



Formulation of Management Scenarios for Knowledge-Hiding Behavior in Government Organizations (Iranian Public Universities): A Fuzzy Cognitive Mapping Approach

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ABSTRACT

Objective: The current study identified the factors affecting the knowledge-hiding behavior and proposed a systematic model of the causal relationships among them. Analyzing the causal effects of these factors on one another helped formulate several scenarios for managing knowledge-hiding behavior in Iranian public universities using the fuzzy cognitive mapping (FCM) approach. **Methodology:** This applied and explanatory study utilized a mixed-methods approach (qualitative-quantitative). Interviews were conducted until theoretical saturation was achieved to identify influencing factors, and purposive sampling was employed. **Results:** Effectiveness of human resources management measures and knowledge management system, collaborative innovation culture and organizational justice are the most important factors in the FCM mapping model. These factors were used to formulate scenarios for managing knowledge-hiding behavior. The scenario formulation showed that a combination of the aforementioned factors can play an important role in managing the factors that create and reduce the knowledge-hiding behavior, such as workplace bullying, political decisions, organizational pessimism and ostracism, professional commitment, ethical leadership, organizational structure, and emotional intelligence. **Conclusions:** The study introduces a systemic perspective to behavioral research using FCM, emphasizing causal feedback loops among variables. This innovation provides a multi-level understanding of how individual-level factors influence broader organizational outcomes, addressing gaps in prior research.

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1. Introduction

Employee knowledge refers to the information or skills required to complete organizational tasks. Employees often engage in knowledge-hiding practices and waste organizations' efforts to ensure knowledge sharing (Hamza et al., 2023). Deliberate attempts to conceal the knowledge a colleague seeks is known as knowledge hiding. A body of research has shown that knowledge hiding has significant adverse effects on organizations (Ellmer & Reichel, 2021; Nguyen et al., 2022). For example, Panopto (2018) acknowledges that in 2018, the losses caused by knowledge-hiding behavior for American organizations were estimated at \$47 millions. American workers wasted approximately 5.3 hours a week having to wait for colleagues to share information or knowledge. This wasted time slows down creativity and organizational development and leads to several missed opportunities, employee non-cooperation, and employee non-compliance with work norms (Hickland et al., 2020; Kwahk & Park, 2016). Other negative effects of knowledge hiding include disrupted knowledge transfer process (Wuryanti & Setiawan, 2017), reducing organizational citizenship behavior (Arain et al., 2020), longer time to complete the project and supply the services of organizations to the market (Fixson & Marion, 2012), and decreased power of decision-making, problem-solving and creativity (Chacón-Hena & Arias-Pérez, 2025; Davenport et al., 2016). Given these detrimental effects, numerous researchers have sought to identify the key factors influencing knowledge hiding and propose intervention strategies. Studies have examined various organizational, individual, and interpersonal-level determinants, including leadership style, collaborative culture, workplace bullying, emotional intelligence, job insecurity, psychological ownership, organizational justice, and knowledge management systems (Ali, 2021; Islam & Chaudhary, 2024; Mahmood et al., 2023; Nazari & Akbari, 2022; Offergelt & Venz, 2023; Sepahvand et al., 2021; Singh et al., 2021; X. Wang & Dong, 2022). Knowing each of the factors affecting knowledge hiding and the strength of the effect of each can help provide better solutions for managing the adverse effects of knowledge-hiding behavior. However, while these studies provide valuable insights, they predominantly rely on structural equation modeling (SEM) and interpretative structural modeling (ISM), which analyze direct causal effects but fail to comprehensively capture the interconnected and systemic relationships among factors. Knowledge hiding is a complex issue (He et al., 2021); therefore, several factors interacting with each other affect the knowledge-hiding behavior in organizations, either in a decreasing or increasing direction. According to the systemic theory, it is necessary to explore the relationships between the factors affecting knowledge hiding to increase the reliability of findings compared to the literature. Thus, Knowledge hiding is not merely the result of isolated predictors but emerges from complex, interdependent organizational and psychological influences. While previous studies have attempted to explain knowledge-hiding behavior, they have largely overlooked the need for a systemic approach that accounts for multi-factorial relationships and reciprocal dependencies among influencing variables. The limitations of linear modeling techniques necessitate a framework that can analyze both direct and indirect causal pathways, showing how individual and organizational factors jointly shape knowledge-hiding behavior. To address this gap, the present study applies fuzzy cognitive mapping (FCM) to model the interrelationships among factors affecting knowledge hiding in government organizations focusing on public universities in Iran. Unlike traditional methodologies, which assess factors independently, fuzzy cognitive mapping enables a holistic understanding of how predictors interact within a structured yet interconnected system. This approach provides a more comprehensive perspective by examining the underlying relationships that influence knowledge-hiding behavior beyond simplistic one-directional models.

Furthermore, based on the findings of Kassa and Ning (2023) in their systematic review, it is evident that knowledge management research has predominantly focused on private-sector organizations, leaving government institutions underexplored. Their study highlights that while knowledge-sharing frameworks and knowledge management strategies are well established in corporate settings, public-sector organizations require more attention. Since knowledge management has been relatively less studied in government organizations (Kassa & Ning, 2023), knowledge hiding—being an integral subcategory of knowledge management—has also received limited empirical attention in public-sector settings. Given the individual competition, hierarchical decision-making, and political pressures in government organizations (Laihonen & Kokko, 2023), the need to study knowledge-hiding behaviors in these institutions is imperative. Furthermore, the limited scope of

existing research on knowledge-hiding behaviors in academic environments highlights that this area has not been thoroughly examined. While some studies have explored factors influencing such behaviors, their focus has largely been on categorizing variables and assessing partial impacts. For instance, existing studies (Gani et al., 2020; Huo et al., 2021; Samdani et al., 2019) have examined the effects of organizational interactions, supervisory support, and interactional justice on knowledge-hiding behaviors within higher education settings. However, significant gaps remain in studies that delve into causal relationships and management scenarios for addressing knowledge hiding in universities. This lack of comprehensive research, particularly in the context of public universities and their role in organizational behaviors, underscores the need for further studies to develop more effective strategies aimed at reducing knowledge-hiding behaviors and fostering a culture of knowledge sharing.

Knowledge hiding in the higher education context is unique, as academics are expected to generate knowledge for the purpose of sharing it with students and the community to advance the field (Fullwood et al., 2013). Therefore, the main reason for universities to exist is sharing knowledge. Although universities should possess a knowledge-sharing culture, in most cases, that culture is individualistic in nature and, to some extent, self-serving. This poses challenges for knowledge management in universities, sometimes leading to knowledge-hiding behaviors (Zutshi et al., 2021).

This study addresses a critical gap in empirical research by focusing on government organizations, with a particular emphasis on employees and faculty members within Iranian public universities. It seeks to identify the factors influencing knowledge-hiding behaviors among these groups and aims to develop a causal model that highlights the relationships between these factors using the FCM approach. Identifying the causal relationships among the factors influencing knowledge-hiding behaviors further contributes to designing effective scenarios for managing this behavior. By exploring these dynamics, the study aspires to provide actionable insights that support the development of strategies to reduce knowledge hiding and foster a culture of openness and collaboration in public universities.

The primary research question guiding this study is: What are the scenarios for managing knowledge-hiding behaviors, with an emphasis on a causal model of the relationships among factors influencing knowledge hiding in Iranian public universities, utilizing the Fuzzy Cognitive Mapping approach?

To address this question, the following secondary questions were also addressed:

1. What are the factors affecting knowledge hiding in Iranian public universities from the perspective of research experts?
2. How are the interactions among the factors modeled from a fuzzy-cognitive mapping approach?
3. What are the scenarios for managing knowledge-hiding behaviors, focusing on the major influencing factors within Iranian public universities?

2. Literature Review

The knowledge exchange within organizations is often considered a fundamental driver of innovation, efficiency, and competitive advantage (Grant, 1996). However, knowledge exchange is not always a straightforward process, as employees may either actively share information or deliberately conceal it, leading to two distinct yet interrelated behaviors: knowledge sharing and knowledge hiding (Nguyen et al., 2022). While knowledge sharing fosters collective growth, team collaboration, and institutional success, knowledge hiding disrupts information flow, weakens trust, and slows decision-making processes (Panopto, 2018). Knowledge hiding differs from mere failures in knowledge sharing. This is because it is a deliberate act, where an individual consciously withholds requested knowledge that could enhance organizational productivity or aid colleagues (Ellmer & Reichel, 2021). Unlike situations where employees may lack sufficient expertise or resources to share knowledge, knowledge hiding is often motivated by psychological, interpersonal, or structural concerns, such as distrust, job insecurity, workplace competition, or organizational politics (Kwahk & Park, 2016; Singh et al., 2021). Empirical studies indicate that organizations suffering from high territoriality, exploitative leadership, or poor fairness perceptions experience greater instances of knowledge-hiding behaviors

compared to institutions with transparent communication structures and a collaborative innovation culture (Nazari & Akbari, 2022; Bari et al., 2023).

To comprehensively understand knowledge hiding, it is necessary to examine its underlying psychological, interpersonal, and organizational determinants. The theoretical framework adopts a multi-level perspective, categorizing influencing factors into three interdependent dimensions: individual psychological influences, interpersonal workplace relationships, and organizational governance mechanisms, including structural, managerial, and cultural drivers. Through this lens, the discussion highlights how systemic thinking provides a unified model integrating different theoretical viewpoints into a cohesive understanding of knowledge-hiding behaviors in organizations

Individual-Level Factors: Psychological Drivers of Knowledge Hiding

At the individual level, knowledge hiding is largely influenced by psychological ownership, emotional intelligence, job insecurity, individual competition, and the perception of leadership style. One of the primary theories explaining this phenomenon is psychological ownership theory (Pierce et al., 2001), asserting that individuals often view their knowledge as a personal asset rather than an organizational resource, leading them to resist sharing it. This form of territoriality is exacerbated in environments where employees perceive a direct relationship between knowledge possession and career stability (Brown & Cregan, 2008). Studies have demonstrated that in workplaces with high individual competition, knowledge hiding is more prevalent due to employees' fear that knowledge sharing might reduce their unique value within the organization (Nazari & Akbari, 2022).

Emotional intelligence theory (Goleman, 1995) further elaborates on the psychological aspects influencing knowledge hiding. Employees with higher emotional intelligence exhibit greater interpersonal trust and a stronger inclination toward collaboration, while those with low emotional intelligence tend to conceal information as a defensive mechanism against perceived threats (Mahmood & Toker, 2022). Studies conducted on workplace behaviors confirm that organizations investing in emotional intelligence training programs experience significantly lower rates of knowledge hiding, as trust and communication improve among employees (Jotabá et al., 2022).

