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The influence of knowledge risks on firm sustainability mediated by knowledge management capabilities

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ABSTRACT

Since there has been a paucity of empirical research on the impact of knowledge risks on firm sustainability so far, this paper aims to contribute to the development of this strand by analysing the relationship between knowledge risks and firm sustainability, with knowledge management capabilities as a mediating variable. A structured questionnaire was validated and administered to a sample of 100 companies operating in several sectors.The hypotheses test was performed through a structural equation model, and the results were consistent with previous studies that found a negative effect of knowledge risks on firms' sustainability performance. The hypothesised mediating effect of knowledge management capabilities was supported as well.

Poiché finora vi è stata una scarsità di ricerca empirica sull'impatto dei rischi della conoscenza sulla sostenibilità delle imprese, questo lavoro si propone di contribuire allo sviluppo di questo filone, analizzando la relazione tra i rischi della conoscenza e la sostenibilità delle imprese, con le capacità di gestione della conoscenza come variabile di mediazione. Un questionario strutturato è stato validato e somministrato ad un campione di 100 aziende operanti in diversi settori. Il test delle ipotesi è stato eseguito attraverso un modello di equazioni strutturali e i risultati sono stati coerenti con studi precedenti che hanno riscontrato un effetto negativo dei rischi di conoscenza sulle prestazioni di sostenibilità delle imprese. È stato inoltre supportato l'ipotizzato effetto di mediazione delle capacità di gestione della conoscenza.

Keywords: Knowledge risks, sustainability, knowledge management capabilities, SMEs, mediation analysis, structural equation model.

1 – Introduction

Knowledge risks are risks related to knowledge management, defined as

[…] a measure of the probability and severity of adverse effects of any activities engaging or related somehow to knowledge that can

affect the functioning of an organization on any level (Durst & Zieba, 2019, p. 2).

It is possible to classify knowledge risks in terms of their origin into *human* knowledge risks, *technological* knowledge risks and *operational* knowledge risks (Durst & Zieba, 2019). Human knowledge risks mainly occur within the organisation. This is because they mostly concern the relationships between organizational members (Durst & Zieba, 2019). An example of human knowledge risk is the risk of knowledge hiding, which Connelly and colleagues defined as "

[...] a deliberate attempt by an individual to withhold or conceal knowledge that has been requested by another person (Connelly, Zweig, Webster & Trougakos, 2012, p. 65).

The risk of knowledge leakage can also be considered a human knowledge risk, as it refers to

[…] an intentional or accidental loss of knowledge to unauthorised personnel within or outside the boundaries of an organization, which could use that knowledge to cause damage to the organisation itself (Durst & Zieba, 2017, p. 54).

Organizations may be exposed to technological knowledge risks when technology is used inappropriately, or in case of obsolete technological equipment, exposing the organisation to cyber-attacks due to the lack of protection of the network used for activities like smart working (Borgia, Di Virgilio, La Torre & Khan, 2022; Zieba, Durst & Gonsiorowska, 2022). Operational knowledge risks might affect both the ordinary and extraordinary operations of organizations. The risk of knowledge waste is a typical example and refers to "[...] any failure in the knowledge transformation process" (Ferenhof, Durst & Selig, 2015, p. 161), as it represents the failure to use (and thus waste) valuable knowledge despite its availability in the organisation (Durst & Zieba, 2017).

The negative impact of knowledge risks on organisational performance is well established in the literature. Durst, Hinteregger and Zieba (2019) recognised the threat of knowledge risk to organisations and demonstrated the positive impact of knowledge risk management on organisational performance. The negative consequences of knowledge-hiding behaviours on organisational performance has been investigated in several studies (Farooq & Durst, 2023; Skerlavaj, Černe & Batistič, 2023), including the specific case of organisations' reduced ability to innovate as a result of exposure to such risks (Haar, O'Kane & Cunningham, 2022; Labafi, 2017; Jiang, Wu, Yin, Yang & Wang, 2022). The effects of knowledge risks on knowledge transfer in organizational networks was investigated by Trkman and Desouza (2020), while Saringianni, Thalmann and Manhart (2015) examined the negative effects of technological knowledge risk in the context of financial firms. The risk of knowledge leakage has also been studied in relation to the impact it might have on SMEs' performance (Durst & Aisenberg Ferenhof, 2014). The relationship between knowledge risks and the organisational sustainability has been investigated in the literature as well, although there are still few studies on this subject (Bratianu, Neştian, Tiță, Voda & Guță, 2020; Durst & Zieba, 2020; El Khatib & Ali, 2022; Zieba, Durst, & Hinteregger, 2022).

