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Impact of Scholarly Communication and Information Devices On The Development Of Scientific Research In Moroccan Universities

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Abstract :

The concept of "scientific research development" is a fairly complex, and it's dependent on a several contingency factors that impact the General Dynamics of research. The existing literature provides a large number of studies on the impact and factors that influence the development of scientific research, among others: the budget devoted to research, the strategies set by the high decision-making authorities, the motivation of researchers and the means set at their disposal, the involvement and the expectations of socio-economic actors in terms of research and development....

In our research we tried to explore the role of factors related to the deployment of scholarly communication and information devices in Moroccan universities, through a sample of three universities, and using a quantitative approach.

Keywords: Scholarly Communication, Research Development, Scientific Information, Research Visibility, Research Valorization
JEL Classification: D83
Paper type: Empirical research

1. Introduction

It is obvious that the development of scientific and technological research is a real engine of socio-economic development, and that the new Morocco can only be thought in this context by adopting an ambitious policy of scientific research and by strengthening its capacity for innovation.

Being aware of all these parameters, the kingdom has undertaken several actions to strengthen the level of scientific research in Moroccan universities and to improve its ranking at the regional and global level, in this sense many initiatives have emerged, namely the signing of several partnerships and cooperation agreements with foreign research organizations, the establishment of several scholarship programs for university students, the creation of several spaces for sharing and promoting the results of scientific research, the process of putting online scientific journals published by Moroccan researchers, the establishment of exchange programs and funding for the mobility of young researchers….

Our paper aims to study the role and the impact of the scholarly communication and information which is a permanent necessity for researchers' professional life - on the development of research dynamics and the rise of Moroccan universities as well as the promotion of their scientific productions, taking as a sample three universities: UIT, UMV and UCA.

Thus our objective would be to study the articulation of scholarly information/communication and the development of research within these three universities. The object of our research would be to study the possible correlation that there may be between these variables.

We chose the quantitative approach, and opted for the questionnaire as a method of collecting information. In this paper, we will present the results of our survey, after a presentation of the context of the research and the hypotheses designed.

2. Literature review and hypothesis development

The review of the literature and the design of a theoretical framework will allow us to formulate our research hypotheses, to argue them and to refute or confirm them following the results of the empirical study. The final objective is to propose a theoretical model synthesizing the links between all the variables of our research problem. This one consists in measuring the effects of scholarly communication and information devices on the development of research. This relationship will be determined by the mediating effect of the research visibility, the ranking of universities and the scientific research valorization.

In order to do so, we will first present the context of the research, followed by a synthesis of the different variables that allowed the construction of the conceptual model, and finally we will present the explanation and justification of the hypotheses designed.

2.1. Background

It is obvious that the development of scientific research is a very broad concept and depends on a variety of contingency factors, among others: the budget devoted to the financing of scientific research, the policy and strategy adopted to manage the research sector, the involvement of researchers and scientists... We have chosen to work on the role of the scholarly communication and information, on the development of scientific research (Russell, 2001), for this reason, it seems important to us to talk, first, about the theoretical basis of this concept and the adjacent concepts, then to specify in a second step the theoretical framework of our research and the formulation of hypotheses according to which : research visibility, universities ranking, and the research valorization are mediating variables explaining the relationship between the scholarly communication and information and the research development, at the end of the paper we will present present the research model.

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2.2. Hypotheses development

Scientific and technical communication (STC) is considered to be the activity whose purpose is the dissemination of the issues and results, of basic or applied scientific research, either for peers or for a wide audience (in this case we often speak of science popularisation).

B. Lamizet and A. Silem (2001) define scientific communication as "the transmission between researchers of information and knowledge produced as a result of their research activities". For information and communication sciences, it is about understanding the exchange, appropriation, rewriting and ultimately the generation and dissemination of new knowledge.

