Driving knowledge management in criminal analysis: Exploring the synergy between organisational culture, knowledge management processes, and artificial intelligence

Impulsar la gestión del conocimiento en el análisis criminal: Explorando la sinergia entre la cultura organizativa, los procesos de gestión del conocimiento y la inteligencia artificial

Impulsionando a gestão do conhecimento na análise criminal: explorando a sinergia entre cultura organizacional, processos de gestão do conhecimento e inteligência artificial

- Date of receipt: 2024/05/05
- Date of evaluation: 2024/07/16
- Date of approval: 2024/09/03

To reference this article / Para citar este artículo / Para citar este artigo: Pinzón-Rodríguez., N., Roldán-Martínez, A., & Alba, M. (2024) Driving knowledge management in criminal analysis: Exploring the synergy between organizational culture, knowledge management processes, and artificial intelligence. *Revista Criminalidad, 66*(3), 163-182. https://doi.org/10.47741/17943108.671

Nelson Fabián Pinzón Rodríguez
Capitán de la Policía Nacional de Colombia
Magíster en Gerencia Estratégica de Tecnologías de la Información
nelson.pinzon1527@correo.policia.gov.co
https://orcid.org/0009-0007-3153-3650

Andrés Eduardo Roldán Martínez
Magíster en Gerencia Estratégica de Tecnologías de la Información
Ing.andres26@hotmail.com
https://orcid.org/0009-0006-9062-861X

Marisleidy Alba Cabañas
PhD in Management
Fundación Universitaria Konrad Lorenz
marisleidy.albac@konradlorenz.edu.co
https://orcid.org/0000-0001-6935-6097

Abstract

Criminal analysis has become increasingly relevant in Colombia, particularly after a 2009 study by the International Criminal Investigative Training Assistance Programme. This study identified a lack of institutional understanding among analysts responsible for managing criminal data, resulting in a fragmented knowledge model. In response, the Criminal Analysis Centre was established in 2015 within INTERPOL and the Directorate of Criminal Investigation of the National Police of Colombia, with a specific focus on the "criminal actor" to address previously unmet needs.

Information and knowledge management play a crucial role in criminal intelligence, emphasising the importance of continuous access to documented information and robust data collection capabilities. The Centre, staffed by 79 analysts across four key analytical lines, employs various techniques to study criminal behaviour and communications. Despite technological advancements, significant challenges remain in the timely and effective production of analytical outputs. To overcome these, improvement initiatives have been proposed, targeting organisational, product, and process dimensions. Effective criminal information management is deemed essential for the success of these initiatives, which also require appropriate strategic and budgetary attention.

The study examines four hypotheses related to knowledge management maturity—culture, processes, technology, and an integrative hypothesis—evaluating their relevance and impact. The results align with previous research, highlighting the need for advanced technologies and tools to enhance effectiveness at each stage of the process, including collaborative tools and data exploitation techniques.

Furthermore, an integrated approach is proposed, combining organisational culture, knowledge management processes, and technological infrastructure. Artificial intelligence is also introduced as an innovative tool for managing info-knowledge, addressing a gap in existing proposals that integrate AI throughout the entire knowledge management cycle and incorporate organisational culture as a key element.

Keywords:

Info-knowledge; technological infrastructure; data exploitation techniques; data mining; management model
JEL: 032.

Resumen

El análisis criminal se ha vuelto cada vez más relevante en Colombia, particularmente después de un estudio realizado en 2009 por el Programa Internacional de Asistencia para la Capacitación en Investigación Criminal (International Criminal Investigative Training Assistance Program). Este estudio identificó una falta de comprensión institucional entre los analistas responsables de la gestión de datos criminales, lo que resultó en un modelo de conocimiento fragmentado. En respuesta, en 2015 se creó el Centro de Análisis Criminal dentro de la Dirección de Investigación Criminal e INTERPOL de la Policía Nacional de Colombia, con un enfoque específico en el «actor criminal» para abordar las necesidades previamente insatisfechas.

La gestión de la información y el conocimiento juegan un papel crucial en la inteligencia criminal, enfatizando la importancia del acceso continuo a información documentada y a capacidades robustas de recolección de datos. El Centro, que cuenta con 79 analistas repartidos en cuatro líneas analíticas clave, emplea diversas técnicas para estudiar el comportamiento y las comunicaciones delictivas. A pesar de los avances tecnológicos, siguen existiendo importantes retos en la producción puntual y eficaz de resultados analíticos. Para superarlos, se han propuesto iniciativas de mejora en los ámbitos de la organización, los productos y los procesos. La gestión eficaz de la información criminal se considera esencial para el éxito de estas iniciativas, que también requieren una atención estratégica y presupuestaria adecuada.

El estudio examina cuatro hipótesis relacionadas con la madurez de la gestión del conocimiento -cultura, procesos, tecnología y una hipótesis integradora- evaluando su relevancia e impacto. Los resultados concuerdan con investigaciones anteriores, destacando la necesidad de tecnologías y herramientas avanzadas para mejorar la eficacia en cada fase del proceso, incluidas las herramientas de colaboración y las técnicas de explotación de datos.

Además, se propone un enfoque integrado que combina la cultura organizativa, los procesos de gestión del conocimiento y la infraestructura tecnológica. También se introduce la inteligencia artificial como herramienta innovadora para la gestión del infoconocimiento, abordando un vacío en las propuestas existentes que integran la IA a lo largo de todo el ciclo de gestión del conocimiento e incorporan la cultura organizativa como elemento clave.

Palabras clave:

Infoconocimiento; infraestructura tecnológica; interpretación por Técnicas de explotación de datos; minería de datos; modelo de gestión
JEL: 032.

Resumo

A análise criminal tem se tornado cada vez mais relevante na Colômbia, principalmente após um estudo realizado em 2009 pelo International Criminal Investigative Training Assistance Program. Esse estudo identificou uma falta de entendimento institucional entre os analistas responsáveis pelo gerenciamento de dados criminais, resultando em um modelo de conhecimento fragmentado. Em resposta, o Centro de Análise Criminal foi criado em 2015 na Diretoria de Investigação Criminal e Interpol da Polícia Nacional da Colômbia, com foco específico no "ator criminal" para atender às necessidades não atendidas anteriormente.

A gestão da informação e do conhecimento desempenha papel crucial na inteligência criminal, enfatizando a importância do acesso contínuo a informações documentadas e de recursos robustos de coleta de dados. O Centro, que conta com uma equipe de 79 analistas em

quatro linhas analíticas principais, emprega várias técnicas para estudar o comportamento e as comunicações criminosas. Apesar dos avanços tecnológicos, ainda há desafios significativos na produção oportuna e eficaz de resultados analíticos. Para superá-los, foram propostas iniciativas de aprimoramento, com vistas às dimensões organizacional, de produto e de processo. O gerenciamento eficaz de informações criminais é considerado essencial para o sucesso dessas iniciativas, que também exigem atenção estratégica e orçamentária adequada. Neste estudo, são examinadas quatro hipóteses relacionadas à maturidade da gestão do conhecimento — cultura, processos, tecnologia e uma hipótese integrativa —, em que são avaliados sua relevância e impacto. Os resultados se alinham com pesquisas anteriores, destacando a necessidade de tecnologias e ferramentas avançadas para aumentar a eficácia em cada estágio do processo, incluindo ferramentas de colaboração e técnicas de exploração de dados. Além disso, é proposta uma abordagem integrada, a qual combina cultura organizacional, processos de gestão do conhecimento e infraestrutura tecnológica. A inteligência artificial também é apresentada como uma ferramenta inovadora para gerenciar o infoconhecimento, abordando uma lacuna nas propostas existentes que integram a inteligência artificial em todo o ciclo de gestão do conhecimento e incorporam a cultura organizacional como um elemento-chave.

Palavras-chave:

Infoconhecimento; infraestrutura tecnológica; interpretação técnicas de exploração de dados; mineração de dados; modelo de gestão
JEL: 032.

Introduction

A study by Scheepers and Schultz (2019) underscores the importance of information and knowledge management in criminal intelligence, noting that effective criminal prosecution requires continuous access to documented information and past experiences, as well as a strong data collection capability. This highlights the need to effectively create, retain, and transfer knowledge within the context of criminal analysis, an area of improvement also identified at the Criminal Analysis Center (Amaya & Cortés, 2014).

