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IMPACT OF KNOWLEDGE MANAGEMENT AND INTELLECTUAL CAPITAL ON ORGANIZATIONAL PERFORMANCE IN CONSTRUCTION SME

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ABSTRACT

Objective: This paper explores the relationship between intellectual capital and knowledge management in construction companies and how they impact organisational performance.

Theoretical Framework: The construction industry is characterized by a unique set of challenges related to knowledge management and intellectual capital. Project-based work is a dominant feature, necessitating robust knowledge sharing among stakeholders.

Method: This article employs a statistical approach to examine the variables under investigation through a Structural Equation Modelling (SEM). The hypothesis proposed was tested using this methodology. Data were collected via a questionnaire administered to 88 individuals occupying managerial roles in small and medium-sized enterprises (SMEs) operating within the construction industry.

Results and Discussion: The study concludes that intellectual capital and knowledge management have a significant positive impact on the performance of construction companies and recommends that these concepts be integrated into the management practices of construction companies.

Research Implications: Correct combination by companies in the construction sector of the constructs intellectual capital and knowledge management can create dynamics that significantly improve the performance of the organisations from the construction sector.

Originality/Value: Construction companies, like any other businesses, can benefit from effective knowledge management and the efficient use of intellectual capital to increase their competitiveness and long-term success.

Keywords: intellectual capital, knowledge management, construction companies, organisational performance, SME, strategic partnerships.

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IMPACTO DA GESTÃO DO CONHECIMENTO E DO CAPITAL INTELECTUAL NO DESEMPENHO ORGANIZACIONAL EM PME DA CONSTRUÇÃO

RESUMO

Objetivo: Este artigo explora a relação entre capital intelectual e gestão do conhecimento em empresas de construção e como eles impactam o desempenho organizacional.

Estrutura teórica: O setor de construção é caracterizado por um conjunto único de desafios relacionados à gestão do conhecimento e capital intelectual. O trabalho baseado em projetos é uma característica dominante, necessitando de compartilhamento robusto de conhecimento entre as partes interessadas.

Método: Este artigo emprega uma abordagem estatística para examinar as variáveis sob investigação por meio de uma Modelagem de Equações Estruturais (SEM). A hipótese proposta foi testada usando esta metodologia. Os dados foram coletados por meio de um questionário administrado a 88 indivíduos que ocupam cargos gerenciais em pequenas e médias empresas (PMEs) que operam no setor de construção.

Resultados e discussão: O estudo conclui que o capital intelectual e a gestão do conhecimento têm um impacto positivo significativo no desempenho das empresas de construção e recomenda que esses conceitos sejam integrados às práticas de gestão das empresas de construção.

Implicações da pesquisa: A combinação correta por empresas do setor de construção dos construtos capital intelectual e gestão do conhecimento pode criar dinâmicas que melhoram significativamente o desempenho das organizações do setor de construção.

Originalidade/Valor: Empresas de construção, como quaisquer outros negócios, podem se beneficiar de uma gestão de conhecimento eficaz e do uso eficiente de capital intelectual para aumentar sua competitividade e sucesso a longo prazo.

Palavras-chave: capital intelectual, gestão de conhecimento, empresas de construção, desempenho organizacional, SME, parcerias estratégicas.

IMPACTO DE LA GESTIÓN DEL CONOCIMIENTO Y DEL CAPITAL INTELECTUAL EN EL DESEMPEÑO ORGANIZACIONAL EN LAS PYMES DE LA CONSTRUCCIÓN

RESUMEN

Objetivo: Este artículo explora la relación entre el capital intelectual y la gestión del conocimiento en las empresas de construcción y cómo afectan el desempeño organizacional.

Marco teórico: La industria de la construcción se caracteriza por un conjunto único de desafíos relacionados con la gestión del conocimiento y el capital intelectual. El trabajo basado en proyectos es una característica dominante, que requiere un intercambio sólido de conocimientos entre las partes interesadas.

Método: Este artículo emplea un enfoque estadístico para examinar las variables en investigación a través de un modelo de ecuaciones estructurales (SEM). La hipótesis propuesta se puso a prueba utilizando esta metodología. Los datos se recopilaron a través de un cuestionario administrado a 88 personas que ocupan puestos directivos en pequeñas y medianas empresas (PYME) que operan dentro de la industria de la construcción.

Resultados y discusión: El estudio concluye que el capital intelectual y la gestión del conocimiento tienen un impacto positivo significativo en el desempeño de las empresas de construcción y recomienda que estos conceptos se integren en las prácticas de gestión de las empresas de construcción.

Implicaciones de la investigación: La combinación correcta por parte de las empresas del sector de la construcción de los constructos capital intelectual y gestión del conocimiento puede crear dinámicas que mejoren significativamente el desempeño de las organizaciones del sector de la construcción.

Originalidad/Valor: Las empresas constructoras, como cualquier otro negocio, pueden beneficiarse de una gestión eficaz del conocimiento y del uso eficiente del capital intelectual para aumentar su competitividad y su éxito a largo plazo.

Palabras clave: capital intelectual, gestión del conocimiento, empresas constructoras, desempeño organizacional, PYMES, alianzas estratégicas.