The current paper seeks to contribute to this research strand, which is clearly still in its infancy, by proposing a study of the impact of knowledge risks (KRs) on firm sustainability (FS). The mediating role of knowledge management capabilities (KMCs) was also included in the analysis, as we considered to be a valuable support for organizational knowledge management efficiency, and consequently useful to knowledge risks' prevention and mitigation. Thus, KRs - human (KRsH), technological (KRsT) and operational (KRsO) - are assumed to have a negative

impact on FS and, through mediation, on employees' KMCs, which are assumed to have a positive impact on FS. The proposed research model was used to design and validate a structured questionnaire, which was then administered to a sample of 100 firms from different sectors. The results of the analysis confirmed the negative relationship between KRs and FS, a finding consistent with previous studies on the same topic. The mediating effect of KMCs was also verified, supporting the hypothesis of a positive effect of KMCs on FS. This paper has both theoretical and practical implications. From a theoretical perspective, it contributes to the emerging research strand on the relationship between KRs and FS. From a practical point of view, this study may encourage sustainability managers to consider that the undermining of FS may also be the "risk side" of knowledge.

The remainder of the paper is organized as follows. In the second section, the literature review is provided, on the basis of which the hypotheses of the study are formulated. The third section is concerned with the presentation of materials and methods supporting the analysis, while in the fourth section the results are presented. The paper ends with discussion and conclusions, highlighting limitations and suggesting ideas for further research on the same topic (section 5).

2 – Literature Review and Hypotheses Development

Studies of the impact of KRs on FS are part of a broader research strand which analyses the relationship between this type of risk and organizational performance. Bratianu, Neştian, Tiţã, Voda and Guţã (2020) analyzed the relationship between KRs and FS, considering organizational performance as a mediating variable in this relationship, and decision-making as a moderating variable in the relationship between organisational performance and sustainability. The authors confirmed both the existence of a link between KRs and FS and the hypothesised mediating and moderating effects. The conceptual paper of Durst and Zieba (2020) proposed a framework for identifying the potential impacts of KRs on the environmental, economic and social dimensions of SF, as well as strategies and tools for preventing and mitigating KRs. El Khatib and Ali (2022) explored the relationship between Krs and FS in the context of knowledge-intensive firms, including in their study the mediating role of organizational performance. The empirical analysis conducted by the authors confirmed the role of KRs in reducing FS, as well as the mediation of organisational performance in this relationship. Through a survey of 179 professionals from knowledge-intensive organisations concerned with KRs and their management, Zieba, Durst and Hinteregger (2022) analyzed the impact of knowledge risk management on organisational sustainability, also considering the role of innovativeness and agility in this relationship. The results showed that knowledge risk management positively impact both organizational innovativeness and agility. In view of the above, the following hypothesis is drawn:

H1: *KNOWLEDGE RISKS (KRS) NEGATIVELY IMPACT FIRM'S SUSTAINABILITY (FS).*

with related sub-hypotheses:

H1a: Human knowledge risks (KRsH) negatively impact firm's sustainability (FS).

H1b: Technological knowledge risks (KRsT) negatively impact firm's sustainability (FS).

H1c: Operational knowledge risks (KrsO) negatively impact firm's sustainability (FS).

In the present study, the mediating effect of KMCs on the relationship between KRs and FS was also hypothesized. The mediation hypothesis assumes a direct effect of KRs on KMCs and of KMCs on FS. These hypotheses were formulated taking into account the results of some previous studies. Knowledge acquisition, sharing and application are considered the three factors of KMC (Gharakhani & Mousakhani, 2012).

In the literature, the positive effects of knowledge acquisition, sharing and application on organisational, financial and non-financial performance have been widely acknowledged (Abbas, Hussain, I., Hussain, S., Akram, Shaheen & Niu, 2019; Jilani, Fan, Islam & Uddin, 2020; Hu, Sarfraz, Khawaja, Shaheen & Mariam, 2022; Laeeque & Babar, 2017; Li, Huang & Tsai, 2009; Ordieres-Meré, Prieto Remon & Rubio, 2020; Omar, Aris & Nazri, 2016; Wu & Haasis, 2013). Similarly, several contributions demonstrated the negative effects that different types of KRs (KRsH, KRsT, KRsO) might have on KMCs (Bratianu, Neştian & Guţă, 2022; Nestian & Guta, 2023; Durst & Henschel, 2020; Lambe, 2013).