Additionally, job insecurity theory explains how concerns about employment stability affect an individual's willingness to share information. Employees experiencing heightened job insecurity—particularly in hierarchical or politically-driven workplaces—tend to hoard knowledge as a strategic tool to maintain their relevance and influence (Wen & Ma, 2021). Research has shown that knowledge hiding can be mitigated through transparent job security policies and structured recognition programs that reassure employees about their professional standing (Khalid & Aftab, 2024).

Perceived leadership style plays a significant role in shaping individual knowledge-hiding behaviors, as employees interpret leadership practices based on their personal experiences rather than objective organizational directives. Rooted in leadership perception theory (Shamir, 1995), individuals assess leadership effectiveness and ethicality through subjective lenses, influenced by trust, previous interactions, and workplace dynamics. Studies suggest that employees who perceive leadership as fair and transformational exhibit higher engagement in knowledge-sharing behaviors, whereas those who view leadership as exploitative or politically motivated tend to withhold information as a defensive mechanism (Bari et al., 2023). Moreover, leader-member exchange theory (Graen & Uhl-Bien, 1995) further explains how the quality of interaction between leaders and employees influences workplace behavior. Employees who experience high-quality exchanges—characterized by transparency, inclusion, and ethical decision-making—are more likely to reciprocate trust through knowledge-sharing. Conversely, those in low-quality exchanges—where leadership is perceived as hierarchical, unfair, or indifferent—often engage in territorial knowledge behaviors to protect their professional standing (Mahmood & Toker, 2022).

Research highlights that perceived ethical leadership mitigates knowledge-hiding tendencies by fostering organizational citizenship behaviors, where employees view knowledge-sharing as a collective asset rather than an individual burden (Oubrich et al., 2021). However, in workplaces where leadership is perceived as ambiguous or inconsistent, employees are more likely to rationalize knowledge hiding as a means of preserving their competitive advantage (Nazari & Akbari, 2022). Studies confirm that perceived leadership styles directly impact the psychological ownership of

knowledge, shaping employees' willingness to engage in collaborative learning environments (Khalid & Aftab, 2024). Therefore, within an individual-level framework, perceived leadership style functions as a cognitive mechanism that regulates employees' trust, security, and strategic decision-making, influencing the prevalence of knowledge-hiding behaviors across organizational contexts (Tokyzhanova & Durst, 2023).

Interpersonal and Group Dynamics: The Role of Organizational Relationships

At the interpersonal level, knowledge hiding is shaped by workplace relationships, team dynamics, and the psychological climate of an organization. Employees' willingness to share or withhold knowledge is deeply influenced by perceived fairness, trust, and the quality of social exchanges, reinforcing behavioral reciprocity in workplace interactions.

Social exchange theory provides a crucial framework for understanding why employees engage in defensive knowledge behaviors. According to this theory, individuals evaluate interactions based on perceived costs and benefits. When employees believe their contributions are undervalued or exploited, they are more likely to rationalize knowledge hiding as a self-protective response (Dodokh, 2020). However, organizations that prioritize psychological safety and reciprocity effectively reduce these behaviors, creating environments where knowledge sharing is framed as mutually beneficial (Imamoglu et al., 2019).

Beyond reciprocity-based reasoning, organizational behavior theory suggests that negative workplace climates foster defensive workplace attitudes, encouraging knowledge hoarding in response to perceived threats (Mahmood et al., 2023). One of the strongest contributors to this defensive stance is organizational bullying, where employees experience hostile interactions, fear, or exclusion. Research indicates that psychological insecurity caused by bullying leads employees to disengage from collaborative efforts, resorting to protective knowledge behaviors to preserve their workplace status and avoid mistreatment (Islam & Chaudhary, 2024).

Another significant interpersonal factor is organizational cynicism, which shapes employees' perceptions of leadership, transparency, and fairness (Nazari & Akbari, 2022). Employees who perceive managerial deception or institutional mismanagement tend to develop negative attitudes toward workplace cooperation, reinforcing territorial behaviors that diminish knowledge exchange. Cynical employees are less likely to participate in collaborative efforts, as they believe knowledge sharing does not lead to meaningful recognition or professional advancement (Mahmood et al., 2023).

Furthermore, organizational exclusion directly reinforces defensive knowledge behaviors. Employees who feel marginalized or ignored by leadership and peers are more likely to withdraw from informal and formal knowledge-sharing networks, reinforcing individualized knowledge-hoarding strategies (Sepahvand et al., 2021). Studies highlight that organizations that foster open communication, inclusive leadership, and ethical workplace practices successfully mitigate the effects of exclusion, cynicism, and workplace hostility, reducing psychological barriers to knowledge sharing (Islam & Chaudhary, 2024).

Thus, organizations that cultivate strong interpersonal trust, minimize workplace hostility, and establish collaborative incentives foster open knowledge-sharing environments, reducing the prevalence of defensive knowledge-hiding behaviors while reinforcing positive social exchange mechanisms across teams.

Organizational-Level Factors: Cultural, Managerial, and Structural Drivers of Knowledge Hiding

At the organizational level, knowledge hiding is shaped by organizational structure, strategic human resource management, knowledge management systems, organizational culture, and organizational justice (Jasimuddin & Saci, 2022; Kılınç, 2025; Teixeira et al., 2024; Tokyzhanova & Durst, 2024). Organizations that fail to implement effective frameworks for knowledge utilization risk fostering territorial behaviors, where employees perceive knowledge as a scarce resource rather than a shared asset (X. Wang & Dong, 2022).

According to the resource-based view (Barney, 1991), knowledge is one of the most critical intangible assets that contributes to sustainable competitive advantage. However, when knowledge management policies lack transparency and inclusivity, employees may withhold expertise

strategically, reinforcing defensive knowledge behaviors (Karabatak et al., 2024). Empirical studies confirm that institutions prioritizing structured knowledge-sharing mechanisms experience higher collaboration and trust, reducing individual tendencies toward knowledge hoarding (Kılınç, 2025).

The cultural orientation of an organization also plays a crucial role. Collaborative innovation culture theory (Jasimuddin & Saci, 2022; Sukumaran & Lanke, 2021) emphasizes that institutions fostering interdisciplinary research, collective problem-solving, and mutual engagement create environments where knowledge hiding is minimized. In contrast, organizations with competitive, fragmented structures may reinforce territorial workplace behaviors, limiting opportunities for open knowledge exchange (Zutshi et al., 2021). Organizations that cultivate unified, innovation-driven cultures ensure that employees perceive knowledge as a collective tool rather than an individual advantage, reducing defensive behaviors related to knowledge withholding. Social identity theory (Tajfel & Turner, 1979) reinforces this by emphasizing that when employees feel institutionally integrated within an organization, their likelihood of engaging in open knowledge exchange increases, whereas organizational fragmentation amplifies territoriality (Mahmood & Toker, 2022).

Additionally, strategic human resource management decisions influence knowledge-sharing dynamics. Transparent and equitable human resource policies, particularly regarding career development, performance evaluations, and incentive structures, foster a culture where knowledge is shared openly rather than held as a form of intellectual leverage (Dodokh, 2020; Oubrich et al., 2021). Decentralized organizations particularly benefit from human resource strategies that reinforce trust, as autonomy in decision-making enhances collaborative engagement and mitigates knowledge-hiding tendencies (Tokyzhanova & Durst, 2023). Thus, organizations that optimize knowledge management systems, reinforce inclusive cultural frameworks, and align human resource management policies with collaborative incentives are more likely to reduce territorial knowledge behaviors and create sustainable knowledge-sharing environments that drive innovation and institutional success.

Rooted in organizational justice theory (Greenberg, 1987), fairness influences knowledge-hiding behaviors by fostering employees' trust in institutional processes. When justice mechanisms fail to ensure transparency in promotions, evaluations, or resource distribution, employees may resort to knowledge hoarding as a defensive strategy, viewing knowledge as a tool for professional leverage (Mahmood et al., 2023). Empirical studies indicate that justice-driven organizations cultivate environments where employees feel secure in knowledge-sharing practices, thereby reducing selective withholding tendencies (Nazari & Akbari, 2022). Moreover, job insecurity theory (Wen & Ma, 2021) supports this notion, highlighting that employees in organizations with weak justice frameworks are more likely to engage in knowledge hoarding as a survival strategy, reinforcing territorial and protective information behaviors (Karabatak et al., 2024). Empirical studies confirm that when fairness is perceived within an organization, collaborative social norms emerge, discouraging toxic workplace behaviors and fostering trust (Nazari & Akbari, 2022). However, in organizations where justice is inconsistent or lacking, workplace bullying tends to increase, which in turn exacerbates knowledge-hiding behaviors (Islam & Chaudhary, 2024). Studies have further demonstrated that employees who experience hostile interactions or perceive exclusion from decision-making processes engage in knowledge concealment as a means of psychological defense against workplace mistreatment (Sepahvand et al., 2021). Additionally, organizational cynicism—a sentiment shaped by perceptions of managerial deception, ethical ambiguity, or power imbalances—has been identified as a significant driver of knowledge hoarding. Employees with heightened organizational cynicism are less likely to participate in collaborative knowledge-sharing efforts, as they perceive that such actions would neither yield recognition nor align with their personal interests (Jasimuddin & Saci, 2022).

Integrating Theories through Systems Thinking: A Holistic Model

The systems theory (Von Bertalanffy, 1968) offers a holistic perspective that integrates individual, interpersonal, and organizational-level influences into a unified knowledge management framework. Rather than viewing knowledge hiding as a series of isolated behaviors, systems thinking allows for the analysis of feedback loops and interdependencies, demonstrating how structural changes at the organizational level reverberate through interpersonal relationships and individual psychological responses (Tokyzhanova & Durst, 2023).

While many empirical studies have explored how organizational and interpersonal factors influence individual-level outcomes, these studies often fall short in addressing the full complexity of these interactions. A common limitation is the use of methods like structural equation modeling or interpretive structural modeling, which may not comprehensively capture the nuances of these relationships. Moreover, feedback mechanisms, whereby individual-level factors influence both interpersonal and organizational dynamics, are frequently overlooked in existing research. Individual characteristics and perceptions not only shape interpersonal behaviors but also influence organizational policies, structures, and culture through these interactions. This chain of impact underscores the importance of examining multi-level relationships in research related to knowledge-hiding practices.

3. Research Methodology

The fuzzy cognitive mapping theory was first used by Kosko (1986) to show the causal relationships among factors involved in a decision-making process. This approach aims to show the causal relationships between nodes or concepts of a system (Wee et al., 2014). A cognitive mapping model represents one's perception of a specific issue through analyzing the issues and graphically displaying interconnected and interacting concepts or nodes. Fuzzy cognitive mapping models are a practical means of managing and solving problems, dealing with internally interacting decision-making variables out of decision-makers' control. These models help decision makers identify and analyze the latent causal relationships of problems that play a fundamental role in finding appropriate solutions (Bueno & Salmeron, 2009).

