



ORIGINAL RESEARCH ARTICLE

Towards Smart Customer Relationship Management in the Beyond Physical Space and Digital Environments: A Knowledge Management Approach

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ABSTRACT

With the emergence of metaverse technologies, organizations are moving towards Smart Customer Relationship Management beyond physical boundaries, redefining how value, interaction, and personalized experiences are created for customers in virtual–real integrated spaces. Generally, many effective marketing insights are hidden under customer characteristics and their purchasing patterns, and knowledge-based marketing management can help to reveal them. Recent emphasis on customer relationship management has made the marketing function an ideal application area for analyzing customer data. Therefore, considering this sense of need, the general objective of the present study, namely the relationship between knowledge management and customer relationship management, was examined. According to the results of the study, knowledge management has a positive and significant effect on customer relationship management. This relationship is 1.88 percent, and a positive value indicates that the effect is positive and direct. Considering the multiple correlation coefficient, it can be said that the customer relationship management variable is explained by knowledge management. Finally, considering the relationships in the model, research suggestions were presented. The study contributes to metaverse-based CRM research by proposing a knowledge-driven model for intelligent decision-making beyond the physical space. ©authors

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Introduction

In today's world, digital transformation and the growth of information technologies have fundamentally changed human and organizational interactions (Fici et al, 2024). One of the influential areas in this transformation is customer relationship management (CRM), which has gained great importance due to its key role in maintaining and promoting customer loyalty and improving organizational performance (Berestetska et al, 2023). However, traditional CRM environments, which were mainly based on physical interactions and presence in specific locations, are no longer able to meet the complex and diverse needs of customers in the digital age (Hadi et al, 2024). These limitations have forced organizations to move towards intelligent customer relationship management in environments beyond the physical space; environments that include digital, virtual, and even technology-based interactions such as the metaverse (Elshaer et al, 2023). Previous research shows that organizations are able to collect (Damar, 2021), analyze, and intelligently use customer data by utilizing digital technologies (Kim et al, 2023), but there are still serious gaps in the field of transforming raw data into actionable knowledge and strategic decision-making (Duman, 2023). Knowledge management, as a set of processes and tools for creating, storing, sharing, and applying knowledge in the organization, can fill this gap (Toraman et al, 2022). However, integrating knowledge management with intelligent CRM in environments beyond the physical space requires a deep understanding of customer behavior, their information needs, and how to create value from existing knowledge (Kaguma et al, 2023). Therefore, a central question raised in this research is: How can organizations use knowledge management to develop intelligent and value-creating customer relationships in digital environments and beyond the physical space? In addition, the emergence of environments beyond the physical space, including cyberspace, social networks, mobile applications, online platforms, and even augmented and virtual reality technologies, has created new opportunities and challenges for customer relationship management (Ramadan, 2023). Notable opportunities include broader access to customer information, creating personalized interactions, increasing the speed of response, and enhancing the customer experience (Pion-Tonachini et al, 2019). On the other hand, challenges such as the large volume of data, the complexity of customer behavior analysis, security and privacy concerns, and the difficulty in creating integration between different communication channels have faced organizations with complex issues (Metaverse, 2022). Customer participation in the metaverse involves active co-creation, interaction, and decision-making in immersive virtual environments where users shape products, services, and brand experiences beyond traditional physical and digital boundaries (Malekolkalami, 2024).

This fact makes the necessity of designing and developing knowledge-based solutions for intelligent management of customer relationships in digital environments and beyond the physical space more evident than ever before (Roy et al, 2023). Recent research in the field of digital CRM shows that organizations are often able to analyze customer behavior and predict their needs using data-based systems, but these analyses are limited to collecting information and often do not reach the application stage and strategic decision-making (Kankam-Kwarteng et al, 2022). Knowledge management can fill this gap by providing a framework for transforming data into information and information into operational knowledge. In this regard, another question that arises is what mechanisms and processes in knowledge management can play the best role in improving the quality of customer relationships in environments beyond the physical space and how can they be implemented in an organizational framework? (Tajeddini et al, 2024). On the other hand, intelligent customer interactions in digital environments require accurate knowledge of customer characteristics, preferences, and digital content consumption patterns (Yum et al, 2023; Darvish, 2024). In the space beyond the physical space, customers play a more active role in content production, feedback, and interaction with brands. This change in the customer