1 INTRODUCTION

The construction industry, a pillar of the global economy, hosts a myriad of stakeholders, including contractors, sub-contractors, architects, engineers, suppliers, and clients. Its intricate projects necessitate extensive coordination among diverse participants, making it a complex web of interactions. This multifaceted industry is not only highly regulated but also rife with risks and uncertainties, requiring companies to manage resources astutely for sustained competitiveness and long-term success.

Intellectual capital represents the intangible assets that elude traditional financial statements. It encompasses the collective wisdom, skills, experience, and expertise of a company, along with intangibles like relationships, organisational culture, brand, and reputation (Edvinsson and Malone, 1997). Intellectual property, such as patents, trademarks, and copyrights, is also part of this dynamic mix. In the realm of construction companies, intellectual capital takes the form of the knowledge, skills, and experience of employees, the reputation of the company, and its ability to innovate solutions to construction challenges.

Knowledge management, as elucidated by Alavi and Leidner (2001), is the orchestrated process of creating, sharing, using, and managing an organisation's knowledge and information. Its effective implementation fosters innovation, encourages knowledge dissemination, and enhances collaboration. In construction companies, where projects are often intricate and multifaceted, knowledge management becomes pivotal. It

ensures that the right knowledge and information are accessible to the right people at the right time, thereby optimizing project performance (Tezel and Koskela, 2017).

The construction industry is characterized by a unique set of challenges related to knowledge management and intellectual capital. Project-based work is a dominant feature, necessitating robust knowledge sharing among stakeholders. Furthermore, the sector grapples with significant uncertainties and risks that can obstruct effective intellectual capital management. Thus, the strategic deployment of knowledge management practices and the judicious use of intellectual capital emerge as critical success factors for construction companies (Agyekum *et al*., 2020).

As the industry undergoes transformations driven by technological advancements, sustainability imperatives, and changing client expectations, the role of intellectual capital and knowledge management becomes even more pronounced. Companies must not only manage their tangible and intangible assets effectively but also adapt to evolving industry paradigms. The ability to innovate, foster a learning culture, and leverage intellectual capital for strategic advantage becomes paramount in this dynamic landscape.

Moreover, the socio-economic landscape has witnessed a growing emphasis on sustainability and responsible business practices. Construction companies are increasingly evaluated not only on the basis of project completion but also on environmental impact, social responsibility, and ethical considerations. Intellectual capital, encompassing the human, relational, and structural aspects, plays a pivotal role in enabling companies to navigate this landscape successfully.

This paper investigates the crucial roles played by intellectual capital and knowledge management in the construction industry, due to the gap on literature regarding their intricate connections and profound impacts on organisational performance. In the following sections, we will delve deeper into the specific components of intellectual capital, explore how knowledge management is implemented in construction companies, and analyze their combined impact on organisational performance. By unraveling these intricate connections, we aim to provide valuable insights for practitioners, researchers, and policymakers in the construction industry.

2 LITERATURE REVIEW

Construction companies are knowledge-intensive organisations that rely heavily on their intellectual capital to create value for their clients. Intellectual capital refers to the knowledge, skills, experience, expertise and relationships that are not reflected in a company's financial statements (Matos *et al*., 2020). The concept of intellectual capital has become increasingly important for construction companies as they face growing competition and pressure to deliver projects faster, better and cheaper.

In the construction industry, knowledge management has been recognized as a critical success factor for companies to remain competitive (Bhatti *et al*., 2011). Knowledge management is the process of creating, sharing, using and managing an organisation's knowledge and information (Alavi & Leidner, 2001; Mehralian *et al*., 2018). By effectively managing their knowledge, construction companies can improve their performance, reduce their costs and increase their innovation capabilities. Several studies have explored the relationship between intellectual capital and the performance of construction companies. Aminbakhsh *et al*. (2013) found that intellectual capital has a positive effect on the performance of construction companies. They found that companies that invest in their intellectual capital, such as their knowledge, skills and experience, are more likely to be successful in delivering projects on time and within budget.

Besides being dependent on the productive capacity of the employees, the productivity of an organisation is linked to the performance of the intellectual capital that, in turn, eases organisational performance (Ahangar, 2011). In this way, it becomes essential that SMEs become increasingly aware of the strategic asset that is knowledge management (Bhatti *et al*., 2011). Some organisations' underlying problem is the inability to apply knowledge management policies appropriate to their contexts and environments (Al Koliby *et al*., 2022). Authors like Mehralian *et al*. (2018) reiterate the importance of developing and investing in intellectual capital and knowledge management concepts from the very beginning of organisations' lives and throughout their time in business. Only in this way is it possible to positively impact organisational environments, thus improving the outlook for future generations of professionals (Pigola *et al*., 2022).

SMEs must proactively plan their social decisions if knowledge management is to have a significant impact on the relationship between intellectual capital and organisational performance (Archer-brown *et al*., 2018). In other words, because SMEs

are more prevalent in society, they are compelled to take these concerns seriously because the benefits they stand to gain are contingent upon their social involvement. Particularly noteworthy are the direct effects of strategic knowledge management on the relational capital, structural capital, and knowledge sharing components of intellectual capital (Heisig *et al*., 2016; Cabrilo *et al*., 2018; Oliveira *et al*., 2020).