This approach uses symbolic description to describe and model a phenomenon or system. The fuzzy cognitive mapping integrates the accumulated knowledge and experience of specialists or experts who know the system and its behaviors well in different situations. In other words, it uses the description of specific areas through the concepts, the mutual causal relationships to structure and model complex issues (Papakostas et al., 2008). The main purpose of fuzzy cognitive mapping is to show the causal relationships among concepts (factors of a complex system) and analyze the inference patterns (Kosko, 1986).

In light of the above-mentioned issues, it can be concluded that the knowledge-hiding behavior, according to a systemic thinking, is formed under the influence of various factors. These factors are consistently interacting with one another; therefore, there is a need for appropriate problem-solving approaches to manage such behaviors in organizations to ensure a more rational and effective design of knowledge-hiding behavior management policies. The current research relied on the fuzzy cognitive mapping approach and proposed a model of the causal relationships among factors affecting knowledge hiding in Iranian public universities to facilitate the management of adverse effects of this behavior. This research is applied in terms of function. In terms of purpose, it is explanatory because it mainly aims to discover the causal relationships among factors affecting knowledge-hiding behavior. The present research used a fuzzy cognitive mapping approach to suggest policies to manage this behavior with a focus on the key factors. From a methodological perspective, this research is mixed (qualitative-quantitative). It used a combination of different methods in several phases of study based on a predetermined plan, and the findings are the result of a mixture of methods (McBeath & Bager-Charleson, 2020). The research process is described below:

Identification of Factors: The initial phase of the study focused on identifying the key determinants impacting knowledge-hiding behaviors within Iranian public universities. This was achieved through a series of semi-structured interviews, conducted with subject matter experts deeply familiar with the operational and organizational dynamics of public education institutions. A purposeful sampling methodology was employed to ensure the selection of participants most relevant to the research objectives. Sampling continued until theoretical saturation was achieved, where no new insights or themes emerged. In total, the content of 15 interviews was meticulously analyzed, providing a comprehensive understanding of the contextual variables and nuanced factors that contribute to knowledge-hiding practices specific to public universities in Iran. Given that FCM reflects expert knowledge, one critical element of this research was the precise recruitment of experts with the necessary knowledge and skills to contribute to the development of the cognitive mapping

model (Skład, 2019). In qualitative research, Kuzel (2019) recommended that the sample size in homogeneous samples be 6 to 8; however, regardless of data homogeneity, 12 to 20 subjects are generally considered appropriate for qualitative research.

In this study, the statistical population comprised experts actively involved in public universities, each possessing significant expertise in areas such as university administration, human resource management, organizational behavior, and academic knowledge management. These professionals were selected based on their extensive practical experience, with an average tenure of 10–15 years in public education institutions. Many had played instrumental roles in diagnosing the causes of knowledge-hiding behaviors and designing effective policies to address these challenges. Their diverse professional backgrounds included policymakers, human resource managers, departmental heads, and organizational analysts, ensuring that the study benefited from a wide range of perspectives. Several participants had also contributed to scientific research on academic knowledge management, enhancing both the theoretical depth and practical relevance of the research. This selection process ensured the inclusion of experts with systemic understanding and practical insights to analyze and model the complexities of knowledge-hiding behaviors in public universities.

Development of Initial Causal Model: A focus group comprising six experienced experts, each deeply familiar with the causes and dynamics of knowledge-hiding behavior in public universities, was convened to collaboratively develop the initial causal model. The process involved structured discussions facilitated by a moderator, during which each participant contributed their perspective on the causal relationships among the identified factors. After achieving consensus, these relationships were visually represented in a conceptual causal model using Vensim software. Importantly, Vensim was employed exclusively for graphical representation and visualization purposes, rather than for data collection or analysis.

Validation of the Causal Model: Following the development of a visual representation of the causal relationships, the model was presented to 15 domain experts who had previously participated in the interview phase. This step was conducted to rigorously validate the proposed relationships and ensure their alignment with expert insights and research objectives. Each expert played a critical role in assessing the logical flow and coherence of the causal connections depicted in the model, ensuring the relationships accurately reflected the realities of public universities.

Quantification of Causal Relationships: The quantification phase was conducted with the involvement of a new panel of 15 experts, distinct from the original group, yet equally qualified in domain expertise. These experts were introduced and recommended by the initial panel to maintain continuity while incorporating fresh perspectives. This group was selected based on their significant experience in university administration, human resource management, organizational behavior, and academic knowledge management, as well as their familiarity with knowledge-hiding phenomena and quantitative methodologies, such as fuzzy linguistic analysis. Leveraging this diverse expertise ensured precision and credibility throughout the research process. Based on Figure 1, these experts evaluated the causal relationships using fuzzy linguistic variables to quantify the dynamics between the factors.

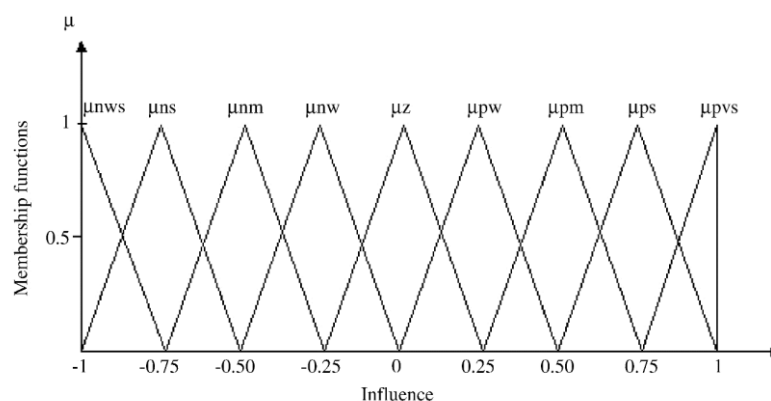


Fig. 1. Membership Functions of the Linguistic Variable Effect (Papageorgiou et al., 2006)

Assessing the Possibility of Integrating Experts' Cognitive Maps: Having collected individual cognitive maps from experts, the possibility of merging their maps was assessed using the Kruskal-Wallis test, correlation analysis, and distance ratio analysis. After confirming the absence of any significant difference between the experts' mental maps, the final proximity matrix was developed to integrate their cognitive maps using the cognitive mapping approach (Nakayama & Armstrong, 2005). This integration ensured a cohesive representation of expert perspectives specific to the operational dynamics of Iranian public universities.

In the fuzzy cognitive mapping model, the concepts (C) represent the key features of the modeled system. Weighted arcs (W) connect nodes or concepts, illustrating the relationships among them over time. The positive and negative relationships between concepts are denoted by weights, where W signifies the degree to which one concept influences another (Papageorgiou et al., 2006).

Identifying the Most Important Variables and Developing Scenarios: With a systemic model of relationships between the factors affecting knowledge-hiding behavior in Iranian public universities, this research formulated scenarios for managing knowledge-hiding practices. The fuzzy cognitive mapping model identified key factors based on their centrality and output degrees using FCMapper software. Scenario development was then conducted in distinct phases to explore potential strategies for addressing these behaviors.

In the first phase, the activity levels of the key factors were set to their highest possible values (i.e., one), ensuring their maximum potential activation within the model. This step established a baseline scenario for comparison and served as a reference point to measure the sensitivity of the model's variables to changes in the activity levels of key factors.

In the subsequent phases, the activity levels of the same key factors were reduced to zero, simulating their absence within the model. This approach allowed the investigation of cascading effects which resulted from the removal of these pivotal factors and their influence on other system variables (Stylios & Groumpos, 2004). During each simulation phase, equation 1 was applied to calculate the value vector of cognitive mapping nodes. Iterative simulations continued until the value vector of nodes reached a stable state, providing a robust and reliable foundation for scenario analysis.

This methodological approach enabled a comprehensive understanding of the system's sensitivity and highlighted critical decision points for effectively managing knowledge-hiding behavior in public universities, offering practical insights into creating strategies tailored to their organizational and academic context.

$$A_i^t = f \left(A_i^{t-1} + \sum_{j \neq i, j=1}^N A_j^{t-1} \cdot W_{ij} \right) \quad (1)$$

In this formula, A^t represents the value of each concept (C) at time t, and A^{t-1} stands for the value of nodes at each iteration (t-1). W_{ij} indicates the weight of the causal relationship between the nodes. The function f refers to the value of nodes, ranging from 0 to 1 (L. Wang et al., 2019).

As for the validity of findings, Creswell and Miller (2000) stated that the research findings are valid when at least two of the following criteria are met: collaboration and prolonged engagement in the field, triangulation, peer checking, disconfirming evidence, researcher reflexivity, member checking, thick and rich description, and the audit trail. In the present research, to ensure the validity of findings, thick and rich description of findings and the audit trail were used. Therefore, in the Findings Section, efforts were made to provide a detailed description of the analytic steps and enable the audience to make intersubjective judgment, also known as the audit trail. In the Discussion and Conclusion Section, the research findings were compared with those of previous studies.

4. Modeling and Scenario Development

4-1. Designing a Causal Model of Factors Affecting Knowledge Hiding

After identifying the variables affecting knowledge-hiding behavior in government organizations (Case study: Iranian public universities), the causal relationships between these factors were identified using a fuzzy cognitive mapping approach. This methodology involved gathering cognitive maps directly from 15 experts with extensive experience in public universities. The experts contributed their insights on the causal relationships between the identified variables, and the relationships were

represented in a fuzzy format. Each cognitive map reflected the expert's unique perspective and utilized fuzzy linguistic variables to quantify the strength and direction of these relationships.

To ensure the validity and reliability of the statistical analyses, the first step involved defuzzification of the fuzzy linguistic variables. This step was necessary for conducting tests aimed at assessing the feasibility of integrating experts' cognitive maps. The simple average method was employed for defuzzification, which involved converting the fuzzy linguistic variables into crisp values. This method was chosen due to its ease of implementation, transparency, and its ability to effectively harmonize diverse expert opinions by providing a straightforward numerical representation of fuzzy data. The decision to use the simple average method was guided by its extensive application in similar research studies, highlighting its credibility and acceptance in the scientific community. While alternative methods such as the center of gravity approach or more complex defuzzification techniques could have been utilized, the simple average was deemed optimal for the objectives of this study. Its simplicity not only facilitated the integration of data from multiple experts but also ensured that the process remained computationally efficient without sacrificing consistency or robustness. Following defuzzification, the resulting crisp values were used to construct adjacency matrices for each expert's cognitive map. These matrices formed the basis for conducting statistical analyses to test the alignment of the experts' perspectives. In this regard, before constructing the integrated adjacency matrix of the experts, a statistical analysis was conducted using the non-parametric Kruskal-Wallis test to determine whether significant differences existed among the experts' characteristics—such as educational level and work experience—and the domain index which quantifies the relative importance and influence of cognitive map nodes within the FCM model. The domain index was calculated using FCMapper software, which is specifically designed for analyzing fuzzy cognitive maps and extracting indices like centrality and domain. The Kruskal-Wallis test was performed using SPSS software, a widely accepted tool for non-parametric statistical analyses. The test results revealed that there were no statistically significant differences between the experts' groups ($p\text{-value} > 0.05$). This finding indicates that the perspectives of the experts were consistent and did not differ significantly based on variations in their educational backgrounds or professional experience. Such consistency ensured that the integrated adjacency matrix would represent a reliable synthesis of expert opinions across diverse characteristics.