Considering what found in the reviewed literature, the present study's further hypotheses are:

H2: *KNOWLEDGE RISKS (KRS) NEGATIVELY IMPACT KNOWLEDGE MANAGEMENT CAPABILITIES (KMCS).*

With related sub-hypotheses:

H2a: Human knowledge risks (KRsH) negatively impact Knowledge Management Capabilities.

H2b: Technological knowledge risks (KRsT) negatively Knowledge Management Capabilities.

H2c: Operational knowledge risks (KrsO) negatively impact Knowledge Management Capabilities.

H3: *KNOWLEDGE MANAGEMENT CAPABILITIES (KMCS) POSITIVELY IMPACT FIRM'S SUSTAINABILITY (FS)*

H4: *KNOWLEDGE MANAGEMENT CAPABILITIES (KMCS) MEDIATE THE RELATIONSHIP BETWEEN KNOWLEDGE RISKS (KRS) AND FIRM'S SUSTAINABILITY (FS).*

The Figure 1 shows the conceptual framework, which graphically represents the relationships between the variables, and the hypotheses formulated in this study:

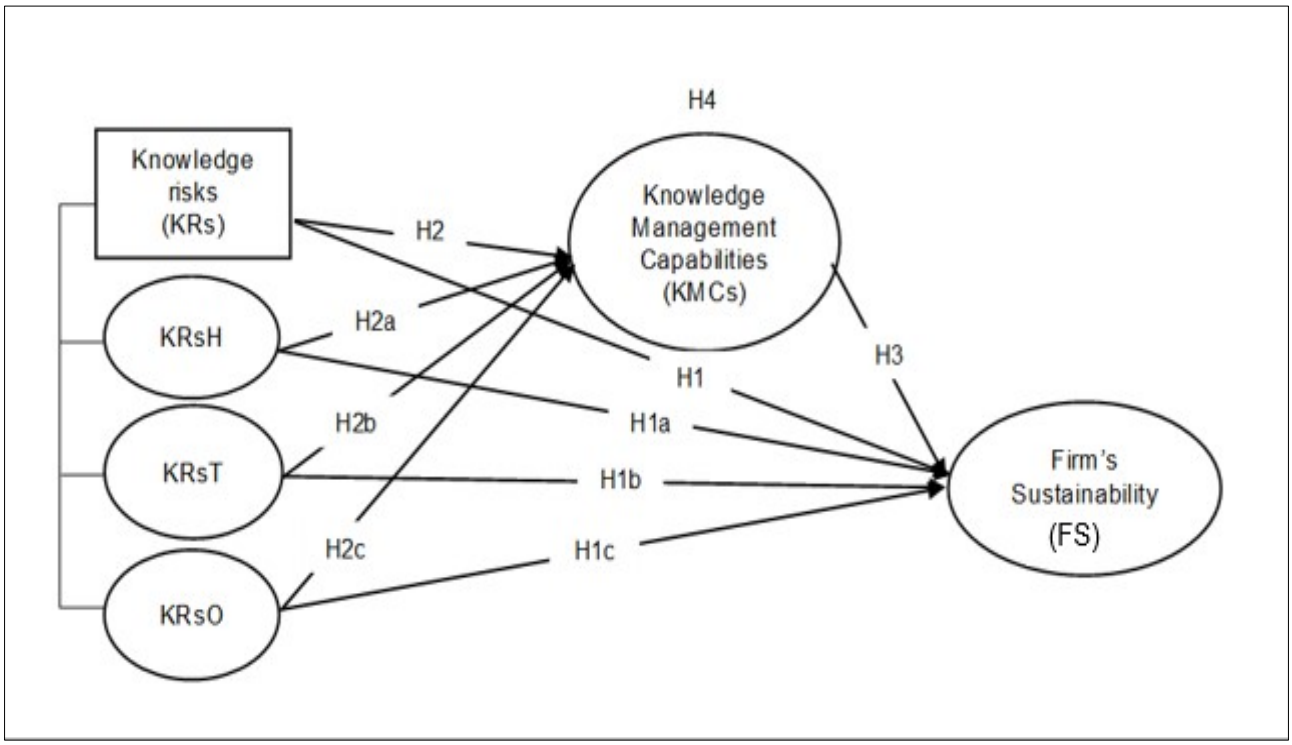

Fig. 1 – The conceptual framework of the relationships between the variables, and the hypotheses formulated in this study (Source: Authors' conceptualization)