Because of employees' ability to share information, knowledge management develops as an important role for the relationship between intellectual capital and organisational performance, where it starts to register a positive variation, increasing all operational dynamics of SMEs (Hussinki *et al*., 2016; Wang *et al*., 2015; Wang *et al*., 2016. Because knowledge management interacts both directly and indirectly with intellectual capital, it can have a favorable impact on organisational performance (Amjad *et al*., 2019). Later, by providing more unbiased data, the writers Bansal *et al*. (2022) bolstered the theory even further. They concluded that organisations with high levels of knowledge management and intellectual capital typically outperform their rivals.

Kianto *et al*., (2013) caution against making too much of an analysis. The author reminds us that although knowledge management has a role in the relationship between intellectual capital and organisational performance, effective policies for managing intellectual capital are necessary for the latter. That is to say, the likelihood of SMEs having a beneficial impact on their performance is significantly diminished if, as previously indicated, they do not make investments in the management of intellectual capital and do not modify their policies (Wang *et al*., 2016).

As well as depending on the production capacity of its workforce, an organisation's productivity is also influenced by the effectiveness of its intellectual capital, which improves organisational performance (Ahangar, 2011). Therefore, it is imperative that SMEs learn more about managing knowledge, the strategic asset (Bhatti *et al*., 2011). The fundamental problem for certain organisations is that they fail to implement knowledge management practices appropriate to their environments and circumstances. Scholars such as (Mehralian *et al*., 2018) stress the importance of creating and allocating resources for knowledge management and intellectual capital from the beginning of an organisation's existence and throughout its existence. It is only through this approach that organisational environments can be effectively affected, improving prospects for the next generations of professionals (Pigola *et al*., 2022). SMEs must proactively plan their social decisions so that knowledge management has a significant

impact on the relationship between intellectual capital and organisational performance (Archer-brown *et al*., 2018). In other words, since SMEs are more prevalent in society, they are obliged to take these concerns seriously, since the benefits they stand to gain depend on their social involvement. The direct effects of strategic knowledge management on the relational capital, structural capital and knowledge sharing components of intellectual capital stand out (Heisig *et al*., 2016), (Cabrilo *et al*., 2018) and (Oliveira *et al*., 2020).

In terms of knowledge management, Ling (2013) and Kianto *et al*. (2013) found that companies that have implemented knowledge management practices are more likely to have a competitive advantage. They found that companies that have a knowledge management culture, such as sharing knowledge between different projects and departments, are more likely to be successful in delivering projects on time and within budget. Similarly, Tezel and Koskela (2017) developed a knowledge management framework for project-based construction that emphasized the importance of knowledge sharing between different projects and departments.

Overall, the literature suggests that both intellectual capital and knowledge management are critical success factors for construction companies. Bassi and Buren (1999) highlight the necessity of organisations appropriately understanding the importance of intellectual capital in organisational performance. The correct planning and investment in these components ease the development of competitive advantage. The challenge resides in the organisations that, aside not knowing what offers them with the advance and growth, they do not grasp how and where to invest for this might happen. As such, and to overcome this recurring problem in businesses, Carriere (2009) underline the significance for organisations to state, in a clear fashion, what their medium-long term aims are. Put another way, by mandating that they invest in their employees' training, development, and career advancement, they will enable them to contribute intangible value to the company. But there's still another essential presumption: selecting the best candidates. It is essential that there be more investment made in this sector because of this. Promoting key organisational themes like vision, mission, and values will be made possible by these investments being consistent, and this will in turn encourage the promotion of organisational culture (Carriere, 2009).

The basis for the growth of the relationship between intellectual capital and organisational performance in SMEs is said to be organisational culture (Asiaei *et al*.,

2015). Certain intellectual capital categories, like relational and structural capital, can also grow as a result of this process. In other words, there is a two-way link between intellectual capital and organisational performance. Since effective leadership encourages and facilitates information exchange, the writers stress the significance of leadership in this interaction. supports this theory and adds human capital as a key component for enhancing organisational performance (Bhatti and Christofi, 2020). It is feasible to keep raising the performance of SMEs by properly using human capital in tandem with organisations' emotional intelligence (Li, 2021). Therefore, in order for this resource to have a major influence on organisations, investment structures that facilitate its development must be established (Chen and Zhu, 2020).

The relationship between knowledge management and organisational performance can also be mediated by the creation of intellectual capital (Daud *et al*., 2011). One of the most important components that SMEs may use to increase their performance is knowledge management. Considering the findings that Ling (2013) emphasizes in his research is another method to explain this outcome. Thus, (Agostini & Nosella, 2017) offer two approaches to accomplish this. Every organisation contains intellectual capital. But we may either think about it and make an investment in it or not. Here, organisations are split into two categories. In the first group, as a result of lack of investment intellectual capital is underutilized. The second one enhances organisational performance by taking into account investment and the upkeep of intellectual capital. Improvements in SMEs' internal organisation, which are directly related to their performance but not immediately to their financial success, are also advantageous in this regard (Jardon *et al*., 2014).

It is safer to state, therefore, that effective organisational planning contributes to improved performance through wise use of intellectual capital (Asiaei and Jusoh, 2017) and enables advancements toward organisational sustainability (Kopia, 2017). Other writers, like Han and Li (2015), highlight the significance of intellectual capital by highlighting the fact that an organisation's capacity to make timely and accurate decisions is based on its ability to see opportunities and risks. The productivity of SMEs can only be effectively increased in this manner, as it is a factor that directly affects how well organisations perform (Kengatharan, 2019).

