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Designing a Smart Marketing Strategy Model for the Ministry of Agriculture Jihad: A Digital Transformation–Based Approach

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Abstract

This study aimed to design and validate a digital transformation–based smart marketing strategy model for the Ministry of Agriculture Jihad by identifying its key components, determining their causal and hierarchical relationships, and evaluating the empirical adequacy of the proposed model. An applied exploratory sequential mixed-methods design was employed. In the qualitative phase, a seven-stage meta-synthesis was conducted on Persian and international studies published between 1991 and 2026, resulting in the selection of 33 high-quality studies from 308 initially retrieved records. Extracted codes were synthesized through qualitative content analysis and prioritized using Shannon entropy. In the second phase, 25 experts in agricultural management, marketing, technology, and digital transformation participated in interpretive structural modeling to determine the hierarchical relationships among the identified components. In the quantitative phase, a researcher-developed questionnaire was electronically administered to managers and experts of the Ministry and provincial Agricultural Jihad organizations. A total of 668 valid responses were analyzed using partial least squares structural equation modeling in SmartPLS. Reliability, convergent validity, discriminant validity, multicollinearity, effect size, explanatory power, and predictive relevance were assessed. The meta-synthesis identified 37 dimensions classified into 13 principal components. Shannon entropy showed that entry into online markets and digital-marketing education had the highest importance coefficients, followed by support for agricultural startups. Interpretive structural modeling placed supportive policies and regulations and digital and technological infrastructure at the foundational level, while sustainability and smart agriculture emerged as the most dependent final outcome. Cronbach's alpha and composite reliability coefficients exceeded 0.70, average variance extracted values were above 0.50, and both Fornell–Larcker and HTMT criteria confirmed discriminant validity. All variance inflation factors were below 3. Positive Q^2 coefficients confirmed predictive relevance, and the structural model explained approximately 65% of the variance in the endogenous constructs. Smart marketing in the Ministry of Agriculture Jihad should be implemented as an integrated transformation process beginning with supportive regulation and digital infrastructure, progressing through analytical capability, farmer empowerment, knowledge management, supply-chain integration, innovation, and market development, and ultimately leading to customer value, brand development, and sustainable smart agriculture.

Keywords: Smart Marketing Strategy, Digital Transformation, Ministry of Agriculture Jihad, Artificial Intelligence

1. Introduction

The rapid expansion of digital technologies has fundamentally altered the logic through which organizations understand markets, interact with customers, coordinate value chains, and formulate marketing strategies. Traditional marketing approaches, which largely depended on periodic market research, mass communication, managerial intuition, and relatively stable distribution channels, are increasingly being replaced by intelligent, connected, and data-driven systems capable of continuously sensing environmental changes and responding to them in real time. Smart marketing represents this transition by integrating artificial intelligence, big-data analytics, cloud computing, the Internet of Things, digital platforms, automation, and algorithmic decision-making into marketing planning and implementation. Rather than viewing technology merely as a communication tool, smart marketing treats it as an organizational capability through which market information is collected, interpreted, shared, and converted into targeted strategic action. Artificial intelligence can improve the effectiveness of marketing operations by automating routine activities, identifying complex patterns, supporting forecasting, and generating more timely recommendations for decision-makers (Todorova & Antonova, 2023). Data-driven marketing further enables organizations to design personalized campaigns and allocate resources more accurately, although the effectiveness of these systems depends on ethical data governance, transparency, and the responsible use of customer information (Mathew, 2025). The growing importance of artificial intelligence in marketing research also reflects a broader movement toward predictive, adaptive, and customer-responsive marketing models in which machines complement managerial judgment rather than simply replace conventional promotional tools (Jahanfar & Elahi Khorasani, 2023). Consequently, the design of smart marketing strategies has become an important organizational requirement, particularly for public institutions operating in complex, data-intensive, and socially consequential sectors such as agriculture.

Smart marketing is closely related to the emergence of Marketing 5.0, which emphasizes the use of human-mimicking technologies to create, communicate, deliver, and enhance value. Within this perspective, intelligent technologies are expected to improve customer understanding, service personalization, operational efficiency, and strategic responsiveness, while their implementation also raises challenges concerning technological readiness, privacy, organizational culture, access inequalities, and human acceptance (Movahed et al., 2024). The development of post-digital and post-human marketing structures has further expanded the discussion beyond the simple adoption of digital media by emphasizing the changing relationship among human actors, artificial intelligence, algorithms, platforms, and automated decision systems (Torabi et al., 2024). Smart marketing therefore cannot be reduced to social-media promotion or online sales. It involves the integration of technological infrastructure, data-analysis capabilities, organizational learning, customer intelligence, digital channels, and strategic governance. In retail environments, for example, the integration of artificial intelligence and the Internet of Things has enabled smart stores to offer personalized shopping experiences, automate inventory management, track consumer behavior, and connect physical and digital touchpoints (Gupta et al., 2025). Evidence from smart unmanned stores similarly suggests that service innovation and technology-supported experiential relationships can shape customer evaluations and shopping outcomes, demonstrating that technological infrastructure creates value only when it is translated into a meaningful service experience (Wu et al., 2024). These developments indicate that an effective smart marketing strategy must simultaneously address technological adoption, service design, customer experience, information integration, and organizational capability.

The rise of intelligent platforms has also transformed the structure of markets by allowing multiple actors to exchange information, coordinate transactions, and create value through interconnected digital ecosystems. Smart platform businesses depend on several interrelated factors, including technological architecture, network effects, user participation, governance mechanisms, data integration, and the ability to develop trust among stakeholders (Ahmadzadeh et al., 2024). In such systems, marketing success is increasingly determined by the quality with which channels are integrated rather than by the effectiveness of each individual channel. Omnichannel integration can improve the consistency, transparency, flexibility, and continuity of customer interactions across physical and digital environments, thereby strengthening perceived service quality and reducing fragmentation in the customer journey (Rahim Monfared & Hamidizadeh, 2025). Digital platforms are particularly relevant to the agricultural sector because agricultural value chains involve farmers, input suppliers, government agencies, transport operators, wholesalers, retailers, exporters, and consumers whose decisions are often based on incomplete, delayed, or inconsistent information. A unified digital platform can connect these actors, provide real-time price and inventory data, facilitate market access, improve traceability, and support coordinated decision-making. However, the value of platformization depends on access to reliable infrastructure, the willingness of actors to share information, and the presence of governance arrangements that clarify data ownership, responsibility, and participation rules.

The effectiveness of smart marketing is also closely connected to the capacity to transform raw data into actionable market intelligence. Business-intelligence frameworks that use sentiment analysis can help organizations interpret consumer opinions, detect emerging preferences, and adjust digital marketing actions in dynamic e-commerce environments (Kyaw et al., 2023). Data-driven models are particularly valuable where market behavior is affected by seasonal variation, geographical differences, supply uncertainty, and rapidly changing consumer expectations. A meta-synthesis of data-driven marketing in smart tourism has shown that intelligent marketing models commonly incorporate data collection, customer analysis, personalized communication, digital interaction, and continuous performance evaluation (Khosravi & Naderi, 2023). Similarly, systematic research on smart tourism marketing has emphasized the central role of artificial intelligence in customer segmentation, recommendation systems, experience management, forecasting, and strategic communication (Abbasivarki et al., 2024). Although tourism and agriculture differ in their institutional and operational characteristics, both sectors involve geographically dispersed actors, fluctuating demand, heterogeneous customers, and a strong dependence on information quality. Accordingly, the conceptual advances achieved in smart tourism and service marketing can inform the development of intelligent agricultural marketing, provided that they are adapted to the distinctive requirements of food security, product perishability, rural infrastructure, climatic risk, and public-sector accountability.

Digital transformation is not achieved merely by installing new technologies. It requires complementary changes in organizational structures, employee competencies, workflows, strategic priorities, and institutional culture. Employees' awareness of smart technologies, artificial intelligence, robotics, and algorithms may produce both constructive and adverse outcomes. Such awareness can enhance engagement, resilience, and proactive customer service when workers perceive technology as a supportive resource, but it can also create anxiety, insecurity, or resistance when technology is interpreted as a threat (Teng et al., 2025). Resistance to smart-technology adoption has also been observed in organizational settings where users face uncertainty, perceived complexity, limited resources, inadequate support, or concerns about operational disruption (Park et al., 2024). These findings are especially important for the Ministry of Agriculture Jihad, because the implementation of smart marketing requires the participation of managers, experts, local agencies, extension personnel, and farmers with substantially different levels of technological readiness. Without appropriate training, involvement, and change management, advanced systems may remain underused or become disconnected from everyday decision processes. Thus, education and empowerment must be regarded as core elements of the strategy rather than as supplementary activities conducted after technological implementation.

The transformation of marketing systems also affects how consumers form attitudes, make decisions, and develop relationships with brands. Digital marketing strategies can influence purchase intentions by improving access to information, reducing perceived uncertainty, and enabling more targeted communication (Lee & Chen, 2023). Social-media marketing can strengthen brand equity and loyalty when it creates emotional attachment and sustained interaction with consumers (Tabelessy, 2024). Store image, service atmosphere, and social-media communication likewise interact in shaping purchase decisions, showing that digital communication operates alongside broader experiential and perceptual factors rather than independently of them (Tiufany & Lina, 2024). For agricultural products, these mechanisms are relevant to the development of national brands, the promotion of regional and organic products, the communication of safety and quality information, and the creation of trust in digital markets. Smart marketing can help consumers verify product origin, compare prices, access health and production information, and establish more direct relationships with producers. Nevertheless, digital communication also creates new behavioral challenges. Intensive smartphone use and the fear of missing out can disrupt interpersonal interactions and influence consumer behavior, indicating that technology-mediated marketing must be designed with awareness of its social and psychological consequences (Paul et al., 2023). Accordingly, smart agricultural marketing should balance engagement and convenience with responsible communication, transparency, and respect for consumer autonomy.

The strategic value of digital marketing is especially evident in campaign design. Smart campaigns use customer data, behavioral information, channel analytics, and automated content delivery to align messages with the characteristics of specific audiences. A smart marketing campaign model for startups on social media emphasizes the importance of data-driven targeting, content design, interaction, platform selection, timing, performance measurement, and continuous optimization (Mahmoodi Meymand et al., 2024). Agricultural enterprises, cooperatives, and government-supported producers can use similar mechanisms to introduce products, promote seasonal offerings, communicate export capabilities, and educate consumers about health, sustainability, and product authenticity. Neuromarketing research in sustainable food production also suggests that marketing strategies may become more effective when they account for the cognitive and emotional mechanisms underlying consumer responses to product attributes, environmental claims, and communication stimuli (Faeghi et al., 2024). However, such techniques must be incorporated carefully, particularly in a public-sector context, because persuasion practices that rely on advanced behavioral data may create ethical concerns if they are not accompanied by informed governance and clear accountability.