Scholarly communication is a multidimensional concept, commonly understood as the sharing and exchange of scientific information. However, this concept is much more complex than we think, it contains a set of dimensions related to various concepts, among others the visibility and facility of access to scientific production between researchers, which has undergone a significant transformation with the development of Information and Communication Technologies (ICT). This has been observed by Björk (2004), who confirms that scientific production has been one of the areas that has benefited the most from the arrival of the Internet. He states that the electronic channel has greatly facilitated the delivery of scientific publications, as information good to the final user.

In this passage, we will try to explain the relationship between the different variables, starting with the relationship between scholarly communication and the visibility of research, which we will try to explain through open access, a movement that has made a lot of progress in the publication of research results. Many research organizations have joined this movement and have supported the creation of open archives and other bibliographic databases. The concept of openness corresponds to three basic principles: accessibility, sustainability, and freedom (Le Gall, 2005).

« Open access is very useful for researchers », Suber (2012) and Babini (2014), it allows rapid access to digital content, improves visibility and productivity of researchers and increases the impact factor, (Borgman and Furner, 2002). It should be noted that the concept of quality/visibility is multidimensional and cannot be measured by a single indicator or action, (Bollen, Van de Sompel Hagberg and Chute, 2009). Open access allows users to read and access the full texts of articles without any economic, legal or technical barriers (Budapest Open Access Initiative, 2001).

Based on these elements of literature, we support the following hypothesis:

- **H1a: When researchers communicate enough about their research, they have more visibility.**

It must be understood that scientific research is considered to be the driving force behind scientific innovation. Whether through basic or applied research, the scientific research system is intimately linked to the patterns of innovation processes through the production, transmission and transfer of knowledge, data, and know-how (OECD, 1996).

"Scientific knowledge is the keystone of innovation and, in its most applied forms, an essential component of our economy ». The results of basic research can be transformed into concrete commercial and industrial applications, provided there is an additional investment from both the private sector (PENIN, 2010) and public research organizations (PERKMANN, WEST, 2014). In a knowledge-based economy, it is therefore important that scientific and technical information can circulate both rapidly and freely without financial or legal constraints (DILLAERTS 2012; DILLAERTS 2014).

"Scientific research is part of a process that aims to transform knowledge into a key product of the economy and an engine of innovation and growth. As a result, scientific communication, which ensures the dissemination and reappropriation of knowledge, becomes a central issue

(PROSSER, 2007)" (PROSSER, 2007). The literature review brings us some results related to the influence of scholarly communication and information on the research valorization, and leads us to formulate the following hypothesis:

- **H1b: The deployment of scholarly communication and information system allows a better valorization of the scientific research results.**

In order to prove the impact of scientific exchange on university rankings, Aguillo, Ortega and Fernandez (2008) stated that: « In a world where we are increasingly connected, the popularity and global visibility of the academic world, is clearly linked to its attachment to the global internet network ». Therefore, it is essential to consider publications on the Internet, which are not only the main tool for scientific communication, but also an accurate reflection of the overall organization and performance of the university. Beyond the methodological shortcomings that can be criticized in international or continental university rankings (Fert, 2008; Gingras, 2008), we believe that being on an international ranking list is an excellent marketing operation because it provides more visibility for universities.

It is also worth mentioning that the official language of scientific research worldwide is indeed English, it means that any researcher wishing to publish in indexed renowned journal, must do it in English. The data show that English-speaking universities are better, which may be related to the advantages of using English as a communication tool. Over the years, English has displaced most other languages with regional or marginal status. Publications in French, German, Spanish or other languages ... will reduce the international visibility and influence of research results and weaken the ranking of universities. In view of these findings, we support the following hypothesis:

- **H1c: The scholarly communication of scientific information has a positive impact on the universities ranking.**

The opening of research results to the public is undoubtedly very beneficial to the research development, the innovation support, and the scientific and economic outreach of a country. As Claudio (2017) explains1, it has been proven that the high visibility offered by open access can lead to more citations, i.e. the number of citations has become more and more important as a measure of the scientific production of any researcher, and consequently of any university, which leads us to meditate on the relationship between visibility and the development of scientific research. Indexing measures are supposed to be indicators of the researcher efficiency and its impact.