3 –Research Method

3.1 – *Sampling, data collection*

Based on the model in this study proposed, a structured questionnaire (Fife-Schaw, 1995) was designed and developed to gathering data from a sample of Italian companies from different sector. Data collection was between May and June 2023, online via the Microsoft Forms application. Of 100 questionnaires administered, 81 returned with a completion rate of 80%.

3.2 – *Questionnaire and measures*

The questionnaire consisted of two sections, one dedicated to demographic data (gender, age, education, work seniority), and the other to constructs, namely KRs (KRsH, KRsT, KrsO), FS and KMCs. Six items adapted from Zieba, Durst, Gonsiorowska and Zralov (2021) were used to measure KRs, some sample items were "In my company, knowledge is often not shared between colleagues, "In my company, it happens that valuable knowledge is forgotten". FS was measured using four items provided by Gelhard and Von Delft (2016), some sample items were "My company offers environmentally friendly products/services on the market", "Our competitors see us as a leader in the field of sustainability". For the measurement of KMCs, nine items from the study by Tseng and Lee (2014) were used, some sample items were "My company is able to convert knowledge into the design and realisation of new products/services", "My company has internal processes to apply knowledge gained from past experience".The hypotheses test was perfromed through a structural equation model (SeM) (Hayes 2017).

3.3 *Data analysis technique*

In order to achieve the objectives of this study, data analysis starts with the presentation of descriptive statistics for all variables considered. Then, a confirmatory factor analysis (Brown, 2015) is carried out to verify whether the hypothesised structure for KRs, FSs and KMCs can be statistically justified. A correlation analysis between the scales of KRs, KMCs and FS is also performed using Pearson's correlation index and scatterplot plots. A mediation model is them applied to assess whether the effect of KRs on FS is mediated by KMCs. SPSS v28 statistics were used for all analyses, and an alpha confidence level of 0.05 was chosen for the tests.

4. Research results

4.1 – *Descriptive statistics*

In this sub-section, descriptive statistics for all considered variables are presented. For each quantitative variable, the main indices of centrality (mean, median) and minimum and maximum of the distribution are reported, together with the variability indices (standard deviation) (Table 1). The results relating to the demographic characteristics of the interviewees are presented as well (Table 2.).

Table 1 – Descriptive statistics of the variables.

Variables	N	Min	Max	Mean	Std. Deviation
KRsH1	81	1	5	2,49	1,174
KRsH2	81	1	5	2,25	1,019
KRsT1	81	1	5	2,19	1,014
KRsT2	81	1	4	2,27	,881
KRsO1	81	1	5	2,35	1,174
KRsO2	81	1	5	2,46	1,275
FS1	81	1	5	3,40	1,137
FS2	81	1	5	3,31	1,158
FS3	81	1	5	3,37	1,066
FS4	81	1	5	3,49	1,050
KMCs1	81	2	5	3,91	1,002
KMCs2	81	1	5	3,65	1,206
KMCs3	81	1	5	3,73	1,194
KMCs4	81	1	5	3,52	1,236
KMCs5	81	2	5	3,84	1,018
KMCs6	81	1	5	3,72	1,109
KMCs7	81	1	5	3,69	1,211
KMCs8	81	1	5	3,44	1,255
KMCs9	81	1	5	3,16	1,156
Valid N (listwise)	81				

Table 2 – Respondents' profile.