In the next steps, distance ratio analysis and a correlation test were conducted using the experts' cognitive maps, with calculations performed through Cognizer™ and UCINET softwares. As seen in Figure 2, the results of the Distance Ratio analysis, calculated using the Elgfeld-Smith and Wirth formula, demonstrate a high level of alignment among the cognitive maps of the experts, as evidenced by consistently low average distance ratios (all below 0.11). This metric, derived from the aforementioned formula and supported by Cognizer™ computations, indicates minimal divergence in causal relationships across the expert maps, affirming strong coherence and compatibility. Additionally, the low distance ratios support the statistical feasibility of integrating these maps into a unified cognitive model, which could effectively encapsulate the experts' collective knowledge. Therefore, the findings confirm that variations between individual maps, as quantified through the Elgfeld-Smith and Wirth formula, are not significant enough to hinder the synthesis of a comprehensive and representative framework.

Distance Ratio Analysis Test

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	Expert 14	Expert 15
Expert 1	0.000	0.120	0.100	0.080	0.110	0.090	0.100	0.120	0.110	0.100	0.090	0.110	0.100	0.120	0.110
Expert 2	0.120	0.000	0.110	0.100	0.090	0.120	0.110	0.090	0.100	0.080	0.110	0.100	0.120	0.110	0.090
Expert 3	0.100	0.110	0.000	0.090	0.120	0.080	0.100	0.110	0.090	0.100	0.120	0.110	0.090	0.080	0.100
Expert 4	0.080	0.100	0.090	0.000	0.080	0.100	0.090	0.110	0.120	0.100	0.110	0.090	0.080	0.120	0.100
Expert 5	0.110	0.090	0.120	0.080	0.000	0.090	0.100	0.080	0.090	0.100	0.110	0.080	0.090	0.120	0.100
Expert 6	0.090	0.120	0.080	0.100	0.090	0.000	0.110	0.120	0.100	0.090	0.080	0.100	0.110	0.090	0.120
Expert 7	0.100	0.110	0.100	0.090	0.100	0.110	0.000	0.090	0.120	0.100	0.090	0.080	0.090	0.110	0.100
Expert 8	0.120	0.090	0.110	0.110	0.080	0.120	0.090	0.000	0.100	0.110	0.080	0.100	0.090	0.100	0.120
Expert 9	0.110	0.100	0.090	0.120	0.090	0.100	0.120	0.100	0.000	0.090	0.110	0.120	0.100	0.080	0.110
Expert 10	0.100	0.080	0.100	0.100	0.100	0.090	0.100	0.110	0.090	0.000	0.120	0.090	0.110	0.080	0.120
Expert 11	0.090	0.110	0.120	0.110	0.110	0.080	0.090	0.080	0.110	0.120	0.000	0.100	0.090	0.120	0.100
Expert 12	0.110	0.100	0.110	0.090	0.080	0.100	0.080	0.100	0.120	0.090	0.100	0.000	0.110	0.090	0.080
Expert 13	0.100	0.120	0.090	0.080	0.090	0.110	0.090	0.090	0.100	0.110	0.090	0.110	0.000	0.120	0.100
Expert 14	0.120	0.110	0.080	0.120	0.120	0.090	0.110	0.100	0.080	0.080	0.120	0.090	0.120	0.000	0.110
Expert 15	0.110	0.090	0.100	0.100	0.100	0.120	0.100	0.120	0.110	0.120	0.100	0.080	0.100	0.110	0.000

Fig. 2. Distance Ratio Analysis

Subsequently, the Quadratic Assignment Procedure (QAP) was employed to analyze the correlation between adjacency matrices, particularly focusing on the cognitive maps of the experts. This test assessed the alignment and similarity of the causal relationships identified by different experts' cognitive maps. The correlation coefficients are reported in Figure 3, where the highest values among the coefficients have been highlighted. The QAP analysis was conducted using UCINET software, which is widely utilized for social network analysis and cognitive mapping applications.

QAP Correlations

	expert 1	expert 2	expert 3	expert 4	expert 5	expert 6	expert 7	expert 8	expert 9	expert 10	expert 11	expert 12	expert 13	expert 14	expert 15
expert 1	1.000	0.832	0.784	0.639	0.814	0.712	0.806	0.555	0.489	0.625	0.760	0.807	0.765	0.556	0.632
expert 2	0.832	1.000	0.625	0.578	0.694	0.677	0.647	0.591	0.500	0.797	0.815	0.632	0.820	0.592	0.811
expert 3	0.784	0.625	1.000	0.626	0.810	0.743	0.650	0.484	0.773	0.766	0.635	0.779	0.734	0.667	0.649
expert 4	0.639	0.578	0.626	1.000	0.825	0.816	0.666	0.746	0.808	0.727	0.790	0.697	0.747	0.820	0.697
expert 5	0.814	0.694	0.810	0.825	1.000	0.438	0.561	0.628	0.781	0.612	0.574	0.762	0.835	0.487	0.544
expert 6	0.712	0.677	0.743	0.816	0.438	1.000	0.611	0.522	0.548	0.431	0.688	0.558	0.777	0.741	0.776
expert 7	0.806	0.647	0.650	0.666	0.561	0.611	1.000	0.619	0.606	0.840	0.535	0.822	0.543	0.646	0.807
expert 8	0.555	0.591	0.484	0.746	0.628	0.522	0.619	1.000	0.423	0.801	0.696	0.814	0.817	0.560	0.774
expert 9	0.489	0.500	0.773	0.808	0.781	0.548	0.606	0.423	1.000	0.651	0.778	0.720	0.488	0.837	0.644
expert 10	0.625	0.797	0.766	0.727	0.612	0.431	0.840	0.801	0.651	1.000	0.563	0.628	0.753	0.754	0.831
expert 11	0.760	0.815	0.635	0.790	0.574	0.688	0.535	0.696	0.778	0.563	1.000	0.807	0.593	0.746	0.817
expert 12	0.807	0.632	0.779	0.697	0.762	0.558	0.822	0.814	0.720	0.628	0.807	1.000	0.829	0.546	0.581
expert 13	0.765	0.820	0.734	0.747	0.835	0.777	0.543	0.817	0.488	0.753	0.593	0.829	1.000	0.837	0.734
expert 14	0.556	0.592	0.667	0.820	0.487	0.741	0.646	0.560	0.837	0.754	0.746	0.546	0.837	1.000	0.482
expert 15	0.632	0.811	0.649	0.697	0.544	0.776	0.807	0.774	0.644	0.831	0.817	0.581	0.734	0.482	1.000

Fig. 3. Correlation Coefficient of Expert Maps

The statistical significance of the results, as illustrated in Figure 4, validated the reliability of the observed patterns and confirmed that the alignment in perspectives among the experts was not coincidental. This finding highlights the robustness of analysis and supports the credibility of the integrated cognitive mapping approach.

QAP P-Value

	expert 1	expert 2	expert 3	expert 4	expert 5	expert 6	expert 7	expert 8	expert 9	expert 10	expert 11	expert 12	expert 13	expert 14	expert 15
expert 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
expert 15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Fig. 4. The Significance Level of the Correlation Test of Experts' Cognitive Maps

Finally, once the feasibility of integration was confirmed through appropriate statistical tests, the defuzzified values from all individual adjacency matrices were averaged across experts. This process resulted in the development of a unified and coherent adjacency matrix that captured the collective insights and relationships identified by the experts. This final adjacency matrix served as the foundation for modeling within the fuzzy cognitive mapping framework. Figure 5 shows the final adjacency matrix used for modeling in the fuzzy cognitive mapping.

Using the adjacency matrix, the causal model based on the fuzzy cognitive mapping approach can be statically analyzed and tested. Calculating the centrality of nodes is one such static analysis to evaluate the relative importance of each node. Table 1 shows the sum of absolute values of the weight of input causal relations to each Indegree (C_i) node, as well as the sum of absolute values of the weights of output causal relations from each Outdegree (C_o) node. Indegree (C_i) represents the degree of dependence of a factor on other factors. If a variable's input degree value is high, that variable is highly affected by other variables, and Outdegree (C_o) indicates the effect of each factor on others. The high value of the output degree for a variable indicates that other variables are highly affected by this variable. Therefore, this variable is regarded as a critical variable affecting knowledge hiding, and high-priority consideration should be given to this variable to manage knowledge-hiding behavior. In other words, the greater the influence of a factor on other factors, the more chances that this factor is a

primary cause and its management can decrease or increase the probability of occurrence of other relevant factors. Additionally, the factors' centrality degrees (the sum of the degrees of input and output of each factor) affecting knowledge-hiding behavior are presented in Table 1. This index shows the importance of each factor in the experts' cognitive mapping model. It can be concluded that the centrality of a factor indicates its active role in the adjacency matrix (the interaction matrix of the desired factors). In this research, collaborative innovation culture (C1), organizational justice (C2), the effectiveness of human resource management measures (C16), and the effectiveness of the knowledge management system (C17) enjoyed high scores of centralities and output in the fuzzy cognitive mapping model.

