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A Maturity Evaluation Framework for Sales Team Digital Capability Based on AHP and Fuzzy Comprehensive Assessment

XIANGMIN, Li [1*] GE, Zhang [2]

[1] Owner, Ym Trading Limited, Denver, USA, US
[2] School of Information and Communication Engineering, Beijing University of Posts and Telecommunications, Beijing, China, CN

***** XIANGMIN, Li is the corresponding author, E-mail: meisson.lee@gmail.com*

Abstract: The steps involved in applying the Analytic Hierarchy Process (AHP) to company sales data analysis include defining the analysis objectives, constructing a hierarchical model, conducting comparative analysis and constructing matrices, testing matrix consistency, and calculating weights and rankings. This process enables companies to better understand the drivers of sales data and, through multilevel analysis, identify effective strategies to enhance sales performance. In addition to AHP, this study further incorporates the Fuzzy Comprehensive Evaluation Method to address the qualitative and uncertain characteristics of digital sales capability indicators. Combined with expert scoring and survey data, the proposed AHP–fuzzy model converts subjective judgments into quantitative results, providing a more accurate and flexible evaluation of maturity. The empirical cases demonstrate that organizations with strong deployment of digital tools may still exhibit uneven maturity when data literacy or cultural readiness is insufficient. The model helps managers identify capability gaps, optimize digital enablement strategies, and guide continuous improvement in sales team digital transformation.

Keywords: Digital Sales Management, Analytic Hierarchy Process -AHP, Fuzzy Comprehensive Evaluation, Capability Maturity Assessment.

Disciplines: Finance. **Subjects:** Financial Econometrics.

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1 INTRODUCTION

Digital sales management involves optimizing sales processes, enhancing sales efficiency, improving customer relationship management, and enabling data-driven decision-making through the application of advanced digital technologies and tools, including CRM systems, big data analytics, artificial intelligence, and cloud computing [1-3]. These technologies enable businesses to collect, analyze, and use sales-related data more effectively, leading to more informed business decisions, increased sales team productivity, personalized customer experiences, and ultimately improved commercial outcomes. For example, by using CRM systems, sales teams can track customer information, monitor sales pipelines, and manage performance indicators in real time, thereby enhancing customer relationship management and improving customer satisfaction.

Importantly, digital sales management is not limited to the online transfer of traditional sales activities. Instead, it requires a fundamental redesign and optimization of sales workflows to fully leverage the capabilities of digital tools. It encompasses multiple core components, including Customer Relationship Management (CRM) platforms, big-data-driven customer analytics, AI-assisted sales forecasting, and automation systems. These technologies help organizations better understand customer needs, precisely target potential customers, streamline sales processes, and optimize sales strategies [4]. A CRM system serves as a central hub for managing customer information and tracking sales progress. Big data analytics enable the extraction of valuable insights from large-scale sales datasets. Artificial intelligence enhances sales predictions and strategic planning, while automation tools simplify routine tasks, allowing sales teams to focus on higher-value customer engagement.

Furthermore, digital sales management significantly enhances organizational competitiveness by improving operational efficiency, generating accurate customer insights, and enhancing the overall customer experience. Through advanced analytics and intelligent automation, sales teams can reduce repetitive manual work, accelerate decision-making cycles, and implement highly personalized engagement strategies[5-7]. This enables businesses to maintain customer loyalty, enhance conversion rates, and respond promptly to shifting market conditions and competitive pressures. Digital sales management represents a critical shift from intuition-driven to evidence-based sales operations, supporting strategic decision-making and enabling continuous improvement across the sales function.

Despite the increasing adoption of digital tools in sales environments, organizations vary widely in their digital capabilities. Many firms struggle to assess whether their sales teams possess the necessary technological skills, data literacy, workflow integration, and cultural readiness to fully benefit from digital transformation initiatives. Existing frameworks for evaluating digital maturity are often designed for enterprise-wide transformation rather than the specific context of sales organizations. Therefore, a systematic, quantitative method is necessary to assess the digital capability maturity of sales teams and to identify priority areas for improvement[8]. To address this gap, this study proposes a comprehensive framework for evaluating the sales team's digital capability, based on the Analytic Hierarchy Process (AHP) and fuzzy comprehensive assessment. This model enables organizations to objectively assess digital readiness, allocate resources effectively, and guide the progressive development of capabilities within the sales function.

