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Research article

Open Innovation Adoption and Performance in SMEs: A LISREL Analysis of the Case of Morocco

Adopción de la innovación abierta y rendimiento en las pymes: Un análisis LISREL del caso de Marruecos

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Abstract

Introduction: Open innovation is crucial for business competitiveness (Chesbrough, 2003). As companies face internal resource constraints, they turn to collaborative approaches to drive innovation. However, most research focuses on large firms, leaving a gap in understanding open innovation in Moroccan SMEs. This article examines the key factors influencing its adoption and its impact on SME performance. **Methodology:** A survey was conducted among 99 Moroccan SMEs using self-administered questionnaires via Google Forms. The collected data was analyzed using structural equation modeling, specifically the LISREL method. **Results:** Findings indicate that the adoption of open innovation is

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influenced by several factors, including knowledge of the concept, company size and age, ownership structure, strategy, and internationalization. **Discussion:** A positive correlation emerges between open innovation and SME performance improvement. SMEs perceive it as a means to strengthen their innovation processes and reputation, despite resource limitations. **Conclusion:** Open innovation presents a key opportunity for Moroccan SMEs. Its implementation enables them to overcome constraints and enhance their competitiveness.

Keywords: Open innovation; Moroccan SMEs; performance; external collaboration; LISREL; internationalization; strategy; resources.

Resumen

Introducción: La innovación abierta es crucial para la competitividad empresarial (Chesbrough, 2003). Dado que las empresas enfrentan limitaciones en sus recursos internos, recurren a enfoques colaborativos para impulsar la innovación. Sin embargo, la mayoría de las investigaciones se centran en grandes empresas, dejando un vacío en la comprensión de la innovación abierta en las pymes marroquíes. Este artículo examina los principales factores que influyen en su adopción y su impacto en el rendimiento de las pymes. **Metodología:** Se realizó una encuesta entre 99 pymes marroquíes mediante cuestionarios autoadministrados a través de Google Forms. Los datos recopilados fueron analizados utilizando la modelización por ecuaciones estructurales, específicamente el método LISREL. **Resultados:** Los hallazgos indican que la adopción de la innovación abierta está influenciada por varios factores, entre ellos el conocimiento del concepto, el tamaño y la antigüedad de la empresa, la estructura de propiedad, la estrategia y la internacionalización. **Discusión:** Se observa una correlación positiva entre la adopción de la innovación abierta y la mejora del rendimiento de las pymes. Estas perciben la innovación abierta como una herramienta para fortalecer sus procesos de innovación y su reputación, a pesar de sus limitaciones de recursos. **Conclusión:** La innovación abierta representa una oportunidad clave para las pymes marroquíes. Su implementación les permite superar restricciones y mejorar su competitividad.

Keywords: Innovación abierta; pymes marroquíes; rendimiento; colaboración externa; LISREL; internacionalización; estrategia; recursos.

1. Introduction

The adoption of open innovation is gaining momentum within the Moroccan business community, reflecting a growing recognition of its significance. Indeed, according to the 2022 edition of the Global Innovation Index (GII), Morocco progressed from 77th to 67th place among the 132 economies assessed. At the international level, the expression "open innovation" (or "open innovation") has rapidly spread in recent years. Articles praising the advantages of this organizational model are multiplying, prizes reward "best openness practices" and many companies are communicating their desire to review their innovation processes in the light of these new recommendations. In this research, we will examine the reasons for this enthusiasm, that is to say the motivations which push Moroccan SMEs to open their processes, as well as the practices which allow this opening.

The Open Innovation Model was initially proposed by Henry Chesbrough, a professor at Berkeley, in his 2003 work which had a significant impact on both innovation practitioners and researchers. Open innovation can be defined as an organizational device that allows a company to take advantage of the sources of innovation available in its environment (ideas, knowledge, skills, etc.) and to promote the results of its own innovation activities. in collaboration with external actors.

Open innovation differs from the traditional so-called "closed" approach because it opens the boundaries of the organization to incoming and outgoing flows of knowledge and innovative technologies, rather than innovating in an exclusively internal environment. This concept is based on the fundamental idea that useful knowledge is now widely distributed in society. It promotes sharing and collaboration between various economic actors, whether or not they belong to the same company or the same sector of activity, or even whether they have different positions in the value chain.

The objective is to multiply the stakeholders in the innovation process, going beyond a simple partnership. It is a distributed process that intentionally manages knowledge flows across organizational boundaries, using monetary and non-monetary mechanisms consistent with the company's business model. It is an interaction between the company and its external environment aimed at generating new innovations. No organization has a monopoly on good ideas, and even if an organization is effective internally, it must actively and broadly engage in external knowledge networks and communities.