Run	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27
C1	0.00	0.00	0.00	0.83	0.84	0.00	0.92	-0.76	0.00	-0.76	0.00	-0.74	-0.83	0.00	0.00	0.77	0.92	0.00	0.00	0.89	0.86	0.88	0.00	0.00	0.00	0.00	-0.83
C2	0.79	0.00	0.91	0.88	0.86	0.00	0.89	-0.91	-0.86	-0.78	-0.86	-0.82	0.00	0.00	-0.89	0.81	0.86	0.00	0.00	0.00	0.92	0.82	0.00	0.00	0.00	0.00	0.00
C3	0.88	0.00	0.00	0.00	0.00	0.00	0.00	-0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00	-0.83	0.00	0.00	-0.85	0.00	-0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00	0.00
C5	0.81	0.00	0.79	0.83	0.00	0.00	0.84	-0.84	-0.86	0.00	0.00	-0.88	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.81
C6	0.78	0.00	0.84	0.00	0.00	0.00	0.00	-0.87	0.00	0.00	-0.86	0.00	-0.79	0.00	0.00	0.73	0.84	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.00	-0.87
C7	0.00	0.00	0.85	0.86	0.00	0.00	0.00	-0.87	0.00	-0.83	0.00	0.00	-0.81	0.00	0.00	0.00	0.00	-0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C8	-0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	
C9	-0.78	-0.78	-0.81	-0.81	-0.76	0.00	0.00	0.83	0.00	0.81	0.85	0.77	0.00	0.00	0.85	-0.79	0.00	0.00	0.00	0.00	-0.79	0.00	0.00	0.00	0.00	0.00	0.00
C10	-0.86	-0.77	-0.79	0.00	-0.77	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.79	0.00	0.00	-0.77	0.00	0.00	0.00	0.00	-0.82	-0.84	0.00	0.00	0.00	0.00	0.84
C11	-0.85	0.00	-0.82	-0.78	-0.79	0.00	0.00	0.85	0.71	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.82	0.00	0.00	0.00	0.00	0.00	0.00
C12	-0.64	0.00	-0.81	-0.82	0.00	0.00	0.00	0.77	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	
C13	0.00	-0.76	-0.82	0.00	0.00	0.00	0.00	0.00	0.76	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.83	0.00	-0.75	0.00	0.00	0.00	0.00	0.00	0.00
C14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	
C15	0.00	0.00	-0.83	0.00	0.00	0.00	0.00	0.82	0.00	0.77	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.82	
C16	0.91	0.82	0.88	0.89	0.85	0.89	0.92	-0.89	-0.91	0.00	-0.89	-0.87	0.00	-0.78	-0.87	0.00	0.89	0.00	0.00	0.89	0.91	0.00	0.00	0.00	0.00	0.00	-0.88
C17	0.79	0.86	0.85	0.86	0.00	0.00	0.91	-0.88	0.00	0.00	0.00	-0.80	0.00	-0.86	0.00	0.88	0.00	0.00	0.00	0.00	0.87	0.00	0.00	0.00	0.00	0.00	-0.85
C18	-0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.83	
C19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82	
C20	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C21	0.00	0.00	0.87	0.00	0.00	0.88	0.92	0.00	0.00	0.00	0.00	-0.79	0.00	0.00	0.00	0.00	0.86	0.00	0.00	0.87	0.00	0.82	0.00	0.00	0.00	0.00	0.00
C22	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C23	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C24	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C25	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C26	0.00	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C27	-0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.83	-0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Fig. 5. Adjacency Matrix of Factors Affecting Knowledge-Hiding Behavior

Table1. Comparison of Input Degree, Output Degree and the Centrality of Factors Affecting Knowledge-Hiding Behavior

Factors	Centrality	In-degree	Out-degree
Collaborative innovation culture (C1)	21.46	10.62	10.84
The effectiveness of human resource management measures (C16)	20.55	5.59	14.96
Organizational justice (C2)	16.86	3.99	12.87
The effectiveness of the knowledge management system (C17)	16.26	6.83	9.42
Organizational pessimism (C10)	16.07	8.02	8.05
Organizational unity and integrity (C21)	15.26	9.24	6
Perceived transformational leadership (C7)	15.51	10.46	5.04
Workplace bullying (C9)	14.50	4.87	9.63
Professional commitment to organization (C3)	14.34	11.76	2.58
Organizational silence (C8)	13.47	10.97	2.51
Territoriality (C27)	12.56	10	2.56
Psychological security of employees (C5)	12.28	4.87	7.41
Perceived ethical leadership (C4)	11.87	7.57	4.30
Instrumental thinking (C13)	11.31	5.78	5.53
Organizational impoliteness (C11)	10.76	4.35	6.41
Workplace ostracism (C12)	10.35	5.69	4.66

Finally, the experts' model of cognitive mapping is illustrated in Figure 6 using Vensim software, due to its high capability of clearly drawing feedbacks between the factors within a system.

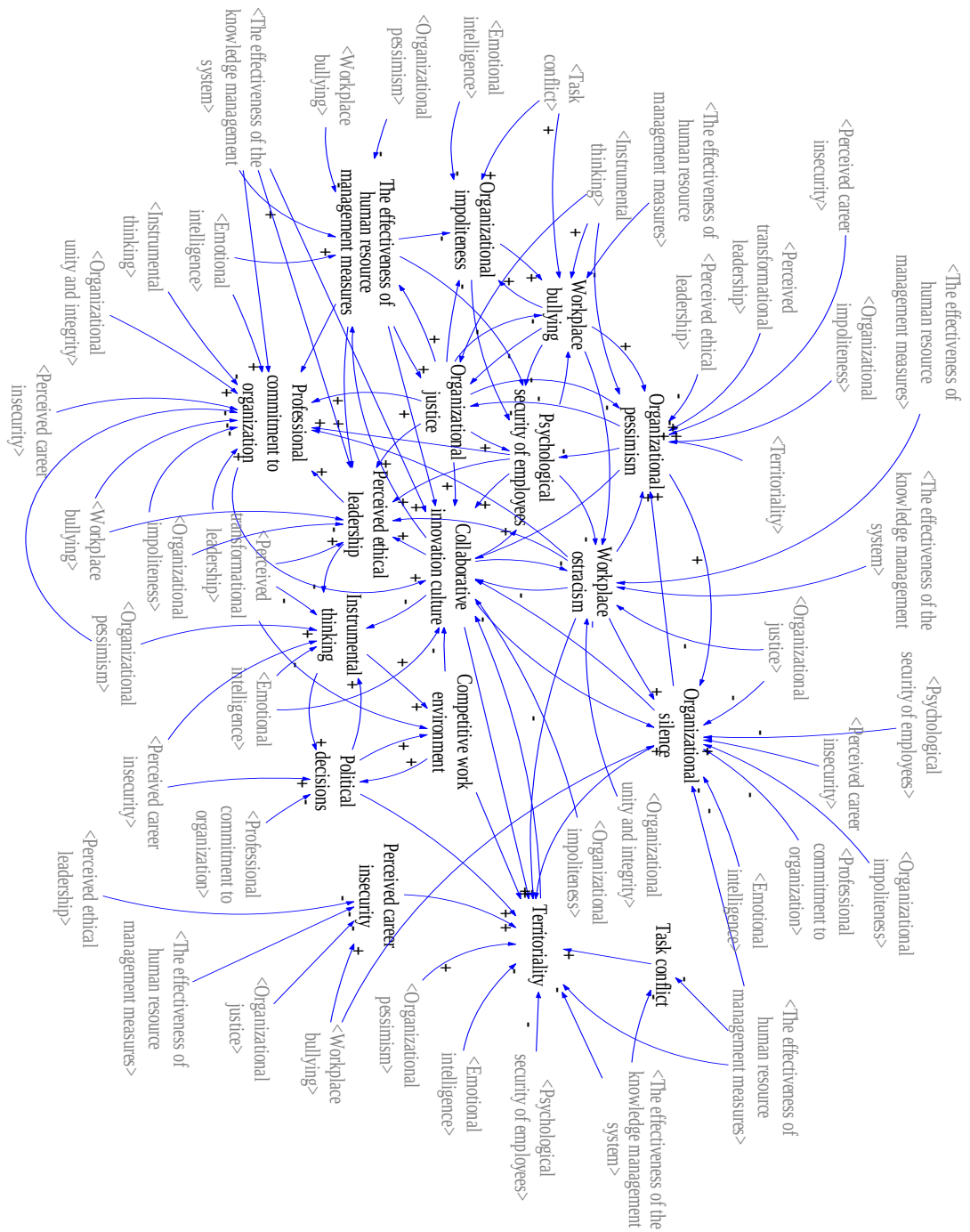


Fig. 6. Fuzzy Cognitive Mapping Model of Relationships among Factors Affecting Knowledge Hiding

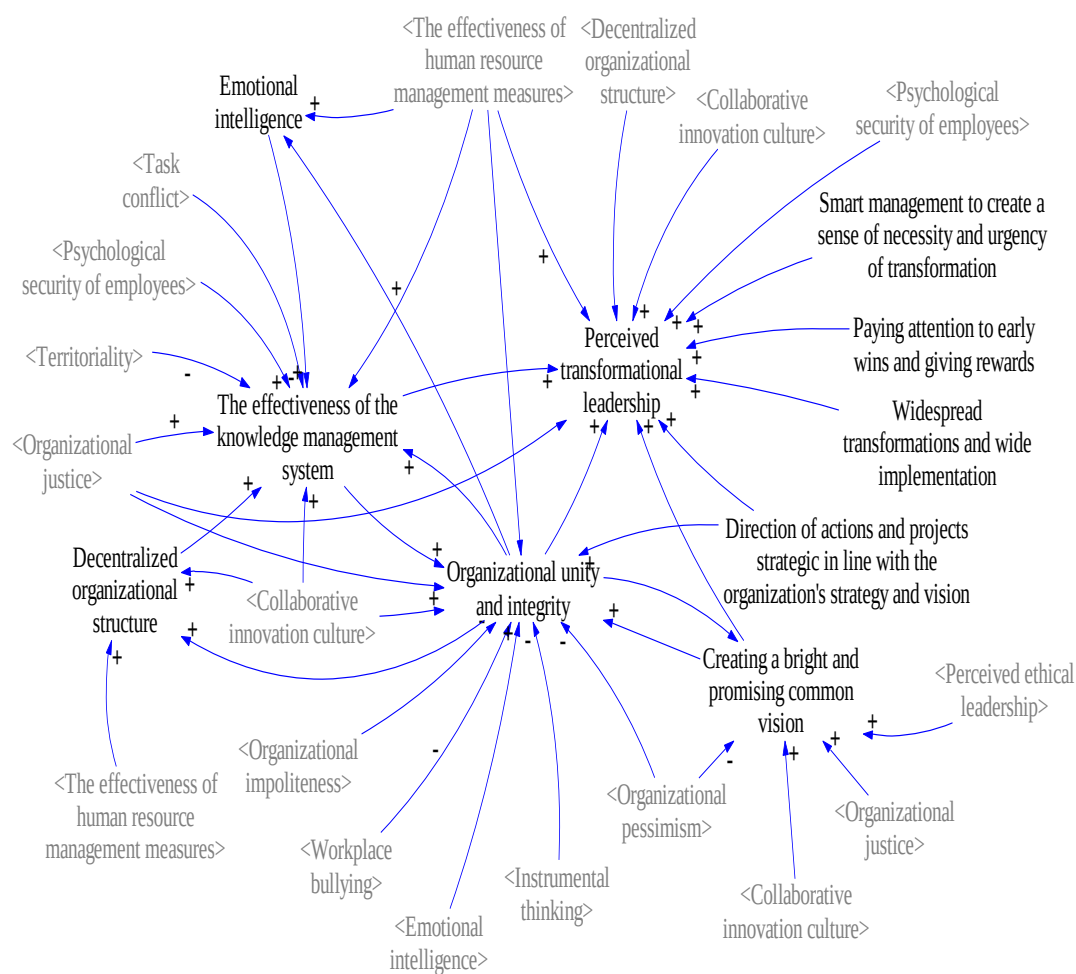


Fig. 6. Continued

4-2. Formulation of Knowledge-Hiding Behavior Management Policies

The knowledge-hiding behavior management scenarios have been formulated using a dynamic analysis (Equation 1). According to the degree of centrality and degree of output of factors affecting knowledge hiding, the following scenarios have been formulated to manage this behavior.