2 RELATED WORK

2.1 DIGITAL CAPABILITY IN SALES

Digital sales management encompasses a range of tools and technologies, each with its distinct functions and advantages. First is Customer Relationship Management (CRM) systems. CRM systems are a core tool in digital sales management, enabling businesses to track customer information, sales progress, and performance metrics in real-time, thereby managing customer relationships more effectively [9]. Standard CRM systems include Salesforce, Microsoft Dynamics 365, and HubSpot. Big data analytics is also a crucial component of digital sales management. By collecting and analyzing large amounts of sales data, businesses can identify potential sales opportunities, refine their sales strategies, and enhance sales efficiency. Big data analytics tools include Google Analytics, Tableau, and Power BI. Artificial intelligence (AI) technology is also increasingly important in digital sales management.

Through machine learning algorithms, AI can help businesses predict sales trends, optimize sales strategies, and enhance sales efficiency. Standard AI tools include IBM Watson, Google AI, and Microsoft Azure AI [10]. Sales automation tools are another key component. Through automation tools, businesses can streamline tedious daily tasks, such as email marketing, sales follow-up, and contract management, thereby improving work efficiency [10]. Standard sales automation tools include Marketo, Pardot, and HubSpot.

Key components of digital capability in sales:

Data and analytics: Leveraging data to understand customer behavior, identify high-potential leads, and personalize customer experiences. This includes using algorithms to match accounts with reps, recommend products, and analyze sales performance.

Digital tools and platforms: Utilizing a variety of technologies such as CRM systems, online marketplaces, social media, and mobile applications to manage customer relationships, conduct sales, and provide support[11].

Customer-centric approach: Shifting the focus to how customers want to engage, which often means enabling them to research, compare, and purchase independently but also ensuring a seamless transition to human-led support when needed.

Hybrid sales models: Blending digital and human-led interactions to create a flexible and responsive sales process. This allows for both the speed and convenience of online channels and the expertise and trust of human interaction[12].

Internal efficiency: Using digital tools to improve internal operations, such as performance tracking, sales forecasting, and identifying the best practices of top performers to scale their methods across the team.

2.2 MATURITY MODELS (CMMI, DIGITAL MATURITY FRAMEWORKS)

W-CMM (Capability Maturity Model for Software), developed in 1987 by the Software Engineering Institute (SEI) at Carnegie Mellon University (CMU SEI), is a framework for evaluating software contractors' capabilities and improving software quality [13-15]. Its purpose is to help software companies manage and improve their software engineering processes, enhance their development and improvement capabilities, and thus develop high-quality software on time and within budget. The underlying idea is that by focusing on and continuously improving the infrastructure of effective software engineering processes, and by constantly implementing management practices and process improvements, difficulties in software production can be overcome. CMM is the most widely recognized and practical international software production process standard, endorsed by numerous countries and the global software industry. It has become an indispensable component for companies involved in large-scale software development.

CMMI (Capability Maturity Model Integration) is a concept proposed by the U.S. Department of Defense [16]. They aim to integrate all existing and future capability maturity models into a single framework. This framework addresses two issues: first, reforming software acquisition methods; and second, establishing a process improvement framework that incorporates sound system development principles from the perspective of integrated product and process development.

CMM/CMMI classifies software process maturity into

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five levels. The basic characteristics of each level are as follows:

(1) Initial: Work is disorganized; initial plans are frequently abandoned during project execution. Management is haphazard and lacks sound management systems. Project success is unstable; it relies heavily on the project leader's experience and ability, and the work order is disrupted once they leave.

(2) Repeatable: Management is institutionalized; basic management systems and procedures are established, and management work is systematic. Standardization is initially achieved, and development work is implemented relatively well in accordance with established standards. Changes are carried out in accordance with legal requirements, ensuring baselines, stability, and traceability. The planning and management of new projects are based on practical experience and on the environment and conditions that enabled previous successful projects to be repeated [17].

