovation contributes to better product offerings and the formulation of better long-term plans. Using new materials and precision manufacturing techniques improves product quality, while the ability to digitize and process data provides comprehensive insights for future planning (Gunawan et al., 2020).

Changes in distribution channels (mean 4, CV 0.38) reflect adaptation to vertical integration and automation, which increases the efficiency and autonomy of distribution systems. Although this impact has a higher coefficient of variation, indicating variability in respondents' perceptions, it remains essential in the context of Industry 4.0. Overall, the results of this research emphasize the importance of marketing innovation in various operational and strategic aspects of companies in the digital era. Companies must adopt effective innovation management practices to remain competitive and relevant in an ever-evolving market.

Effect of Question Classification on Research Results

The survey responses were categorized based on company size, business field, and geographic business culture. Descriptive statistical methods were used to evaluate the data. The results are summarized in Table 4, showing that larger companies tend to rate the impacts of marketing innovations higher than smaller companies. Similarly, companies in the automotive sector place greater importance on these impacts than those in other industries.

Table 4. Effect of Respondents' Answer Classification on Questions

Impact	0 - 250 Employees (n = 19)		251+ Employees (n = 31)		Automotive (n = 21)	Other fields (n = 29)	CR (n = 21)	INA (n = 19)	Asia (n = 10)
$\bar{x}$	CV		$\bar{x}$	CV		$\bar{x}$	CV	$\bar{x}$	CV
1	4.8		0.31	4.9		0.23	5.0	0.17	4.2
2	4.0		0.25	5.2		0.16	5.3	0.13	4.2
3	4.6		0.16	4.9		0.27	4.8	0.29	5.0
4	5.0		0.20	5.1		0.23	5.7	0.08	5.0
5	4.6		0.29	4.5		0.29	4.5	0.29	3.3
6	3.6		0.34	4.9		0.28	4.7	0.31	3.1
7	4.6		0.20	5.1		0.16	5.1	0.16	5.0
8	3.7		0.35	4.1		0.39	4.2	0.30	4.6
9	4.5		0.11	4.3		0.23	4.6	0.27	4.6
10	4.0		0.20	4.2		0.37	5.2	0.14	3.6
11	5.5		0.15	4.8		0.22	4.6	0.26	4.8

The analysis reveals that large enterprises perceive the impacts of marketing innovations more significantly than small and medium-sized enterprises (SMEs). The automotive sector particularly values these impacts, likely due to its heavy reliance on technological advancements. Additionally, companies with an Asian corporate culture exhibit varied responses compared to those with a global corporate culture, indicating the influence of cultural factors on the perceived importance of these impacts (El Manzani et al., 2024; Holguin et al., 2020).

This study categorizes survey responses based on three main criteria: company size, business sector, and geographical business culture. Descriptive statistical methods were used to evaluate the data, with results summarized in Table 4. The table shows that large companies tend to rate marketing innovation's impact higher than small companies. Similarly, companies in the automotive sector give higher ratings to these impacts than companies in other industries.

Table 4 reveals that companies with 251 or more employees have a higher average ($\bar{x}$) impact rating than companies with 0-250 employees. For instance, for the first impact, large companies give an average rating of 4.9 with a coefficient of variation (CV) of 0.23, while small companies give an average rating of 4.8 with a CV of 0.31. This result indicates that large companies value the impact of marketing innovation more.

Companies in the automotive sector also show higher ratings for the impact of marketing innovation compared to companies in other fields (Halim et al., 2021; Llopis-Albert et al., 2021). For example, for the second impact, automotive companies give an average rating of 5.3 with a CV of 0.13, while companies in other fields give an average rating of 4.2. It suggests that the automotive sector highly values marketing innovation, likely due to its high dependence on technological advancements.

Additionally, companies with an Asian business culture show varying responses compared to companies with a global business culture. For instance, for the fourth impact, companies with an Asian culture give an average rating of 5.0, whereas companies with a worldwide culture show more varied ratings. This difference indicates that cultural factors influence the perception of the impact of marketing innovation.

This analysis reveals that large companies perceive marketing innovation's impact more significantly than small and medium-sized enterprises (SMEs). The automotive sector particularly rates this impact higher, likely due to its reliance on technological advancements. Furthermore, companies with an Asian business culture exhibit varied responses compared to companies with a global business culture, indicating that cultural factors influence the perception of the importance of marketing

innovation impact (Abdul-Halim et al., 2019; Gunawan et al., 2020).

This study provides insights into how company size, business sector, and geographical culture influence how companies assess the impact of marketing innovation. Large companies and the automotive industry tend to value these innovations more, while variations in responses from companies with different business cultures suggest that marketing strategies must be tailored to specific cultural contexts.

CONCLUSION

This research identifies 15 key attributes in implementing marketing innovation in Industry 4.0, including augmented reality, virtual cryptocurrencies, and the Internet of Things (IoT). These innovations reflect a combination of technological and non-technological advancements recognized by companies as essential marketing tools in the digital era. The impacts of implementing these marketing innovations include increased competitiveness, improved customer communication, enhanced work efficiency, and changes in distribution channels and corporate culture. Survey results indicate that all these impacts are considered significant by respondents, with average ratings ranging from 4.0 to 5.1 on a 6-point scale.

Large companies tend to rate marketing innovation's impact higher than small companies, with the automotive sector showing the highest ratings. Implementing these innovations often involves significant capital investment and enhances business image and value. This study highlights the importance of corporate cultural adaptation in responding to the changes brought by Industry 4.0 and the need for innovative marketing strategies to increase competitiveness, enter new markets, and improve product quality. Geographical differences and industry sectors also influence perceptions of the importance of these impacts, indicating the need for approaches tailored to each company's specific context.

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