Scenario 1: The activity level of all factors was set at one. As mentioned, the activity degree is usually defined as a range between 0 and 1. The simulation results reached a stable state after 20 recurrences. In Figure 7, the status of factors affecting knowledge hiding in the first scenario is shown in black. In other words, this scenario is considered without changes in factors as the basis for measuring the sensitivity of the elements of the cognitive mapping model to the changes of interest.

Scenario 2: In the next step, the effect of changes of two key factors in the cognitive mapping model was investigated. As previously mentioned, the collaborative innovation culture (C1) and the effectiveness of human resource management measures (C16) in the cognitive mapping model were found with a high score both in the centrality degree and the output degree. The results of analyzing the second scenario show that if these factors are set at 0 in the cognitive mapping model, significant changes will be achieved in the other variables of model. For example, organizational silence (C8), workplace bullying (C9), organizational pessimism (C10), organizational impoliteness (C11), organizational ostracism (C12), territoriality (C27), and political decisions (C19) increased significantly. Moreover, there was a significant decrease in the score of organizational justice (C2), professional commitment to organization (C3), perceived ethical leadership (C4), psychological security of employees (C5), emotional intelligence (C6), and creating a bright and promising common vision (C22). It should be noted that, on certain occasions, the results of the second scenario (red

diagram) were similar to those of the first scenario. That is because some variables of the cognitive mapping model were identified as the only influential variables within the model.

Scenario 3: In the next step, the effect of changes of four key factors in the fuzzy cognitive mapping model was investigated. As mentioned before, the collaborative innovation culture (C1), the effectiveness of human resource management measures (C16), the effectiveness of the knowledge management system (C17), and organizational justice (C2) enjoyed high scores of both centrality degree and output degree in the fuzzy cognitive mapping model. The results of the third scenario in the diagram in blue show that, if the status of these factors in the cognitive mapping model is considered inactive, incremental changes will happen to some variables of model. For example, organizational silence (C8), workplace bullying (C9), organizational pessimism (C10), organizational impoliteness (C11), organizational ostracism (C12), perceived career insecurity (C15) and political decisions (C19) increased significantly. There was also a significant decrease in the score of professional commitment to organization (C3), perceived ethical leadership (C4), psychological security of employees (C5), decentralized organizational structure (C20), and organizational unity and integrity (C21). It indicates their unfavorable state in the fuzzy cognitive mapping model.

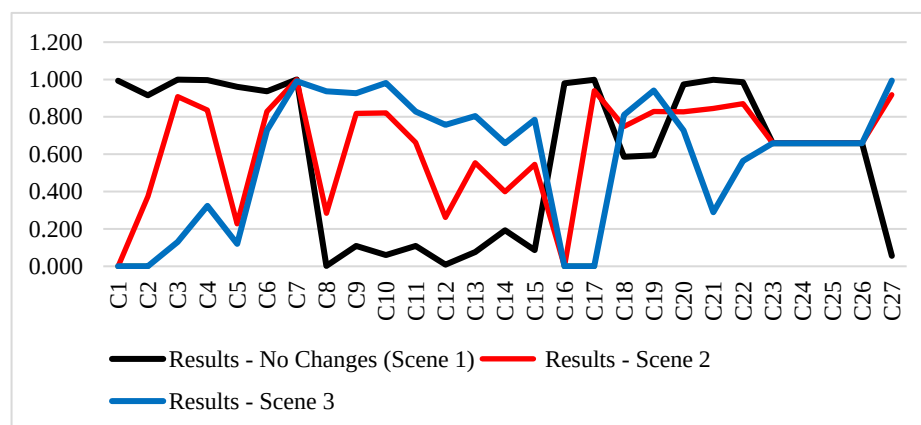


Fig. 7. Comparison of the Results of Knowledge-Hiding Behavior Management Scenarios

Table 2 shows the changes in factors within the cognitive mapping model caused by the second scenario. As observed, by implementing the second scenario and assuming a zero-activity level of collaborative innovation culture (C1) and the effectiveness of human resource management measures (C16), factors such as organizational silence (C8), workplace bullying (C9), organizational pessimism (C10), organizational impoliteness (C11), task conflict (C14), competitive work environment (C18), territoriality (C27), and political decisions (C19) increased significantly. On the contrary, factors such as organizational justice (C2), professional commitment to organization (C3), perceived ethical leadership (C4), psychological security of employees (C5), and emotional intelligence (C6) decreased significantly.

Table 3 shows the changes in factors within the cognitive mapping model caused by the third scenario. As it can be seen, by implementing the third scenario and assuming a zero-activity level of collaborative innovation culture (C1), the effectiveness of human resource management measures (C16), the effectiveness of the knowledge management system (C17), and organizational justice (C2), factors including organizational silence (C8), workplace bullying (C9), organizational pessimism (C10), Organizational impoliteness (C11), organizational ostracism (C12), territoriality (C27), and political decisions (C19) increased significantly. However, factors such as professional commitment to organization (C3), perceived ethical leadership (C4), psychological security of employees (C5), organizational unity and integrity (C21), decentralized organizational structure (C20), and creating a bright and promising common vision (C22) decreased significantly.

Table 2. Comparing the Results of Scenarios 1 and 2

Factors	The results of scenario 1	The results of scenario 2	The amount of changes	The intensity of changes
Organizational justice (C2)	0.916	0.327	-0.541	High negative change
Professional commitment to organization (C3)	0.999	0.908	-0.091	High negative change
Perceived ethical leadership (C4)	0.997	0.837	-0.161	High negative change
Psychological security of employees (C5)	0.961	0.227	-0.734	High negative change
Emotional intelligence (C6)	0.937	0.828	-0.108	High negative change
Perceived transformational leadership (C7)	1.000	0.999	-0.001	Medium negative change
Organizational silence (C8)	0.002	0.284	0.282	High positive change
Workplace bullying (C9)	0.109	0.818	0.709	High positive change
Organizational pessimism (C10)	0.068	0.820	0.760	High positive change
Organizational impoliteness (C11)	0.109	0.663	0.553	High positive change
Instrumental thinking (C13)	0.076	0.554	0.478	High positive change
Task conflict (C14)	0.192	0.399	0.207	High positive change
Perceived career insecurity (C15)	0.086	0.545	0.459	High positive change
The effectiveness of the knowledge management system (C17)	0.999	0.940	-0.059	High negative change
Competitive work environment (C18)	0.586	0.749	0.162	High positive change
Political decisions (C19)	0.658	0.829	0.235	High positive change
Organizational unity and integrity (C21)	0.998	0.845	-0.153	High negative change
Territoriality (27)	0.081	0.918	0.862	High positive change

Table 3. Comparing the Results of Scenarios 1 and 3

Factors	The results of scenario 1	The results of scenario 3	The amount of changes	The intensity of changes
Professional commitment to organization (C3)	0.999	0.113	-0.869	High negative change
Perceived ethical leadership (C4)	0.997	0.324	-0.673	High negative change
Psychological security of employees (C5)	0.961	0.120	-0.841	High negative change
Emotional intelligence (C6)	0.937	0.728	-0.209	High negative change
Perceived transformational leadership (C7)	1.000	0.991	-0.009	Medium negative change
Organizational silence (C8)	0.002	0.937	0.935	High positive change
Workplace bullying (C9)	0.109	0.927	0.818	High positive change
Organizational pessimism (C10)	0.068	0.981	0.921	High positive change
Organizational impoliteness (C11)	0.109	0.828	0.719	High positive change
Workplace ostracism (C12)	0.009	0.757	0.748	High positive change
Instrumental thinking (C13)	0.076	0.804	0.728	High positive change
Task conflict (C14)	0.192	0.659	0.467	High positive change
Perceived career insecurity (C15)	0.086	0.784	0.698	High positive change
Political decisions (C19)	0.594	0.941	0.347	High positive change
Decentralized organizational structure (C20)	0.974	0.727	-0.247	High negative change
Organizational unity and integrity (C21)	0.998	0.289	-0.709	High negative change
Creating a bright and promising common vision (22)	0.986	0.564	-0.422	High negative change
Territoriality (27)	0.056	0.994	0.914	High positive change

5. Discussion and Analysis

The present study identified the factors influencing the formation of knowledge-hiding behavior in government organizations, focusing on Iranian public universities. Then, using the fuzzy cognitive mapping approach, the research modeled the causal relationships among factors affecting knowledge-hiding behavior. After identifying the most significant factors within the causal model, multiple scenarios were developed to manage knowledge-hiding behavior effectively. Through static analysis within the fuzzy cognitive mapping approach, four key variables were identified as having the highest degree of centrality: collaborative innovation culture (C1), organizational justice (C2), the effectiveness of human resource management practices (C16), and the effectiveness of the knowledge management system (C17). Then, the dynamic analysis in the cognitive mapping approach demonstrated that alterations in these fundamental variables trigger cascading effects across the system, influencing multiple interconnected components and reshaping the complex relationships that drive knowledge-hiding behavior within organizations. For example, in the fuzzy cognitive mapping model, the causal loop (the effectiveness of human resource management measures, innovative

collaborative culture, creating a common vision, organizational unity and integrity, emotional intelligence, the effectiveness of knowledge management system, the effectiveness of human resource management measures) demonstrates that effective human resource management strategies can play a vital role in fostering a culture of collaborative innovation within government organizations, particularly public universities. Innovation in these institutions emerges through teamwork that emphasizes learning and cultivating creative mindsets. An effective human resource management system in public universities engages innovative and forward-thinking personnel, develops essential skills, evaluates performance based on collaboration and innovation, and rewards creativity as a foundation for establishing a culture of collaborative innovation (Jotabá et al., 2022). As collaborative innovation culture strengthens, the process of social identification (Hogg, 2016) enables individuals within the organization to perceive themselves as integral members of the university community. This sense of belonging fosters a shared vision and aligned goals (Sukumaran & Lanke, 2021), which in turn promotes empathy, unity, and organizational integrity. In an environment enriched by teamwork and empathy, opportunities for enhancing employees' emotional intelligence emerge, particularly through the development of social awareness and interpersonal skills. Employees with high emotional intelligence are more likely to share knowledge due to increased empathy and trust, reducing behaviors like knowledge hiding and mitigating the adverse effects of interpersonal conflicts and misunderstandings. Such individuals are naturally inclined toward teamwork, creativity, and innovative initiatives. Therefore, strengthening emotional intelligence among employees becomes pivotal to ensuring the effectiveness of the university's knowledge management system. As Mahmood and Toker (2022) suggest, employees with higher emotional intelligence contribute significantly to minimizing knowledge hiding and enhancing knowledge-sharing practices. In turn, an effective knowledge management system creates a strong foundation for improving human resource management measures. For instance, facilitating rapid knowledge transfer, fostering innovation, and generating new knowledge can enhance training processes, skill development initiatives, and mechanisms for rewarding creativity and innovation within public universities (Zaim et al., 2018).