(3) Defined: The development process, including technical and managerial work, is standardized and documented. A comprehensive training and expert review system has been established. All technical and management activities are controllable, and there is a shared understanding of the project's processes, positions, and responsibilities.

(4) Managed Level: Quantitative quality objectives have been established for products and processes. Productivity and quality in development activities are measurable. A process database has been established. Control over project products and processes has been achieved. Process and product quality trends can be predicted, enabling timely corrections when deviations occur[18].

(5) Optimizing Level: Focus can be placed on improving processes, adopting new technologies, and methods. Means are available to prevent defects, identify weaknesses, and improve them. Statistical data on process effectiveness can be obtained and analyzed to derive optimal methods.

2.3 AHP IN MANAGEMENT EVALUATION

The Analytic Hierarchy Process (AHP) is a research method that combines qualitative and quantitative approaches to calculate decision weights for solving complex multi-objective problems. Proposed in the early 1970s by John Satie, an operations researcher and professor at the University of Pittsburgh, AHP applies to unstructured, complex decision problems involving multiple objectives, criteria, factors, and levels [19]. The advantage of AHP lies in its combination of quantitative and qualitative analysis. It leverages the decision-maker's experience to assess the relative importance of each achievable criterion across the objectives and to assign weights to each criterion for each decision option. These weights are then used to derive the order of merit of each option, making it relatively effective for problems that are difficult to solve using quantitative methods.

The main characteristic of AHP is that, by establishing a hierarchical structure, it transforms human judgment into a comparison of the relative importance of each pair of factors, thereby converting difficult-to-quantify qualitative judgments into an operational comparison of importance. In many cases, decision-makers can directly apply the Analytic Hierarchy Process (AHP) to inform their decisions, thereby significantly enhancing their effectiveness, reliability, and feasibility.

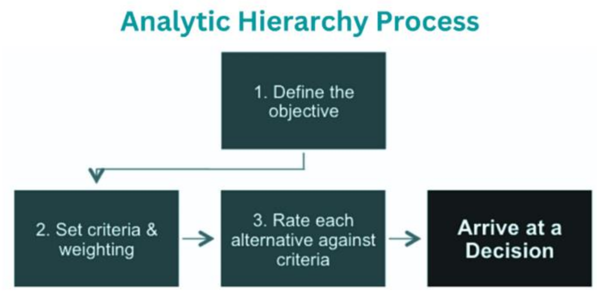

FIGURE 1. ANALYTIC HIERARCHY PROCESS (AHP) ARCHITECTURE DIAGRAM

As shown in Figure 1, its essence is a way of thinking. It decomposes complex problems into multiple components, then constructs a hierarchical structure based on the dominance relationships among these components, and determines the overall ranking of decision options through pairwise comparisons [20]. The entire process embodies the basic characteristics of human decision-making: decomposition, judgment, and synthesis, thereby overcoming the shortcomings of methods that avoid the decision-maker's subjective judgment.

Using AHP as a supporting tool for decision-making will help to gain a better insight into complex decision problems. Structuring the problem as a hierarchy forces you to think through the situation, consider possible decision criteria, and select the most significant criteria with respect to the decision objective. Using pairwise comparisons helps to discover and correct logical inconsistencies. The method also allows for "translating" subjective opinions, such as preferences or feelings, into measurable numeric relations. AHP helps make decisions more rational, and more transparent, and easier to understand. The results of the pair-wise comparisons are presented in a matrix [21]. The first (dominant) normalized right eigenvector of the matrix provides the ratio scale (weighting), and the Eigenvalue determines the consistency ratio. To make the method easier to understand and to demonstrate its broad range of applications, we provide examples across different decision hierarchies.

2.4 FUZZY METHODS FOR SUBJECTIVE JUDGMENT MODELING

The Fuzzy Comprehensive Evaluation Method (FCEM) is a fuzzy mathematics-based approach for addressing fuzzy, uncertain, or multi-indicator decision-making problems [22].

This method combines fuzzy set theory with mathematical models to quantify and synthesize the fuzzy information from various evaluation indicators, yielding the final evaluation result. Fuzzy comprehensive evaluation is widely applied in multiple fields, including decision analysis, engineering evaluation, economic assessment, and environmental assessment. It can handle multi-indicator, uncertain, and fuzzy problems, providing a relatively flexible and comprehensive evaluation method.