	Frequency	Percent
Gender		
Man	46	56,8
Woman	35	43,2
Total	81	100,0
Age		
22-30	4	4,9
31-40	19	23,5
41-50	18	22,2
>50	40	49,4
Total	81	100,0
Education		
Diploma	29	35,8
Degree	38	46,9
Master	7	8,6
Doctorate	7	8,6
Total	81	100,0
Job position		
Employee	49	60,5
Managers	32	39,5
Total	81	100,0
Work seniority (years)		
< 1	3	3,7
1 - 5	7	8,6
6 - 10	14	17,3
11 - 15	9	11,1
> 15	48	59,3
Total	81	100,0
Company size		
Micro enterprise (fewer than 10 employees, turnover not exceeding 2 million euros)	22	27,2
Small business (fewer than 50 employees, turnover not exceeding 10 million euros)	13	16,0
Medium enterprise (less than 250 employees, turnover not exceeding 40 million euros)	11	13,6
Large company (more than 250 employees, turnover of more than 40 million euros)	35	43,2
Total	81	100,0

From the demographic profiles, emerged that interviewees were mostly men (56.8%), and 49% were aged over 50. Furthermore, respondents are mostly graduates (46.9%), holding the role of employees in their organization (60.5%), and with a work seniority that for the majority of the sample exceeds 15 years (59.3%). Regarding the size of the organizations, the sample is made of 27.2% micro-enterprises, 29.6% SMEs, and 43.2% large enterprises.

4.2 – *Confirmatory factor analysis (CFA)*

4.2.1 – KRs confirmatory factor analysis

In the present study, six items for KRs was considered (KRsH1, KRsH2, KRsT1, KRsT2, KRsO1, KRsO2), expecting to extract only one factor. Kaiser-Meyer-Olkin Measure (KMO) index is equal to ,752 and Bartlett's Test of Sphericity refused null hypothesis of sphericity as expected (p<,001) (Table 3). CFA extracted only one factor as expected, with Eigenvalue greater than one, equal to 3,830, corresponding to 63.8% of variance explained (Table 4). Regarding communalities, apart from KRsT2 (communality = ,315), the extracted factor explains at least the 50% of the variance of the variables (Table 5). Observing factor loadings, we can conclude that the extracted factor is highly correlated with all the variables considered (factor loadings >0,7), except from KRsT2 that has a lower value (factor loading = 0.561) (Table 6).

Table 3 – KMO and Bartlett's Test (KRs).

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,752
Bartlett's Test of Sphericity	Approx. Chi-Square	274,591
	df	15
	Sig.	<,001

Table 4 – Total Variance Explained (KRs) (Extraction Method: Principal Axis Factoring)

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3,830	63,826	63,826	3,429	57,149	57,149
2	,757	12,610	76,436			
3	,527	8,783	85,219			
4	,412	6,859	92,078			
5	,343	5,721	97,799			
6	,132	2,201	100,000			

Table 5 – Communalities (KRs) (Extraction Method: Principal Axis Factoring)**.**

	Initial	Extraction
KRsH1	,534	,578
KRsH2	,571	,634
KRsT1	,558	,508
KRsT2	,508	,315
KRsO1	,744	,751
KRsO2	,732	,643

Table 6 – Factor Matrix[a] (KRs) (Extraction Method: Principal Axis Factoring.
[a] 1 factors extracted. 5 iterations required

	Factor 1
KRsO1	,866
KRsO2	,802
KRsH2	,796
KRsH1	,761
KRsT1	,713
KRsT2	,561

4.2.2 – KMCs confirmatory factor analysis

Items related to KMCs were nine, and also in this case, is expected only one factor's extraction. KMO index is ,915, and Bartlett's Test of Sphericity refused null hypothesis of sphericity as expected (p<,001) (Table 7).

Table 7 – KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,915
Bartlett's Test of Sphericity	Approx. Chi-Square	601,835
	df	36
	Sig.	<,001

CFA extracted only one factor as expected, with Eigenvalue greater than one, equal to 6,240, corresponding to 69.3% of variance explained (Table 8). Concerning communalities, the extracted factor explains at least the 50% of the variance of the variables (Table 9). Observing factor loadings, extracted factor is highly correlated with all the variables considered (factor loadings >0,7) (Table 10).

Table 8 – Total Variance Explained (KMCs) (Extraction Method: Principal Axis Factoring).

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6,240	69,336	69,336	5,902	65,578	65,578
2	,731	8,120	77,456			
3	,560	6,222	83,678			
4	,427	4,749	88,427			
5	,299	3,326	91,754			
6	,217	2,414	94,167			
7	,207	2,298	96,465			
8	,169	1,872	98,338			
9	,150	1,662	100,000			

Table 9 - Communalities (KMCs) (Extraction Method: Principal Axis Factoring).