In agriculture, marketing is inseparable from the organization of production, distribution, quality control, and resource management. Agricultural products are frequently perishable, production is exposed to climatic uncertainty, and supply and demand are spatially dispersed. These characteristics create a need for intelligent forecasting, real-time monitoring, traceable logistics, and coordinated market information. Smart marketing can therefore improve not only promotional effectiveness but also production planning, inventory management, transportation, pricing, and the reduction of waste. Technologies that enhance experiences and service quality in smart destinations demonstrate how integrated digital systems can coordinate information, mobility, service delivery, and user interaction across a complex ecosystem (Sustacha et al., 2023). Smart-city and smart-destination research similarly shows that technological transformation becomes more effective when individual digital applications are connected within an integrated institutional and urban system (Labudová, 2024). Agricultural marketing requires a comparable systemic perspective, because isolated applications for pricing, online sales, remote sensing, or product tracking will have limited value unless they are linked to shared databases, organizational workflows, and coordinated strategic objectives.

The development of smart agricultural marketing also requires attention to sustainability. Digital transformation should not be evaluated solely in terms of sales growth or operational speed; it should also contribute to environmental efficiency, social inclusion, rural development, and responsible resource use. Smart evaluation of environmentally sustainable government procurement demonstrates that public policies can use structured criteria to align purchasing decisions with broader environmental goals (Shahin et al., 2024). Within the Ministry of Agriculture Jihad, smart marketing strategies can promote products that comply with environmental and health standards, encourage low-input and precision agriculture, support the intelligent management of water resources, and reduce losses throughout the supply chain. Strategies for smart development in other sectors similarly emphasize that technological initiatives must be prioritized according to institutional feasibility, stakeholder needs, and long-term sustainability rather than adopted merely because they are novel (Aslani et al., 2024). Therefore, the proposed model must connect marketing intelligence with sustainable production, quality standardization, responsible consumption, and agricultural policy.

Policy and regulatory conditions are especially important because the Ministry of Agriculture Jihad is not a conventional commercial enterprise. It is a public institution responsible for agricultural development, food security, farmer support, rural livelihoods, market regulation, and sectoral coordination. The Ministry's marketing strategy must therefore integrate public value with market performance. Trade-facilitating regulations, digital certificates, data-sharing protocols, quality standards, supportive financing, and equitable access to technology can create the institutional foundation for intelligent markets. Conversely, fragmented regulations, interorganizational inconsistencies, weak rural connectivity, limited digital literacy, and unclear responsibilities may obstruct the implementation of smart platforms. Research on smart destination management has identified governance fragmentation, inadequate infrastructure, limited coordination, human-resource deficiencies, and weak stakeholder participation as major barriers to intelligent transformation (Naeim-Abadi et al., 2023). These barriers are highly relevant to agricultural governance, where responsibilities are distributed across national agencies, provincial organizations, cooperatives, private firms, and local producers. Effective smart marketing therefore requires a model that clarifies the relationships among infrastructure, policies, skills, market information, supply-chain processes, innovation, and customer-oriented outcomes.

The adoption of smart electronic services also depends on how users evaluate the service-marketing mix, perceived usefulness, accessibility, security, and trust. Evidence concerning smart electronic payment adoption indicates that service design and marketing-related factors can substantially influence users' willingness to accept digitally mediated transactions (Igder, 2023). This issue has direct implications for agricultural e-commerce, digital payments, online ordering, and platform-based transactions, especially where farmers and rural users may have limited prior experience with electronic systems. Knowledge sharing, satisfaction, and previous social-commerce experience can also shape purchase intentions among smart-device users (Kwon, 2023). Accordingly, the Ministry's smart marketing strategy should not assume that platform availability automatically produces adoption. It must create perceived value, trust, simplicity, technical support, and meaningful incentives for producers, intermediaries, and customers.

Despite the growing body of research on artificial intelligence, smart platforms, digital campaigns, customer analytics, and technology-enabled service systems, the available studies remain fragmented across tourism, retailing, banking, food industries, startups, smart cities, and electronic services. Existing Iranian studies have advanced understanding of smart business platforms, smart tourism, digital campaigns, neuromarketing, and data-driven marketing, but they do not provide an integrated strategy specifically designed for the institutional conditions of the Ministry of Agriculture Jihad. Moreover, much of the current literature examines individual technologies or isolated marketing outcomes rather than the causal and hierarchical relationships among policy, infrastructure, artificial intelligence, farmer empowerment, knowledge management, supply-chain integration, market development, customer orientation, branding, quality, and sustainability. A comprehensive model is therefore needed to identify the relevant components, determine which elements function as foundational drivers, clarify how the components influence one another, and empirically validate the resulting structure within the population of agricultural managers and experts.

Accordingly, the aim of the present study was to design and validate a digital transformation–based smart marketing strategy model for the Ministry of Agriculture Jihad by identifying its principal components, determining their causal and hierarchical relationships, and evaluating the empirical fit of the proposed model.

2. Methods and Materials

This study employed an applied, exploratory sequential mixed-methods design to develop and validate a smart marketing strategy model for the Ministry of Agriculture Jihad within the context of digital transformation. The research was applied in purpose because it sought to generate a practical strategic model capable of addressing identified marketing needs, improving managerial decision-making, and supporting the Ministry's transition toward data-driven, technology-enabled, and intelligent marketing practices. In terms of data-collection procedures, the study combined documentary and field methods and was conducted as a cross-sectional survey because the empirical data were collected from the participants during a defined period without manipulating the study variables. The research was grounded primarily in a positivist philosophical orientation, while its methodological logic incorporated both deductive and inductive reasoning. Deductive reasoning was used to derive an initial conceptual framework from the theoretical literature and previously published studies, whereas inductive reasoning was applied to interpret the extracted evidence, obtain expert judgments, establish the relationships among the identified components, and refine the final model. The exploratory sequential design consisted of three interconnected phases. The first phase was a qualitative meta-synthesis conducted to identify the concepts, indicators, subcomponents, and principal dimensions of a smart marketing strategy compatible with the organizational responsibilities and digital transformation requirements of the Ministry of Agriculture Jihad. The second phase used interpretive structural modeling to determine the causal and hierarchical relationships among the components identified during the meta-synthesis. The third phase was a quantitative cross-sectional survey in which the proposed model was empirically evaluated and validated through structural equation modeling. The findings of each phase informed the subsequent phase; therefore, the qualitative findings provided the conceptual foundation for the expert-based structural analysis, and the outputs of the interpretive structural modeling phase guided the construction of the quantitative measurement and structural models.

The population of the qualitative meta-synthesis phase consisted of relevant Persian and international scientific publications addressing smart marketing, strategic marketing management, marketing intelligence, digital marketing, agricultural marketing, organizational digital transformation, data-driven decision-making, intelligent technologies, and related concepts.

Persian-language studies published between approximately 1991 and 2026 and international studies published between 2000 and 2026 were considered for examination. The documentary sources included peer-reviewed journal articles, conference papers, academic books, dissertations, and research reports retrieved from Persian databases and repositories such as the National Library of Iran, the Scientific Information Database, Noormags, and IranDoc, as well as international academic databases including ScienceDirect, SpringerLink, Emerald, and other relevant scholarly search environments. Publications were selected purposively according to their conceptual relevance, methodological quality, accessibility of full text, and direct contribution to explaining the dimensions or mechanisms of smart marketing strategy and digital transformation. Sources that were duplicated, lacked sufficient methodological information, addressed unrelated sectors without transferable implications, or did not provide identifiable findings concerning the study concepts were excluded during the screening process.

The participant group in the interpretive structural modeling phase comprised 25 experts selected through purposive and homogeneous sampling. The experts included university faculty members and specialists with relevant knowledge of agricultural management, marketing management, strategic management, information technology, digital transformation, and the institutional functions of the Ministry of Agriculture Jihad. Selection was based on demonstrated academic or professional expertise, familiarity with the research subject, and the ability to evaluate the contextual applicability of the identified components. Expert participation was required because interpretive structural modeling depends on informed judgments regarding whether and how one component influences another. The expert checklists were distributed in successive rounds, either through direct contact or online communication platforms, to facilitate clarification of the identified concepts and achieve adequate agreement on the components and their relationships. The resulting expert judgments were aggregated to determine the final set of indicators and to construct the structural self-interaction matrix.

The quantitative population consisted of managers, decision-makers, department heads, and experts working at different organizational and administrative levels of the Ministry and provincial Agricultural Jihad organizations. Participants were selected through non-probability availability sampling because access to knowledgeable organizational respondents depended on their occupational position, familiarity with marketing and digital transformation processes, and willingness to participate. Nevertheless, respondents were screened to ensure that they possessed sufficient experience or organizational knowledge to evaluate the questionnaire statements. The required sample size was examined through statistical power analysis based on Cohen’s framework. The calculation considered an anticipated medium effect size of at least 0.15, a statistical power of no less than 0.80, a confidence level of 95%, and the number of latent and observed variables included in the proposed model. The conceptual model contained six latent variables and 17 observable dimensions or principal indicators. The power analysis indicated a minimum acceptable sample of approximately 227 cases, while the estimated upper boundary was 1,034 cases. The questionnaires were distributed electronically among eligible managers and experts, and 668 complete and usable questionnaires were ultimately retained for quantitative analysis. This sample size exceeded the minimum requirement and was considered adequate for estimating the measurement and structural models, examining the stability of the parameter estimates, and evaluating the explanatory capacity of the proposed smart marketing strategy model.

Data were collected using a document extraction form, an expert evaluation checklist, a structural self-interaction matrix, and a researcher-developed questionnaire. In the qualitative phase, a structured document extraction form was used to record bibliographic, methodological, and substantive information from each selected study. The bibliographic information included the title, authors, publication year, publication type, and source. Methodological information included the research design, study context, population, sampling procedure, and analytical method, where available. The substantive section of the form focused on the main findings, proposed dimensions, strategic factors, organizational requirements, technological capabilities, marketing intelligence mechanisms, digital infrastructures, environmental conditions, implementation processes, and performance consequences associated with smart marketing and digital transformation. Note-taking and systematic coding were used to organize the extracted evidence. Statements with similar meanings were initially treated as primary codes, conceptually overlapping codes were grouped into subcategories, and related subcategories were subsequently integrated into broader dimensions. This process generated an initial classification system representing the principal elements of a smart marketing strategy for the Ministry of Agriculture Jihad.

An expert checklist was developed from the codes, concepts, and categories identified through the meta-synthesis. The checklist enabled the expert panel to assess the relevance, clarity, necessity, contextual suitability, and conceptual distinctiveness of each proposed component. Expert judgments were obtained in several rounds so that ambiguous or overlapping indicators could be revised, merged, or removed. Agreement between coders and experts was examined to determine whether the identified propositions were sufficiently stable to enter the interpretive structural modeling phase. Inter-coder agreement was evaluated through percentage agreement and Cohen's kappa coefficient. The components retained after the agreement assessment formed the final input for constructing the structural self-interaction matrix. This matrix was designed to capture the direction of the relationship between every pair of components. For each pair, experts determined whether the first component influenced the second, the second influenced the first, the relationship was reciprocal, or no meaningful relationship existed. These judgments were represented using the conventional symbols V, A, X, and O. Group judgments were determined according to the dominant expert opinion, with a relationship being accepted when it obtained support from more than half of the panel members.