Basic Steps of the Fuzzy Comprehensive Evaluation Method:

(1) Determine Evaluation Indicators: Determine the indicators used for the evaluation problem and define the evaluation level or membership function for each indicator.

(2) Determine Membership Functions: Define a fuzzy membership function for the evaluation level of each indicator, mapping the indicator's value to a membership degree value, representing the degree of the indicator at a certain evaluation level [23-24].

(3) Construct an Evaluation Matrix: Transform the evaluation levels of each indicator into an evaluation matrix, where the elements represent the membership degree value of each indicator at each evaluation level. (4) Determine Weights: Based on the requirements of the problem or expert opinions, determine the weights of each evaluation indicator to quantify the importance of different indicators.

(5) Fuzzy Comprehensive Evaluation: Multiply the evaluation matrix by the weights to obtain a weighted evaluation matrix. Perform fuzzy comprehensive operations (such as maximum, minimum, and average values) on each column of the weighted evaluation matrix to obtain the comprehensive evaluation result.

(6) Defuzzification: Defuzzify the comprehensive evaluation result to transform the fuzzy evaluation result into a specific numerical value.

(7) Result Analysis and Decision-Making: Analyze and make decisions based on the defuzzified evaluation result to determine the final evaluation level or make corresponding decisions.

In this study, the Fuzzy Comprehensive Evaluation Method provides an effective mechanism for quantifying the maturity of digital capabilities in sales teams, where many influencing factors—such as digital tool proficiency, data-driven decision-making capability, process automation level, and digital-oriented culture—are inherently subjective and qualitative[25]. These indicators often involve linguistic evaluations (e.g., "high level of CRM usage," "moderate analytics capability," "low automation adoption"), making traditional crisp evaluation methods insufficient. By converting subjective expert judgments and survey responses into membership degrees, the fuzzy evaluation method enables the model to capture nuanced differences in maturity across sales organizations. This facilitates more accurate and holistic measurement of digital sales capability maturity, ensuring that both tangible technological readiness and softer human-capability factors are systematically assessed [26]. Thus, the fuzzy evaluation method is a critical component of a comprehensive, reliable maturity assessment framework tailored to digital sales transformation environments.

3 METHODOLOGY

3.1 FRAMEWORK DESIGN

To systematically evaluate the digital capability maturity of sales teams, this study establishes a hierarchical evaluation framework grounded in literature on digital transformation, sales enablement, and organizational capability modeling. The framework emphasizes the comprehensive nature of digital sales readiness, incorporating technological, analytical, process, and cultural dimensions. Four primary dimensions and associated sub-indicators are identified through theoretical review and expert consultation. These indicators collectively capture the technological infrastructure, data utilization capability, workflow digitalization, and human-centered factors essential to digital sales transformation.

The framework is structured to balance capability inputs and performance outcomes, ensuring that both operational practices (e.g., CRM adoption, automation use) and organizational enablers (e.g., data literacy, digital training) are considered. Each dimension represents a critical pillar supporting digital sales maturity, while the sub-indicators provide granular evaluation criteria for measuring the depth and breadth of digital adoption within sales teams.

TABLE 1. DIGITAL SALES CAPABILITY EVALUATION FRAMEWORK

Primary Dimension	Example Sub-Indicators	Description
Digital Tools Usage	CRM utilization, sales automation, pipeline management tools	Degree of adoption and effective use of digital platforms and tools in sales activities
Data Capability	Data literacy, dashboard usage, sales forecasting models	Ability to collect, analyze, and apply sales data to guide decisions and monitor performance
Sales Process Digitization	Lead management automation, workflow digitalization, AI-assisted sales support	Extent to which sales processes are digitalized and intelligent systems are embedded into workflows
Talent & Culture	Digital skills training, collaborative	Organizational readiness reflected in workforce digital

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	digital tools, digital mindset	skills, training investment, and digital-oriented culture

This multidimensional framework provides a structured basis for conducting weighted assessment through the Analytic Hierarchy Process (AHP) and modeling subjective perceptions using fuzzy comprehensive evaluation. By linking technology capabilities with strategic and human factors, the model enables a holistic evaluation of sales teams' digital maturity and supports targeted capability-enhancement strategies.