	Initial	Extraction
KMCs1	,662	,648
KMCs2	,747	,719
KMCs3	,616	,573
KMCs4	,664	,653
KMCs5	,769	,722
KMCs6	,709	,624
KMCs7	,728	,738
KMCs8	,755	,692
KMCs9	,669	,532

Table 10 – Factor Matrix[a] (KMCs) (Extraction Method: Principal Axis Factoring.
[a] 1 factors extracted. 4 iterations required

	Factor 1
KMCs7	,859
KMCs5	,849
KMCs2	,848
KMCs8	,832
KMCs4	,808
KMCs1	,805
KMCs6	,790
KMCs3	,757
KMCs9	,730

4.2.3 – FS confirmatory factor analysis

FS was measured using four items, and also in this last case, is expected only one factor's extraction. KMO index is ,803, and Bartlett's Test of Sphericity refused null hypothesis of sphericity as expected (p<,001) (Table 11). Also in this case, CFA extracted only one factor as expected, with Eigenvalue greater than one, equal to 2,907, corresponding to 72,6% of variance explained (Table 12).

With regard to communalities, the extracted factor explains at least the 50% of the variance of the variables, apart fron FS4 (communalities= ,419) (Table 13). Observing factor loadings, allows the conclusion that the extracted factor is highly correlated with all the variables considered (factor loadings >0,7), excluding SF4 which has a lower value (factor loading = 0,648) (Table 14).

Table 11 – KMO and Bartlett's Test (FS).

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,803
Bartlett's Test of Sphericity	172,546	274,591
	6	15
	<,001	<,001

Table 12 – Total Variance Explained (FS) (Extraction Method: Principal Axis Factoring).

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,907	72,671	72,671	2,589	64,721	64,721
2	,550	13,740	86,411			
3	,347	8,676	95,087			
4	,197	4,913	100,000			

Table 13 – Communalities (FS) (Extraction Method: Principal Axis Factoring).

	Initial	Extraction
FS1	,523	,569
FS2	,643	,718
FS3	,720	,883
FS4	,400	,419

Table 14 – Factor Matrix[a] (FS) (Extraction Method: Principal Axis Factoring).
[a] 1 factors extracted. 9 iterations required

	Factor 1
FS3	,939
FS2	,847
FS1	,754
FS4	,648

4.3 – *Correlation analysis*

At this stage of the analysis, the correlation between the scales is performed, As shown in Table 15 and Figure 2, KRs is negatively correlated with both the other two scales: its correlation with KMCs is equal to -0,771 and it's statistically significant ($p<0,05$); its correlation with FS is statistically significant ($p<0,05$) and equal to -0,574. Furthermore, the correlation between KMCs and FS is significant ($p<0,05$) and positive, with a value of 0,785.

Table 15 – Correlations and Confidence Intervals (a. Estimation is based on Fisher's r-to-z transformation)

	Pearson Correlation	Sig. (2-tailed)	95% Confidence Intervals (2-tailed)[a]	
			Lower	Upper
KMC - KR	-,771	<,001	-,847	-,665
KMC - FS	,785	<,001	,684	,857
KR - FS	-,574	<,001	-,704	-,406