Criminal analysis has grown in importance in Colombia, particularly after the 2009 study conducted by the International Criminal Investigative Training Assistance Program (ICITAP), which highlighted a lack of institutional understanding of the subject among analysts responsible for processing criminal data. This resulted in a fragmented knowledge model (Amaya & Cortés, 2014). In response to this finding, which was supported by other epistemological and methodological references on criminal intelligence, the Criminal Analysis Center was established in 2015 as part of the Directorate of Criminal Investigation and INTERPOL of the National Police of Colombia, with a specific focus on the "criminal actor," a need that had been previously identified but not adequately addressed.

The Criminal Analysis Center, which currently operates with 79 analysts across four main analytical lines, employs various techniques to study criminal behavior, analyze cases and communications, and examine relationships between individuals or organizations. Despite technological advances aimed at improving data processing and reducing response times, challenges remain in the timely and effective creation of analytical products. To address these challenges, improvement initiatives have been proposed on three key fronts: organizational, product, and process. These initiatives aim to strengthen the comprehensive management of criminal analysis, recognized as a broader concept than mere group direction.

Effective management of criminal information is crucial for the success of these initiatives. According to Martínez-Musiño (2010) well-organized information can significantly contribute to the production of criminal analysis, but managing this information requires strategic and budgetary attention. In this regard, the adoption and alignment of technologies with criminal analysis processes are essential to generate a positive impact, as highlighted by Gartner (2023) in relation to innovation and the achievement of the Center's strategic goals.

In addition to technology, knowledge management is a fundamental pillar in the construction of criminal analysis products. Pinzón and Roldán (2023) emphasize

the need for effective knowledge conversion to ensure its continuous availability and utility for analysis. Consistent with this, Villasana et al. (2021) highlight that implementing efficient knowledge management supported by technology enhances innovation capacity, organizational performance, and facilitates strategic decision-making.

Given the current challenges faced by the Criminal Analysis Center under the Directorate of Criminal Investigation and INTERPOL in Colombia, there is a need to develop a knowledge management model that integrates organizational culture, knowledge management processes, and technological infrastructure within the unit. This model should facilitate the efficient transfer of knowledge and the retrieval of stored data, particularly unstructured data, as proposed by Alba (2020) and Hsieh et al. (2009) within the info-knowledge framework.

This study proposes a comprehensive approach that combines organizational, technological, and knowledge management aspects within the specific context of criminal analysis in Colombia. Furthermore, it introduces artificial intelligence as a tool for managing info-knowledge for the first time in the field, while also integrating the organizational culture variable into the existing theoretical model. Although this article does not have direct implications for the policies of the National Police or the Directorate of Criminal Investigation and INTERPOL, it could influence the structuring of improvement plans to strengthen information and knowledge management within the Criminal Analysis Center.

It is important to note that criminal analysis has been studied from various perspectives, such as knowledge management and its relationship to corporate social responsibility in the context of contributing to the clarification of criminal acts, and unified communication as a tool for building knowledge networks (Gottschalk, 2010). A practical example of knowledge management is the research conducted by the South African Police Service, which focused on the collection, analysis, and dissemination of information to anticipate and monitor criminal activities, contributing to organizational learning within the unit (Scheepers & Schultz, 2019).

However, to date there are no proposals that integrate artificial intelligence throughout the entire knowledge management cycle within the stages of criminal analysis, nor that incorporate organizational culture into these proposals. To address this gap, four hypotheses related to knowledge management maturity were analyzed: culture, processes, and technology as individual precursors, and a fourth hypothesis that considers these dimensions in an integrated manner. This approach will allow for the evaluation of the relevance of each dimension in relation to the others and their impact on the maturity of knowledge management.

The results of this research align with the characteristics of the criminal investigation process, showing similarities to the findings of Salcedo et al. (2021) and Alba (2020), such as the limited development of knowledge management and the lack of a shared structure to integrate information with knowledge. However, they also highlight the need to integrate information technologies (IT) and tools for data exploitation, including data mining and Natural Language Processing. These characteristics, which span from information acquisition to the feedback process, suggest that analysts need to use advanced technologies such as collaborative work tools, Wikis, and forums to enhance their effectiveness at each phase of the process.

For the development of the proposal, four hypotheses related to knowledge management maturity were analyzed: culture, processes, and technology as individual precursors of knowledge management, and a fourth integrative hypothesis that considers these three dimensions together. This approach will allow us to determine the relevance of each dimension in relation to the others and their potential impact on the maturity level of knowledge management.

Culture and maturity level in knowledge management

Organizational culture is a fundamental pillar of the knowledge management framework, exerting a transcendental influence on how knowledge is shared, transferred, and applied within an organization (Nonaka et al., 1995). This relationship between culture and knowledge management has been the subject of study and reflection by various academics and experts in the field. According to the proposals of Lotti Oliva (2014), knowledge manifests as a strategic asset of utmost relevance whose creation process is significantly favored by a culture that fosters trust, open communication, and a willingness to exchange ideas.

It is imperative to understand that maturity models, such as the well-known Capability Maturity Model (CMM), play an essential role in categorizing knowledge management at different levels as a reflection of the evolution and sophistication of an organization in this area. These models cannot be separated from the direct influence exerted by organizational culture on the entity's daily processes. Therefore, to achieve greater maturity in knowledge management, it becomes essential to foster a culture that promotes openness, constructive debate, collective learning, and the valuation of knowledge as a strategic resource (Lotti Oliva, 2014; Nonaka et al.,1995).

From a holistic perspective, organizational culture encompasses various facets that intertwine to shape an organization's raison d'être. Aspects such as information systems, people management, operational processes,

leadership, reward systems, and organizational structure form the basis upon which an organization's culture is built.

Organizational culture, which encompasses the organization's vision, values, and practices in regards to knowledge, is a determining factor in developing mature capabilities in knowledge management. Gupta and Govindarajan (2000) highlight organizational culture, its impact on the successful implementation of knowledge management practices, and organizational change progress, thereby viewing organizational culture as a highly relevant axis of maturity of management. Thus, a culture resistant to change, which rewards individuality over collaboration or does not value continuous learning, can hinder knowledge management efforts and limit maturity development. Each of these elements exerts a direct influence on the entity's knowledge management maturity level, with the interaction between them being a key determinant of the process (Nonaka et al., 1995). In this context, Albers (2009) postulates that an ideal organizational culture for knowledge management is characterized by trust, openness, teamwork, collaboration, and a willingness to take risks.

This set of values and principles acts as a catalyst for the implementation of advanced knowledge management practices and the adoption of innovative technologies (Ngosi et al., 2011).

However, it is crucial to note that an organizational culture that does not promote collaboration, which rewards individuality over teamwork, or does not value continuous learning can pose a significant obstacle to knowledge management efforts and limit maturity development in this area (Ngosi et al., 2011). The literature also highlights that organizations where poor communication and distrust prevail are at a disadvantage for sharing, using, or generating new knowledge (Ciganke et al., 2008).

Furthermore, organizational routines, which can amount to a bias in information interpretation, and the tendency to hoard and keep knowledge secret, constitute significant barriers to the development of an effective knowledge management culture (Ciganke et al., 2008; Snowden, 2002). It is evident that the influence of organizational culture on knowledge management maturity transcends the boundaries of theory to manifest as a determining factor of the success or failure of initiatives in this field.

This study sets out to explore this relationship in the context of criminal analysis, with the aim of investigating the strong links between organizational culture and maturity in knowledge management as fundamental pillars for success in the field. Hence, hypothesis **H1: Organizational culture is a precursor of maturity in knowledge management.**

Processes and maturity level in knowledge management

The studies by Gold et al. (2001) indicate that knowledge management processes are closely linked to different stages of knowledge management maturity. In the initial stages, the focus is on transitioning from individual to organizational knowledge, utilizing interactions among people (social capital) and establishing organizational doctrine. As the phases progress, there is a more complete integration of knowledge, moving towards a global knowledge approach.

Similarly, Wibowo and Waluyo (2015) describe the degrees of knowledge management that help identify the level at which an organization is operating in this regard, basing their explanation of effectiveness (productivity, competitiveness, and profitability) on stages or phases. Depending on the author, these are specifically linked to knowledge management processes defined as explicit definition, management, control, and action, which can lead to an ideal state of maturity. Moreover, Buheji and Al-Zayer (2010) point out that processes are a determining factor in the maturity level of knowledge management in an organization. According to their research, the way these processes are designed, implemented, and managed can have a significant impact on maturity level.