3.2 AHP Weighting Method

The Analytic Hierarchy Process (AHP) is used to determine the relative weights of the evaluation dimensions within the digital sales capability framework. AHP decomposes complex decision problems into hierarchical structures and determines the importance of each criterion through expert pairwise comparisons. Based on the hierarchical model, a pairwise comparison matrix $A = (a_{ij})$ is constructed, where a_{ij} represents the relative importance of factor i compared to factor j, using the Saaty 1–9 scale.

After constructing the comparison matrix, the priority weight vector w is computed by extracting and normalizing the principal eigenvector associated with the maximum eigenvalue $\lambda_{\max}$. These weights represent the relative importance of each criterion within the evaluation system. The consistency of judgment is then verified to ensure the reliability of expert comparisons.

The consistency index (CI) and consistency ratio (CR) are calculated as follows:

$$CI = \frac{\lambda_{\max} - n}{n - 1}$$

$$CR = \frac{CI}{RI}$$

where n is the order of the matrix and RI is the Random Index. A judgment matrix is considered to have acceptable consistency when $CR < 0.1$. If the condition is not satisfied, the pairwise comparisons must be revised until consistency is achieved.

By applying the AHP method, this study objectively determines the weights of each dimension of digital sales capability, providing a scientifically grounded basis for subsequent fuzzy comprehensive evaluation.

3.3 Fuzzy Membership Function

To evaluate the digital capability maturity of sales teams more objectively and accurately, a fuzzy membership function is applied to convert qualitative linguistic evaluations into quantitative membership degrees. Since maturity attributes such as "data literacy", "CRM utilization effectiveness", and "digital culture readiness" are difficult to measure precisely, fuzzy set theory enables a more flexible representation of indicator performance and expert perceptions.

A linguistic evaluation set V is, is defined as:

$$V = \{\text{Very Low (VL)}, \text{Low (L)}, \text{Medium (M)}, \text{High (H)}, \text{Very High (VH)}\}$$

Correspondingly, the fuzzy membership function maps each indicator score to a membership degree within $[0,1]$. In this study, a typical triangular membership function is adopted due to its simplicity and suitability for expert-judgment-driven evaluation. The triangular membership function is defined as:

$$\mu_A(x) = \begin{cases} 0, & x \le a \\ \frac{x-a}{b-a}, & a < x \le b \\ \frac{c-x}{c-b}, & b < x < c \\ 0, & x \ge c \end{cases}$$

Where a, b, c represent the lower bound, peak point, and upper bound of the evaluation interval, respectively.

Table 2. Linguistic Scale and Membership Function Parameters

Linguistic Term	Interval ([a,b,c])	Description
Very Low (VL)	(0, 0, 0.25)	Minimal digital adoption or capability
Low (L)	(0, 0.25, 0.5)	Limited tool usage and digital awareness
Medium (M)	(0.25, 0.5, 0.75)	Moderate or uneven digital capability
High (H)	(0.5, 0.75, 1.0)	Strong digital adoption and data literacy
Very High (VH)	(0.75, 1.0, 1.0)	Highly advanced, strategically integrated digital capability

Survey-based results and expert assessments are translated to fuzzy membership values through the defined membership functions. For example, if a sales team receives a score of $x = 0.70$ on "CRM utilization", its membership vector may be expressed as:

$$R = [0.00, 0.10, 0.60, 0.30, 0.00]$$

Indicating that the capability level lies primarily within the "Medium–High" maturity range. Once the fuzzy membership matrix for all indicators is constructed, it is integrated with AHP-derived weights to calculate the overall maturity score, allowing for a balanced combination of subjective expert judgment and objective mathematical analysis.