This means that innovation is generated by accessing, exploiting and absorbing knowledge flows that cross company boundaries, whether inbound or outbound knowledge. An organization that embraces open innovation will consider external ideas and technologies as standard practice within its company, and will also allow unused internal ideas and technologies to be used by other external companies.

Over the past few years, Inauen and al., 2011; Shin and al., 2018; Srisathan and al., 2020; Valdez-Juárez and Castillo-Vergara, 2020, have shown considerable interest in exploring how open innovation influences competitive advantage and performance.

Nevertheless, research on open innovation within SMEs reveals that these companies face challenges in establishing effective mechanisms, mainly attributed to their smaller size. Despite being more flexible and adaptable, SMEs often encounter limitations in resources and expertise needed to foster a culture of continuous innovation and open innovation. Notably, the scarcity of human resources possessing the necessary skills to comprehend, assimilate, and explore scientific discoveries contributes to a diminished absorptive capacity in SMEs. This, in turn, impedes the effective monitoring and integration of external knowledge into their internal innovation processes. Despite the increasing interest in open innovation, it is worth noting that the majority of existing studies primarily concentrate on larger enterprises.

Therefore, to remedy this gap in the field of research on innovation in Morocco, this article aims to explore the factors that favor the implementation of open innovation and its impact on the performance of small businesses and Moroccan medium-sized enterprises (SMEs).

Our research question can be formulated as follows: "What are the factors that explain the implementation of open innovation within Moroccan SMEs?" To answer this research question, this article will be structured as follows: after a review of the literature on the determinants of open innovation, a conceptual model is proposed. The methodology for validating this model will be presented in a third point and finally the results will be discussed in relation to the literature.

2. Methodology

2.1. Review of the literature on the determinants of the adoption of open innovation

In the realm of management, innovation unfolds as a collaborative and ongoing process, heavily shaped by a company's internal structure and the way they coordinate efforts (Dosi et al., 1990). Similarly, scholars such as Karshenas and Stoneman (1993), K. Ahsina (2012) and Cohen and Levinthal (1990) argue that these structural characteristics strongly guide and influence the innovative behaviors of individuals within organizations.

2.2. Company size

The discussion regarding the influence of size on innovation traces its roots back to the foundational research of Schumpeter. In his perspective, innovation activity escalates at a rate exceeding mere proportionality as the size of the company expands. Since then, size has emerged as one of the focal variables extensively investigated in determining its impact on innovation.

Chesbrough & Vanhaverbeke, along with González-Benito and colleagues, highlight a primary trait of small and medium-sized enterprises (SMEs): their compact scale, which presents a dual nature as both a strength and a weakness. Precisely, the constraints faced by SMEs often stem from limited resources, spanning human, financial, or IT realms.

To address this, SMEs are turning to open innovation models and collaborating with other companies, particularly larger ones with greater resources, to develop their projects, making them more attractive.

In light of these studies, we can formulate the following hypothesis:

Hypothesis 1: Open innovation activity increases more proportionally than the firm size.

2.3. The age of the company

Two conflicting perspectives have emerged concerning how a company's age impacts innovation. The initial theory proposes that with maturity, a company amasses the experience and expertise essential for innovation, establishing a positive correlation between firm age and its innovative capacity.

Furthermore, innovations originating from more established firms are suggested to wield more influence compared to those from younger counterparts. In contrast, the second viewpoint suggests that entrenched procedures and established routines in older firms hinder the adoption of new external advancements, serving as a barrier to innovation. However, research in this domain has yet to conclusively support either of these conflicting propositions.

Hypothesis 2: "The age of companies would have an ambiguous effect on the implementation of open innovation".

2.4. Strategic Direction

Does the clarity of a company's strategic direction increase its chances of being innovative?

Only one study has empirically addressed this question. The results demonstrated that the most innovative companies in niche sectors like small-scale mechanical and instrumental engineering were distinguished by a well-defined strategy. However, these results do not allow generalizations, and further research is needed to reach a consensus.

In the realm of business growth strategy, diversification does not appear to be a favored approach according to the results. Indeed, studies consistently linking negative diversification strategies with innovation reveal a significant relationship.

Concerning diversification, it frequently comes with formal and financial controls that may act as deterrents to technological initiatives. This notion is further supported by studies investigating the correlation between control measures and innovation.

Hypothesis 3: "A well-defined strategy would have a positive effect on the implementation of open innovation within companies."