Buheji and Al-Zayer (2010) argue that when an organization establishes clear and effective processes for capturing, storing, distributing, and utilizing knowledge, it is laying the groundwork for a mature approach to knowledge management. These processes may include identifying knowledge sources, creating knowledge databases, implementing knowledge management systems, and promoting collaboration among employees. Standardizing processes in relation to knowledge management practices in the organization's daily activities can enhance efficiency, effectiveness, and consistency in knowledge management.

Furthermore, well-defined processes can facilitate knowledge transfer among organization members, foster innovation and continuous learning, and contribute to the development of a knowledge-oriented organizational culture. This study seeks to verify that knowledge management processes determine levels of maturity in knowledge management, so these premises and arguments allow us to propose hypothesis **H2: Knowledge management processes are a precursor to maturity in knowledge management.**

Information technologies in the maturity of knowledge management

According to Fillion et al. (2015), Information Technologies (IT) constitute a determining factor in the level of maturity of knowledge management. This level is influenced by organizations' ability to establish robust technological infrastructures that support both business and knowledge management strategies. This aligns with the thesis proposed by Nonaka et al. (1995), who argue that technology acts as the primary facilitator of knowledge management. In other words, technology not only supports knowledge management but also facilitates its implementation and execution.

Following this line of thought, Alavi and Leidner (2001) emphasize the importance of organizations focusing on continuous development and improvement of systems to acquire, distribute, and interpret knowledge. This is crucial for achieving sustainable competitive advantage and enhancing performance. Therefore, the implementation of appropriate information technologies can enhance an organization's internal resources and capabilities, making it more efficient at knowledge management and more competitive in its sector.

According to Alghail et al. (2022), technological infrastructure in organizational knowledge management systems is palpable and acts as a driver of knowledge management initiatives in organizations. This infrastructure is established as the fundamental basis for developing knowledge management, demonstrating that organizations improve by using technology to generate, apply, and safeguard their organizational knowledge. This aligns with the arguments put forward by Arjonilla and Medina (2002), who highlight that organizations use a variety of tools for knowledge creation, with Information and Communication Technologies (ICT) being the most relevant. Additionally, they emphasize that the integration of IT and knowledge provides competitive advantages. According to Hsieh et al. (2009), the effectiveness and efficiency of the technological infrastructure supporting the implementation of Knowledge Management (KM) are crucial in all phases of knowledge management maturity.

However, the level of relevance of technological infrastructure in each of these phases goes beyond viewing it as an isolated element; it becomes a cross-cutting lever of all phases of knowledge management maturity and should thus be differentially valued to understand how it drives each phase of maturity, as proposed by Gottschalk (2006).

The level of maturity in knowledge management can affect an organization's performance, as outlined by Gottschalk (2006), who emphasizes that performance implications suggest that Stage I may be suitable for a specific organization, while Stage IV may be appropriate for another. Additionally, he notes that an organization in Stage I can evolve to a different stage depending on emergent needs.

In this context, for example, if an organization only uses office tools (spreadsheets) as described in the first stage, but needs to promptly demonstrate financial performance, it may carry out some basic activities. However, it will not be able to perform real-time results analysis, data cross-referencing, and pattern identification if it remains in this stage.

Furthermore, it is important to note that this lever must align with what Marabelli and Newell (2019) propose. These authors highlight that the rapid growth of data and IT tools in the era of big data play a crucial role in knowledge management to enhance competitiveness.

In this regard, this study seeks to verify that IT is a means to achieve maturity in knowledge management. Therefore, based on the arguments presented, we formulate the following hypothesis, **H3: Information technologies are a precursor to maturity in knowledge management.**

Culture, process, and IT in the level of knowledge management maturity

The relationship between organizational culture, processes, and technology in knowledge management is fundamental to the success of initiatives, as well as to the maturity of knowledge management in an organization. Several studies have independently investigated each of these variables as precursors to knowledge maturity. However, according to Romero-Artigas et al. (2011), knowledge management implementation is complex and can only be understood from a socio-technical perspective where a synergy relationship is established with technological, process, and cultural elements to expand its capabilities.

The three variables complement each other and are precursors to knowledge management maturity, as mentioned by Syrjä (2019). Culture influences how knowledge is perceived, valued, and shared within an organization, with processes leveraging the activities and workflows that facilitate knowledge creation, capture, distribution, and application. These processes must align with the culture and specific needs of the organization, integrating at a technological level. Technology provides the tools and platforms that facilitate knowledge capture, storage, search, and distribution in the organization, improving knowledge efficiency and accessibility.

Based on the aforementioned, and according to Ngosi et al. (2011), a common factor in the level of knowledge

management maturity is finding clearly established processes, having an organizational culture oriented towards knowledge openness, and using technologies to strategically identify, share, and utilize knowledge.

In the study conducted by Romero-Artigas et al. (2011), the three variables are related from three perspectives:

- Epistemological perspective: This represents the creation of a knowledge repository as a source that contributes to providing information to all employees and helps create a knowledge network.
- Ontological perspective: Specifically in the social aspect, the repository can be shared, along with experiences and viewpoints of all members.
- Sociotechnical perspective: The influence of technologies and information systems and the capabilities of organizational knowledge management determine a level of maturity of these capabilities to manage intellectual capital.

In this sense, integrated management at the cultural, process, and information technology levels is required as a key aspect to reconfigure and realign knowledge capabilities and adapt to changing environments.

At the police level, the study conducted by Syrjä (2019) concludes that the relationship between organizational culture, processes, and technology in knowledge management is fundamental for the success of knowledge initiatives in the organization. However, some of the reviewed proposals point to the achievement of this integration of variables, but only at the design level or with some variables being more integrated than others, which makes it difficult to achieve maturity in knowledge management.

One of the proposals is provided by Rosales (2023), which establishes a relationship between the technological component and knowledge management maturity, emphasizing how artificial intelligence facilitates the transition from tacit to explicit knowledge. Nonetheless, Rosales does not refer to integration with the organization's processes and offers few proposals for promoting culture in knowledge management.

The theoretical model presented by Belinski et al. (2019) establishes the relationship between culture, processes, and information technology, leading to adequate information management. However, the variables are managed individually without considering their relationship, how they are articulated, and their impact on knowledge maturity. This study seeks to evaluate the integration of these variables (culture, knowledge management processes, and IT infrastructure) for achieving the level of maturity in knowledge management required by organizations. Thus, the following hypothesis is proposed, **H4: Organizational culture, knowledge management processes, and information technologies are precursors to maturity in knowledge management.**

Method

For this study, the selected population was the group of analysts from the Criminal Analysis Center of the Directorate of Criminal Investigation and INTERPOL. These analysts are divided into four main areas that lead, supervise, and perform tasks related to data processing and analysis. Their work focuses on preparing reports on criminal actors, which serve as a basis for decision-making in both operational and strategic contexts.

A census sampling approach was chosen, which included 79 analysts. All of them are in the police's employ, encompassing different ranks such as officers, executive-level commanders, and patrol officers.

The analysts specialize in specific areas of analysis, such as citizen security, public safety, crime mapping, as well as support and management. However, due to the procedural nature of the study, it was not deemed necessary to identify these areas in detail, as the only relevant variable is the type of observed crime, which does not affect the report preparation process.

The research is correlational, with a non-experimental cross-sectional design. Data collection was conducted using a self-administered electronic survey. Data analysis was performed using empirical equations through SPSS software.

Data collection was carried out through the application of a questionnaire during March and April 2024. The questionnaire by Hsieh et al. (2009) was applied online using the Google Forms tool.

The study followed established ethical guidelines to ensure the confidentiality and informed consent of the participants. All participants were informed about the purpose of the study and were assured that their participation was voluntary and that the collected data would be handled confidentially.

Data analysis was performed using empirical equations through the SPSS software. Appropriate statistical techniques were employed to evaluate the relationships between the variables and to derive meaningful conclusions from the collected data.

The materials used included the questionnaire based on the study by Hsieh et al. (2009), administered through Google Forms. The equipment used were computers and data analysis software (SPSS).

Measures

Organizational Culture (PromOC)

The variable PromOC was introduced into the model as an independent variable. Indicators related to aspects such as discussions held, mechanisms for knowledge sharing, and the promotion of knowledge management were considered for its measurement. Additionally, business cases justifying knowledge management activities, the implementation of formal programs for knowledge socialization, and lessons learned were evaluated. The continuity of knowledge management actions and their alignment with organizational strategy were also analyzed. A Likert scale from 1 to 5 was used to assess each of these indicators.