3 THEORY AND HYPOTHESIS

Over the years, several theories have been developed where the constructs of intellectual capital and knowledge management come together for the benefit of organisations. Thus, the most relevant theories for this research are in one hand the Resource-Based View Theory that states that a firm's resources, including intellectual capital and knowledge, contribute to its competitive advantage and financial performance. In other words, construction companies that invest in intellectual capital and knowledge management can achieve a competitive advantage in the industry and improve their financial performance (Rehman *et al*., 2022).

On the other hand, the Social Capital Theory ennobling the social relationships and networks play a crucial role in knowledge sharing and innovation. Construction companies that build strong relationships with their employees, customers, suppliers, and other stakeholders can create a social capital that facilitates knowledge sharing and contributes to better performance and innovation (Yu *et al*., 2022). And finally, the Knowledge-Based View Theory that suggests that a firm's ability to create, transfer, and apply knowledge is essential for its competitive advantage and success. Construction companies that manage their knowledge effectively and apply it to their projects and operations can achieve better performance, quality, and innovation (Akil *et al*., 2021).

Considering the literature review presented, the following hypotheses were formulated:

H1: The intellectual capital management positively affect the performance of construction companies.

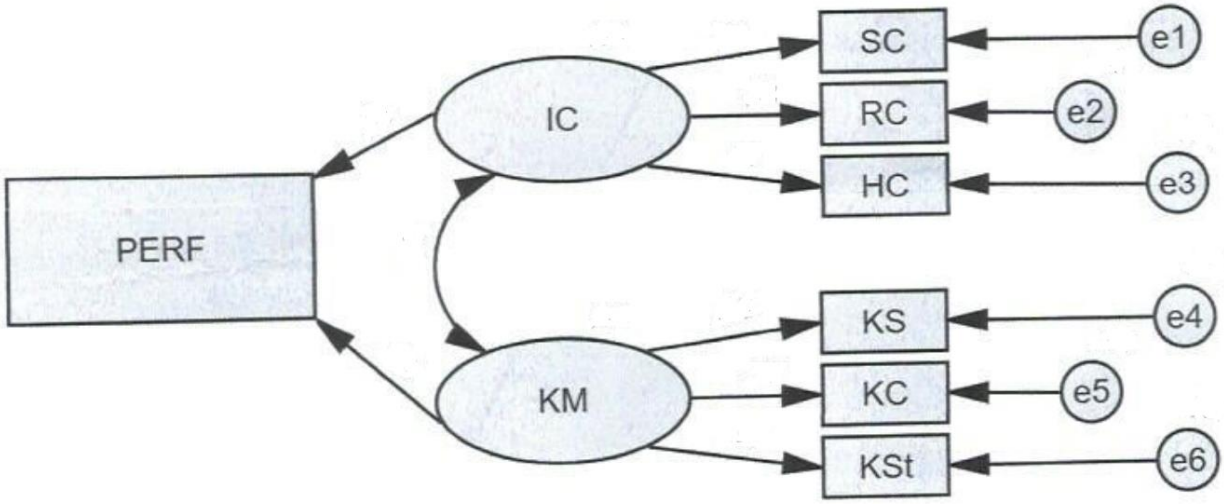
H2: The knowledge management practices positively affect the performance of construction companies.

4 DATA AND METHOD

The validation of the hypotheses to be investigated is based on a set of observational data resulting from the application of the questionnaire presented in the appendix. Based on the theoretical considerations, the following structural equation model has been constructed.

Figure 1

Proposed Structural Equation Modeling



Organizational performance emerges as the dependent and observable variable in the model, representing the degree of success achieved by the organization in terms of various indicators that can include financial performance, innovation, productivity and customer satisfaction, as described earlier Performance is therefore measured empirically and is directly influenced by two latent variables: knowledge management and intellectual capital.

The latent variable, knowledge management, refers to the organization's ability to efficiently manage its processes for creating, storing, and disseminating knowledge. Although not directly observable, this variable can be inferred through the three observable variables knowledge sharing, knowledge creation and knowledge storage. The latent variable, intellectual capital, encompasses the set of intangible assets that are fundamental to organizational success. Like knowledge management, intellectual capital is not directly measurable but is inferred through three observable components relational capital, structural capital and human capital. The relationships between these constructs are critical for the exchange of information and knowledge between the organization and the external environment, providing access to new markets, innovation, and opportunities for collaboration. The observable variables were measured through Q7 to Q34 of the questionnaire in appendix.

The empirical analysis used in this study is based on the use of primary statistical data collected from several SMEs operating in the construction sector. For the

construction of the database, data were collected concerning the characteristics of individuals working in companies of the construction sector and data corresponding to the intellectual capital and knowledge management of the organisations that develop their economic activity in the same area. Therefore, the proposed structural model suggests that both knowledge management and intellectual capital have a direct impact on organizational performance.

$$[PERF = \beta 1 \cdot * KM + \beta 2 \cdot * IC + \epsilon] \quad (1)$$

In a second phase, in order to confirm the proposed SEM, the provided feedback was collected using a five-point Likert scale, which ranged from (1) strongly disagree to (5) strongly agree. This structured approach facilitated a comprehensive evaluation of the pertinent constructs within the study, ensuring a nuanced understanding of the relationships under scrutiny. The results that will be presented in this study refer to the descriptive statistics of the variables in question, the relationships existing between them, and the SEM so that the hypotheses raised can be tested. All this statistical analysis was performed using IBM SPSS AMOS VS 24.