The quantitative instrument was a researcher-developed questionnaire derived directly from the qualitative meta-synthesis and interpretive structural modeling findings. Accordingly, the questionnaire was not based solely on a predetermined standardized scale; rather, its items operationalized the dimensions and indicators identified as relevant to smart marketing strategy in the organizational context of the Ministry of Agriculture Jihad. The questionnaire consisted of a demographic and occupational information section and a substantive section measuring the latent constructs and observable indicators of the proposed model. The demographic section obtained information needed to describe the respondents' organizational and professional characteristics, whereas the substantive items assessed the perceived status and relationships of the strategic, technological, informational, organizational, managerial, environmental, and performance-related dimensions included in the model. Responses to the substantive items were recorded using a Likert-type scale, allowing respondents to indicate their degree of agreement with each statement. Electronic administration was used to facilitate access to participants from different organizational units and geographical locations and to reduce missing or incorrectly recorded responses.

The quality of the qualitative phase was evaluated based on credibility, transferability, dependability, and confirmability. Credibility was enhanced through systematic engagement with the literature, repeated comparison of the extracted codes with the original texts, examination of concepts from multiple theoretical and empirical perspectives, peer discussion, expert review, and the revision of categories that lacked sufficient evidential support. Transferability was addressed by clearly describing the study context, selection criteria, analytical procedures, and conceptual characteristics of the resulting model so that readers could judge the applicability of the findings to other public-sector or agricultural organizations. Dependability was supported by maintaining a traceable analytical process, including the initial search records, screening decisions, extraction forms, coding notes, category definitions, expert judgments, and successive revisions of the model. Confirmability was strengthened by linking each final category to the underlying documentary evidence and by examining the consistency among the raw data, codes, interpretations, structural relationships, and final conclusions.

The content validity of the researcher-developed questionnaire was assessed through expert examination of the relevance, comprehensiveness, clarity, and contextual appropriateness of the items. The measurement model was subsequently evaluated through indicator reliability, internal consistency reliability, convergent validity, and construct distinctiveness. Standardized factor loadings were examined to determine the extent to which each observed item represented its intended latent construct. Items with sufficiently high loadings were retained, whereas items with very weak loadings were considered for removal. A loading of approximately 0.70 or higher was regarded as desirable. However, indicators with loadings between 0.40 and 0.70 could be retained when their removal did not produce a meaningful improvement in composite reliability or average variance extracted and when they possessed substantial theoretical importance. Cronbach's alpha and composite reliability were calculated to assess internal consistency. Coefficients of 0.70 or higher were considered acceptable, while values above 0.80 indicated strong reliability. Convergent validity was examined using the average variance extracted, with values of at least 0.50 indicating that a construct explained an adequate proportion of the variance in its indicators. Collectively, these procedures ensured that the questionnaire was conceptually grounded in the qualitative evidence and psychometrically appropriate for validating the proposed model.

Data analysis was performed sequentially in accordance with the mixed-methods design. The qualitative evidence was first analyzed through the seven-stage meta-synthesis procedure proposed by Sandelowski and Barroso. The process began with the formulation of focused research questions addressing the nature of the components of a smart marketing strategy, the organizational and technological actors involved, the period covered by the evidence, and the mechanisms through which the components contributed to digital transformation. A systematic search of Persian and international academic sources was then conducted using combinations of keywords related to smart marketing, marketing intelligence, strategic marketing, digital transformation, digital agriculture, agricultural marketing, customer intelligence, data analytics, organizational capabilities, and marketing performance. The retrieved records were screened through their titles, abstracts, keywords, full texts, and methodological characteristics. Relevant studies were retained, while duplicate, methodologically inadequate, or conceptually unrelated publications were excluded. Information from the eligible studies was entered into the extraction form and subjected to qualitative content analysis. Primary findings were coded, codes with similar meanings were integrated into concepts, and related concepts were classified into subdimensions and principal dimensions. The coding structure was repeatedly compared with the original studies to prevent conceptual drift and ensure that the final categories accurately represented the underlying evidence. The quality of the analysis was examined through coder agreement and expert review, after which the final set of components was reported as the qualitative foundation of the proposed model.

The relationships among the confirmed components were analyzed through interpretive structural modeling. The expert judgments recorded in the structural self-interaction matrix were first transformed into an initial binary reachability matrix. According to the conventional conversion rules, the symbols representing directional, reverse-directional, reciprocal, or absent relationships were replaced with combinations of zero and one. The diagonal elements were assigned a value of one because each component was considered reachable from itself. The initial reachability matrix was then examined for transitivity. Thus, when one component influenced a second component and the second component influenced a third component, an indirect relationship between the first and third components was incorporated where required. This procedure produced the final reachability matrix. For each component, a reachability set containing the component itself and the components it could influence was identified, together with an antecedent set containing the component itself and the components capable of influencing it. The intersection of these two sets was subsequently calculated. Components whose reachability and intersection sets were identical were assigned to the highest available level of the hierarchy and removed from the subsequent iteration. The procedure was repeated until all components were allocated to their respective structural levels. The final hierarchical model demonstrated which components operated as fundamental drivers, which occupied intermediary or linkage positions, and which represented dependent or outcome-oriented elements.

MICMAC analysis was used as a complementary procedure to examine the driving power and dependence power of the identified components. Driving power was calculated from the number of components directly or indirectly influenced by a given component, whereas dependence power reflected the extent to which the component was affected by other elements in the system. Based on these two characteristics, the components were classified as autonomous, dependent, linkage, or independent drivers. Autonomous components were expected to possess relatively weak driving and dependence power, dependent components had weak driving but strong dependence power, linkage components had strong driving and dependence power, and independent variables demonstrated strong driving but limited dependence. This classification supported the interpretation of the structural hierarchy and helped identify the components that should receive priority in implementing a smart marketing strategy. The interpretive structural modeling and MICMAC calculations were performed using spreadsheet-based procedures and the MICMAC analytical environment.

Quantitative data were analyzed using partial least squares structural equation modeling in SmartPLS. Before evaluating the model, the returned questionnaires were examined for completeness, response quality, and suitability for analysis. Descriptive statistics were calculated to summarize the respondents' characteristics and the distribution of responses to the questionnaire constructs. The structural equation modeling procedure was conducted in two major stages. The measurement model was assessed first to determine whether the observed indicators adequately measured their corresponding latent constructs. Indicator loadings, Cronbach's alpha, composite reliability, and average variance extracted were examined for this purpose. Construct distinctiveness was also evaluated to ensure that the dimensions represented conceptually separate aspects of the smart marketing strategy rather than redundant measures of the same phenomenon. Indicators that did not meet acceptable statistical criteria were reviewed in light of their theoretical importance before any decision regarding their retention or removal was made.

After the adequacy of the measurement model had been established, the structural model was evaluated to examine the proposed relationships among the latent constructs. The direction, magnitude, and statistical significance of the standardized path coefficients were estimated using a bootstrapping procedure. The coefficient of determination for each endogenous construct was examined to determine the proportion of variance explained by its predictors. The predictive capacity and overall explanatory adequacy of the model were also assessed using the relevant predictive relevance and model-fit criteria available within the partial least squares framework. The quantitative results were interpreted alongside the hierarchy obtained from interpretive structural modeling. Convergence between the expert-derived causal structure and the statistically estimated relationships was considered evidence supporting the robustness of the model. Through this integrated analytical process, the study identified the principal components of smart marketing strategy, established their causal and hierarchical configuration, and empirically evaluated the adequacy of the proposed digital transformation–based model for the Ministry of Agriculture Jihad.

3. Findings and Results

The qualitative phase was conducted through meta-synthesis, which involved interpreting and integrating the findings of previous studies rather than merely summarizing their literature or reanalyzing their primary data. The procedure enabled the findings of conceptually related studies to be combined to produce a more comprehensive understanding of smart marketing strategy in the agricultural sector. The seven-stage process of Sandelowski and Barroso was followed to formulate the research questions, systematically search the literature, screen and select eligible studies, extract information, analyze and synthesize qualitative findings, control analytical quality, and present the final categories. The first phase specifically sought to identify the principal components, dimensions, and operational indicators of a digital transformation–based smart marketing strategy for the Ministry of Agriculture Jihad.

The scope of the meta-synthesis was defined according to the population of evidence, the analytical objective, the research procedure, and the publication period. A broad preliminary search was undertaken, while the formal eligibility window included Persian-language studies published between 1991 and 2026 and international studies published between 2000 and 2026. The searches covered the National Library of Iran, SID, Civilica, Magiran, IranDoc, Noormags, Google Scholar, ScienceDirect, SpringerLink, Emerald, Scopus, ProQuest, EBSCO, IEEE, and other relevant scientific repositories. The search strategy began with general expressions and was progressively refined using more specific Persian and English combinations related to smart marketing, agricultural marketing, digital agriculture, and marketing strategy in the agricultural sector.

Table 1. Meta-synthesis research framework and search strategy

Framework element	Specification
Population of evidence: Who?	Scientific journal articles, books, dissertations, conference papers, and other scholarly sources that identified or explained dimensions of smart marketing strategy, digital agriculture, agricultural marketing, or digital transformation in agriculture
Research objective: What?	Identification of the principal components, dimensions, and operational indicators of a smart marketing strategy model for the Ministry of Agriculture Jihad
Analytical procedure: How?	Thematic examination of eligible sources, identification and prioritization of relevant factors, extraction of codes, integration of conceptually similar codes, and classification of the codes into dimensions and principal categories
Publication period: When?	Persian studies published from 1991 to 2026 and international studies published from 2000 to 2026
Main Persian search terms	استراتژی بازاریابی هوشمند برای وزارت جهاد کشاورزی؛ بازاریابی هوشمند در کشاورزی؛ استراتژی بازاریابی در صنعت کشاورزی
Main English search terms	Smart Marketing Strategy for the Ministry of Agriculture Jihad; Smart Marketing in Agriculture; Marketing Strategy in the Agricultural Industry
Databases and repositories	National Library of Iran, SID, Civilica, Magiran, IranDoc, Noormags, Google Scholar, ScienceDirect, SpringerLink, Emerald, Scopus, ProQuest, EBSCO, and IEEE
Initial search results	308 potentially relevant records
Final eligible studies	33 studies retained after four stages of screening and quality assessment

The systematic search initially produced 308 potentially relevant records. The studies were successively reviewed according to their titles, abstracts, full-text content, research methods, and relevance to the research questions. The inclusion criteria required studies to have been published within the specified field and period, to have employed a recognizable scientific method, to have reported adequate information concerning smart marketing, agricultural marketing, digital agriculture, or related strategic mechanisms, and to have undergone an appropriate scholarly review process. Qualitative investigations, systematic reviews, and quantitative studies that provided interpretable findings relevant to the qualitative synthesis were eligible. Studies were excluded when they lacked sufficient information, duplicated the objectives or findings of another publication, employed an inadequate methodological design, were not directly related to the research purpose, or lacked adequate scientific quality.