2.5. Internationalization of the company

Generally, a company encounters two strategic alternatives: - Should it confine its operations to the local market, or should it expand internationally? Alternatively, should it sustain internal growth, or should it seek external expansion? Regarding the first choice, , the research is largely consistent: internationalization has a significantly positive effect on innovation. To remain competitive in the international market, a company must constantly innovate.

Regarding the second choice, the results are mixed regarding the connection between external expansion and innovation. Both a significant positive correlation and a significant negative correlation are observed. The positive correlation is attributed to the access to new technologies offered by external growth. Conversely, the adverse correlation is attributed to a decline in productivity resulting from the intricacies of post-acquisition management. Therefore, we will undertake to test the validity of the following hypothesis:

Hypothesis 4: "Internationalization strategy has a significantly positive effect on the implementation of open innovation within companies."

2.6. The company's human resources mobilization practices

The connection between human resource strategies and open innovation is gaining attention within the realm of human resource management literature. A recent conceptual argument proposes that HR practices can serve as pivotal tools in navigating and surmounting cognitive and organizational barriers encountered in the open innovation process.

Certain HR practices—such as autonomy, participation, information sharing, communication, compensation, profit sharing, and skill development—are seen as catalysts for fostering innovation. They facilitate the exchange of knowledge, encourage fair treatment, and promote discretionary behavior among employees. Shipton et al. outlined two configurations for a formal Human Resource Management (HRM) system, each designed to influence employees' innovative behavior differently.

The first, a control-oriented system, aims to align employees' innovative actions with the company's strategic goals and broader institutional expectations. This approach is in line with conventional HRM literature on high-performance work systems, suggesting that specific HR practices can bolster employee loyalty, learning, and intrinsic motivation, ultimately enhancing their ability to accomplish organizational objectives.

Conversely, the entrepreneurship-focused HRM system prioritizes challenging employees' established beliefs, fostering critical thinking, and encouraging scrutiny of the organization's operations and performance. Consequently, the exploration will revolve around testing the following hypothesis:

Hypothesis 5: "Human resources mobilization practices will promote open innovation within companies".

2.7. The implementation of open innovation and the impact on performance

Belderbos, Carree and Lokshin (2004), Faems, Van Looy and Debackere (2005), found that interorganizational cooperation leads to progressive innovations, high productivity and higher levels of turnover. Just as scientific cooperation with research institutes also implies an increase in sales linked to the creation of new products. From this literature review, we put forth the following hypothesis:

Hypothesis 6: "The implementation of innovation has a positive impact on business performance" After this review of the literature, we designed a conceptual model based on this literature and whose hypotheses included in the following table:

Table 1.

Summary of research hypotheses

Hypothesis number	Title of hypotheses
H1	Open innovation activity increases more proportionally than the firm size
H2	The age of companies would have an ambiguous effect on the implementation of open innovation
H3	A well-defined strategy would have a positive effect on the implementation of open innovation within companies
H4	Internationalization strategy has a significantly positive effect on the implementation of open innovation within companies
H5	Human resources mobilization practices will promote open innovation within companies
H6	The implementation of innovation has a positive impact on business performance

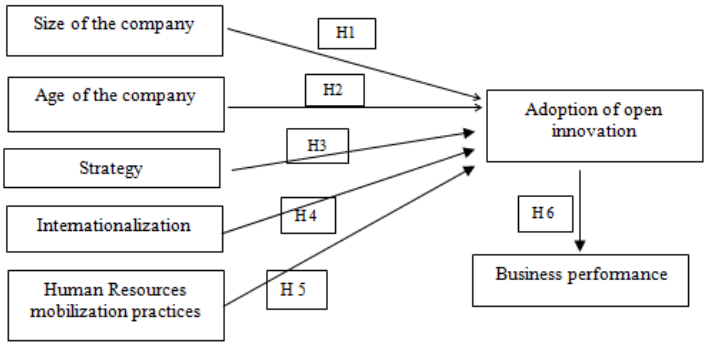
Source: Own elaboration (2025).

Hence, various contingency factors such as size, age, a clearly defined strategy, internationalization, and practices related to mobilizing human resources play a role in shaping the adoption of open innovation projects.

The adoption of this managerial tool results in increasing the productivity and performance of companies. Consequently, we put forth the subsequent conceptual model to undergo testing within the context of Moroccan companies, aiming to examine and validate its applicability.

Figure 1.

Our conceptual model of research



Source: Own elaboration (2025).