Knowledge Management Process (PromKM)

The PromKM variable was incorporated into the model as a key independent variable. Indicators included the availability of a specific budget for knowledge management-related activities, the effectiveness of measurement mechanisms, and the ability to link knowledge management to organizational performance.

Technology Infrastructure (PromIT)

The PromIT variable was incorporated into the model as a fundamental independent variable. Indicators identified mechanisms to leverage both internal and external knowledge, the implementation of pilot projects to test new ideas and approaches, and the effective collection of relevant knowledge. A Likert scale from 1 to 5 was used, based on the study by Hsieh et al. (2009).

Knowledge Management Maturity (PromKMMat)

The PromKMMat variable was introduced into the model as a dependent variable. Indicators considered the formality of knowledge management within the organization, the implementation of knowledge management principles, the development of knowledge management activities, and the systems implemented to ensure their effectiveness and compliance. The adaptation and reorganization of knowledge management processes, and their integration into the organization's daily activities were also evaluated. The evaluation was based on the study by Hsieh et al. (2009), using a Likert scale from 1 to 5.

Data analysis and results

In order to estimate the PromKMmat variable, information from the independent variables PromIT, PromKM, and PromOC was obtained. For this purpose, the following linear model was proposed:

$$PromKMmat = \beta 0 + \beta 1 PromIT + \beta 2 PromKM + \beta 3 PromOc + \varepsilon$$

Where,

- $\beta 0$ is the constant or intercept.
- $\beta 1$, $\beta 2$ and $\beta 3$ are the coefficients for PromOC, PromKM, and PromIT, respectively.
- PromOC, PromKM, and PromIT are the independent variables representing Organizational Culture, Knowledge Management, and Information Technology.
- ε is the term for error.

To estimate properly, it was necessary to validate some assumptions such as the collinearity assumption, which implies that none of the independent variables are related to each other. To achieve this, collinearity statistics were calculated, such as tolerance, which should be greater than 0.20, and the variance inflation factor (VIF), which should not exceed three or be considered acceptable up to 5. The results of the present study are shown in Table 2, with VIF values less than 3 and tolerance values greater than 0.20.

Another aspect to highlight in regression analyses is a demonstration that the model is well explained by the independent variables. For this purpose, the adjusted correlation coefficient—adjusted R-squared—was used, in this case with a value of 0.700, indicating that changes in the dependent variable PromKMmat are explained by the independent variables to 70.00 %, implying a high correlation coefficient of 0.844. These results are visualized in Table 1 where, in addition, another assumption is verified: that the residuals are not correlated, meaning they are independent. In this case, the Durbin-Watson indicator is used, which should be around 2 (1.5-2.5).

Table 1. | Model Summary [b]

Model	R	R-squared	Adjusted R-squared	Standard error of the estimate	Durbin-Watson
1	.844[a]	.712	.700	.36232	2.144
a. *Predictors: (Constant). PromIT. PromKM. PromOC*					
b. *Dependent variable: PromKMmat*					

Note: Model Summary.

In Table 2, the unstandardized coefficients with their respective statistical significance are observed. It is noted that the variables are statistically significant at 95 %, except for PromKM, whose Sig. value was slightly higher at 0.052. It needn't be removed given its proximity to the cutoff point, and therefore, it is retained in the model. Regarding the standardized values, they are important for identifying which variable has the greatest influence. In the table, it is observed that PromOC is the variable with the greatest impact with a value of 0.534, followed by PromIT with a coefficient of 0.251. It is important to mention that all coefficients are positive, indicating a direct relationship between the independent variables and PromKMmat.

It is useful to apply the Bootstrap technique to confirm the previously presented results and thus confirm the reliability of the findings.

In Table 3, the results of the sampling simulation are shown where the beta coefficients coincide with those already presented. The "bias" column indicates the degree of variability of the 1000 coefficients calculated with the bootstrap, which used a selection of 1000 samples. Very low biases were found, with values of -0.003, 0.002, and -0.001. This indicates that the changes in the different samples were similar; it follows, therefore, that the coefficients are credible.

Table 2. | Regression Coefficients [a] and Collinearity Statistics

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
		B	Dev. Error	Beta			Tolerance	VIF
1	(Constant)	.653	.192		3.409	.001		
	PromOC	.500	.082	.534	6.065	.000	.490	2.042
	PromKM	.138	.070	.165	1.976	.052	.542	1.844
	PromIT	.228	.079	.251	2.883	.005	.501	1.998
a. Dependent variable: PromKMmat								

Note: In the table. the unstandardized coefficients are observed along with their respective statistical significance.

Table 3. | Sampling Simulation for Coefficients

Model		B	Sampling simulation[a]				
			Bias	Dev. Error	Sig. (two-tailed)	Confidence interval 95 %	
						Lower	Upper
11	(Constant)	.653	.011	.239	.005	.259	1.186
	PromOC	.500	-.003	.081	.001	.331	.644
	PromKM	.138	.002	.073	.057	-.006	.275
	PromIT	.228	-.001	.083	.008	.075	.398
a. Unless otherwise stated. the results of the sampling simulation are based on 1000 samples of simulation.							

Note: The results of the sampling simulation are shown in Table 3.

The residuals are crucial for determining the relevance of the model. In this instance, it is observed that the residuals range from -0.621 to 0.809, which are values indicating that no outliers were present since they fall within the suggested range of -3 to 3. This is evident in Table 4. However, the main assumption in regression analysis is that the distribution of residuals behaves approximately normally.

To test the shape of the residuals, Figure 1 is presented with a histogram. An approximately normal distribution is observable, confirming the assumption. This was further verified by calculating the Smirnov-Kolmogorov value which, at a value greater than 0.05, confirms this hypothesis and regression analysis.

All of the above allows us to confirm that the model is statistically suitable and that the final model is:

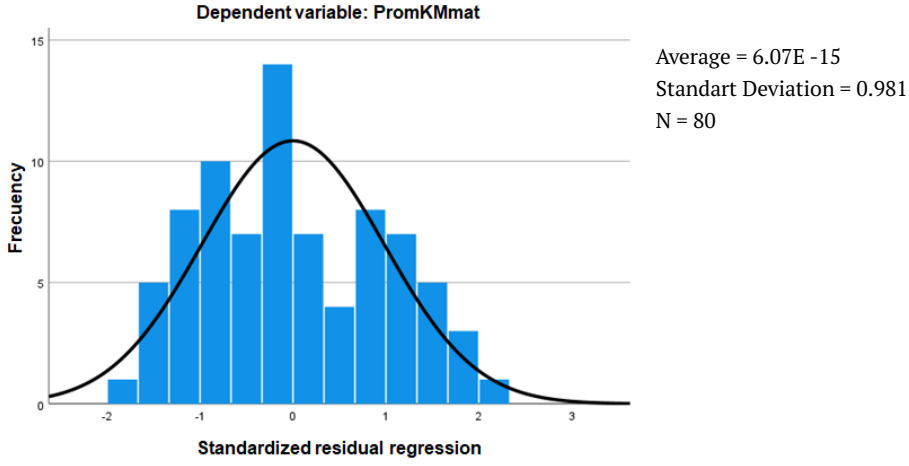
$$PromKMmat = 0.653 + 0.500\ PromIT + 0.138\ PromKM + 0.228\ PromOC$$

Table 4. | Residual Statistics [a]

	Minimum	Maximum	Mean	Deviation	N
Predicted value	1.5187	4.1709	3.1688	.55842	80
Residual	-62124	.80928	.00000	.35538	80
Dev. from predicted value	-2.955	1.795	.000	1.000	80
Dev. residual	-1.715	2.234	.000	.981	80
a. Dependent variable: PromKMmat					

Note: Waste behavior.

Figure 1.| Residuals histogram



Note: Figure 1 shows the verification of the shape of the waste.

In regards to correlations, Spearman's correlation was chosen since the variables under review do not follow a normal distribution (Kolmogorov-Smirnov < 0.05).

Table 5 displays the different coefficients, as well as any found biases and deviations from once again using the Bootstrap technique. It was found that the dependent variable PromKMmat is statistically related at a 95 % confidence level to all independent variables; thus, it is clear that they can be used to estimate the dependent variable. Additionally, minimal biases were found in all

cases among the 1000 samples. Lastly, the table shows the range within which the coefficient lies; for example, the correlation coefficient between PromKMmat and PromOC was 0.768, falling between 0.641 and 0.844 with a 95 % confidence level. A similar situation is observed for the other independent variables.