The Critical Appraisal Skills Programme framework was used to evaluate the methodological quality of the eligible studies. Each study was assessed on ten criteria: alignment with the research objective, currency of information, methodological logic, appropriateness of the research design, adequacy of sampling, quality of data collection, reflexivity or transferability, ethical considerations, accuracy of data analysis, clarity of findings, and overall research value. Each criterion received a score ranging from one to five. Total scores of 41–50 were classified as excellent, 31–40 as very good, 21–30 as good, 11–20 as moderate, and 0–10 as weak. Only studies with total scores of at least 31 were retained. Following the four-stage screening process, 275 records were excluded and 33 studies entered the final meta-synthesis. The retained studies received total quality scores ranging from 32 to 45, indicating that all were classified as either very good or excellent.

Table 2. Studies retained in the meta-synthesis and their quality-assessment results

Code	Study title	CASP score	Quality classification
S01	Strategic Analysis for Advancing Smart Agriculture with the Analytic SWOT/PESTLE Framework: A Case for Turkey	41	Excellent
S02	Identification and Prioritization of Factors Affecting the Marketing of Agricultural and Rural Products in Ilam Province, with Emphasis on Agricultural and Rural Cooperatives	33	Very good
S03	Beyond the Market—New Practices of Supply in Times of Crisis: The Example of Community-Supported Agriculture	35	Very good
S04	Smart Agriculture for Developing Nations: Status, Perspectives, and Challenges	37	Very good
S05	Agriculture: An Integrated SWOT–BWM–WASPAS Approach	40	Very good
S06	Mapping the Factors Affecting the Adoption of the Internet of Things in the Storage Segment of the Wheat Supply Chain	41	Excellent
S07	Identifying the Best Strategies for Improving and Developing Sustainable Rain-Fed Agriculture	34	Very good
S08	Innovation of Agricultural Economic Management in the Process of Constructing Smart Agriculture through Big Data	32	Very good
S09	Presenting a Framework for Digital Marketing in Agricultural Entrepreneurship	33	Very good
S10	Agriculture 4.0: The Role of Innovative Smart Technologies in Sustainable Farm Management	37	Very good
S11	Exploring the Impact of Innovation Adoption in Agriculture: The Suitability of Precision-Agriculture Technologies for the Italian Farm System	37	Very good
S12	Internet Marketing and Web-Based Agricultural Services as a Step toward Entrepreneurship in the Agricultural Sector	33	Very good
S13	Analyzing National Data on Agricultural Technology Penetration in Turkey	35	Very good
S14	Organic Vegetables from Community-Supported Agriculture in Italy: Emergy Assessment and Potential for Sustainable, Just, and Resilient Urban–Rural Food Production	33	Very good
S15	Market Structure and Resilience of Food Supply Chains under Extreme Events	38	Very good
S16	Designing a Strategic Model for the Smart Management of the Supply Chain of Essential Agricultural Products from Farm to Market	39	Very good
S17	Factors Affecting the Supply-Chain Network of Banana and Mango Products in Rural Areas of Sistan and Baluchestan Province	37	Very good
S18	Environmental Sustainable Value in Agriculture Revisited: How Does the Common Agricultural Policy Contribute to Eco-Efficiency?	44	Excellent
S19	Smart Agriculture: A Literature Review	40	Very good
S20	Designing a Business Model for the Distribution of Agricultural Products Based on the DSRM Framework	37	Very good
S21	A Theoretical Framework on Network Dynamics for Precision-Agriculture Technology Adoption	38	Very good
S22	The Path to Smart Farming: Innovations and Opportunities in Precision Agriculture	35	Very good
S23	Opinion Paper: Precision Agriculture, Smart Agriculture, or Digital Agriculture	45	Excellent
S24	Searching for Sustainability in the Digital Agriculture Debate: An Alternative Approach for a Systemic Transition	33	Very good
S25	Food Networks: Collective Action and Local Development—The Role of Organic Farming as a Boundary Object	39	Very good
S26	Blockchain-Integrated IoT for the Food Supply Chain: A Grey-Based Delphi–DEMATEL Approach	35	Very good
S27	Fostering Organic-Farming Sustainability through Alternative Food Networks	33	Very good
S28	Economic Aspects of Manure Management and Practices for Sustainable Agriculture in Turkey	44	Excellent
S29	Cybersecurity Threats and Side-Channel Attacks in Digital Agriculture	45	Excellent
S30	Exploring the Adoption of Precision-Agriculture Technologies: A Cross-Regional Study of European Union Farmers	43	Excellent
S31	When Will I Be Successful? The Use of Social Media in Agricultural Direct Marketing in Germany	43	Excellent
S32	Marketing Communication Strategy for Millennial Farmers in the Yogyakarta Special Region through Social Media	35	Very good
S33	The Virtual Good Farmer: Farmers' Use of Social Media and the Representation of "Good Farming"	39	Very good

Information from the selected studies was recorded in a structured extraction form containing the title, authors, publication year, methodological characteristics, research objective, principal findings, and factors related to smart marketing strategy. During qualitative content analysis, relevant statements were treated as initial codes. Semantically similar codes were merged into dimensions, and dimensions addressing a common strategic domain were classified under broader components. The analysis produced 37 dimensions. Their frequencies represented the number of retained studies in which each dimension was identified, while Shannon entropy analysis was used to quantify the relative informational importance of each dimension.

The highest frequencies belonged to entry into online markets and digital-marketing education, each of which appeared in 17 studies. Support for agricultural startups appeared in 16 studies. Integrated data-platform development, smart local markets, digital agricultural exports, trade-facilitating regulations, intelligent quality standards, and technological empowerment were each identified in ten studies. Smart product tracking, production-to-consumption information integration, intelligent product-quality monitoring, and innovative smart packaging had the lowest frequencies, appearing in four studies. Nevertheless, all 37 dimensions were retained because each had a defensible conceptual role in the model.

Table 3. Frequency and Shannon entropy results for the extracted dimensions

Extracted dimension	Frequency	Information expression	Uncertainty, (E_j)	Importance coefficient, (W_j)
Development of integrated data platforms	10	−0.1214	0.0336	0.0335
Improvement of communication networks and rural internet	6	−0.0841	0.0233	0.0232
Implementation of cloud systems in the supply chain	6	−0.0841	0.0233	0.0232
Demand-forecasting algorithms	6	−0.0841	0.0233	0.0232
Analysis of weather patterns and risks	6	−0.0841	0.0233	0.0232
Intelligent decision-making dashboards	6	−0.0841	0.0233	0.0232
Intelligent tracking of agricultural products	4	−0.0621	0.0172	0.0171
Optimization of distribution routes	5	−0.0735	0.0203	0.0203
Integration of production-to-consumption information	4	−0.0621	0.0172	0.0171
Precise customer segmentation	5	−0.0735	0.0203	0.0203
Consumer-behavior analysis	8	−0.1037	0.0287	0.0286
Design of targeted campaigns	8	−0.1037	0.0287	0.0286
Entry into online markets	17	−0.1733	0.0480	0.0479
Creation of smart local markets	10	−0.1214	0.0336	0.0335
Development of digital agricultural exports	10	−0.1214	0.0336	0.0335
Support for agricultural startups	16	−0.1667	0.0462	0.0460
Digitalization of production processes	9	−0.1128	0.0312	0.0311
Novel technologies such as remote sensing	6	−0.0841	0.0233	0.0232
Trade-facilitating regulations	10	−0.1214	0.0336	0.0335
Supportive policies for farmers	9	−0.1128	0.0312	0.0311
Intelligent quality standards	10	−0.1214	0.0336	0.0335
Digital-marketing education	17	−0.1733	0.0480	0.0479
Improvement of data-oriented skills	6	−0.0841	0.0233	0.0232
Empowerment in the use of technology	10	−0.1214	0.0336	0.0335
Intelligent price-information databases	6	−0.0841	0.0233	0.0232
Sharing of marketing experiences	6	−0.0841	0.0233	0.0232
Integrated agricultural-information system	6	−0.0841	0.0233	0.0232
Collaboration with the private sector	6	−0.0841	0.0233	0.0232
Development of regional sales networks	6	−0.0841	0.0233	0.0232
Intelligent monitoring of product quality	4	−0.0621	0.0172	0.0171
Export standards	5	−0.0735	0.0203	0.0203
Innovative and intelligent packaging	4	−0.0621	0.0172	0.0171
Intelligent management of water resources	5	−0.0735	0.0203	0.0203
Precision and low-input agriculture	9	−0.1128	0.0312	0.0311
Reduction of waste in the supply chain	8	−0.1037	0.0287	0.0286
Creation of a national agricultural-products brand	6	−0.0841	0.0233	0.0232
Promotion of health and organic values	7	−0.0942	0.0261	0.0260

Shannon entropy confirmed that entry into online markets and digital-marketing education had the largest importance coefficients, with (W_j=0.0479). Support for agricultural startups ranked immediately afterward, with (W_j=0.0460). The lowest coefficients were obtained for intelligent product tracking, production-to-consumption information integration, intelligent quality monitoring, and innovative smart packaging, each with (W_j=0.0171). These results indicated that the previous literature placed its strongest emphasis on market digitalization, capability development, entrepreneurial innovation, and digitally enabled market access.

The thematic synthesis ultimately produced 13 principal components: digital and technological infrastructure; data analytics and artificial intelligence; smart supply-chain management; customer-based marketing; development of new agricultural markets; innovation and digital transformation; supportive policies and regulations; education and empowerment of farmers; market knowledge and information management; communication and networking; product quality and standardization; sustainability and smart agriculture; and brand management and value creation. Each component incorporated several dimensions and a set of operational indicators.