Among the other findings of this research is the causal loop of collaborative innovation culture, organizational ostracism, organizational pessimism, psychological security of employees, territoriality, and collaborative innovation culture.

The existence of a collaborative innovation culture paves the way for less ostracism in the workplace and, subsequently, less organizational pessimism. In other words, through cooperation and team work, valuing the ideas and opinions of others, the belief that others are not selfish and are trustworthy, emerges in an organization (Brown, & Cregan, 2008; Taheri & Fazeli, 2023), thereby leading to a sense of collaborative security and psychological safety to share information or knowledge. In this condition, the sense of ownership or territoriality of knowledge is reduced and the collaborative innovation culture within public universities is again strengthened.

Similarly, the causal loop of effectiveness of human resource management measures, emotional intelligence, territoriality, collaborative innovation culture, instrumental thinking, organizational unity and integrity, the effectiveness of knowledge management system, organizational professional commitment, organizational silence, organizational pessimism, and the effectiveness of human resource management measures emphasizes the cyclical nature of these factors within public universities. Effective human resource management measures cultivate emotional intelligence (Mahmood & Toker, 2022), alleviating territoriality and supporting collaboration (Jotabá et al., 2022). This fosters shared goals and strengthens knowledge management systems (Zaim et al., 2018), enhancing professional commitment while reducing organizational silence and pessimism.

Instrumental thinking—a mindset where knowledge is used primarily for self-serving goals—plays a critical role in this cycle. In environments with weak collaborative cultures, instrumental thinking can dominate, leading to behaviors that undermine trust and transparency. However, as the collaborative innovation culture strengthens, individuals shift from using knowledge selfishly to adopting a more collective and cooperative approach. By fostering teamwork, mutual trust, and shared values, collaborative innovation culture diminishes the negative impacts of instrumental thinking, encouraging practices that prioritize the organization's broader goals over personal gain.

Through this self-reinforcing cycle, public universities can enhance organizational cohesion, reduce knowledge-hiding behaviors, and establish academic environments where trust, cooperation, and

transparency thrive. These causal loops provide valuable insights into breaking destructive cycles and fostering a collaborative and innovation-driven academic culture.

The results also revealed that in the fuzzy cognitive mapping model, there exists a causal loop of organizational justice, organizational professional commitment, political decisions, instrumental thinking, competitive work environment, collaborative innovation culture, territoriality, organizational pessimism, psychological security of employees, workplace bullying, and organizational justice. When faculty and staff in public universities perceive fairness in their treatment by senior management, they are more likely to identify themselves as integral members of the institution. Fair treatment fosters trust between supervisors and subordinates, which subsequently strengthens organizational trust and leads to positive outcomes, such as organizational professional commitment (DeConinck, 2010; Imamoglu et al., 2019; Jasimuddin & Saci, 2022). Higher levels of professional commitment reduce involvement in political decisions, where individuals attempt to influence others for personal benefit. Faculty and staff with strong professional commitment are less likely to engage in political maneuvering or instrumental use of others, and instead, contribute to diminishing destructive individual competition, thereby paving the way for a collaborative innovation culture (Heidari Haratemeh, 2023). Within public universities, a collaborative culture reduces territoriality over knowledge and decreases organizational pessimism. As distrust and negativity decline, the psychological security of faculty and staff improves, enabling individuals to share their ideas and opinions more freely. This sense of security minimizes deviant behaviors such as workplace bullying by fostering an environment of support, mutual respect, and risk-taking. Positive attitudes towards the organization become more prevalent. Research by Sepahvand et al. (2021) highlights team and group work as effective solutions to issues like territoriality of knowledge and its consequences, including deviant behaviors and workplace bullying. Faculty and staff in such collaborative conditions feel valued, and their interactions are characterized by friendship, partnership, and cooperation. Supported by the institution, they are more likely to develop positive beliefs and attitudes towards the university (Islam & Chaudhary, 2024). As a result, perceived organizational justice is reinforced, creating a virtuous cycle that enhances cohesion and trust within public universities.

6. Theoretical Contributions

Based on an analysis of the main causal loops within the research model, organizational justice plays a central role in shaping knowledge accessibility and workplace interactions through multi-level systemic effects. While organizational justice theory (Greenberg, 1987) traditionally focuses on job satisfaction and employee attitudes, this study extends its scope by illustrating its recursive influence across individual, interpersonal, and organizational dimensions, demonstrating how justice-driven governance fosters institutional trust and mitigates knowledge-hiding tendencies. At the individual level, perceived fairness enhances psychological security, reinforcing emotional intelligence and reducing defensive workplace behaviors, such as knowledge territoriality and strategic concealment. Employees who feel secure in their roles are more likely to engage in open knowledge exchange, while perceived injustice exacerbates self-protective knowledge-hoarding behaviors. This aligns with psychological ownership theory (Pierce et al., 2001), which suggests that institutional instability and unfair treatment intensify territorial attitudes toward knowledge, restricting accessibility to preserve professional relevance.

At the interpersonal level, organizational justice regulates trust-building mechanisms, shaping workplace dynamics through political behavior, organizational pessimism, and workplace bullying. Employees exposed to unfair decision-making, exclusionary practices, or hierarchical favoritism are more likely to conceal knowledge as a defensive strategy, reinforcing instrumental thinking and competitive knowledge monopolization. This expands social exchange theory (Blau, 1964) by demonstrating that justice-based interventions reduce destructive workplace competition, fostering a collaborative culture that actively counteracts knowledge-hiding tendencies.

At the organizational level, justice-driven governance regulates institution-wide knowledge-sharing frameworks through organizational culture, human resource management effectiveness, and knowledge management systems. The study refines the knowledge-based view (Grant, 1996) by demonstrating that knowledge is not merely a static organizational asset but a dynamic resource

shaped by fairness-driven institutional mechanisms. Findings confirm that innovation-driven cultures and effective human resource policies are key enablers of transparent knowledge accessibility, actively shaping workplace norms that discourage territoriality and knowledge hoarding. A significant contribution of this research is its revision of resource-based view (Barney, 1991) within the knowledge governance framework. Traditionally, resource-based view conceptualizes knowledge as a valuable intangible asset that organizations must leverage for sustained competitive advantage. However, prior studies have often focused on the existence of knowledge within institutions without addressing the mechanisms governing its accessibility, utilization, and distribution. This study challenges this limitation by demonstrating that knowledge is not merely a passive resource but an evolving and relational construct shaped by institutional policies, leadership strategies, and human resource interventions. For example, empirical findings indicate that effective human resource measures, particularly those that develop emotional intelligence and foster collaborative work environments, play a crucial role in regulating knowledge accessibility. Organizations that prioritize fairness-driven human resource strategies, ethical leadership, and participatory decision-making effectively reduce territorial knowledge behaviors, ensuring knowledge flows more freely across institutional boundaries. By cultivating an innovation-driven culture, human resource interventions actively shape how knowledge is created, shared, and sustained, reinforcing collaborative workplace norms rather than allowing knowledge to be hoarded or restricted due to competitive tensions.

This study extends leadership perception theory (Shamir, 1995) by demonstrating that perceptions of ethical and transformational leadership are shaped through systemic interactions within organizational frameworks, rather than forming in isolation. The findings indicate that leadership evaluations are directly influenced by organizational justice, organizational professional commitment, collaborative innovation culture, knowledge management effectiveness, and human resource strategies, creating reinforcing feedback loops that sustain leadership credibility and institutional trust. A key contribution of this research is the identification of multiple interconnected feedback cycles, such as the causal loop of the organizational justice, perceived ethical leadership, professional commitment, collaborative innovation culture, the effectiveness of knowledge management system, the effectiveness of human resource management measures, and organizational justice. The study also emphasizes how transformational leadership is shaped by interconnected processes, showing that employees' perceptions of leadership develop through continuous interactions within a responsive and evolving organizational environment. These insights refine transformational leadership theory (Bass, 1985) by illustrating that transformational leadership is not solely a product of individual leadership style, but rather an emergent outcome of justice-driven institutional governance, structured knowledge-sharing systems, and participatory human resource policies. This perspective shifts the conventional view of transformational leadership as primarily tied to charismatic traits, emphasizing instead the role of macro-level organizational mechanisms in reinforcing leadership effectiveness.

Furthermore, the study contributes to justice theory (Greenberg, 1987) by establishing that organizational justice is central to leadership perception, shaping employees' evaluations through their experiences of fairness, accountability, and institutional trust. These findings challenge traditional interpretations that associate organizational justice primarily with job satisfaction, demonstrating instead that fairness-driven policies actively shape leadership legitimacy.

Finally, this study expands the knowledge-based view (Grant, 1996) by linking leadership perception to knowledge accessibility within organizations. Leaders who cultivate transparent and collaborative knowledge-sharing environments are more likely to be perceived as transformational and ethically grounded, reinforcing the argument that effective leadership is intertwined with open knowledge governance structures. This study provides a theoretical expansion by revealing the reciprocal relationship between macro-level organizational structures and individual/interpersonal behaviors in shaping knowledge-hiding dynamics. Unlike traditional models that treat factors such as human resource effectiveness, organizational justice, and knowledge management systems as independent variables, this research identifies self-reinforcing causal loops, demonstrating how organizational policies shape individual behaviors, which in turn reshape broader institutional frameworks.

Findings confirm that justice-driven human resource policies enhance psychological security and emotional intelligence, reducing knowledge territoriality and fostering collaborative innovation

culture. A supportive organizational environment strengthens interpersonal trust, encouraging transparent knowledge exchange rather than instrumental concealment strategies. However, this influence is bidirectional—as employees engage in open collaboration, institutional cohesion strengthens, leading to adaptive human resource strategies and governance refinements.

Ultimately, by employing fuzzy cognitive mapping, this study reveals interconnected causal loops within public universities, highlighting the central role of human resource management measures, organizational justice, knowledge management effectiveness, and an innovation-driven culture in regulating knowledge behaviors. At the individual level, cultivating emotional intelligence through human resource interventions reshapes workplace dynamics by reducing territoriality and reinforcing collective knowledge-sharing norms. As employees shift away from self-serving and instrumental thinking, organizations benefit from greater institutional unity and improved knowledge accessibility. This research advances systems theory (Von Bertalanffy, 1968) within knowledge governance, demonstrating that macro-level interventions alone cannot sustain open knowledge-sharing cultures unless they integrate adaptive feedback mechanisms derived from employees' lived experiences. Institutions must implement responsive leadership and human resource strategies, ensuring that employees' contributions dynamically shape governance frameworks, thereby fostering a trust-based, knowledge-driven academic environment.