The other values represent the relationships between the different independent variables.

Table 5. | Spearman Correlations

				Prom OC	Prom KM	Prom IT	Prom KMmat
PromOC	Correlation coefficient			1.000	.566**	.577**	.768**
	Sig. (two-tailed)				0.000	0.000	0.000
	N			80	80	80	80
	Sampling simulation[c]	Bias		0.000	-0.004	-0.006	-0.005
		Standard error		0.000	0.086	0.084	0.044
		Confidence interval 95 %	Lower	1.000	0.391	0.394	0.671
			Upper	1.000	0.729	0.721	0.844
PromKM	Correlation coefficient			.566**	1.000	.545**	.623**
	Sig. (two-tailed)			0.000		0.000	0.000
	N			80	80	80	80
	Sampling simulation[c]	Bias		-0.004	0.000	-0.008	-0.006
		Standard error		0.086	0.000	0.101	0.085
		Confidence interval 95 %	Lower	0.391	1.000	0.330	0.440
			Upper	0.729	1.000	0.709	0.777
PromIT	Correlation coefficient			.577**	.545**	1.000	.595**
	Sig. (two-tailed)			0.000	0.000		0.000
	N			80	80	80	80
	Sampling simulation[c]	Bias		-0.006	-0.008	0.000	-0.007
		Standard error		0.084	0.101	0.000	0.089
		Confidence interval 95 %	Lower	0.394	0.330	1.000	0.387
			Upper	0.721	0.709	1.000	0.748
PromKMmat	Correlation coefficient			.768**	.623**	.595**	1.000
	Sig. (two-tailed)			0.000	0.000	0.000	
	N			80	80	80	80
	Sampling simulation[c]	Bias		-0.005	-0.006	-0.007	0.000
		Standard error		0.044	0.085	0.089	0.000
		Confidence interval 95 %	Lower	0.671	0.440	0.387	1.000
			Upper	0.844	0.777	0.748	1.000
** The correlation is significant at the 0.01 level (two-tailed).							
c. Unless otherwise stated. the results of the sampling simulation are based on 1000 samples of simulation sampling.							

Note: Table 5 shows the different coefficients. as well as any found biases and deviations.

Discussion

For hypothesis 1, the regression results show that the organizational culture variable (PromOC) has a significant regression coefficient ($\beta = 0.500$, $p < 0.001$), indicating a positive relationship between organizational culture and knowledge management maturity level. This finding supports the hypothesis that organizational culture influences the level of maturity in knowledge management.

Furthermore, organizational culture emerges as the most influential antecedent of knowledge management maturity level, with a significantly high standardized coefficient (Beta = 0.534). This suggests that cultural aspects within an organization, such as its shared values, norms, and beliefs, play a crucial role in the development and effective implementation of knowledge management processes.

These results are aligned with previous research that has found a positive relationship between organizational culture and knowledge management. For example, according to Nonaka et al. (1995), "Organizational Culture influences how knowledge is created, shared, and used within an organization" (Nonaka et al., 1995). Our findings coincide with this perspective, demonstrating that a strong organizational culture can be a significant predictor of knowledge management maturity level.

The results also align with the study conducted by Steinwachs (1999), where positive and receptive organizational culture that fosters trust, communication, and collaboration encourages continuous learning and, therefore, knowledge management, seeking to address what Datta (2007) indicated in calling for further research into which aspects of organizational culture affect knowledge management processes. This affirms that organizational culture facilitates or hinders the maturity of a knowledge management system and knowledge creation (Ciganke et al., 2008).

Considering organizational culture from the perspective of particular values and beliefs, Albers (2009) highlights within the scope of criminal analysis that the results evidenced in their study reinforce the importance of organizational culture in generating trust and its crucial role in information exchange (Lotti Oliva, 2014). An organizational culture that fosters trust and openness will facilitate the adoption of effective knowledge management practices.

The importance of organizational culture as a predictor of success in knowledge management has been highlighted by several researchers. Among them is Schein, who indicates that "Organizational Culture determines how things are done and how learning takes place in an organization, which in turn influences the effectiveness of Knowledge Management" (1990, p.110).

If we look at the study by Jacks et al. (2012), where a meta-analysis of different research related to organizational culture and knowledge management is conducted, it is demonstrated that within the context of criminal analysis, culture plays a fundamental role, thus reinforcing the assertion that culture can have a strong connection to knowledge management (Alavi et al., 2005; Kappos & Rivard 2008).

These findings have important implications for leaders and managers of organizations. They suggest that to improve the level of maturity in knowledge management it is essential to pay attention to organizational Culture and foster an environment that promotes collaboration, knowledge sharing, and innovation. This can be achieved through initiatives such as creating organizational values oriented towards learning, establishing open communication processes, and recognizing the importance of tacit and explicit knowledge.

For hypothesis 2, the results of this study demonstrate that knowledge management processes are precursors to the maturity level of knowledge management. In this sense, and in line with the theses of Lotti Oliva (2014) and Nonaka et al. (1995), the maturity level is addressed from a holistic perspective by integrating the three evaluated variables: PromOC, PromIT, and PromKM.

Additionally, the results reveal that knowledge management processes (PromKM) have a positive and significant impact (0.138) on knowledge management maturity (PromKMmat).

This finding coincides with the perspective of various previous studies that have highlighted the importance of structured processes for knowledge exchange, creation, and application within organizations (Alavi & Leidner, 2001). Likewise, authors like Wiig (1997) argue that effective knowledge management requires well-defined processes that allow for the identification, sharing, and effective use of knowledge throughout the organization.

In this sense, our results reinforce the idea that adequate attention to knowledge management processes can lead to a higher level of maturity in this area within an organization.

However, there is a shared concern regarding the results of this study and the meta-analysis conducted by Jacks et al. (2012). The results reflect an imbalance in the focus on knowledge management processes, to the detriment of storage and application processes, even while prioritizing knowledge transfer. In this regard, not all knowledge management processes are fully addressed, as emphasis is placed on some more than others.

Although our study revealed that the independent variable "processes" (PromKM) is not the most significant

in contributing to the maturity level of knowledge management, as indicated by Hsieh et al., it does play a crucial role in design, implementation, and management, thereby laying the foundation for a mature approach.

In this context, and in line with this imbalanced view of knowledge management processes, it is suggested that the incorporation of technology be prioritized to strengthen the other processes, and that culture be considered a cross-cutting aspect of the processes, rather than as a mere reinforcer of knowledge transfer.

This aligns with Martínez-Musiño's (2010) thesis, which highlights that criminal information production arises from data processing. This data must be stored in a way that is available for the generation of new knowledge.

For hypothesis 3, the study's findings align with the thesis of Nonaka et al. (1995), who has described IT as a facilitator of knowledge management, and not merely a supporter of it; in this sense, the findings also support IT implementation and execution.

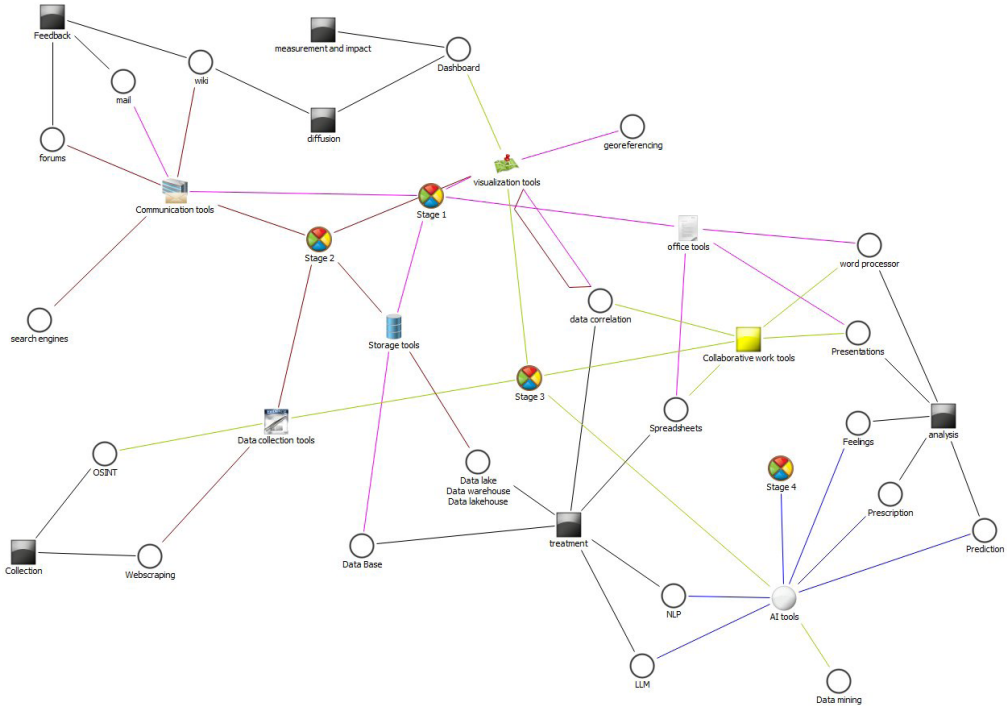
It is considered that the result is linked to the maturity level of the Criminal Analysis Center and the interest of the members in the specific variable studied. This approach aligns with what Hsieh et al. (2009) have pointed out in relating the results of maturity levels and their diversity to obstacles in knowledge flows. Additionally, they indicate that these obstacles vary depending on the stage of the analyzed group.