Table 4. Principal components, dimensions, and operational indicators of the proposed model

Principal component	Dimension	Operational indicators
Digital and technological infrastructure	Development of integrated data platforms	Integration of production, distribution, and consumption data; creation of intelligent decision-support dashboards; standardization of agricultural-data formats; connection of the information systems of affiliated organizations
Digital and technological infrastructure	Improvement of communication networks and rural internet	Increased access to stable internet for farmers; development of communication infrastructure in disadvantaged regions; reduction of connectivity costs for agricultural operators; expansion of digital services throughout the agricultural value chain
Digital and technological infrastructure	Implementation of cloud systems in the supply chain	Real-time storage of product and inventory information; improved transparency and product traceability; reduction of internal infrastructure costs through cloud migration; facilitation of collaboration among producers, distributors, and regulators
Data analytics and artificial intelligence	Demand-forecasting algorithms	Analysis of consumer behavior using historical data; forecasting seasonal and climate-related purchasing patterns; use of machine learning for more accurate market forecasts; optimization of production and distribution according to predicted demand
Data analytics and artificial intelligence	Analysis of weather patterns and risks	Forecasting the effects of climate variability on product supply; identification of climate risks in production regions; analysis of relationships between weather conditions and price fluctuations
Data analytics and artificial intelligence	Intelligent decision-making dashboards	Real-time display of prices, demand, and inventory; intelligent alerts regarding market fluctuations; comparative analysis of production-region performance
Smart supply-chain management	Intelligent tracking of agricultural products	Registration of product characteristics from farm to market; QR-code or RFID-based tracking; greater transparency concerning product authenticity and safety; increased consumer trust through access to product-route information
Smart supply-chain management	Optimization of distribution routes	Calculation of the shortest routes to reduce transportation costs; intelligent scheduling for perishable products; analysis of traffic and road conditions; optimal allocation of the distribution fleet according to demand and destination
Smart supply-chain management	Integration of production-to-consumption information	Connection of farmer, transportation, and market systems; creation of an information cycle covering planting, harvesting, and sales; reduction of information errors among value-chain institutions; comprehensive data analysis for marketing policymaking
Customer-based marketing	Precise customer segmentation	Identification of consumer groups according to purchasing patterns; classification by demographic and geographical characteristics; differentiation according to product needs and preferences; intelligent customer clustering through data-mining algorithms
Customer-based marketing	Consumer-behavior analysis	Examination of seasonal and periodic consumption; analysis of customer loyalty and repeat purchases; identification of determinants of agricultural purchasing decisions; prediction of behavioral changes from historical data
Customer-based marketing	Design of targeted campaigns	Selection of appropriate messages for each customer group; use of behavioral data to determine campaign timing
Development of new agricultural markets	Entry into online markets	Development of online agricultural-product sales; improvement of digital access channels; creation of online ordering systems for producers; collaboration with e-commerce platforms
Development of new agricultural markets	Creation of smart local markets	Use of regional data to regulate supply and demand; establishment of digital stalls with real-time pricing; connection of local farmers to consumers through intelligent applications; intelligent inventory management in local markets
Development of new agricultural markets	Development of digital agricultural exports	Establishment of online platforms for introducing export products; use of international e-commerce platforms; digital standardization of export specifications and certificates; analysis of global demand through data-oriented tools
Innovation and digital transformation	Support for agricultural startups	Provision of financial facilities and technology loans; creation of specialized agricultural accelerators; provision of workshop and laboratory infrastructure; support for innovative smart-marketing ideas

Innovation and digital transformation	Digitalization of production processes	Online registration of planting, cultivation, and harvesting; sensor-based monitoring of farm conditions; real-time tracking of machinery performance; creation of a digital record for each production unit
Innovation and digital transformation	Novel technologies such as remote sensing	Satellite monitoring of cultivated areas; analysis of soil conditions and plant health; prediction of crop performance through image-processing algorithms; intelligent warnings concerning pests and environmental stresses
Supportive policies and regulations	Trade-facilitating regulations	Simplification of export and import licensing; reduction of bureaucracy in electronic document exchange; development of standards for digital agricultural trade; harmonization of regulations among agricultural institutions
Supportive policies and regulations	Supportive policies for farmers	Targeted subsidies for smart technologies; digital education and farmer empowerment; guaranteed purchasing through intelligent pricing systems; data-based insurance according to climatic and production risks
Supportive policies and regulations	Intelligent quality standards	Definition of digital quality indicators; sensor-based quality-control systems; product-quality tracking throughout the supply chain; digital standard certificates for final consumers
Education and empowerment of farmers	Digital-marketing education	Online courses for farmers and marketing managers; training in digital advertising tools; development of online campaign-management skills; presentation of targeted marketing solutions based on market data
Education and empowerment of farmers	Improvement of data-oriented skills	Training in sales and consumer-data analysis; use of business-intelligence software and dashboards; learning demand-forecasting algorithms; strengthening data-driven decision-making
Education and empowerment of farmers	Empowerment in the use of technology	Training in agricultural digital platforms; introduction to new product-monitoring tools; skills in cloud systems and applications; guidance for the effective use of smart technologies
Market knowledge and information management	Intelligent price-information databases	Real-time registration and updating of agricultural prices; analysis of price trends; accessible price information for producers and distributors; prediction of price changes through data-mining algorithms
Market knowledge and information management	Sharing of marketing experiences	Digital communities for exchanging farmer experiences; documentation of marketing successes and failures; sharing customer-attraction and sales techniques; use of practical experience to improve targeted campaigns
Market knowledge and information management	Integrated agricultural-information system	Collection and integration of production, harvesting, and inventory data; analytical dashboards for managers and policymakers; connection of public and private systems to a unified platform; real-time monitoring of the agricultural value chain
Communication and networking	Collaboration with the private sector	Partnerships with technology companies and digital platforms; joint research-and-development projects; use of private distribution and sales networks; collaborative financing and investment models
Communication and networking	Development of regional sales networks	Creation of intelligent local outlets and agencies; optimization of regional distribution routes; training of regional sellers in new technologies; analysis of sales-network performance
Product quality and standardization	Intelligent monitoring of product quality	Installation of quality-control sensors in collection centers and warehouses; digital registration of product-health status; intelligent quality reports for decision-making
Product quality and standardization	Export standards	Digital quality criteria for export products; compliance with international packaging and transportation requirements; digital certificates of product quality and authenticity
Product quality and standardization	Innovative and intelligent packaging	Traceable packaging using QR codes or RFID; packaging resistant to spoilage and temperature changes; digital product information on packaging; packaging optimization to reduce costs and increase attractiveness
Sustainability and smart agriculture	Intelligent management of water resources	Real-time monitoring of water consumption through sensors and IoT; irrigation-data analysis to reduce consumption; prediction of crop water requirements; intelligent allocation of water at farm and regional levels
Sustainability and smart agriculture	Precision and low-input agriculture	Use of sensors and drones to monitor soil and crops; data-based optimization of fertilizers and pesticides; prediction of crop performance; reduced costs and improved production efficiency
Sustainability and smart agriculture	Reduction of waste in the supply chain	Tracking products to prevent spoilage; optimization of harvesting and transportation schedules; demand forecasting to reduce overproduction; intelligent packaging and storage to extend shelf life
Brand management and value creation	Creation of a national agricultural-products brand	Registration and protection of national brands; digital advertising and targeted campaigns; promotion of the quality and authenticity of Iranian agricultural products; online platforms for increasing brand awareness
Brand management and value creation	Promotion of health and organic values	Transparent information about production processes and materials; use of organic certificates and standards; health-oriented educational and promotional campaigns; specialized markets for healthy and organic products

The quality of coding was examined through comparison of two coders’ judgments. The first coder classified 36 codes as confirmed and five as unconfirmed, whereas the second coder classified 38 as confirmed and three as unconfirmed. Of the 41 evaluated coding decisions, the two coders agreed on 34 positive decisions and one negative decision. The reported Cohen’s kappa coefficient was 0.877, indicating excellent agreement according to the adopted interpretive scale. The coding results were therefore considered sufficiently dependable for constructing the initial model.

The 13 principal components identified through meta-synthesis were entered into interpretive structural modeling. Digital and technological infrastructure was represented by C1; data analytics and artificial intelligence by C2; smart supply-chain management by C3; customer-based marketing by C4; development of new agricultural markets by C5; innovation and digital transformation by C6; supportive policies and regulations by C7; education and empowerment of farmers by C8; market knowledge and information management by C9; communication and networking by C10; product quality and standardization by C11; sustainability and smart agriculture by C12; and brand management and value creation by C13.

Expert judgments regarding the pairwise relationships among the components were entered into the structural self-interaction matrix. The symbol V indicated that component (i) influenced component (j), A indicated that component (j) influenced component (i), X represented a reciprocal relationship, and O indicated the absence of a direct relationship. The self-interaction matrix was converted into an initial binary reachability matrix, after which transitive relationships were incorporated to produce the final reachability matrix. Thus, when one component influenced a second component and the second influenced a third, the indirect effect of the first component on the third was also represented.

Table 5. Final ISM reachability matrix

Variable	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
C1	1	1	1	1	1	1	1	1	1	1	1	1	1
C2	0	1	1	1	1	1	0	1	1	1	1	1	1
C3	0	0	1	1	1	1	0	0	0	1	1	1	1
C4	0	0	0	1	0	0	0	0	0	0	0	1	1
C5	0	0	0	1	1	0	0	0	0	0	0	1	1
C6	0	0	0	1	1	1	0	0	0	0	1	1	1
C7	1	1	1	1	1	1	1	1	1	1	1	1	1
C8	0	1	1	1	1	1	0	1	1	1	1	1	1
C9	0	1	1	1	1	1	0	1	1	1	1	1	1
C10	0	0	1	1	1	1	0	0	0	1	1	1	1
C11	0	0	0	1	1	1	0	0	0	0	1	1	1
C12	0	0	0	0	0	0	0	0	0	0	0	1	0
C13	0	0	0	1	0	0	0	0	0	0	0	1	1

The final reachability matrix was used to calculate the driving and dependence powers of the components and to allocate them to hierarchical levels. Supportive policies and regulations and digital and technological infrastructure had the highest driving power, indicating that they represented the most fundamental conditions for implementing the model. Sustainability and smart agriculture had the greatest dependence power and no driving power beyond its self-relationship, indicating that it was the principal final outcome of the system. Brand management and value creation and customer-based marketing were also located near the outcome side of the hierarchy.

Table 6. Driving power, dependence power, and hierarchical levels of the ISM components

Code	Component	Driving power	Dependence power	ISM level
C1	Digital and technological infrastructure	12	3	7
C2	Data analytics and artificial intelligence	11	5	6
C3	Smart supply-chain management	9	6	5
C4	Customer-based marketing	2	9	2
C5	Development of new agricultural markets	3	8	3
C6	Innovation and digital transformation	5	7	4
C7	Supportive policies and regulations	12	1	7
C8	Education and empowerment of farmers	10	4	6
C9	Market knowledge and information management	10	4	6
C10	Communication and networking	7	6	5
C11	Product quality and standardization	2	8	4
C12	Sustainability and smart agriculture	0	12	1
C13	Brand management and value creation	1	11	2

The iterative level-partitioning process produced seven levels. Sustainability and smart agriculture, C12, occupied the first and most dependent level. Customer-based marketing and brand management and value creation, C4 and C13, constituted the second level. Development of new agricultural markets, C5, was placed at the third level. Innovation and digital transformation and product quality and standardization, C6 and C11, formed the fourth level. Smart supply-chain management and communication and networking, C3 and C10, constituted the fifth level. Data analytics and artificial intelligence, farmer education and empowerment, and market knowledge and information management, C2, C8, and C9, were positioned at the sixth level. Digital and technological infrastructure and supportive policies and regulations, C1 and C7, formed the seventh and foundational level. The hierarchy therefore suggested that policy support and digital infrastructure created the conditions for data-oriented capabilities, knowledge management, and farmer empowerment; these capabilities subsequently enabled intelligent supply chains and interorganizational networks, which facilitated innovation, quality standardization, new-market development, customer orientation, brand value, and ultimately sustainable smart agriculture.