7. Conclusion

This study aimed to identify and model the factors influencing knowledge-hiding behavior in public universities in Iran using a mixed-method approach and fuzzy cognitive mapping. Initially, key factors were extracted through expert interviews, followed by the design of causal relationships based on expert opinions, and finally, managerial scenarios were developed to control and reduce knowledge-hiding behavior.

The findings revealed that knowledge-hiding behavior is influenced by three primary levels: individual, interpersonal, and organizational. The study demonstrates that organizational level changes, such as the reform of human resource management policies, enhancement of organizational justice, and improvement of knowledge management systems, directly impact interpersonal and individual levels. For example, when public universities strengthen managerial transparency and foster a collaborative innovation culture, positive interactions among employees increase, while workplace bullying and organizational cynicism decrease. These changes create a sense of security, reducing defensive behaviors such as knowledge ownership and knowledge hiding.

However, this process is not one-directional; rather, it establishes a dynamic and recursive cycle within the organization. At the individual level, increasing employees' emotional intelligence can enhance interpersonal interactions, strengthening trust-based relationships and influencing managerial structures. For instance, employees with higher emotional intelligence are more likely to actively participate in decision-making sessions and propose constructive recommendations for managerial policies. This adaptability enables the organization to implement broader strategic changes in management systems and knowledge-sharing frameworks.

Ultimately, the dynamism of knowledge behaviors within organizations depends on multi-level interactions among individuals, groups, and managerial structures. Public universities aiming to reduce knowledge-hiding behaviors and promote a knowledge-sharing culture must align their managerial policies to reinforce this recursive cycle, improving individual and interpersonal engagement and transforming the organization into a knowledge-driven and innovation-focused environment.

This study makes a significant theoretical contribution by incorporating organizational justice theory, social exchange theory, psychological ownership theory, resource-based view, and transformational leadership theory. Findings demonstrate how organizational justice and human resource strategies regulate knowledge behaviors, shaping employees' perceptions and interactions within academic institutions. Additionally, by expanding social exchange theory, the study highlights how trust and fairness reduce defensive knowledge practices and encourage open collaboration. The integration of psychological ownership theory explains the mechanisms through which job insecurity and institutional instability influence territorial attitudes toward knowledge. Furthermore, the research refines the resource-based view, demonstrating that knowledge is not merely a passive asset but a dynamic resource shaped by organizational policies and managerial interventions.

Beyond these frameworks, the study also aligns with systems theory, emphasizing that knowledge behaviors do not operate in isolation but emerge from recursive and multi-level interactions within organizational structures. The findings underscore the importance of adaptive organizational policies, showing that interventions at the institutional level can reshape interpersonal relationships and individual attitudes while employee-level changes also feed back into broader structural reforms, creating a continuous, evolving system of knowledge governance.

8. Managerial Recommendations

Based on the above findings, practical suggestions are provided to managers of public universities to reduce knowledge concealment behavior. Facilitating teamwork initiatives across academic and administrative departments, as well as encouraging interdisciplinary and inter-faculty collaborations, is a strategic approach to addressing knowledge-hiding behaviors among faculty and staff in public universities. By encouraging collaborative efforts toward shared academic and institutional objectives, rather than individual competition, faculty and staff can engage in meaningful interactions that build trust and reduce defensive behaviors. Collaborative projects, focused on solving key challenges such as improving research outcomes or streamlining administrative processes, foster synergy and alignment between diverse groups. Structured brainstorming sessions further enable open dialogue, welcoming diverse perspectives and enhancing communication and cooperative problem-solving, key factors in reducing knowledge hiding.

Establishing knowledge-sharing incentives, such as public recognition, academic promotions, or rewards for collaborative research, motivates faculty and staff to actively contribute to centralized repositories and joint initiatives. These measures shift the focus from self-serving instrumental thinking toward collective organizational success, fostering a culture where shared knowledge and teamwork are valued. For instance, recognizing joint research publications and rewarding interdisciplinary collaborations reinforce the shared vision and diminish tendencies to conceal knowledge. In line with ethical leadership practices, managers should highlight and celebrate examples of collaboration and ethical behavior through public recognition programs, awards, or institutional announcements. Faculty and staff can also nominate peers who exhibit exemplary ethical practices in knowledge-sharing or teamwork, reinforcing a sense of shared accountability and trust.

Structured mentorship programs, tailored to the unique dynamics of academia, play a pivotal role in managing knowledge hiding among faculty and staff. Senior faculty can mentor junior academics, while experienced administrative staff guide newer employees in navigating the organizational environment. These programs establish trust-based relationships, providing safe spaces for open dialogue. By enhancing psychological security and fostering emotional intelligence, mentorship frameworks encourage the free exchange of knowledge, reducing territorial attitudes and addressing organizational silence.

Additionally, interactive knowledge and innovation platforms within universities—such as faculty innovation hubs or virtual research networks—create central spaces for co-creation and collaboration. These platforms can serve as forums for exchanging ideas, sharing resources, and collectively addressing academic and operational priorities. Such initiatives reinforce psychological safety by allowing faculty and staff to freely contribute without fear of criticism or exploitation. Features like anonymous idea submission systems and peer feedback loops further enhance inclusivity and trust, empowering faculty and staff to share their expertise confidently.

Transitioning toward group-based reward systems is another effective intervention for addressing knowledge-hiding behaviors in universities. By recognizing team efforts in achieving institutional goals, such as securing grants or advancing joint research, universities can cultivate unity and reduce tendencies toward territoriality and instrumental thinking. Celebrating collective successes ensures equitable recognition and reinforces a collaborative culture among faculty and staff.

Specialized workshops focusing on self-awareness, empathy, interpersonal communication, and conflict resolution can directly impact the behaviors associated with knowledge hiding. Role-playing exercises and reflective activities enable individuals to identify emotional triggers and understand how they impact collaboration. Training in active listening, perspective-taking, and respectful communication fosters mutual trust, reducing defensive behaviors like territoriality and promoting

openness. These workshops equip faculty and staff with tools to address challenges constructively, creating a supportive and inclusive university environment.

Additionally, investing in career development programs, such as training sessions, certifications, and professional workshops, enhances the competencies of faculty and staff in public universities. For faculty members, these initiatives foster professional confidence and a sense of accomplishment, encouraging open knowledge sharing and collaboration. Among administrative and support staff, career development programs play an even more critical role by addressing concerns about job security. Providing opportunities for skill-building and professional growth helps staff feel valued and more secure in their roles, alleviating anxiety tied to career stability. Programs that focus on adaptable skills, such as project management, effective communication, and problem-solving, empower both faculty and staff to contribute meaningfully to the university's goals while feeling confident in their professional development. By integrating such initiatives with transparent communication and supportive organizational frameworks, public universities can foster an environment where trust and collaboration thrive. This approach reduces defensive behaviors like knowledge hiding, encouraging a culture of shared academic and institutional success.

Human resource management in public universities must adopt an ethical approach to ensure the effectiveness of its actions and policies. Ethical leadership within human resource management fosters an environment of trust, fairness, and transparency, which are essential for reducing knowledge-hiding behaviors. By prioritizing integrity and moral accountability in their practices—such as equitable recruitment, fair promotion processes, and transparent allocation of resources—human resource managers can set a strong ethical foundation that influences the entire organization. In the recruitment and selection process for public universities, it is essential to identify candidates whose attributes align with the academic and institutional goals of these organizations. To effectively address knowledge-hiding behaviors, hiring criteria should prioritize traits such as high emotional intelligence, a low tendency toward instrumental thinking, a collaboration-oriented mindset, and a willingness to share knowledge openly. Additionally, addressing traits such as organizational cynicism and impoliteness during recruitment is critical, as these behaviors can undermine trust, weaken team cohesion, and hinder knowledge-sharing practices. For instance, human resource managers in public universities can utilize psychometric tests to assess candidates' attitudes and beliefs regarding fairness, trust, and transparency within organizational contexts. Candidates exhibiting excessive pessimism may contribute to negative dynamics, such as territorial behaviors and knowledge hoarding, which are particularly detrimental in academic environments.

Revising academic performance metrics to include qualitative measures, such as teaching excellence and community engagement, along with publication quantity, can relieve excessive pressure and reduce competition-driven knowledge hiding. Clear and equitable processes for resource allocation, such as research funding and access to facilities, can help reduce feelings of insecurity and competition among faculty members. Transparency fosters trust and discourages territorial behaviors tied to resource scarcity.

9. Limitations and Recommendations for Researchers

This study has several limitations that future researchers can address. Since it relies on self-reported data, subjective biases may influence responses. Although expert evaluations and semi-structured interviews were conducted to extract key factors, future studies could enhance causal validation by integrating observational or experimental methods. These approaches would improve the accuracy of causal inferences and provide deeper insights into knowledge-hiding behaviors in academic institutions. Another limitation is the exclusive focus on public universities, which may restrict the generalizability of findings to private universities, government research organizations, or public-private academic collaborations. Different governance structures and institutional priorities may shape knowledge-hiding behaviors differently, necessitating further investigation in diverse academic contexts. Additionally, the complexity of multi-layered interactions among individual, interpersonal, and organizational factors presents challenges for the universal application of these findings. Future research should explore how knowledge-hiding mechanisms vary across different academic disciplines, as faculty members in engineering, humanities, and sciences may exhibit distinct tendencies.

This study does not incorporate a longitudinal analysis, limiting its ability to assess how knowledge-hiding behaviors evolve over time in response to organizational shifts, leadership transitions, or policy interventions. Future research could adopt longitudinal designs to examine whether these behaviors persist, diminish, or intensify over time, offering insights into the stability of causal relationships within academic settings.

Recommendations for Future Research

Future researchers, using structural equation modeling, should consider analyzing causal relationships among individual-level factors and their impact on interpersonal and organizational outcomes. This approach can clarify how variables such as emotional intelligence and job insecurity shape behaviors like organizational pessimism and workplace silence, ultimately influencing broader institutional dynamics.

Further studies could compare knowledge-hiding behaviors across different types of public universities, such as comprehensive, specialized, and regional universities, or even across faculties within a single institution. Examining these variations could provide valuable insights into how structural, cultural, and operational differences affect knowledge-sharing and retention.

Additionally, research focusing on disciplinary comparisons could uncover unique patterns in knowledge governance across academic fields, identifying whether faculty in distinct domains have varying tendencies toward knowledge concealment or open collaboration.

Finally, future investigations should integrate adaptive policy recommendations that account for feedback loops between individual, interpersonal, and organizational factors. By employing longitudinal analyses and advanced modeling techniques, researchers can refine interventions that reduce knowledge-hiding behaviors, fostering transparent, collaborative, and innovation-driven academic environments.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

No data was used for the research described in the article.

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