Following Gottschalk's (2006) proposal, the study allows us to indicate that Information Technologies (IT) function as a key driver in all maturity stages of Knowledge Management (KM). This indicates that IT's importance transcends any specific phase of the knowledge management process.

Being a crucial driver in the maturity stages of knowledge management, as demonstrated in this study through the weight assigned to PromIT in the maturity equation, it is essential that the information technologies driving this maturity incorporate Artificial Intelligence in big data processing. This is in line with what Zhao et al. (2022) pointed out, with the aim of enhancing competitiveness and improving effectiveness in knowledge management.

Following Gottschalk's (2006) proposal regarding the classification of the contribution of Information Technologies to knowledge management, it is suggested to establish four stages or phases to measure the level of maturity of IT in the knowledge management of the Criminal Analysis Center.

Figure 2. | IT maturity level stages of knowledge management correlated with phases of criminal analysis



Note: The graph shows the correlation of IT maturity level stages of knowledge management with phases of criminal analysis.

Figure 2 illustrates the correlation between the different stages of maturity levels of Information Technologies in knowledge management. It proposes specific tools associated with each stage in alignment with the phases of criminal analysis: collection, processing, analysis, dissemination, measurement and impact, and feedback. Below are the most relevant aspects of these correlated components.

Stage 1 indicates that technologies aimed at knowledge management are basic. Although they allow for the development of criminal analysis products, they present several difficulties. This creates opportunities for improvement, especially in historical data retrieval, processing, and visualization. These limitations mainly impact timeliness.

The basic tools associated with this stage contribute to the criminal analysis cycle in the phases of processing, analysis, dissemination, measurement and impact, and feedback, as described below:

Databases: whether structured or unstructured, databases are centralized repositories where information and data are stored. These serve as historical inputs for the preparation of criminal analysis products.

Office tools: word processors, spreadsheets, and presentation tools are applications that facilitate data processing, including organization and classification. Additionally, they allow for information visualization according to the needs of the end-user. These tools record essential information elements: who, what, how, when, where, why, and for what purpose, in relation to the analyzed event.

Data correlation: these tools are indispensable for an analyst applying criminal analysis techniques, particularly to case analysis, comparative case, and communications analysis. They validate connections between the entities analyzed, whether between individuals, individuals and criminal organizations, or individuals and assets, among others.

Correlation is important in the context of security, particularly within the framework of criminal analysis, because it facilitates the development of analytical techniques such as those established in the "Manual Único de Policía Judicial" (Single Judicial Police Manual), including comparative case analysis and telephone communications analysis (Fiscalía General de la Nación, n.d., p. 38).

This can be evidenced by the systematic review conducted by Heerde and Hemphill on the associations between the perpetration of physically violent behaviors and property offenses, victimization, and the use of hallucinogenic substances among homeless youth. In their review, they compile and evaluate evidence from published studies, concluding that "physically violent behaviors or property offenses perpetrated, physical or property victimization experienced, and substance use may be associated through shared risk factors related to the situational context of homelessness" (2014, p. 585-592).

Georeferencing: allows for the location of geographical coordinates on a map, used to visualize events or objects of interest, as well as to detect focal zones (hot spots).

Stage 2 indicates that technologies aimed at knowledge management have an intermediate contribution. Here, there is already a clear interest in generating basic interoperability of information sources that are key for conducting criminal analysis. At this level, there is a focus on data quality processes, strengthening source collection, and improving communication to ensure more precise and timely data and information for analysts. The following tools are presented along with their functions:

Data lake, data warehouse, data lakehouse: these are big data storage platforms used to centralize both structured and unstructured data in a single repository. They also incorporate Extraction, Transformation, and Loading (ETL) or Extraction, Loading, and Transformation (ELT) processes to address specific needs or improve the quality of the data before delivering them to other systems for analysis and exploitation.

Webscraping: these are robot-like tools used to gather data in batches. This task is fundamental to criminal analysis when there is a large number of targets or it is anticipated that the obtained information will be extensive, and when manual processing would affect response speed.

Data correlation: new functionalities from graph theory are incorporated, aspects such as centrality, pattern detection, timelines, and sequences become factors that contribute to the detection of aspects of interest that are difficult for humans to detect.

Wiki, forums, and search engines: these are tools that facilitate collaborative creation, editing, linking, and organization of knowledge. Additionally, they allow users to keep the content updated and establish discussion threads to share best practices and experiences. They also offer search engines that help analysts easily retrieve historical products.

Stage 3 indicates that technologies aimed at knowledge management have a superior contribution. Here, the incorporation of artificial intelligence subcomponents to process and analyze the data can be evidenced, as presented below:

OSINT: although criminal analysis is primarily based on information obtained from investigative processes

(criminal data), it is equally important to consider publicly available information through open-source intelligence.

Business Intelligence: new forms of data visualization (descriptive analysis) are incorporated, containing more dynamic and automatic methods such as dashboards linked to databases or centralized repositories from stages 1 and 2.

Data and text mining: allows for structuring and identifying common patterns in the data through supervised and unsupervised algorithms. In this phase, analytics and artificial intelligence are introduced into criminal analysis, addressing concepts such as pattern clustering and density. These analyses facilitate the generation of ideas, recommendations, and considerations in criminal analysis products.

Collaborative tools: the construction of analysis products is sometimes translated into an exercise that must be carried out by various officials, a situation that complicates the delivery of the final product. Therefore, the incorporation of collaborative office tools allows for reducing response times and making real-time contributions.

Stage 4 indicates that knowledge management technologies offer an advanced level of contribution. These leverage the capabilities of artificial intelligence for data processing and analysis, also incorporating generative artificial intelligence as support tools for the analyst. Some minimal technologies at this level are presented below:

Natural Language Processing (NLP): tools are incorporated that, articulated with Long Language Models (LLM), understand the analyst's questions associated with specific contexts through training and machine learning models. The application of these tools allows for building or reconstructing criminal analysis products based on historical sources, enhancing response times, effectiveness, and decision-making.

Predictions and prescriptions: allow for generating future scenarios. These tools will facilitate end-users to make decisions that can modify trends, generate criminal disruption, better understand the dynamics of the criminal actor, among others.

Hypothesis 4 suggests that organizational culture, knowledge management processes, and information technologies are precursors to knowledge management maturity.

The results of our study support this hypothesis by showing that all independent variables (organizational culture, knowledge management, and information technology) have significant coefficients in the regression model. This implies that each of these variables positively influences knowledge management maturity in the organization.

A deeper understanding of how organizational culture, knowledge management processes, and information technologies interact can lead to more effective optimization of knowledge management in an organization. In other words, the organization could focus on developing a culture that values learning and innovation while implementing processes and technologies that facilitate the capture and distribution of knowledge.

We also find that the standardized coefficients in the regression model show the relative importance of each independent variable in predicting knowledge management maturity. The highest coefficient corresponds to the organizational culture variable, suggesting that it has the greatest influence on knowledge management maturity.

This is aligned with what Schein (1993) described. It is imperative to develop an organizational culture that fosters trust, collaboration, communication, continuous learning, and knowledge transfer, which in turn will enable effective knowledge management practices and enhance its maturation.