In view of this, we support the following hypothesis:

- **H2a: Visibility is a factor that has a positive influence on the development of scientific research.**

Valorization is a general concept that brings together two concepts: commercialization and transfer. In fact, it can be fragmented into two main fields: on the one hand, that of commercial, financial or economic valorization and, on the other hand, that of social valorization of research2.

Professors (Biaou Gauthier, Akpona, Sokpon, 2008) explain that "The valorization of research results is essential to any university", they prove through a study that the valorization of university research results is an indispensable condition for the mobilization of financial

[1] " Pros and Cons of Open Access vs Traditional Publishing in Scientific Journals | LinkedIn ", consulté le 11 novembre 2020, https://www.linkedin.com/pulse/pros-cons-open-access-vs-traditional-publishing-journals-luz-claudio/.

[2] Alain Grisé, *La valorisation de la recherche universitaire: clarification conceptuelle*, Étude (Sainte-Foy, Québec: Conseil de la science et de la technologie, 2005).

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resources and that is essential to strengthen the links between universities and industries to go beyond the stage of scientific publications in order to create national wealth".

In our research work we have retained the following hypothesis:

- **H2b: The valorization of research is a factor that exerts a positive influence on the development of scientific research.**

For a long time, the academic world has been obsessed with rankings, which goes beyond improving university performance (quality of training, integration of laureates into the labor market, quality of scientific research in laboratories...). Universities rankings are seen as a normative tool that can influence and guide the behaviour of different actors in higher education and research field, and influence scientific research strategy and orientation in a holistic way (Hazelkorn, 2011). The use of internal university rankings is an aspect of managerial culture that has manifested itself particularly in the last decade (Boure, 2010), infiltrating the communication space (Weingart and Maasen, 2007). Communication then became a function of the university's management; it was integrated into its organization, (Tristani-Potteaux, 1997). Nevertheless, nowadays, classifications in the knowledge economy are part of the proliferation of new public management tools (Levoin and Oger, 2012; Bruno, 2008). Communication between institutions (D'Almeida, 2007), is included in the actions required to manage university communication.
In our research work, we support the following hypothesis:

- **H2c: The ranking of universities is a factor that has a positive influence on the development of scientific research.**