The quantitative model was evaluated using data obtained from 668 managers and experts. Of the respondents, 601 were men, representing 90.0% of the sample, and 67 were women, representing 10.0%. In terms of age, 100 respondents were between 25 and 35 years old, 267 were between 36 and 45, 176 were between 46 and 55, and 125 were 56 years or older. These groups represented 15.0%, 40.0%, 26.3%, and 18.7% of the sample, respectively. Regarding education, 275 participants held a bachelor's degree, 283 held a master's degree, and 110 held a doctoral degree, corresponding to 41.3%, 42.5%, and 16.2% of the sample. Regarding work experience, 108 participants had 10–15 years of experience, 276 had 16–20 years, 142 had 21–25 years, 75 had 26–30 years, and 67 had more than 31 years of work experience. These groups represented 16.3%, 41.3%, 21.3%, 11.3%, and 9.8% of the sample, respectively.

The descriptive results showed that the mean scores of all constructs were above the theoretical midpoint of the response scale. Supportive policies and regulations had the highest mean score, (M=4.3938), followed by smart supply-chain management, (M=4.2229), communication and networking, (M=4.1542), and brand management and value creation, (M=4.1417). Data analytics and artificial intelligence had the lowest mean score, (M=3.6729), although it also remained above the scale midpoint. The variance values ranged from 0.192 for customer-based marketing to 0.473 for innovation and digital transformation. Most skewness and kurtosis coefficients remained within conventional limits, although positive skewness was more pronounced for sustainability and smart agriculture and brand management and value creation.

Before estimating the structural model, multicollinearity was evaluated using variance inflation factors. The VIF coefficients ranged from 1.003 to 2.687. Since all values were below the conservative threshold of 3, there was no evidence of critical multicollinearity among the constructs.

Table 7. Descriptive statistics and multicollinearity assessment of the research constructs

Construct	Mean	Skewness	Kurtosis	Variance	Range	VIF
Digital and technological infrastructure	3.8250	−0.216	0.566	0.225	2.00	1.170
Data analytics and artificial intelligence	3.6729	−0.496	0.314	0.339	2.25	1.045
Smart supply-chain management	4.2229	−0.625	−0.470	0.358	2.00	1.161
Customer-based marketing	4.0938	0.018	−0.032	0.192	2.25	1.249
Development of new agricultural markets	3.8734	−0.883	0.163	0.465	2.50	2.687
Innovation and digital transformation	3.7405	−0.301	−0.171	0.473	3.00	2.566
Supportive policies and regulations	4.3938	−0.241	−0.621	0.302	2.00	1.258
Education and empowerment of farmers	4.1000	−0.938	0.134	0.319	2.00	1.166
Market knowledge and information management	3.8397	0.273	−0.318	0.399	3.00	1.402
Communication and networking	4.1542	−0.800	0.051	0.259	2.00	1.562
Product quality and standardization	3.9000	0.088	−0.558	0.439	3.00	1.085
Sustainability and smart agriculture	3.9125	1.215	−0.628	0.410	3.00	1.003
Brand management and value creation	4.1417	1.677	−0.749	0.213	2.67	1.005

The measurement model was evaluated through standardized factor loadings, Cronbach's alpha, composite reliability, average variance extracted, the Fornell–Larcker criterion, and the heterotrait–monotrait ratio. All retained indicators had acceptable relationships with their corresponding latent constructs. Cronbach's alpha coefficients ranged from 0.736 to 0.865 and were therefore above the minimum acceptable value of 0.70. Composite reliability coefficients ranged from 0.733 to 0.896, also exceeding the required threshold. Average variance extracted ranged from 0.530 to 0.633 and was above 0.50 for every construct. These findings supported the internal consistency and convergent validity of the measurement model.

The Fornell–Larcker results indicated that the reported square-root values on the main diagonal exceeded the corresponding interconstruct correlations. The lowest diagonal value was 0.810 for innovation and digital transformation, while the highest was 0.894 for customer-based marketing. The HTMT coefficients ranged from 0.235 to 0.839 and were all below 0.90. The highest HTMT coefficient was observed between market knowledge and information management and brand management and value creation, at 0.839. Consequently, both the Fornell–Larcker and HTMT assessments supported the discriminant validity of the constructs.

The structural model was examined using the coefficient of determination, effect-size coefficients, and Stone–Geisser predictive-relevance coefficients. The individual reported (R^2) values for the endogenous constructs were 0.336, 0.623, 0.350, 0.345, 0.484, 0.527, 0.669, 0.433, 0.419, 0.499, 0.419, and 0.873. The model-level interpretation indicated that a substantial proportion of variation in the endogenous components was explained by their predictors. The (Q^2) coefficients were positive for all constructs and ranged from 0.110 to 0.645, confirming predictive relevance. Innovation and digital transformation and supportive policies and regulations had the strongest predictive-relevance coefficients, whereas customer-based marketing had the lowest positive coefficient. The (F^2) coefficients ranged from 0.283 to 0.667, indicating predominantly moderate-to-large effects.

Table 8. Reliability, convergent validity, discriminant validity, and predictive assessment of the model

Panel A. Reliability, convergent validity, predictive relevance, and effect sizes

Code	Construct	Cronbach's alpha	AVE	Composite reliability	(Q^2)	(F^2)
C1	Digital and technological infrastructure	0.796	0.547	0.755	0.456	0.283
C2	Data analytics and artificial intelligence	0.865	0.530	0.801	0.493	0.500
C3	Smart supply-chain management	0.790	0.566	0.864	0.382	0.667
C4	Customer-based marketing	0.737	0.601	0.783	0.110	0.634
C5	Development of new agricultural markets	0.811	0.604	0.764	0.383	0.483
C6	Innovation and digital transformation	0.825	0.633	0.758	0.645	0.338
C7	Supportive policies and regulations	0.803	0.614	0.794	0.556	0.547
C8	Education and empowerment of farmers	0.784	0.628	0.733	0.440	0.555
C9	Market knowledge and information management	0.798	0.570	0.832	0.312	0.539
C10	Communication and networking	0.856	0.611	0.896	0.438	0.630
C11	Product quality and standardization	0.736	0.535	0.827	0.487	0.319
C12	Sustainability and smart agriculture	0.794	0.582	0.736	0.440	0.439
C13	Brand management and value creation	0.777	0.620	0.804	0.367	0.340

Panel B. Fornell–Larcker discriminant-validity matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
C1	0.889												
C2	0.570	0.891											
C3	0.536	0.663	0.892										
C4	0.717	0.536	0.463	0.894									
C5	0.553	0.729	0.600	0.627	0.866								
C6	0.634	0.582	0.627	0.735	0.755	0.810							
C7	0.330	0.753	0.537	0.635	0.537	0.696	0.848						
C8	0.738	0.782	0.526	0.638	0.629	0.636	0.511	0.854					
C9	0.749	0.711	0.538	0.620	0.662	0.556	0.593	0.836	0.890				
C10	0.538	0.537	0.327	0.333	0.535	0.735	0.719	0.628	0.864	0.886			
C11	0.638	0.666	0.384	0.500	0.739	0.638	0.464	0.502	0.637	0.737	0.834		
C12	0.738	0.728	0.738	0.383	0.527	0.739	0.439	0.553	0.388	0.636	0.508	0.837	
C13	0.627	0.429	0.352	0.773	0.639	0.333	0.686	0.457	0.483	0.593	0.793	0.728	0.840

Panel C. HTMT discriminant-validity matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
C2	0.736											
C3	0.500	0.536										
C4	0.739	0.599	0.803									
C5	0.543	0.582	0.637	0.627								
C6	0.527	0.738	0.555	0.637	0.373							
C7	0.666	0.584	0.548	0.730	0.647	0.786						
C8	0.610	0.594	0.539	0.710	0.638	0.483	0.755					
C9	0.485	0.302	0.601	0.555	0.728	0.593	0.438	0.536				
C10	0.646	0.634	0.448	0.422	0.510	0.444	0.584	0.375	0.773			
C11	0.235	0.564	0.549	0.549	0.388	0.394	0.621	0.810	0.549	0.584		
C12	0.594	0.520	0.594	0.498	0.664	0.637	0.640	0.777	0.585	0.383	0.549	
C13	0.554	0.594	0.649	0.637	0.402	0.548	0.606	0.585	0.839	0.500	0.738	0.694

Overall, the qualitative and quantitative findings converged on a multidimensional smart marketing strategy model in which digital infrastructure and supportive regulation served as the foundational drivers. These drivers strengthened data analytics, market-information management, and the digital capabilities of farmers and organizational actors. The resulting capabilities supported intelligent supply-chain operations, networking, technological innovation, quality standardization, access to new markets, customer-oriented marketing, and agricultural brand development. The positive reliability, validity, predictive-relevance, and effect-size findings supported the empirical adequacy of the proposed model for the Ministry of Agriculture Jihad.