The assessment of intellectual capital drew upon Matos *et al.*'s (2020) scale, encompassing an evaluation of its three fundamental components: relational, structural, and human. Likewise, the measurement of knowledge management employed the scale developed by Rocha (2021). In the context of gauging organisational performance, particularly in terms of their innovative capabilities, as delineated by Elsaman *et al.* (2022), was used.

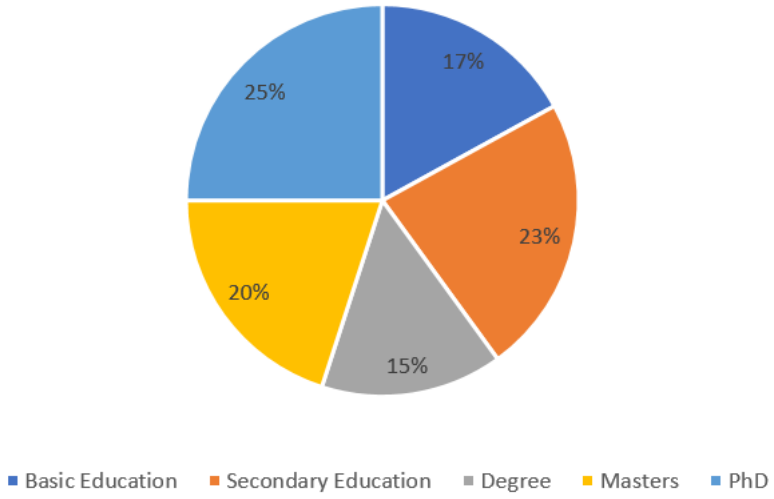
5 DATA ANALYSIS

The study sample comprises the viewpoints of eighty-eight (n=88) individuals holding management positions within Small and Medium-sized Enterprises (SMEs) operating in the construction sector. The sample exhibits a predominantly well-educated profile, with the majority having achieved educational qualifications ranging from graduate to master's level. However, it is noteworthy that only a quarter (25%) of the participants possess doctoral degrees. Approximately two-thirds of the respondents are

employed within the sphere of human resources, either within the department or administrative functions of the organisation under examination.

Figure 2

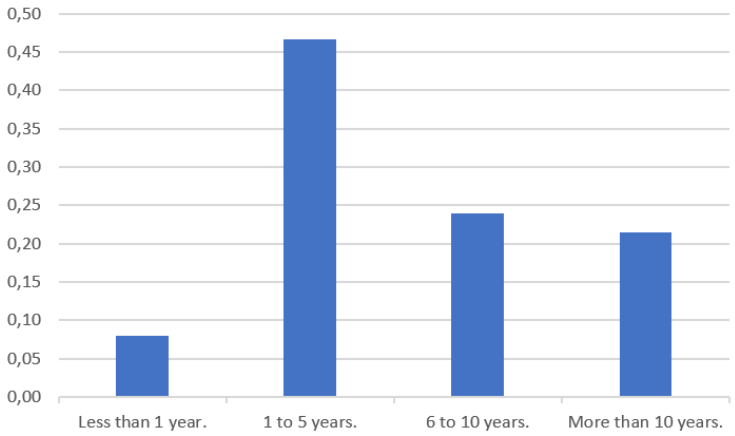
Habilitations



In terms of tenure within their respective organisations, a diverse distribution is observed. Specifically, (8%) of the respondents have been employed in their organisations for less than one year, while a substantial portion (46.6%) has a tenure ranging from one to five years. Furthermore, (23.9%) have contributed their services to the same company for a period spanning six to ten years, with (21.5%) having a work history of more than ten years within the same organisation. Notably, a majority of the surveyed individuals are associated with organisations characterized by a staff size of less than 250 employees and an annual turnover of less than 10 million euros.

Figure 3

Years working for the company.



The hypothesis 1 predicted intellectual capital management would have a positive and significant relationship with organisational performance. The regression analysis showed intellectual capital has a positive and significant relationship with organisational performance (β = .501, p < .01), respectively, and explains 50.1% of its variation (p < .01).

Table 1

Model Summary

Model	R	R2	Adjusted R2	Std. Deviation	Durbin-Watson
1	,501a	,251	,243	,277	1,552

Predictor: (Constant), IC
Dependent Variable: PERF

Table 2

ANOVAa

Model	Sum of the Squares	df	Square Mean	F	Sig
Regression	2,208	1	2,208	28,872	<,001b
Residual	6,578	86	,076		
Total	8,786	87			

Dependent Variable: PERF
Predictor: (Constant), IC

Table 3

Coefficients

	Unstandardized coefficients				
Model	B	Error Error	Standardized beta coefficient	t	Sig
1 (Constant)	2,149	,387		5,548	<,001
IC	,520	,097	,501	5,373	<,001

As can be seen from the model summary table, R2 explains that 25.1% of the variance in performance is explained by intellectual capital. Analysis of Table 2 and 3 (ANOVA and Coefficients) confirms the model's adjustability and robustness. The simple linear regression shows that intellectual capital predicts an increase in performance, which is confirmed by the following:

[F(1,86)= 28,872, p<0.001; R2=0,251] (2)

The hypothesis 2 predicted that knowledge management practices would impact positively organisational performance. The regression analysis showed that knowledge management has a positive and significant relationship with intellectual capital and organisational performance (β = ,670, p < .01) (β = ,644, p < .01), respectively, and explains 64.4% of its variation (p < .01).