4 CASE APPLICATION IN SALES MANAGEMENT

Digital capability maturity evaluation provides a structured approach for organizations to assess the readiness of their sales teams for digital transformation and to identify gaps in technology use, data-driven decision-making, workflow digitization, and talent development. By applying the AHP–fuzzy evaluation framework, organizations can quantify digital capability maturity across multiple dimensions and translate qualitative observations into actionable insights. This enables managers to formulate targeted improvement strategies, prioritize investment areas, and track progress in maturity over time. The following examples illustrate how the proposed framework can be applied in real-world sales management scenarios.

Example 1: A B2B Software Company Enhancing CRM Adoption

A medium-sized B2B SaaS enterprise experiences inconsistent sales performance due to varied CRM adoption across its sales teams. Although CRM tools are deployed, many sales representatives rely on manual note-taking and personal spreadsheets, resulting in fragmented customer data and limited forecasting accuracy. Applying the digital capability maturity evaluation model, the organization discovers that its Digital Tools Usage and Data Capability dimensions score significantly lower than others. In particular, membership results show moderate maturity in CRM utilization (0.52) and low data literacy (0.41). Based on these findings, management introduces structured CRM training programs, automates lead assignment workflows, and implements dashboard-driven performance reporting. After six months, CRM adoption rates rise substantially, and the overall digital capability maturity index improves, resulting in more accurate forecasting and shorter deal cycles.

Example 2: A Retail Financial Services Firm Advancing Data-Driven Sales

A regional financial services company aims to enhance customer acquisition and retention, but faces challenges due to inconsistent follow-up procedures and limited data-driven engagement strategies. Sales representatives often rely on intuition rather than analytics to identify high-value prospects and tailor service offerings. Using the AHP–fuzzy evaluation framework, managers assess the maturity of the sales organization and find that Sales Process Digitization is relatively strong (0.71), while Talent & Culture lags (0.46), particularly in areas such as data literacy and digital training. As a result, the company deploys AI-assisted lead-scoring models, introduces data-driven customer segmentation tools, and conducts digital skills workshops focused on interpreting analytics dashboards. Within one quarter, conversion rates improve, and customer satisfaction scores increase, demonstrating the framework's role in guiding capability development and aligning digital tools with employee readiness.

5 CONCLUSION

This study develops a systematic and quantitative evaluation framework for assessing the digital capability maturity of sales teams by integrating the Analytic Hierarchy Process (AHP) with the Fuzzy Comprehensive Evaluation Method. In response to the increasing importance of digital transformation in sales management, the proposed model evaluates digital capability across four key dimensions: Digital Tools Usage, Data Capability, Sales Process Digitization, and talent and culture. Unlike traditional qualitative assessments, this hybrid method transforms expert judgment and subjective survey data into measurable maturity scores, providing a structured mechanism to identify capability gaps and inform digital enablement strategies. Real-world case applications further validate the model's practicality, demonstrating its ability to identify digital adoption challenges, highlight weaknesses in data literacy and cultural readiness, and support managerial decision-making regarding resource allocation and capability enhancement initiatives. Overall, the framework provides a scientific, scalable tool for organizations seeking to benchmark and enhance their digital sales capabilities.

The findings underscore that successful digital transformation in sales is not solely dependent on technology deployment but also requires alignment in human capabilities, data utilization, and cultural readiness. Companies with strong CRM implementation and automation may still fall short if employees lack the literacy and mindset needed to use digital tools effectively. Conversely, data-driven cultures amplify digital ROI and foster sustainable improvements in customer engagement and sales performance. As digital technologies continue to evolve—particularly AI-assisted sales tools, intelligent forecasting, and automated customer engagement workflows—the need for continuous capability assessment becomes even more critical. Future research can extend this work by incorporating longitudinal empirical data across diverse industries, integrating machine-learning–driven maturity prediction, and exploring dynamic updates to the maturity index in real time. Additionally, expanding the evaluation model to include emerging AI-enabled sales competencies and digital ethics constructs may further enhance its relevance in the evolving digital business landscape.

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AUTHOR CONTRIBUTIONS

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ABOUT THE AUTHORS

XIANGMIN, Li

Owner, Ym Trading Limited, Denver, USA, US, meisson.lee@gmail.com.

GE, Zhang

School of Information and Communication Engineering, Beijing University of Posts and Telecommunications, Beijing, China, CN, zhangge208@yeah.net.

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