Conversely, an organizational culture that lacks these aspects and promotes competition will become a hindrance to the progress of knowledge management maturity. Resistance to change, lack of transparency, and reluctance to share knowledge are cultural factors that can hinder the effective implementation of knowledge management practices (Ngosi et al., 2011).

The results of the study have important implications for managerial practice by identifying organizational culture, knowledge management processes, and information technologies as precursors to knowledge management maturity. Organizations can focus their efforts on developing and strengthening these aspects. This could lead to greater efficiency, innovation, and competitiveness in the market.

The proposal to integrate knowledge management processes, culture, and information technologies at the Criminal Analysis Center is based on the info-knowledge model developed by Alba (2020), which has an evolutionary process with a conception of data, information, and knowledge that maintains a relationship at the level of processes and technology with knowledge management maturity.

Additionally, as seen in Figure 3, the proposal to integrate culture is original to this study, thus providing an environment that allows for the creation, utilization, and exchange of knowledge within the organization, and the fostering of the leadership and trust that allow for the strengthening of knowledge management, as well

as its effective application and consequent maturity. At each point on the info-knowledge spiral, actions of organizational culture can be ensured for each information management and knowledge management process.

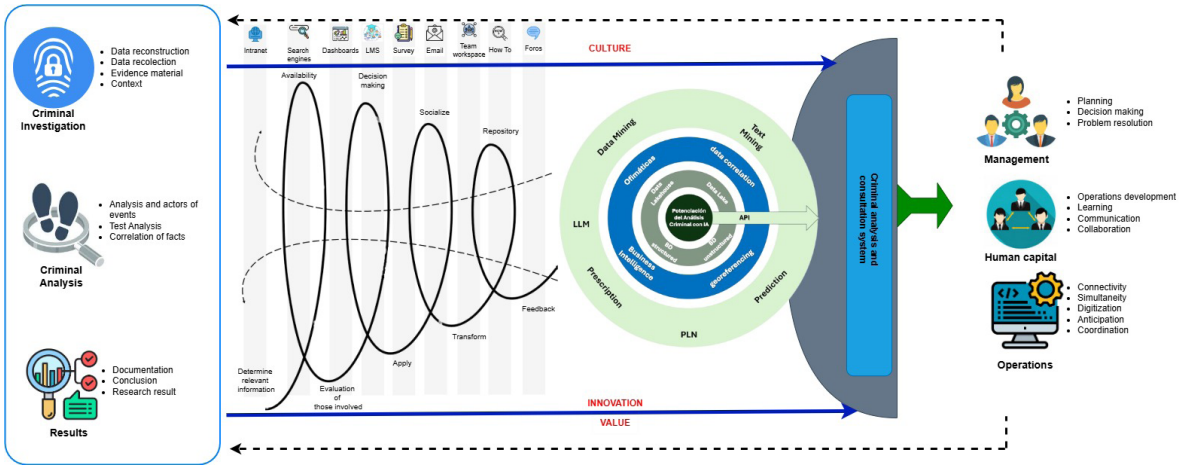
All of this considers a practical approach that seeks to leverage data storage and processing technologies for the construction and management of knowledge, achieving results in three fundamental areas of criminal analysis: management, human capital, and operations.

In this approach, the aim is to present a holistic model that articulates the processes of info-knowledge with a focus on criminal analysis, considering a systemic approach of inputs, processes, technologies, outputs, and feedback, as well as cross-cutting aspects that are considered key to effective operation. The movement of the concentric disk containing the technological tools from its core to its outermost part is what drives the model, serving as a lever for all phases of knowledge management processes in alignment with the requirements of the spiral identified in each cycle.

The integrity of the model is based on an information systems approach, where the first stage (before the spiral) constitutes the input, the spiral and the tools are the means of processing information and carrying out the knowledge conversion processes, and the outputs are presented in three forms (management, human capital, operations). For this purpose, the end of the spiral is the key aspect of info-knowledge generation, relying on tools and technological processes, mainly associated with Artificial Intelligence (data mining, text mining, Natural Language Processing); these interact cyclically on a single platform (empowerment of criminal analysis for investigation) with multiple outputs, through which value is added in the next stage. For the implementation of this conception, an interaction map has been developed showing the IT and organizational culture tools that should be applied to each info-knowledge process.

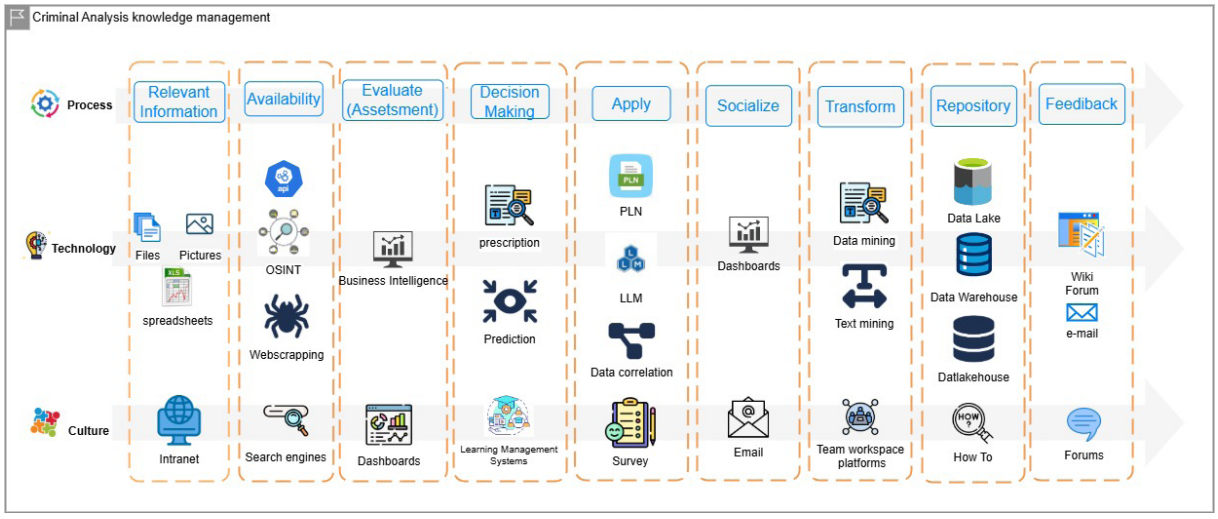
This implementation is aligned with data processing to provide technical validity to the model and enable the use of various integrated technologies that facilitate knowledge management across all the previously described processes. It is important to specify that each technology is aligned with a phase of maturity level, and it is also noted that the order in which the tools associated with processes and culture are indicated does not necessarily have to be presented in that order in practice.

Figure 3. | Info-knowledge management model for criminal analysis



Note: The figure illustrates the information management model constructed for criminal analysis.

Figure 4. | Interaction map of the variables PromOC, PromIT, PromKm in knowledge management of criminal analysis



Note: The figure shows the IT tools for each stage of info-knowledge management.

Conclusions

The research findings clearly demonstrate the significant influence of organizational culture on the level of maturity in knowledge management. The observed positive relationship underscores not only the relevance but also the critical need to integrate robust cultural aspects into the development of knowledge processes. These results are in line with previous studies that have highlighted how organizational culture facilitates and enhances the creation and utilization of knowledge within organizations.

On the other hand, it has been confirmed that knowledge management processes act as essential precursors to the maturity level in knowledge management. Their positive and significant impact evidences the importance of having structured and well-defined processes for the exchange, creation, and application of knowledge within organizations. Despite detecting an imbalance in the focus on certain processes, the need to prioritize the incorporation of advanced technologies to strengthen and balance all knowledge management processes is highlighted. This includes the implementation of emerging technologies and artificial intelligence systems that can provide significant competitive advantages.

Additionally, it is confirmed that information technologies are critical facilitators of knowledge management. Their role as drivers of all stages of maturity underscores the importance of effective and strategic implementation. The adoption of advanced technologies, such as artificial intelligence for processing large volumes of data, is recommended to improve competitiveness and efficiency in knowledge management. These technologies not only facilitate the collection and analysis of data but also optimize decision-making and innovation within the organization.

The results of this study support that all the independent variables considered positively influence the maturity of knowledge management within the organization, highlighting the relative importance of each in predicting this maturity and thereby confirming the hypotheses posed. Among these variables, organizational culture stands out as the most influential factor, suggesting that knowledge management initiatives should focus on strengthening cultural elements to achieve higher levels of maturity.