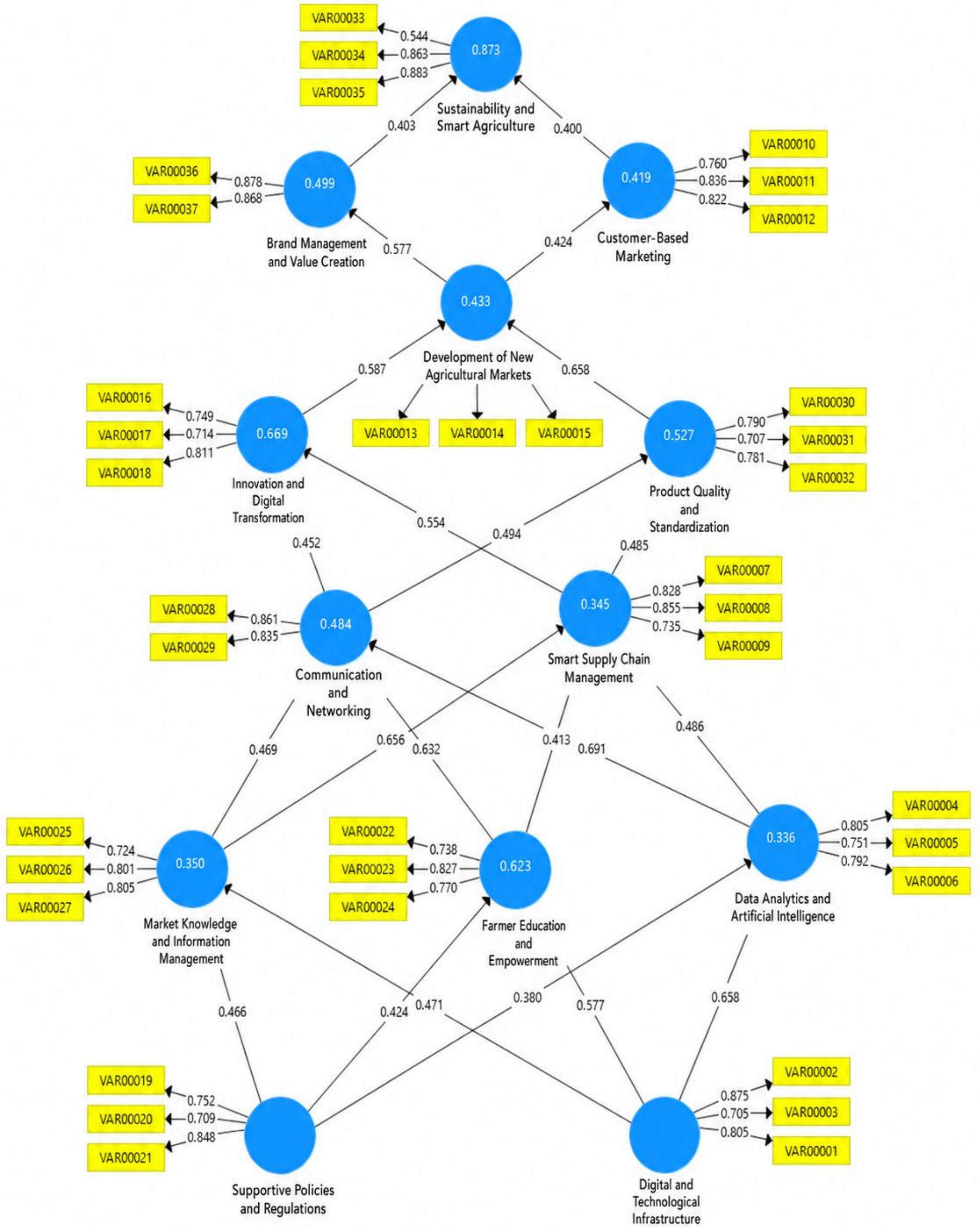

Figure 1. Standardized Factor Loadings of the Smart Marketing Strategy Measurement Model

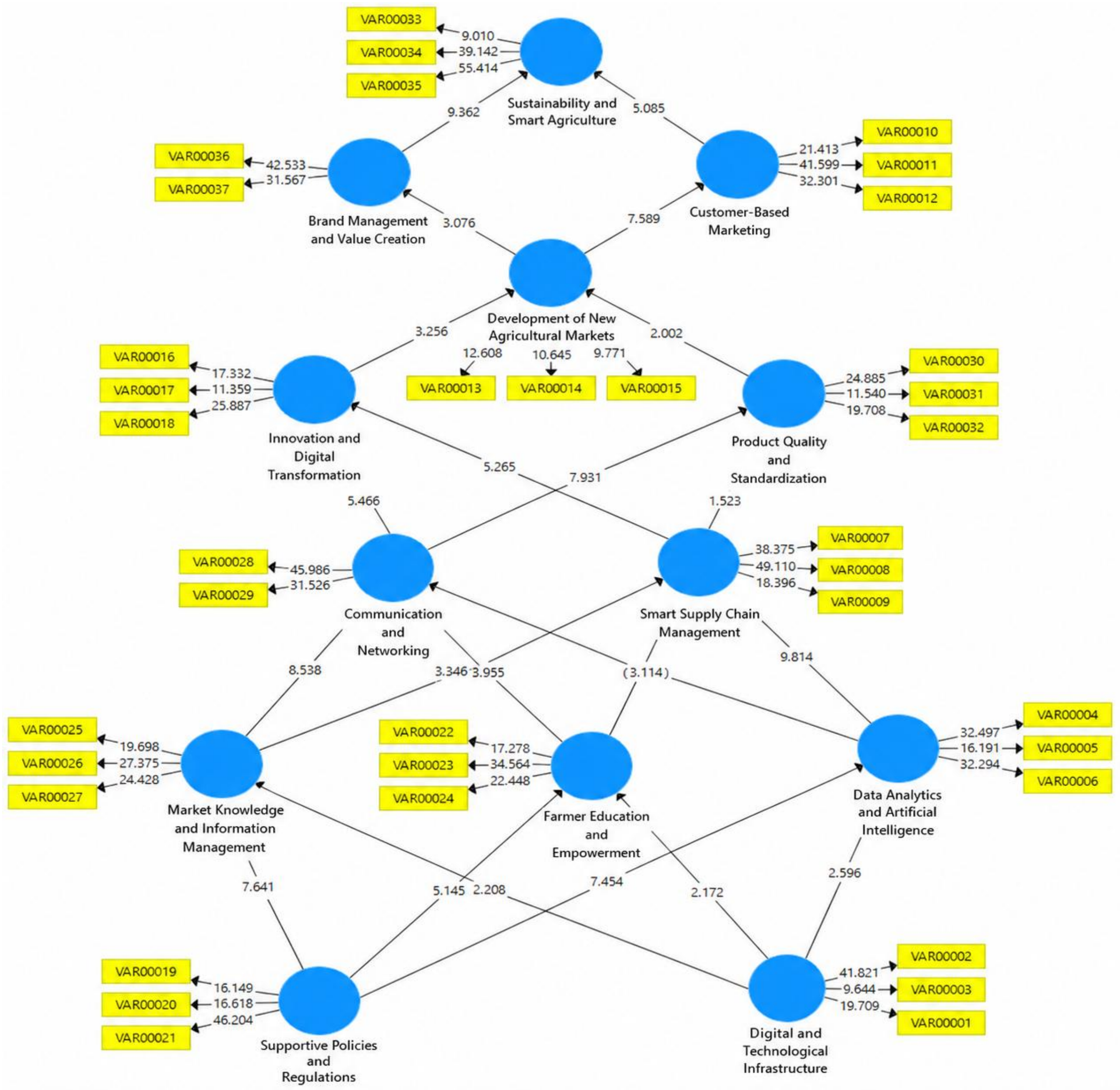

Figure 2. Bootstrapped t-Values of the Smart Marketing Strategy Measurement Model

4. Discussion and Conclusion

The present study designed and validated a digital transformation–based smart marketing strategy model for the Ministry of Agriculture Jihad by integrating qualitative meta-synthesis, interpretive structural modeling, and partial least squares structural equation modeling. The qualitative analysis identified 37 dimensions organized under 13 principal components: digital and technological infrastructure, data analytics and artificial intelligence, smart supply-chain management, customer-based marketing, development of new agricultural markets, innovation and digital transformation, supportive policies and regulations, education and empowerment of farmers, market knowledge and information management, communication and networking, product quality and standardization, sustainability and smart agriculture, and brand management and value creation. The ISM findings arranged these components into seven hierarchical levels and demonstrated that digital and technological infrastructure and supportive policies and regulations constituted the most fundamental drivers of the model, whereas sustainability and smart agriculture represented the most dependent and ultimate outcome. The quantitative results further supported the adequacy of the proposed structure. All constructs demonstrated acceptable internal consistency, convergent validity, and discriminant validity; variance inflation factors were below the critical threshold; predictive-relevance coefficients were positive; and the reported structural results indicated that approximately 65% of the variation in the endogenous components was explained by the model. These findings suggest that smart agricultural marketing is not an isolated promotional activity but a coordinated institutional system in which policy, technology, information, human capabilities, market relationships, and sustainability operate in an interdependent sequence.

The placement of supportive policies and regulations and digital and technological infrastructure at the foundational level indicates that smart marketing cannot develop sustainably in the Ministry merely through the introduction of individual applications, social-media channels, or artificial-intelligence tools. Instead, it requires an enabling institutional environment, interoperable information systems, stable rural connectivity, cloud-based infrastructures, integrated data platforms, and coherent rules for digital trade, information exchange, certification, and farmer support. This finding is consistent with research showing that smart platform businesses depend on the interaction of technological infrastructure, platform governance, user participation, data integration, and network mechanisms (Ahmadzadeh et al., 2024). Smart-development strategies similarly require the prioritization of infrastructure, institutional readiness, and coordinated governance before advanced service applications can generate meaningful outcomes (Aslani et al., 2024). Challenges reported in the management of smart destinations, including fragmented governance, inadequate infrastructure, weak stakeholder coordination, and limited institutional capacity, also support the conclusion that policy and technological foundations determine the feasibility of intelligent transformation (Naeim-Abadi et al., 2023). Therefore, the Ministry's regulatory role should not be treated as external to marketing strategy; it is one of the principal mechanisms through which smart markets are made possible.

The sixth ISM level included data analytics and artificial intelligence, education and empowerment of farmers, and market knowledge and information management. Their placement immediately above the foundational drivers indicates that technological infrastructure and supportive regulation acquire strategic value only when they are converted into analytical intelligence and usable human capabilities. Artificial intelligence can enhance marketing operations through forecasting, automation, pattern recognition, personalization, and decision support (Todorova & Antonova, 2023). Systematic research on artificial intelligence in marketing likewise emphasizes its role in market prediction, customer analysis, recommendation systems, communication management, and the development of adaptive strategies (Jahanfar & Elahi Khorasani, 2023). In agricultural marketing, these capabilities can be applied to demand forecasting, price analysis, climatic-risk evaluation, customer segmentation, and supply–demand coordination. The importance of data-driven analysis is also consistent with business-intelligence frameworks in which sentiment analysis and digital-market data are transformed into practical recommendations for e-commerce decision-making (Kyaw et al., 2023). The resulting model therefore confirms that agricultural information should not remain dispersed across administrative units; it should be integrated into accessible databases and decision dashboards that support managers, farmers, distributors, and policymakers.

The simultaneous placement of farmer education and technological empowerment at this level demonstrates that digital transformation is fundamentally a sociotechnical process. Advanced platforms can fail when users perceive them as complex, threatening, irrelevant, or incompatible with their work practices. Research on smart-factory adoption has shown that user resistance may be shaped by uncertainty, perceived risk, inadequate resources, organizational barriers, and concerns about the consequences of technological change (Park et al., 2024). Awareness of smart technology, artificial intelligence, robotics, and algorithms can similarly produce both positive and negative outcomes; it may improve engagement and proactive service behavior when supported appropriately, but it may also increase insecurity or resistance when employees perceive technology as a threat (Teng et al., 2025). Accordingly, the Ministry should not separate investment in infrastructure from investment in digital literacy, data-oriented decision-making, online marketing competencies, and practical support for technology use. The high Shannon entropy importance assigned to digital-marketing education further reinforces this conclusion. Education was not a peripheral component in the extracted literature but one of the two most frequently emphasized strategic dimensions.