Table 4

Model Summary

Model	R	R2	Adjusted R2	Std. Deviation	Durbin-Watson
1	,644a	,415	,408	,244	1,606

Predictor: (Constant), KM
Dependent Variable: PERF

Table 5

ANOVAa

Model	Sum of the Squares	df	Square Mean	F	Sig
Regression	3,647	1	3,647	61,031	<,001b
Residual	5,139	86	,060		
Total	8,786	87			

Dependent Variable: PERF
Predictor: (Constant), KM

Table 6

Coefficients

		Unstandardized coefficients			
Model	B	Error Error	Standardized beta coefficient	t	Sig
1 (Constant)	2,148	,267		8,045	<,001
KM	,521	,067	,644	7,812	<,001

As can be seen from the model summary table, the R2 explains that 41.5% of the variance in performance is explained by knowledge management. Analysis of Table 5 and 6 (ANOVA and Coefficients) confirms the model's adjustability and robustness. The simple linear regression shows that knowledge management predicts an increase in performance, which is confirmed by the following:

[F(1,86)= 61,031, p<0.001; R2=0,415] (3)

The results are in line with other studies, which indicate that because of employees' ability to share information, knowledge management develops as an important role for the relationship between intellectual capital and organisational performance, where it starts to register a positive variation, increasing all operational dynamics of SMEs (Hussinki *et al*., 2017), (Wang *et al*., 2015), (Wang *et al*., 2016). Because knowledge management interacts both directly and indirectly with intellectual capital, it can have a favorable impact on organisational performance (Amjad *et al*., 2019). Later, by providing more unbiased data, the writers (Bansal *et al*., 2022) bolstered the theory even further. They came to the conclusion that organisations with high levels of knowledge management and intellectual capital typically outperform their rivals. Therefore, hypothesis 1 and hypothesis 2 were supported by the data.

Table 7

Descriptive Analysis, Correlations and Reliability of Variables

	M	SD	1	2	3
Intellectual Capital	3,99	,307	(,888)		
Knowledge Management	3,98	,393	,670**	(,742)	
Organisational Performance	4,22	,307	,501**	,644**	(,812)

Note: N = 88; α de Cronbach in brackets.
** p < .01.

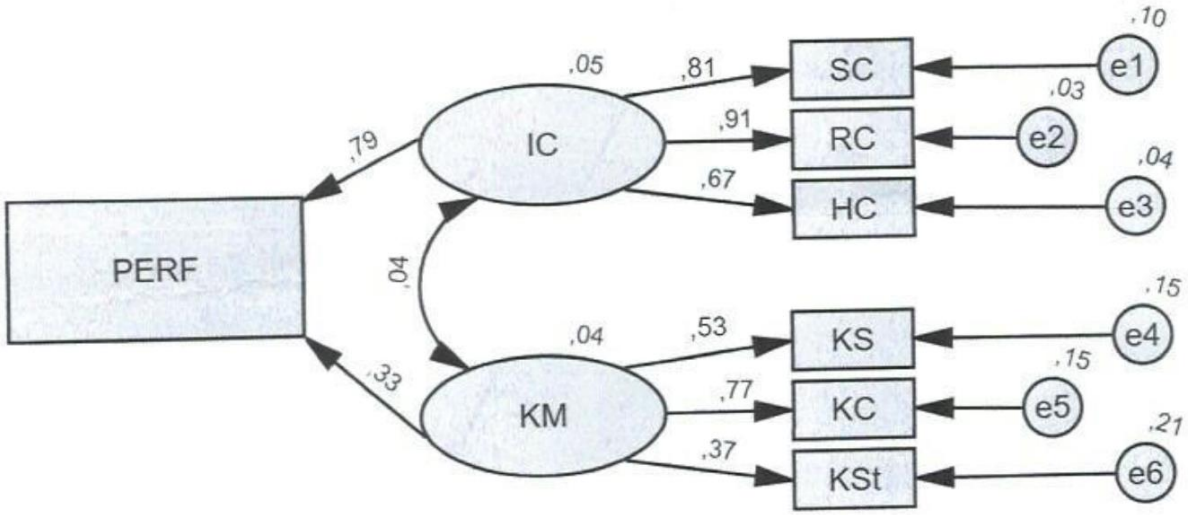
To validate the research hypotheses, SEM was employed, a highly robust statistical method that can be viewed as an extension of multiple linear regression (Diehl, 2004; McCusker and Gunaydin, 2014). SEM permits the evaluation of the impact of multiple independent variables on dependent variables, while simultaneously testing all the relationships among the factors involved in the phenomenon under investigation (García-Morales *et al*., 2013). Although the data do not me*et al*l the distribution and linearity conditions required by the estimation method, it was still considered useful to estimate the structural equation model using IBM SPSS AMOS VS 24 in an empirical approach. By using the combined evidence of regression and SEM estimation, the conclusions are considered to have operational value.