3. Research methodology

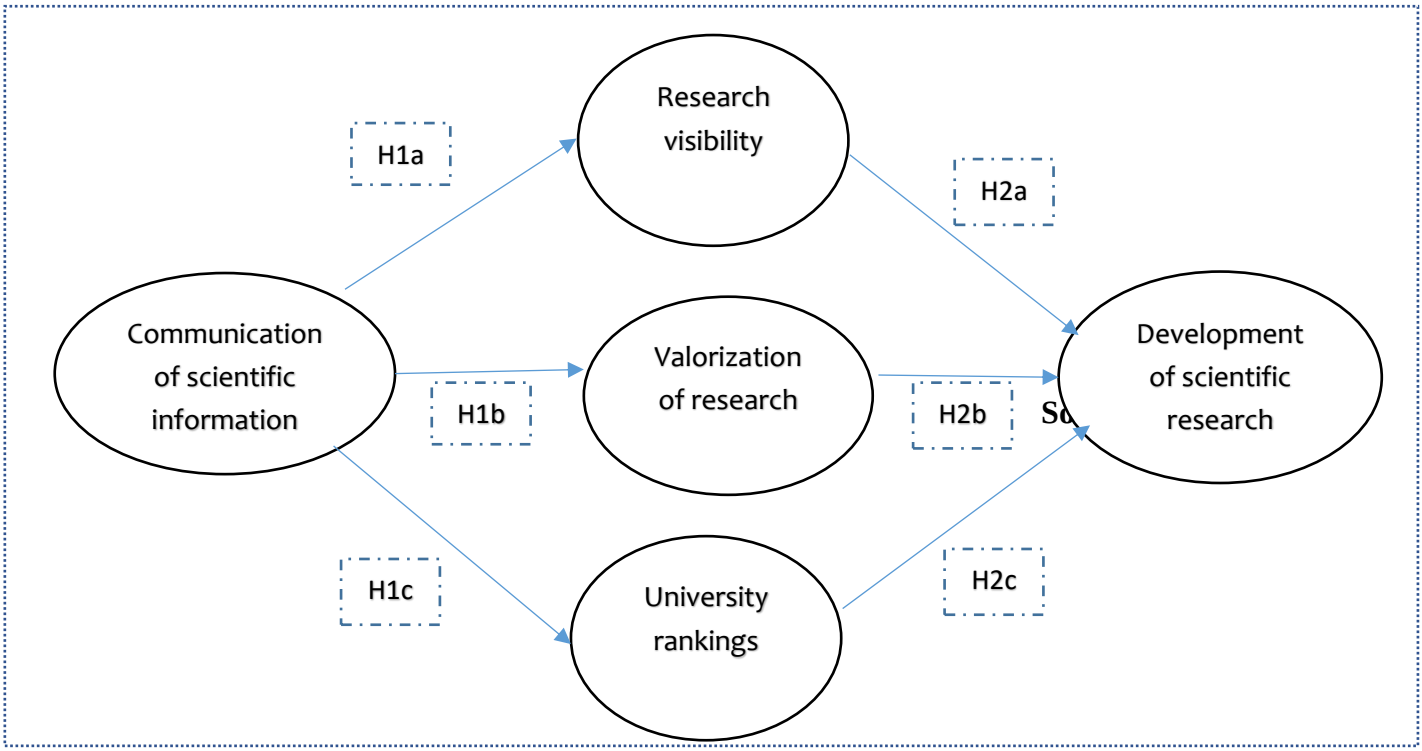
For this study, we have chosen the quantitative approach, which is particularly used to test theories, hypotheses and models, within the framework of a hypothetico-deductive approach (Thiétart, 2014).

3.1. Research model

After having exposed all the hypotheses of our work, we believe that our model, is able of explain and contribute to a better understanding of the role played by the scholarly communication and information on the development of scientific research in the Moroccan context.

Thus, our goal is to first expose the relations between the explanatory, to be explained and mediating variables in a global conceptual model. Retracing all the hypotheses from the literature. Our model highlights the importance of the research visibility, the valorization of research results and the ranking of universities as mechanisms, by which the scholarly communication and information influence the development of scientific research. To this end, we propose the following model.

Figure 1: Overall Conceptual Model of the Research



Source: *Authors*

The goal of our conceptual model is to explain and test the way scholarly communication and information systems contribute to the development of scientific research by improving the visibility of research, encouraging technology transfer and the valorization of research results, and improving university rankings.

3.2. Sample and description

Our field of study is made up of three Moroccan universities: Cadi Ayyad University in Marrakech, Mohammed V University in Rabat and Ibn Tofail University in Kenitra.

The choice of these universities was not made randomly, but after a lot reflection and research, following which we have chosen:

Mohammed V University of Rabat, which is a very old university, having trained the intellectual elite of Morocco after independence, the university provides polyvalent training in various disciplinary fields: Exact Sciences, Economic and Social Sciences, Medical Sciences, Humanities engineering...

It's among the best ranked universities at the national and even continental level, with a large number of institutions under its supervision, with a very large number of active and productive researchers, having a wide network of international cooperation with the different actors of scientific research.

Cadi Ayyad University of Marrakech which is also an old and internationally recognized university, for the quality of its researchers, known for being active and rigorous, who work on several national and international research projects. It is also a large university with many institutions, ranked well, at the national level, and even in international rankings.

And finally the University Ibn Tofail of Kenitra, a young university (several institutions have been created in the last decade) and which has managed to make a very good place among the 12 public universities, and has even managed to be present in international rankings (by positioning itself in the prestigious Times Higher Education THE ranking, more particularly in the Word Universities Ranking 2021, among the first 1000 universities in the world)

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Indeed, we have tried to diversify the universities chosen, by varying the selection criteria, after having drawn up a scientific assessment of each of these universities in order to understand the impact of different communication and scientific information systems on the development of research within these universities, and to see how these systems contribute to the different achievements.