Smart supply-chain management and communication and networking were positioned at the fifth level. This finding indicates that analytical capabilities, knowledge systems, and empowered users enable the Ministry to improve coordination across the agricultural value chain. Agricultural marketing performance depends on the ability to connect production, storage, transportation, distribution, market information, and customer demand. Intelligent tracking, route optimization, real-time inventory monitoring, and the integration of information from production to consumption reduce fragmentation and permit more timely interventions. The finding aligns with the logic of omnichannel integration, according to which value is created when information and service processes remain consistent and connected across multiple contact points rather than functioning as independent channels (Rahim Monfared & Hamidizadeh, 2025). It is also compatible with smart retail systems in which artificial intelligence and the Internet of Things support inventory control, consumer analysis, personalization, and the coordination of physical and digital shopping environments (Gupta et al., 2025). In the agricultural context, networking with private technology firms, logistics providers, digital marketplaces, cooperatives, and regional sales organizations can extend the Ministry's implementation capacity and facilitate the commercialization of innovations.

The fourth level contained innovation and digital transformation together with product quality and standardization. Their position suggests that these outcomes emerge after the establishment of infrastructure, data capabilities, human competencies, supply-chain coordination, and network relationships. The finding is conceptually consistent with Marketing 5.0, in which intelligent technologies are embedded across value-creation processes rather than applied only to advertising or communication (Movahed et al., 2024). The critique of post-human marketing structures also indicates that contemporary marketing systems increasingly involve complex interactions among individuals, algorithms, platforms, automated technologies, and institutional arrangements (Torabi et al., 2024). In agriculture, this interaction may involve remote sensing, smart sensors, digital production records, automated quality monitoring, traceable packaging, and digital certificates. However, digital innovation must produce observable improvements in safety, authenticity, reliability, and product quality if it is to create market value. Research on technology-supported service innovation confirms that technological novelty alone is insufficient; the innovation must improve the quality of users' experiences and subsequent outcomes (Wu et al., 2024). Thus, quality standardization serves as the mechanism through which technological transformation becomes credible and valuable to buyers, regulators, and consumers.

The development of new agricultural markets was positioned at the third hierarchical level. This component included entry into online markets, creation of smart local markets, and development of digital exports. Its location indicates that market expansion is an outcome of earlier institutional, technological, informational, and operational developments. Organizations cannot obtain sustainable benefits from e-commerce platforms when product information is unreliable, supply chains are fragmented, digital payment mechanisms are not trusted, or producers lack the capability to interact with customers. Research on the adoption of smart electronic payment methods demonstrates that service characteristics, accessibility, perceived usefulness, and trust influence users' acceptance of digital transactions (Igder, 2023). Knowledge sharing, satisfaction, and prior social-commerce experience also influence purchase intention in mobile digital environments (Kwon, 2023). Digital marketing strategies can increase consumer purchase intentions by enhancing access to information and improving communication relevance (Lee & Chen, 2023). Therefore, the Ministry's development of online agricultural markets should include secure transactions, transparent price systems, digital product verification, reliable delivery mechanisms, and support for producers' participation, rather than focusing exclusively on the technical creation of a marketplace.

Customer-based marketing and brand management and value creation occupied the second level, immediately preceding sustainability and smart agriculture. This placement suggests that customer orientation and brand value are downstream consequences of the Ministry's broader digital transformation. Once reliable data, integrated supply chains, quality standards, and digital markets are established, the Ministry and agricultural producers can use customer segmentation, behavioral analysis, targeted communication, and national branding more effectively. Data-driven smart marketing models emphasize continuous collection and interpretation of customer data, personalization, interactive communication, and performance assessment (Khosravi & Naderi, 2023). Artificial intelligence–based smart tourism marketing similarly highlights segmentation, recommendation, forecasting, personalization, and customer-experience management as central thematic domains (Abbasivarki et al., 2024). These principles can be adapted to agricultural markets to distinguish customer groups, identify demand for organic or health-oriented products, anticipate seasonal preferences, and tailor communication to domestic and international buyers.

The importance of targeted campaigns and digital branding is further supported by research on social-media marketing. Smart campaign models for startups emphasize data-oriented targeting, suitable content, channel selection, campaign timing, audience interaction, and continuous performance evaluation (Mahmoodi Meymand et al., 2024). Social-media marketing can also strengthen brand love, brand loyalty, and brand equity when it creates relevant and emotionally engaging interactions (Tabelessy, 2024). Store image, service atmosphere, and social-media communication have likewise been associated with consumer purchase decisions, demonstrating that digital promotion must be integrated with broader perceptions of quality and experience (Tiufany & Lina, 2024). In the food industry, neuromarketing-related factors may help explain consumer responses to sustainable production, health claims, packaging, and product presentation (Faeghi et al., 2024). For the Ministry of Agriculture Jihad, these findings support the creation of a coherent national agricultural brand, digital communication of product origin and quality, and evidence-based campaigns emphasizing authenticity, health, sustainability, and regional identity.

Nevertheless, customer-based marketing must be implemented responsibly. Artificial intelligence and extensive customer data may improve personalization, but they also create ethical issues related to privacy, transparency, bias, and manipulation. Data-driven campaigns must therefore balance efficiency and personalization with responsible data governance (Mathew, 2025). Technology-mediated consumer environments can also produce undesirable behavioral consequences. Fear of missing out and smartphone addiction, for example, have been associated with disruptive technology-related consumer behaviors (Paul et al., 2023). This suggests that smart agricultural marketing should avoid excessive, intrusive, or manipulative communication and instead prioritize accurate information, informed choice, accessibility, and public trust. This requirement is particularly important because the Ministry is a public institution whose responsibilities extend beyond commercial performance to food security, social welfare, rural development, and consumer protection.

Sustainability and smart agriculture occupied the first and most dependent ISM level, indicating that sustainability was the final result generated by the interaction of all preceding components. This finding is theoretically important because it positions sustainability not as an isolated environmental initiative but as the cumulative outcome of supportive policies, technological infrastructure, intelligent data use, capable stakeholders, coordinated supply chains, quality systems, customer-responsive markets, and value-oriented branding. Research on smart destinations shows that technology can enhance service experiences when applications are integrated within a broader system of information, mobility, and stakeholder coordination (Sustacha et al., 2023). The relationship between smart tourism, smart destinations, and smart cities also demonstrates that intelligent transformation requires systemic integration rather than disconnected technological applications (Labudová, 2024). In the agricultural setting, this means that water-resource management, precision agriculture, waste reduction, low-input production, traceability, and sustainable consumption should be connected to the marketing model rather than treated as separate technical programs.

The sustainability result is also aligned with evidence emphasizing the role of structured public policy in advancing environmental objectives. Smart evaluation of government procurement policies demonstrates that public organizations can integrate environmental criteria into their strategic decisions and use systematic assessment to improve sustainability performance (Shahin et al., 2024). In the Ministry of Agriculture Jihad, supportive procurement, certification, subsidy, insurance, export, and pricing policies could encourage the adoption of environmentally responsible production methods and create market incentives for sustainable products. The high mean score obtained for supportive policies and regulations in the quantitative phase also indicates that respondents recognized the central importance of the governmental and regulatory environment. Therefore, smart agricultural marketing should be interpreted as a public-value strategy capable of aligning market efficiency with environmental protection, farmer welfare, product quality, and national food-system resilience.

The Shannon entropy findings provided an additional perspective on strategic priorities. Entry into online markets and digital-marketing education received the highest importance coefficients, followed closely by support for agricultural startups. This pattern shows that the existing literature places considerable emphasis on practical market access, capacity building, and entrepreneurial innovation. The strong role of startups is consistent with the need for flexible organizations capable of experimenting with new platforms, logistics systems, analytical tools, and customer-engagement models. At the same time, the importance of online markets should not be interpreted as evidence that channel digitalization alone is sufficient. The ISM hierarchy demonstrated that digital marketplaces depend on infrastructure, policy, data capabilities, education, supply-chain integration, and quality standards. Thus, the combined qualitative findings distinguish between highly visible implementation priorities and the deeper institutional drivers required to sustain them.

Finally, the PLS-SEM findings supported the empirical adequacy of the 13-component framework. Cronbach's alpha and composite reliability coefficients exceeded acceptable thresholds, average variance extracted was greater than 0.50 for every construct, and both the Fornell–Larcker and HTMT criteria supported discriminant validity. Positive (Q^2) coefficients indicated predictive relevance, while the reported (F^2) coefficients showed mostly moderate or strong effects. The absence of critical multicollinearity further suggested that the identified components represented related but distinguishable dimensions of smart marketing strategy. Collectively, these findings support the conclusion that the proposed model captures a coherent strategic system rather than a collection of redundant technological and marketing variables. The model explains smart agricultural marketing as a staged transformation beginning with policy and infrastructure, proceeding through data, knowledge, empowerment, supply-chain integration, and innovation, and culminating in customer value, branding, and sustainable smart agriculture.

The study had several limitations that should be considered when interpreting its findings. The meta-synthesis depended on the quality, accessibility, and reporting completeness of previously published studies and may not have captured unpublished organizational knowledge or emerging practices that had not yet entered the academic literature. Although the screening and coding procedures were systematic and inter-coder agreement was excellent, qualitative synthesis inevitably involves interpretive judgment. The expert panel was selected purposively, and its judgments may reflect the institutional and professional experiences of the included specialists. The quantitative phase used availability sampling, which limits the statistical generalizability of the findings to all employees, farmers, private-sector actors, and regional units associated with the Ministry. In addition, the cross-sectional design did not permit evaluation of changes in technological readiness, implementation performance, or market outcomes over time. The structural model was assessed primarily through managers' and experts' perceptions rather than objective indicators of sales, waste reduction, export growth, customer satisfaction, or environmental performance.

Future studies should examine the proposed model through longitudinal and implementation-oriented designs to determine whether the hierarchical relationships identified in the present research remain stable as digital transformation progresses. Researchers could test the model separately across provincial Agricultural Jihad organizations, agricultural subsectors, product categories, and regions with different levels of digital access. Comparative studies involving farmers, cooperatives, agribusinesses, exporters, technology startups, distributors, and consumers would provide a more comprehensive assessment of stakeholder differences. Future research should also develop objective performance indicators for each component and examine how digital infrastructure, analytical capability, market integration, and policy support influence measurable outcomes such as price stability, supply-chain waste, export performance, farmer income, consumer trust, and resource efficiency. Experimental and quasi-experimental studies could evaluate specific interventions, including intelligent dashboards, digital marketplaces, traceability systems, online training programs, and targeted marketing campaigns.

The Ministry of Agriculture Jihad should implement the model in a staged sequence beginning with the foundational components rather than introducing isolated applications. Priority should be given to integrated agricultural databases, rural connectivity, cloud infrastructure, interoperability standards, digital-trade regulations, and clear data-governance arrangements. These foundations should be followed by extensive training in digital marketing, data analysis, platform use, and intelligent decision-making for managers, extension personnel, and farmers. The Ministry should establish partnerships with private technology firms, universities, cooperatives, logistics providers, and agricultural startups to develop scalable platforms and regionally appropriate solutions. Integrated systems should connect production, inventory, transportation, pricing, quality certification, online sales, and customer information. Implementation performance should be monitored through measurable indicators covering farmer participation, market access, transaction costs, product traceability, customer trust, waste reduction, export development, and environmental sustainability.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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