Finally, the info-knowledge model and the interaction map developed in this study demonstrate the harmonious integration of the independent variables to achieve maturity in knowledge management in the context of criminal analysis. This implies a close connection between organizational culture and the knowledge management cycle, as well as the strategic incorporation of artificial intelligence to support the management of these processes.

Conflict of interest

No conflict of interest was reported among the authors of this academic research. We declare that we have no

financial or personal relationships that could influence the interpretation and publication of the obtained results. Furthermore, we assure compliance with ethical standards and scientific integrity at all times in accordance with the guidelines established by the academic community and those set forth by this journal.

References

Alavi, M., Kayworth, T. R., & Leidner, D. E. (2005). An empirical examination of the influence of organizational culture on knowledge management practices. *Journal of Management Information Systems, 22*(3), 191-224.

Alavi, M., & Leidner, D. E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, 107-136.

Alba, M. (2020). *El infoconocimiento: una propuesta gerencial*. Universidad Externado.

Albers, J. A. (2009). A practical approach to implementing knowledge management. *Journal of Knowledge Management Practice*, *10*(1), 1-14.

Alghail, A., Yao, L., & Abbas, M. (2022). Will knowledge infrastructure capabilities elevate the project management maturity? An empirical study. *VINE Journal of Information and Knowledge Management Systems*, ahead-of-print(ahead-of-print). https://doi.org/10.1108/VJIKMS-12-2021-0289

Amaya, H., & Cortés, Y. (2014). *Gerenciamiento del análisis criminal en Colombia*. Programa Internacional de Entrenamiento en Investigación Criminal - ICITAP.

Arjonilla, S., & Medina, J. (2002). *La gestión de los sistemas de información en la empresa*. Pirámide Ediciones. https://books.google.com.co/books?id=a-SyAAAACAAJ

Belinski, R., Frederico, G. F., & others. (2019). Modelo teórico de avaliação da gestão da informação nos processos logísticos e de gestão da cadeia de suprimentos nas instituições federais de ensino superior brasileiras. *AtoZ: Novas Práticas Em Informação e Conhecimento*, *8*(1), 21-26.

Buheji, M., & Al-Zayer, J. (2010). *Developing a knowledge management maturity model towards government organisations competitiveness*. Proceedings of the 7th International Conference on Intellectual Capital, Knowledge Management and Organisational Learning, 2006, 68-78.

Ciganke, A. P., Mao, E., & Srite, M. (2008). Organizational culture for knowledge management systems: A study of corporate users. *International Journal of Knowledge Management (IJKM)*, *4*(1), 1-16.

Datta, P. (2007). An agent-mediated knowledge-in-motion model. *Journal of the Association for Information Systems*, *8*(5), 20.

Fillion, G., BootoEkionea, J.-P., & Plaisent, M. (2015). *Using the soft system methodology for designing an integrated and inter-firm knowledge management capabilities maturity model in health care organization*. The First International Conference on Multidisciplinary in Management.

Fiscalía General de la Nación. (s.f.). *Manual Único de Policía Judicial* (versión 2). Fiscalía General de la Nación. https://www.fiscalia.gov.co/colombia/wp-content/uploads/Manual-de-Policia-Judicial-Actualizado.pdf

Gartner, Inc. (2023). *La hoja de ruta de TI para la transformación digital empresarial*. https://www.gartner.es/es/tecnologia-de-la-informacion/tendencias/la-hoja-de-ruta-de-ti-para-la-transformacion-digital-empresarial

Gartner, Inc. (2023). *Manual de planificación de la IA generativa*. https://www.gartner.es/es/tecnologia-de-la-informacion/temas/estrategia-de-ia-para-la-empresa

Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems*, *18*(1), 185-214. https://doi.org/10.1080/07421222.2001.11045669

Gottschalk, P. (2006). Expert systems at stage IV of the knowledge management technology stage model: The case of police investigations. *Expert Systems with Applications*, *31*(3), 617-628.

Gupta, A. K., & Govindarajan, V. (2000). Knowledge management's social dimension: Lessons from Nucor Steel. *MIT Sloan Management Review*, *42*(1), 71.

Heerde, J. A., & Hemphill, S. A. (2014). A systematic review of associations between perpetration of physically violent behaviors and property offenses, victimization and use of substances among homeless youth. *Children and Youth Services Review*, *44*, 265-277.

Hsieh, P. J., Lin, B., & Lin, C. (2009). The construction and application of knowledge navigator model (KNMTM): An evaluation of knowledge management maturity. *Expert Systems with Applications*, *36*(2), 4087-4100.

Jacks, T., Wallace, S., & Nemati, H. (2012). Impact of culture on knowledge management: A meta-analysis and framework. *Journal of Global Information Technology Management*, *15*(4), 8-42.

Kappos, A., & Rivard, S. (2008). A three-perspective model of culture, information systems, and their development and use. *MIS Quarterly*, 601-634.

Lotti Oliva, F. (2014). Knowledge management barriers, practices and maturity model. *Journal of Knowledge Management*, *18*(6), 1053-1074.

Nonaka, I., o Nonaka, I., Ikujiro, N., Takeuchi, H., & others. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation* (vol. 105). OUP USA.

Marabelli, M., & Newell, S. (2019). Absorptive capacity and enterprise systems implementation: the role of prior-related knowledge. *ACM SIGMIS Database: The DATABASE for Advances in Information Systems*, *50*(2), 111-131.

Martínez-Musiño, C. (2010). El valor de la información, su administración y alcance en las organizaciones. *Revista Mexicana de Ciencias de la Información*, *1*(2), 10-20.

Ngosi, T., Helfert, M., & Braganza, A. (2011). Increasing knowledge management maturity in organisations: A capabilities-driven model. *Proceedings of the European Conference on Intellectual Capital*, 302-312.

Pinzón, N., & Roldán, A. (2023). *Diseño de un modelo para la gestión de conocimiento en el análisis criminal a través del text mining*. Universidad Externado de Colombia.

Romero-Artigas, D., Pascual-Miguel, F., & Agudo-Peregrina, Á. F. (2011). Intellectual capital management in SMEs and the management of organizational knowledge capabilities: An empirical analysis. In *World Summit on Knowledge Society* (pp. 121-128). Springer.

Rosales, R. P. (2023). Gestión del Conocimiento en las Organizaciones. *Revista EDUCARE-UPEL-IPB-Segunda Nueva Etapa 2.0*, 497-517.

Salcedo Vitola, F., Riveros Marentes, J. C., Cabañas, M. A., & Velázquez Espinoza, N. (2021). Estudio de caso aguardiente: aplicación del modelo de infoconocimiento. *Criterio Libre*, *18*(33), 69-90. https://dialnet.unirioja.es/servlet/articulo?codigo=8046533

Schein, E. (1990). *Organizational Culture. American Psychologist*. Fevereiro.

Schein, E. H. (1993). On dialogue, culture, and organizational learning. *Organizational Dynamics*, *22*(2), 40–52.

Scheepers, S. A., & Schultz, C. M. (2019). Organisational learning in Crime Intelligence: A qualitative review. *Journal of Contemporary Management*, *16*(2), 361-381.

Snowden, D. (2002). Complex acts of knowing: Paradox and descriptive self-awareness. *Journal of Knowledge Management*, *6*(2), 100-111.

Steinwachs, K. (1999). Information and culture-the impact of national culture on information processes. *Journal of Information Science*, *25*(3), 193-204.

Syrjä, J. M. (2019). *Providing explicit knowledge in an experience-driven culture: levels of professionalism in intelligence analysis and its role in the law enforcement knowledge management apparatus*. University of Portsmouth.

Villasana Arreguín, L. M., Hernández García, P., & Ramírez Flores, É. (2021). La gestión del conocimiento, pasado, presente y futuro. *Una revisión de la literatura. Trascender, contabilidad y gestión*, *6*(18), 53-72.

Wibowo, M. A., & Waluyo, R. (2015). Knowledge Management Maturity in Construction Companies. *Procedia Engineering, 125*, 89-94. https://doi.org/10.1016/j.proeng.2015.11.014

Wiig, K. M. (1997). Knowledge management: an introduction and perspective. *Journal of Knowledge Management*, *1*(1), 6-14.

Zhao, Y., Wen, S., Zhou, T., Liu, W., Yu, H., & Xu, H. (2022). Development and innovation of enterprise knowledge management strategies using big data neural networks technology. *Journal of Innovation & Knowledge*, *7*(4), 100273. https://doi.org/10.1016/j.jik.2022.100273