role has turned customer relationship management into a two-way and interactive process that cannot create shared value and an optimal customer experience without effective knowledge management (Makransky et al, 2022). Therefore, the present study, focusing on examining and presenting an approach based on knowledge management, attempts to provide a framework that facilitates intelligent interactions with customers in environments beyond physical space and enables organizations to make strategic decisions and create sustainable competitive advantage (Malki et al, 2023).

Furthermore, from a scientific and research perspective, the integration of knowledge management and intelligent CRM in digital environments and beyond the physical space is still a relatively emerging research area with significant research gaps. Many existing studies have examined digital CRM technologies, but few have examined their interaction with knowledge management processes and how to improve organizational decision-making in environments beyond the physical space. Focusing on this area, this research attempts to explain theoretical models and operational frameworks for creating intelligent and knowledge-based relationships with customers and help solve the challenges in this area. Finally, the importance of this research from an applied perspective is also undeniable. Organizations that can implement intelligent customer relationship management with a knowledge management approach in digital environments and beyond the physical space will be able to create a better customer experience, increase customer loyalty, reduce operating costs, and increase their competitiveness in dynamic and complex markets. This fact highlights the necessity of conducting the present research and designing a comprehensive and knowledge-based approach for intelligent customer relationship management in the digital age.

Literature Review

In the digital age, intelligent customer relationship management in environments beyond physical space is considered one of the key research and application areas that plays a fundamental role in creating competitive advantage and increasing customer loyalty (Loureiro et al, 2023). Technological changes and the expansion of digital environments, such as social networks, online platforms, mobile applications, and even virtual and augmented reality technologies, have created conditions in which traditional and physical interactions with customers alone do not meet their complex and diverse needs. In this regard, the use of knowledge management as a strategic tool allows the collection, analysis, and application of knowledge derived from customer interactions and enables organizations to make intelligent and data-based decisions (Guo et al, 2022). Knowledge management, by providing processes for creating, storing, sharing, and applying knowledge, can transform raw information into actionable, value-added knowledge, so that organizations can deliver personalized services and enhance customer experience (Ioannidis, 2023). At the operational level, smart CRM means leveraging new technologies including artificial intelligence, machine learning, big data analytics, and interaction automation systems that enable organizations to analyze customer behavior and provide accurate predictions of their needs and preferences. Smart CRM manages digital interactions beyond the physical space and uses existing data and knowledge to create two-way, personalized, and value-added relationships with customers (Hu et al, 2020; Gheiratmand et al, 2025).. In the meantime, the integration of knowledge management and smart CRM is the focus of this research; Because knowledge management organizes and analyzes customer data and information, and intelligent CRM applies this knowledge at the operational and strategic levels to enhance optimal customer experience and organizational decision-making (Liu et al, 2022). The space beyond the physical space forces customers to take a more active role in interacting with organizations and generating content and feedback, so that interactions become a collaborative and two-way process. In such an environment, without effective knowledge management, it is not possible to extract value from data and provide personalized services