Our survey population is made up of professors and PhD students from the three universities, who responded to our questionnaire constructed on the basis of Likert scales 1 to 5. In total, the number of professors and doctoral students who actually responded to the questionnaires was 336.

4. Results and Discussion

The main target of this study is to determine the way different devices of scholarly communication and information influence the development of scientific research, via mediating variables. The analyses that we have set up following the processing of the data collected via the SPSS software, have allowed us to confirm some of the research hypotheses initially set up. In this regard, we have - through factorial analysis, and the analysis of structural equations using the AMOS software- succeeded to analyze the links between the four variables (mediating and explanatory) and the variable to be explained.

The objective is to present an exploratory estimation of the validity and reliability of the variables measures on the SPSS software. Then, we will present the results of the descriptive analysis of the data collected from our sample.

4.1. Results and analysis of statistical tests

4.1.1 Results of the factorial rotation with the Varimax method

We have used Principal Component Analysis (PCA), to design and refine instruments of our questionnaire based on scales. Our objective is to condense the information contained within a large number of items into a small set of new dimensions while ensuring minimal loss of information. We, therefore seek to bring out the constructs or dimensions underlying a set of variables. The following table represents a factorial analysis, with Varimax rotation for the validation of the measurement items. The research axes are represented as follows:

Table 1: Factor analysis with Varimax rotation

Axes	Variables	Relative contribution	Own values	Total variance explained	Alpha of Cronbach
University rankings	Number of publications per author	,818	2,373	59,337	,771
	The number of scientific collaborations with foreign partners	,772			
	Reliability of information about researchers' affiliations on Scopus and WOS databases	,735			
	Number of citations per author	,755			

Communication of scientific information	The complexity of using SCOPUS, WOS, Sciences Direct, Springer databases.	,780	2,894	57,876	,817
	Technical problems related to the use of the e-resource platform	,826			
	Lack of training for researchers in the use of the tools.	,703			
	Difficulties encountered in using the institutional address	,757			
	The absence of certain databases	,733			
Development of scientific research	Lack of motivation and incentive for the researcher and doctoral student	,783	1,943	64,754	,726
	Lack of donor interest in investing in national research	,834			
	Lack of participation of socio-economic actors in the development of research	,796			
Valorization of research	Technology transfer	,746	4,098	58,539	,881
	The number of patents filed and commercialized	,742			
	The development of intellectual property management	,796			
	The encouragement of applied research	,803			
	The establishment of a Technology Transfer Office	,795			
	The creation of Innovation Cities for young researchers to help them innovate and create good content	,744			
	Protection and commercialization of research products	,725			
Research visibility	Personal web pages of the researchers	,833	1,977	65,899	,740
	The notoriety of the establishment	,803			
	The presence of researchers in the media and public space	,799			

Source: *Authors*

The "variables" column shows the measurement items that were retained after performing an exploratory factor analysis with a Varimax rotation. Items that interfere with the analysis have been eliminated in order to make the analysis more efficient. For all of the axes created, the total variance explained is satisfactory, it is well above 50% (the minimum threshold

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admitted by the literature). As a result, the information retained after collecting items is considered to be greater than 50% of the initial information.

For each variable, we have a scale created from the factors that emerged from the PCA. We have verified whether this scale is sufficiently accurate to be used in an explanatory analysis. We want to verify if this scale is stable over time and if it allows us to properly measure the construct we have identified. We have therefore carried out an internal consistency analysis using Cronbach's Alpha.

For all the variables in the model, the information retained after constituting a factor using the Varimax rotation is greater than 50%, each item retained has a relative contribution greater than 0.7, which represents a very good result. Thus, Cronbach's Alpha coefficient is satisfactory, it is higher than the minimum standard recommended by the literature.

Although Cronbach's Alpha coefficient is sensitive to sample size and number of items, the results are very satisfying. We therefore perform a convergent and discriminant validity analysis to validate the PCA results.