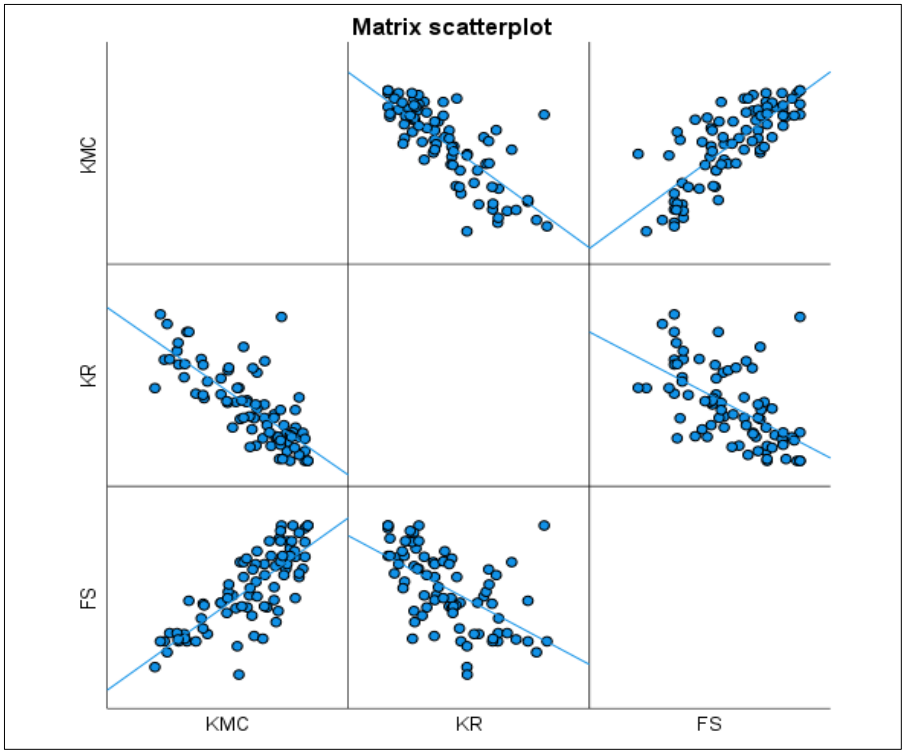

Fig. 2 – Correlation matrix scatterplot

4.4 – *Simple mediation model*

A simple mediation model (Model 4 Process) was employed to evaluate if and how the effect of KRs on FS is mediated by KMCs. To this end, FS was considered the dependent variable, KRs the indipendent, and KMCs the mediator.

The total effect of KRs on FS resulted negative (-0,580) and statistically significant (p<0,001). However, most of the total effect is indirect effect mediated by KMCs, since the indirect effect is equal to -0,66 and significant. The remaining of the total effect is the direct effect of KRs, but it turns out to be not statistically significant (p>0,05) (Table 16).

Table 16 – The mediation model

	Effect	se	t	p	LLCI	ULCI
Total effect of X on Y	-,580	,093	-6,223	<,001	-,765	-,394
Direct effect of X on Y	,081	,111	,728	,469	-,140	,302
Indirect effect of KMC on Y:	-,660	(BootSE) ,081	-	-	(BootLLCI) -,811	(BootULCI) -,492
Completely standardized indirect effect of KMC on Y:	-,653	(BootSE) ,081	-	-	(BootLLCI) -,794	(BootULCI) -,480

5 – Discussion and Conclusions

The aim of the present study was to analyse the potential effects of KRs on FS, mediated by KMCs. The main reason for exploring this topic was, primarily, the scarcity of research in this area, despite the increasing involvement of the academic world and knowledge management professionals in the debate on knowledge risks and their impact on organisational performance. The findings of the analysis revealed that KRs negatively affect FS. More specifically, the results of hypothesis one showed that the three types of KRs, i.e. KRsH, KRsT and KRsO, negatively influence FS. This result is in line with previous empirical studies on the same topic (Bratianu, Neştian, Tiţă, Voda & Guţă, 2020; Durst & Zieba, 2020; El Khatib & Ali, 2022; Zieba, Durst, & Hinteregger, 2022).

Findings of the second hypothesis demonstrated the negative relationship between KRs and KMCs. These result is also confirmed by the findings of previous studies, which showed that KRs which are associated with inappropriate knowledge management deteriorate KMCs (Bratianu, Neştian & Guţă, 2022; Nestian & Guta, 2023; Durst & Henschel, 2020; Lambe, 2013).

he results of the third hypothesis were consistent with previous studies as well, finding a positive relationship between KMCs and FS (Abbas, Hussain, I., Hussain, S., Akram, Shaheen & Niu, 2019; Jilani, Fan, Islam & Uddin, 2020; Laeeque & Babar, 2017; Li, Huang & Tsai, 2009; Ordieres-Meré, Prieto Remon & Rubio, 2020; Omar, Aris & Nazri, 2016; Wu & Haasis, 2013).

Together, the results of this analysis contribute to the development of research on KRs, which still includes few studies on the relationship betweem KRs and FS. From a more practical point of view, the analysis sheds light on the detrimental potential of KRs and the potential of KMCs to mitigate the negative effects such risks might have on FS. In this sense, this study may encourage knowledge management managers to promote the development of KMCs, given their potential to prevent and mitigate KRs.

This study is not without limitations. For instance, the sample is restricted to companies operating in the same area, albeit in different sectors. Future research on the same topic could geographically extend the sample, possibly making some comparisons between companies in different countries. Future research could also investigate new mediating or moderating variables in the KRs-FS relationship.

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