(Mogaji et al, 2024). Digital consumer behavior theories and digital customer experience models provide important conceptual frameworks for analyzing customer behavior and needs, allowing organizations to create intelligent and knowledge-based interactions (Choi, 2022). Furthermore, the success of intelligent customer relationship management depends on several factors, including IT capacity, knowledge-based organizational culture, human capabilities (Dozio et al, 2022), flexible structures, and top management support (Dwivedi et al, 2023). Organizations that manage these factors simultaneously will be able to intelligently apply data and knowledge obtained from customer interactions and improve decision-making processes and customer experience (Gu et al, 2023). Based on the analysis of previous theories and studies, the conceptual framework of the present study includes four main components (Russo et al, 2023): inputs, knowledge processing, outputs, and environmental and organizational factors. Inputs include data and information from customer interactions in digital channels and beyond the physical space. Knowledge processing involves collecting, analyzing, and organizing data to produce actionable knowledge that enables decision-making and improves customer experience. The outcomes include intelligent decision-making, personalized services, and enhanced customer experience. Finally, environmental and organizational factors, such as new technologies, knowledge-based culture, flexible organizational structures, and top management support, influence the success of the processes (Park et al, 2022). This framework shows that the integration of knowledge management and intelligent CRM paves the way for intelligent interactions with customers in digital environments and beyond the physical space, enabling organizations to create sustainable competitive advantage. Knowledge management provides the necessary framework for making intelligent strategic and operational decisions by providing tools for analyzing, organizing, and applying knowledge, and intelligent CRM improves the customer experience by applying this knowledge. The result of this process is increased customer loyalty, reduced operating costs, improved services, and created value for all stakeholders of the organization. Overall, the theoretical framework of this research helps organizations manage digital and offline customer interactions in a systematic and knowledge-based manner, exploit the opportunities of the digital space, and manage its challenges efficiently.

Method

Since all the objectives of this research are aimed at acquiring the necessary knowledge to meet the identified needs, the method of this research is applied based on the purpose because it seeks to develop knowledge in a specific field. In terms of method, because only what is stated is stated and no changes are made to the variables and the research is to further understand the current situation and help in the decision-making process, the research is descriptive, and because the questionnaire tool was used for this research, this research is of the survey type. The main assumption in the survey method is that by applying scientific methods carefully, it is possible to generalize its results to a larger community through the study of a sample. The statistical population of the research includes 289 employees of Saipa Automobile Company. In this research, a standard questionnaire was used for quantitative measurement.

Findings

As can be seen from Table 1, since the sig (significance level) for all variables is greater than 0.05, it can be concluded that the research hypothesis is rejected and the null hypothesis is confirmed. As a result, the data distribution of all variables is normal, and parametric tests and structural equations can be used to test relationships.

Table 1. Results of the reliability study of the main categories and criteria studied in the research

Variables	Significance level	Kolmogorov statistic	Test result
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Employee knowledge	0.100	1.224	Normal
Customer knowledge	0.089	1.298	Normal
Market knowledge	0.086	1.228	Normal
Knowledge management	0.536	0.805	Normal
Customer engagement	0.154	1.132	Normal
Customer upliftment	0.091	1.244	Normal
Returning lost customers	0.122	1.183	Normal
Customer relationship management	0.838	0.619	Normal

Also, to calculate the correlation between the research variables, due to the normal distribution of the variables, the Pearson correlation test was used. The correlation coefficient shows the intensity of the relationship and the type of relationship (direct or inverse). This coefficient is between 1 and -1, and if there is no relationship between the two variables, it is equal to zero. This test examines the relationship between the two variables according to the following assumptions.

Assumption (H0): There is no significant correlation between the two variables. $H_0: \rho=0$

Assumption (H1): There is a significant correlation between the two variables. $H_1: \rho \neq 0$

The judgment about the presence or absence of a relationship is made based on the level of significance obtained. Thus, if the sig of the test is smaller than 0.05, the hypothesis H0 is rejected and there is a significant relationship between the two variables.

Table 2. Calculation of the correlation between the research variables

Variables	Customer Interaction	Customer Upgrade	Returning a lost customer	Customer Relationship Management
Employee Knowledge	0.286**	0.523**	0.531**	0.561**
Customer Knowledge	0.296**	0.573**	0.521**	0.559**
Market Knowledge	0.180*	0.338**	0.394**	0.367**
Knowledge Management	0.275**	0.527**	0.532**	0.537**

** : Correlation is significant at the 99% level (p<0.01)

* : Correlation is significant at the 95% level (p<0.05)

The measurement model indicates the factor loadings of the observed variables (factor) for each latent variable. The strength of the relationship between the factor (latent variable) and the observable variable is indicated by the factor loading. The factor loading is a value between zero and one. If the factor loading is less than 0.3, the relationship is considered weak and it is better to remove it from the model. A factor loading between 0.3 and 0.6 is moderate and if it is greater than 0.6, it is very desirable. In confirmatory factor analysis, it is also important to pay attention to the fit of the model. Common fit indices in measurement models for latent variables of the research are presented below each figure. Among the fit indices, if the ratio of the chi-square to the degree of freedom is less than 2, the model has a good fit. The RMSEA index is less than 0.05 is desirable. The closer the other indicators are to one, the more desirable they are (Qasemi, 2010).