3. Methodology

In this section, we will describe the empirical research methodology adopted starting with a brief description of the sample and the survey used. Subsequently, we present the structural equation method based on the LInear Structural RELationship (LISREL) method used for the estimation.

3.1. The constitution of the sample

The centerpiece of any survey, the questionnaire is the articulation of the conceptual model, expression of the research hypotheses and the operating mode, an instrument for observation and collection of information. Upstream, its reading raises the observer's gaze by the nature of the questions asked". For the choice of our sample, we opted for the convenience method and the activation of a knowledge network due to the absence of a database of companies that apply Open Innovation. Thus, out of a total of 500 questionnaires sent, 99 were completed, representing a response rate of 19.8%.

3.2. The application of structural equation modeling based on the LISREL approach

Why use structural equation modeling? Multiple regression does not allow us to analyze a model with two independent variables, which led us to use structural equation modeling. Structural equation models have been designed since their origin as confirmatory methods. They must be used in the final phase of research to confirm the internal validity of constructs and test hypotheses of a theoretical model. The method therefore applies to deductive research approaches. However, this framework can be very flexible depending on the results of the first statistical tests which may lead to modifying hypotheses of the measurement model and/or the linear relationship model.

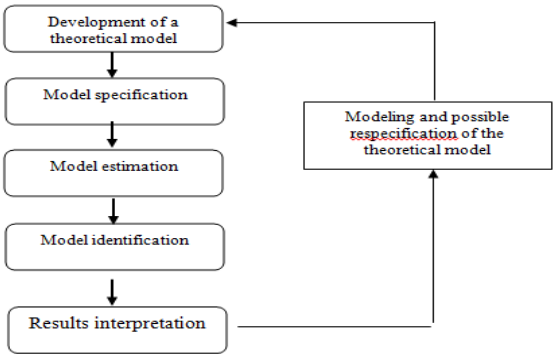
4. Results

The model was tested using the maximum likelihood method, although the data was far from following a normal distribution. The ADF procedure (Browne, 1984) could be indicated in this case, but it requires a much larger sample than ours. To compensate for the violation of the multi-normality of the variables, we carried out a bootstrap procedure, with 1000 draws.

The implementation approach is therefore heuristic. It distinguishes five main phases represented in Figure 2.

Figure 2.

Steps of analysis using structural equation modeling (SEM)



Source: Roussel, P.and al (2005).

4.1. Adjustment of the theoretical model to the data

Testing a structural equation model involves testing the data against the following null hypothesis:

> H0: The data estimated from the theoretical model fits the empirical data well. Rejecting the null hypothesis amounts to not validating the theoretical model and vice versa if the hypothesis is accepted.

The resolution process is based on the comparison of two matrices: the "S" matrix of the covariances or correlations of the observed variables, and the "Σ" matrix of the covariances or correlations of the variables estimated from the theoretical model.

- S = matrix of covariances or correlations between variables calculated from empirical data in the raw data matrix;

- Σ = matrix of estimated covariances or correlations.

The estimation is most often carried out using a maximum likelihood method. It consists of maximizing the likelihood of the covariances or correlations of the observed sample for a larger population. If the data from these two matrices converge, the fit of the theoretical model to the data is considered good fit. In this case, the elements of the residual matrix approach zero. The null hypothesis can be accepted as well as the theoretical model.

4.2. Interpretation of results

The fit of the overall model was tested using several indices with different characteristics. Each of them has its own weaknesses, so it is desirable to combine them in order to carry out a more objective analysis of the adjustment.

Table 2.

Model fit indices (ML, n=1000, Bootstrap)

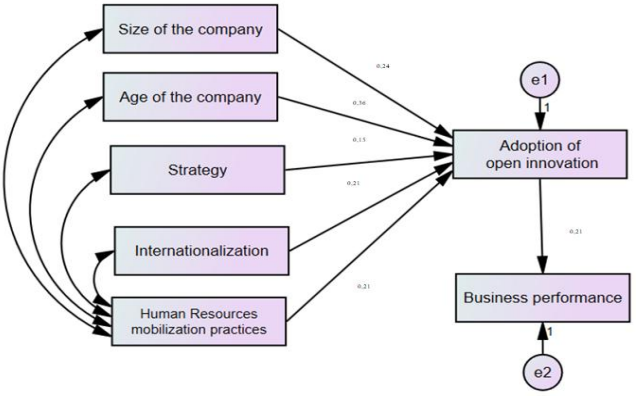
Adjustment indicators	χ2/Δλ	AIC	AGFI	CFI	GFI	NFI	RMSEA	RMR
Standards	< 5	The lowest possible (comparison)	AGFI > 0.90	CFI > 0,95	GFI > 0.90	NFI > 0.90	RMSEA < .06	Closest to 0.
Default Model	0,862	37,448	0,94	1	0,988	0,979	0,000	0,016

Source: Own elaboration (2025)

The model's alignment with the data appears notably satisfactory. It adheres well to the absolute adjustment criteria, notably demonstrated by the Chi-square relative to the number of degrees of freedom, which falls below the 5 threshold. The value of the RMSEA is below the threshold of 0.05. The incremental indices are systematically greater than 0.9. Ultimately, this is the model that is retained in this research. Furthermore, and after 5 iterations, AMOS restores all significant links between variables Figure 3.