Confirmatory factor analysis (CFA) was employed to ascertain the validation of the measurement model, utilising the maximum likelihood method, the most prevalent approach in SEM analysis (Hair *et al*., 2010). The results generated by the IBM SPSS AMOS VS 24 software were observed to ascertain whether the loadings were greater than 0.5 ($\lambda > 0.5$) and whether the individual reliability was equal to or greater than 0.25. Variables that did not meet these criteria were removed (Hair *et al*., 2010). As illustrated in the preceding section, all R2 values exceed 0.25, and the average variance extracted (AVE) is greater than 0.5, in this case 0.737858. Additionally, the loadings range between 0.68 and 0.81, indicating a satisfactory level of convergent validity. In light of these findings, it can be concluded that convergent validity is confirmed.

As outlined by Hair *et al*. (2010), the second phase of the SEM process entails the validation of the structural model, which serves to assess the precision of the proposed research hypotheses. This step permits the assessment of the model's fit (see Figure 4). As per the formulated research hypotheses, the structural model in question reflects the logical linkages between the studied constructs and the visualization of the aforementioned hypotheses, as outlined by Yin (1989).

Figure 4

Structural model with standardized coefficient



It is possible to evaluate through figure 4 a positive correlation between the variables of knowledge management and organizational performance (β = 0.33) and between intellectual capital and organizational performance (β = 0.79). Additionally, a positive yet relatively insignificant correlation was observed between intellectual capital and knowledge management (β=0.04). With regard to the latent variable intellectual capital, it can be seen that it has a positive relationship with all the observable variables. Specifically, the results indicate a positive relationship with structural capital (β=0.81), relational capital (β=0.91), and human capital (β=0.67). The latent variable of knowledge management also exhibits a positive relationship with all observed variables. In this case, the respective values are β=0.53 for knowledge sharing, β=0.77 for knowledge creation, and β=0.37 for knowledge storage. In light of the presented model, both H1 and H2 are accepted hypotheses, indicating that both intellectual capital and knowledge management have a positive effect on the organizational performance of companies in the construction sector.

6 CONCLUSION

The validation of the aforementioned hypothesis are in line with the results obtained in other studies as well as the literature review. The preponderance of the

combination of intellectual capital and knowledge management (Ahangar, 2011) in the lives of SMEs is shown to boost their performance (Pigola *et al*., 2022).

In the specific case of knowledge management, this construct tends to have a very positive and significant impact on the organisational performance of construction companies. Companies can increase their ability to share, retain and apply internal knowledge efficiently by developing effective knowledge management strategies. This leads to increased productivity, quality and innovation in the execution of construction projects. In addition, knowledge management enables rapid adjustment to changes in the business environment and improved decision-making based on up-to-date information. Therefore, effective knowledge management in the activities of construction companies has the capacity to offer substantial benefits and make a significant and positive contribution to the performance and success of the sector.

Intellectual capital, like knowledge management, tends to have a positive and significant impact on the organisational performance of companies in the construction sector. However, its degree of impact differs slightly from that of knowledge management. Construction companies can increase their operational efficiency, promote innovation in their projects and improve the quality of their deliveries by recognizing the value of their employees' knowledge, skills and expertise. The table of knowledge and skills is not just the sum of intellectual capital; it also includes the value of the relationships and strategic partnerships that companies establish. These partnerships increase the companies' ability to meet complicated challenges and seize market opportunities quickly. Thus, intellectual capital is seen as a valuable resource that promotes the overall performance of companies in the construction sector and increases excellence in operations.

This study explores the relationship between intellectual capital, knowledge management and organisational performance. The results show that both intellectual capital and knowledge management are positively associated with organisational performance. Other studies have demonstrated that knowledge management and intellectual capital have a major positive influence on construction organisations' performance. As evidenced by the findings of Aminbakhsh *et al*. (2013), intellectual capital significantly improves both the financial and non-financial performance of construction companies. Similar findings were made by Kaming *et al*. (1997), who

discovered that knowledge management can enhance the efficacy and efficiency of building projects.

In this way, the results show that the correct combination by companies in the construction sector of the constructs intellectual capital and knowledge management can create dynamics that significantly improve the performance of these organisations.

6.1 LIMITATIONS AND FUTURE LINES OF RESEARCH

Although it has a great influence on the literature, the article has limitations. The sample size (N=88) is relatively small and will not be able to express any worldwide representativeness. Data collection is difficult in construction SMEs because most of the managers in these organisations are often in charge of coordinating or monitoring projects directly. The very nature of the questionnaire survey is another limitation. Given the sensitive nature of the issues and notwithstanding the guaranteed anonymity, there may be a voluntary or involuntary tendency to reply in person to socially acceptable matrices.