Table 3. Calculating the correlation between research variables

	INDEX	STANDARD VALUE
NFI	Normed Fit Index	0.9 ≤
RFI	relative fit index	0.9 ≤
IFI	incremental fit index	0.9 ≤
TLI	Tucker-lewis index	0.9 ≤
CFI	Comparative Fit Index	0.9 ≤
GFI	Goodness of fit	0.9 ≤
RMSEA	Root Mean Square Error of Approximation(RMSEA)	0.1 ≥
SRMR	Standardized Root Mean Squared Residual	0.8 ≥
CMIN/DF	Chi-degree freedom	3 ≥
p-value	-	0.05 ≥
NFI	INDEX	

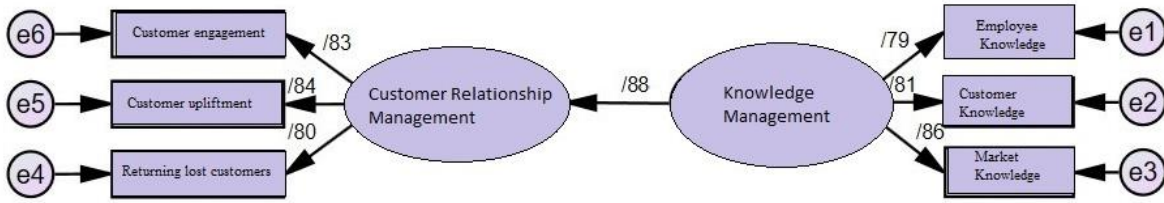


Figure 1. General research model with standard coefficient

The positive factor loading of Customer Relationship Management (CRM) on Knowledge Management demonstrates that effective CRM practices significantly contribute to the development, sharing, and utilization of organizational knowledge. When companies actively engage in managing customer relationships through data collection, feedback systems, and personalized communication, they create a rich repository of customer-based insights. These insights become valuable knowledge assets, enabling the organization to better understand customer needs, preferences, and behavioral patterns. As a result, CRM acts as a strategic driver that enhances knowledge acquisition and supports the transformation of raw customer information into actionable knowledge.

Furthermore, the strong positive loading indicates that CRM not only supports knowledge creation but also facilitates knowledge dissemination across different departments. Through integrated CRM systems and collaborative technologies, customer-related information is systematically stored, shared, and made accessible to employees at various levels. This contributes to improved decision-making, innovation in products and services, and enhanced employee capabilities. Therefore, the positive factor loading confirms that successful implementation of CRM practices directly strengthens knowledge management processes, leading to higher organizational learning capacity and sustainable competitive advantage.

Table 3. Calculating correlation between research variables

INDEX	STANDARD VALUE	ESTIMATE	RESULT
NFI	0.9 ≤	0.95	SUFFICIENT
RFI	0.9 ≤	0.92	SUFFICIENT
IFI	0.9 ≤	0.96	SUFFICIENT
TLI	0.9 ≤	0.93	SUFFICIENT
CFI	0.9 ≤	0.96	SUFFICIENT
GFI	0.9 ≤	0.93	SUFFICIENT
RMSEA	0.1 ≥	0.004	SUFFICIENT
SRMR	0.8 ≥	0.05	SUFFICIENT
CMIN/DF	3 ≥	0.953	SUFFICIENT
p-value	0.05 ≥	0.013	SUFFICIENT