Figure 3.

Model Fit: non-standardized estimators



Source: SPSS-AMOS-23 output.

5. Discussion

The literature on open innovation adoption highlights various factors influencing this approach. Our findings confirm several theoretical propositions while providing new insights into the case of Moroccan SMEs.

Firm size plays a crucial role in open innovation adoption (Schumpeter, 1942; Chesbrough & Vanhaverbeke, 2003; González-Benito et al., 2006). Our analysis reveals a positive correlation between firm size and open innovation, as larger companies possess more resources. Conversely, firm age presents an ambiguous impact (Cohen & Levinthal, 1990). While experience fosters innovation, older firms may struggle with rigid structures that hinder adaptability.

A well-defined strategic orientation enhances open innovation potential, as suggested by Cassiman & Veugelers (2006). Our results support this perspective, reinforcing the importance of a clear vision for successful innovation. Furthermore, internationalization is a key driver of innovation, exposing firms to new markets and technologies (Ahuja, 2000). Our study confirms that Moroccan SMEs engaged in international activities are more inclined to seek external collaborations.

Additionally, human resource practices significantly influence open innovation adoption (Edwards et al., 2005). Our findings indicate that Moroccan SMEs investing in HR development and fostering an innovation-friendly culture are more likely to succeed in open innovation initiatives.

These findings contribute to the existing literature by providing context-specific insights and practical recommendations for economic policymakers and business leaders in emerging markets. The study highlights the necessity for Moroccan SMEs to enhance their strategic orientation, international engagement, and HR practices to optimize their open innovation potential and overall business performance.

6. Conclusion

This article as announced in the introduction aims to fill in the gap on the factors that promote the implementation of open innovation and its impact on the performance of Moroccan small and medium-sized enterprises (SMEs).

We conducted our research using a sample of 99 Moroccan companies to examine our conceptual model. Consistent with the literature we reviewed, it seems that the initiation of innovation systems is primarily influenced by the size of the company. Certainly, the more the size of companies increases, the more important the need to set up innovation systems becomes.

Additionally, we observed positive influences on the adoption of open innovation projects from the following contingency variables: size, age, a clearly defined strategy, internationalization of the company, and practices related to mobilizing human resources. It was also identified that the adoption of this managerial tool exhibited a strong correlation with the performance of the observed companies.

Regarding the impact of our research on the implementation of innovation systems in practice, it can be affirmed that the contributions are manifold and directly stem from the findings presented in the last section. Firstly, the participation of operational staff in the successful adoption of innovation systems through their involvement facilitates the development of strategic solutions that enhance business performance.

Secondly, the ongoing competition from nations like China and other Asian countries is compelling companies to embrace innovation systems in order to distinguish themselves from the lower-tier products offered by these nations. It is useful to emphasize that any research work comes up against certain limits. Among the limitations that can be raised in the context of this research we can cite: The method of data collection by questionnaire is not without limitations. It will only allow us to collect subjective data.

Additionally, considering the relatively small sample size in this study (99 companies), it is essential to approach the generalization of the results with caution.

It's worth noting that our model excludes other management tools besides innovation systems that can impact organizational performance. Furthermore, during this research, we faced an issue with data accessibility primarily associated with the hesitancy of certain business managers to disclose information.

Exploring the contributions and limitations of the research opens up opportunities for future investigations. One avenue involves subjecting the developed model to thorough testing through an in-depth case study to establish internal validity. This approach allows for a more nuanced understanding of the model's applicability and effectiveness in specific real-world scenarios.

Additionally, there is potential for further research in the identification and exploration of other contingency factors that may influence organizational performance, factors not initially considered in the proposed theoretical model. Investigating these additional variables could contribute to a more comprehensive and refined understanding of the complex dynamics influencing innovation systems and organizational outcomes. Our subsequent research, alongside contributions from other researchers, will contribute to the ongoing refinement and enhancement of the content presented in this study.

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