Regarding future research directions, it would be interesting to see how civil construction companies can strategically integrate emerging technologies, such as artificial intelligence, machine learning, and virtual reality, into their knowledge management and intellectual capital development processes, and how this affects their performance. On the other hand, the analysis of the use of specific knowledge management models aims to determine the most effective approaches for construction companies to maximize their performance. Finally, verify the intersection between sustainability practices and the development of intellectual capital in construction companies. This involves investigating how a commitment to sustainable construction practices, including green building and responsible management of natural resources, influences knowledge retention, drives innovation and ultimately affects the long-term performance of these organisations.

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APPENDIX A

Intellectual Capital in Companies in the Construction Sector

INFORMED CONSENT

As a doctoral student in Management at UBI - Universidade da Beira Interior and under the supervision of Professor António João Santos Nunes and co-supervision of Professor Florinda Maria Carreira Neto Matos from UBI and ISCTE respectively, I am carrying out research into Intellectual Capital in companies operating in the construction sector.

Intellectual capital encompasses all forms of intangibles and is the combination of an organization's human, structural and relational resources.

There is a broad consensus that intellectual capital results from the interaction of three categories of capital: Human Capital, Structural Capital and Relational Capital.

- Human Capital is understood as the capital of an organization's people, made up, among other things, of their skills, the accumulated value of their knowledge management practices, their creativity, their capacity for innovation, their networks of relationships and their values. Organizational culture and values are also part of this capital;
- Structural Capital is understood as the organization's support infrastructure, for example, databases, communication and technological infrastructure, knowledge repositories, manuals, client lists, processes, internal standards, certifications, brands and patents;
- Relational Capital corresponds to the strength and loyalty of customers and other stakeholders responsible for cash flows and other factors that will contribute to future growth. Relational capital is fundamental in the processes of market growth and internationalization, as well as in the capacity for resilience and assimilation of digital transformation processes. In the current context of accelerating technological change and business digitalization, this is the most relevant capital for sustainability.

Source: https://www.icscoring.pt

This questionnaire is expected to take an average of 15 minutes and is aimed at individuals of all genders, aged 18 or over, working in an SME in the construction sector and performing management functions.

Completion of the questionnaire is completely anonymous and the results obtained will be used for purely academic purposes, with the information being kept confidential.

All processing of personal data carried out for the duration of the survey is in accordance with the General Data Protection Regulation (EU) 2016/679 and Regulation (EU) 2018/1725 of the European Parliament and of the Council of October 23, 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC.

In this regard, please be honest. If you agree to take part, we will ask for your informed consent.

If you have any questions, please contact us by email (André Sucena: andre.sucena@ubi.pt).

Thank you very much for your cooperation!

1. By selecting the options below, I declare that: I have read and understood this document and agree to participate in the scientific project, giving my informed consent and having the assurance that all my data will remain confidential. I am over 18 years of age;
2. What is your level of education?
3. In which department of the company do you work?
4. How long have you worked for the company?
5. How many employees does the company have?
6. What was the turnover last year?
7. Employees participate in company decisions;
8. Employees are encouraged to always be creative and take initiative;
9. Employees have a high level of education;
10. The company invests long-term in its employees;
11. Employees are committed to the company;
12. All employees are trained to carry out their duties;
13. The company continually invests in training and qualifications for its employees;

14. The capacity and skills of the employees allow them to innovate in their tasks;
15. If an employee leaves the company, knowledge is lost;
16. In the last two years there has been an increase in investment in new systems (tools, software...) which improve production capacity;
17. Employee suggestions are evaluated and implemented when relevant;
18. There has been an improvement in the technical capabilities of work processes;
19. Customer complaints have decreased over the last 2 years;
20. In the last two years the company has invested at least 0.5% of its profits in research and development;
21. Creative ideas are discussed by everyone;
22. In the last 2 years the number of new businesses has increased;
23. Over the last 2 years, customers have shown that they are satisfied with the company;
24. Customer satisfaction with price, quality and meeting deadlines is adequate;
25. The company has an excellent reputation with customers.
26. The company has partnerships with customers;
27. The company has an excellent reputation with suppliers;
28. The company has partnerships with suppliers;
29. Employees are encouraged to put their personal knowledge at the service of the company;
30. Employees have in-depth knowledge and consider issues beyond the material;
31. The company values knowledge creation.
32. The sharing of knowledge between employees to solve problems is supported by the company;
33. The company promotes the sharing of experiences between employees;
34. All employees contribute to the creation of knowledge;
35. Establishing partnerships with other companies helps the company's results;
36. Establishing partnerships with other organizations (e.g. associations or research institutions) helps the company's results;
37. Team members try to take advantage of the synergies involved in working with teams outside the company;
38. Team members meet to discuss the progress of projects with external teams.

39. Team members exchange ideas with a large number of colleagues outside the team.
40. Team members exchange ideas with a large number of professionals working in companies in the same field.
41. The company uses the human resources, financial resources and technologies of partner companies to develop its project portfolio.
42. The company has developed improvements to existing products/services and/or work processes in the last 2 years.
43. In the last 2 years the company has created or improved products/services or work processes based on ideas from employees, customers or suppliers.
44. In the last 2 years the company has developed new working methods.
45. The company is looking to apply new technologies.
46. In the course of each project, strategic innovation skills are developed with a view to the long-term sustainability of the business.
47. An innovation-oriented organizational culture is promoted.
48. The company promotes entrepreneurial and innovative behavior in the various areas in which it operates.

The questionnaire has come to an end. Thank you very much for your time.