Table 4. Calculation of correlation between research variables

		Non-standard estimation	Standard error	Critical Ratio (T-Statistics)	Standard coefficient	Confirm the effect
Customer Relationship Management	Knowledge Management	0.459	0.097	4.734	0.881	Confirm
Customer Engagement	Employee Knowledge	0.162	0.069	2.340	0.671	Confirm
Customer Upgrading	Employee Knowledge	0.409	0.074	5.519	0.782	Confirm
Returning Lost Customers	Employee Knowledge	0.274	0.108	2.530	0.815	Confirm
Customer Engagement	Customer Knowledge	0.874	0.289	3.024	0.745	Confirm
Customer Upgrading	Customer Knowledge	0.760	0.226	3.361	0.590	Confirm
Returning Lost Customers	Market Knowledge	1.665	0.472	3.529	0.675	Confirm
Customer Engagement	Market Knowledge	0.821	0.231	3.299	.6930	Confirm
Customer Upgrading	Market Knowledge	0.732	0.412	3.645	0.697	Confirm
Returning Lost Customers	Knowledge Management	0.536	0.485	3.875	0.611	Confirm

To express the acceptability of the model, the Bentler-Bonnet normalized fit indices, relative fit, incremental fit, Tucker-Lewis, comparative indices and perfect square have been used, and the results obtained from the model can be examined in Table 3. As you can see in Table 3, the comparative fit indices of the developed model are higher than 0.9. The RMSEA index is equal to 0.000 and is appropriate. The chi-square degree of freedom is also less than 2 (0.953). Therefore, in general, considering all the indices, the model has a good fit. According to Table 4, the effect of knowledge management on customer relationship management (significance level = 0.000) was confirmed at a confidence level of 99 percent and its effect was estimated to be 88.7 percent.

Discussion

The increasing development of management information systems provides the ability to use customer data in the form of large databases. Generally, many effective marketing insights are hidden under customer characteristics and their purchasing patterns, and knowledge-based marketing management can help to reveal them. Recent emphasis on customer relationship management has made the marketing function an ideal application area for analyzing customer data. According to the results of the study, knowledge management has a positive and significant effect on customer relationship management. This relationship is 1.88 percent, and a positive value indicates that the effect is positive and direct. According to the multiple correlation coefficient, it can be said that the customer relationship management variable is explained by knowledge management. Therefore, considering the relationships in the model, research suggestions are presented:

In the field of employee knowledge

Regarding the dimensions of employee knowledge that are also mentioned in the exploratory research model, the following are suggested:

- ⊖ Supporting new ideas and developing them through the creativity and innovation department by providing appropriate facilities to leading individuals to create motivation
- ⊖ Increasing the level of competence of Saipa employees through applied training courses in the training unit (such as holding information technology training courses, increasing general capabilities, etc.).

- ⊖ Making education and learning accessible through the LMS system

- ⊖ Creating discussion forums and specialized groups between employees in cyberspace to share information
- ⊖ Holding brainstorming sessions in the organization

- ⊖ Forming a unit to use the knowledge of retired Saipa employees as a treasure trove in the organization that can be very effective in gaining experience and instant knowledge of employees. In the field of customer knowledge Regarding the dimensions of customer knowledge that are also mentioned in the exploratory research model, the following are suggested:

- ⊖ Collecting customer knowledge as one of the most important competitive advantages should always be considered. This can be done through CRM.

- ⊖ Implementing Customer Knowledge Management (CKM) in the organization, through which Saipa Company organizes its products and interacts with customers based on their actual preferences and not on the basis of general pre-defined characteristics. This system helps the organization to better identify customers, their needs, expectations and motivations so that they can target them effectively. This type of knowledge is obtained through channels such as interviews, observation. Organizations not only need knowledge about customers but also data, information and knowledge of customer purchases. The most important advantage that this knowledge provides is to facilitate the market segmentation process and improve the relationship between the organization and the customer.

- ⊖ Creating knowledge for target customers, both potential and actual, to better understand Saipa Company, which can be obtained through data, information or knowledge for the customer from various sources such as other customers, competitors, consulting firms or the company

itself. Customer knowledge is typically a one-way relationship from the company to the customer, providing customers with essential information about the organization so that they can better understand the products and services offered by the organization.

In the field of market knowledge

Regarding the dimensions of market knowledge that are also mentioned in the research exploratory model, the following are suggested:

- ⊖ Implementing a market knowledge management (MKM) system to collect data and information, analyze them for reporting and practical application
 - ⊖ Forming a working group to identify and collect information regarding the riskiness of entering new markets
 - ⊖ Continuously estimating the level of performance in creativity and innovation of Saipa Company compared to the performance of competitors in the market, as well as the level of market need, which in this matter must achieve a balance in order to obtain the desired market share.
 - ⊖ Participate in specialized meetings and internal and external conferences to use the experiences of other companies and even competitors in the field of customer interaction
- Given the dimensions of customer interaction that are also mentioned in the exploratory model of the research, the following are suggested:
- ⊖ It is suggested to hold customer conversation meetings, in such a way that at a specific and predetermined time, many colleagues from different departments of the organization, including marketing, sales, technical and production or other departments, all gather and take a break from their routine work to listen to recorded customer conversations in a simple meeting to gain a comprehensive and not too deep view of what happens in customer conversations and the support team. This will help all those teams to become familiar with the nature of customers' concerns.
 - ⊖ It is recommended that after-sales support and services be provided faster than the customer requests, meaning that within a period of time before the customer himself calls to report a problem and request service, the organization establishes interaction and proactively and patiently addresses the customer's points of view.
 - ⊖ It is recommended that people who are specially trained in customer interaction behavior be hired in the customer interaction department, for example, not being too formal in customer interaction, conveying a sense of friendship to the customer, and

In the field of customer promotion

According to the dimensions of customer interaction that are also mentioned in the exploratory research model, the following are recommended:

- ⊖ It is recommended that new products be informed to valuable and loyal customers.
 - ⊖ Feedback be systematically recorded and analyzed to determine the customer's current needs.
 - ⊖ Market building can be an effective technique for increasing customers
 - ⊖ Targeted advertising through celebrities or the use of the product in films or media series motivates purchase. In the field of returning lost customers
- According to the dimensions of returning lost customers that are also mentioned in the exploratory model of the research, the following are suggested:
- ⊖ Taking responsibility and apologizing to the customer for a problem with the product or a shortcoming in service has a very special effect on customers
 - ⊖ Creating or adding new value to the service or product can be a very effective way to return lost customers. The organization's innovation department, in interaction with CRM, can provide its customers with a more up-to-date or complete service or product, or attract customers again by adding features and benefits to its services.
 - ⊖ Offering discounts and holding a special festival for old customers can create good feedback
- The future of the metaverse in the context of Customer Relationship Management lies in the creation of hyper-personalized, immersive, and AI-driven customer experiences where physical and virtual realities are seamlessly integrated, enabling real-time emotional

engagement, decentralized data ownership, and collaborative value co-creation between customers and organizations across global, persistent digital ecosystems.

Research suggestions

Any research, no matter how comprehensive, is not able to address the different dimensions of a subject due to some substantive and formal limitations, both thematic and temporal. This research was no exception to this rule. Therefore, the following suggestions are presented for conducting research in line with the research topic and its development. ⌘ It is suggested to compare the structural model of the present study in other companies in order to examine its strengths and weaknesses, thus taking a step towards improving or modifying the model to achieve a model suitable for the local community context. ⌘ It is suggested to add new variables to the model to measure the effect of these variables. ⌘ The statistical population of the respondents can leave different results due to the change in cultural and political location. Therefore, it is suggested that future research be examined in the new statistical population. Research limitations ⌘ The conservatism of the participants in answering the questions, ⌘ The lack of control over the personal opinions of the subjects in answering the questions, ⌘ The lack of cooperation of some officials and various departments for the interview, ⌘ The difficulty of coordinating and accessing the participants in the interview ⌘ The lack of culture of collecting information through questionnaires ⌘ Some respondents were unfamiliar with the scientific objectives of the research and gave irrelevant answers ⌘ Lack of time to further develop the research ⌘ The researcher was only able to collect data in Tehran. The results of the research may change as the culture of people in different cities changes.

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Declaration of Competing Interest

The author declares that he has no competing financial interests or known personal relationships that would influence the report presented in this article.

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