4.1.2 Results of the factorial rotation with the Varimax method:

In this step, in order to validate the results obtained by the PCA, we will study the convergent and discriminant validity. For the convergent validity, we use the Rho of Convergent Validity (Average variance extracted) which is calculated by the following formula:

$$\rho_{vc(n)} = \frac{\sum_{i=1}^{p} \lambda_i^2}{\sum_{i=1}^{p} \lambda_i^2 + \sum_{i=1}^{p} var(\varepsilon_i)}$$

Where:
n = the latent variable
λ = the factor contribution
P = the number of items
εi = Measurement error
The Rho of Convergent Validity must be greater than 0.5 for all variables.
In terms of discriminant validity, it is tested when the Rho of Convergent Validity is greater than the square of the correlations between each variable and the other variables of the model.

Table 2: Convergent and Discriminant Validity

	Development of scientific research	**Communication of scientific information**	**Research visibility**	**University rankings**	**Valorization of research**
Rho of convergent validity	0,6475	0,5788	0,6590	0,5934	0,5854
R²ij Development of scientific research	1,000	0,032	0,009	0,178	0,135
R²ij Communication of scientific information	0,032	1,000	0,040	0,050	0,070
R²ij Research visibility	0,009	0,040	1,000	0,075	0,109
R²ij Ranking of universities	0,178	0,050	0,075	1,000	0,299
R²ij Valorization of research	0,135	0,070	0,109	0,299	1,000
Convergent Validity	**Validated**	**Validated**	**Validated**	**Validated**	**Validated**
Discriminatory validity	**Validated**	**Validated**	**Validated**	**Validated**	**Validated**

Source: *Authors*

According to the table above, we were able to have convergent validity and discriminant validity for all variables in the study. This makes it possible to validate the results of the PCA

factorization with Varimax rotation. We now move on to the next step.

4.1.3 Analysis of the Kaiser-Meyer-Olkin Index (KMO) and Bartlett Sphericity Test:

The purpose of analyzing the KMO Index and the Bartlett Sphericity Test is to measure the suitability of sampling. The following table represents the results of the KMO Index and Bartlett Sphericity Test following factor analysis for the validation of the measurement items.

Table 3: KMO Index and Bartlett Sphericity Test

Variables	**KMO index and Bartlett test**		
University rankings	Kaiser-Meyer-Olkin index for the measurement of sampling quality.		,746
	Bartlett Sphericity Test	Chi-square approx.	348,428
		ddl	6
		Meaning	,000
Communication of scientific information	Kaiser-Meyer-Olkin index for the measurement of sampling quality.		,796
	Bartlett Sphericity Test	Chi-square approx.	568,709
		ddl	10
		Meaning	,000
Development of scientific research	Kaiser-Meyer-Olkin index for the measurement of sampling quality.		,675
	Bartlett Sphericity Test	Chi-square approx.	207,113
		ddl	3
		Meaning	,000
Valorization of research	Kaiser-Meyer-Olkin index for the measurement of sampling quality.		,879
	Bartlett Sphericity Test	Chi-square approx.	1072,246
		ddl	21
		Meaning	,000
Research visibility	Kaiser-Meyer-Olkin index for the measurement of sampling quality.		,684
	Bartlett Sphericity Test	Chi-square approx.	221,667
		ddl	3
		Meaning	,000

Source: *Authors*

The KMO index is used to measure the quality of the sample. A value below 0.6 indicates that we have a correlation between items that is not good. If it is less than 0.5, the sample must be reviewed.

For all variables in our model, the KMO index is above 0.6, which is an excellent result. This informs us that the quality of the correlation between the items of each variable is good. The result of Bartlett's sphericity test for all the variables of the model is significant ($p < 0.05$). We can therefore conclude that the correlations of the items of all the variables are not all equal to zero (we do not have an identity matrix).

4.1.4 Correlation test

Through the empirical study, we have related different variables, via the Pearson Correlation test. Thus we assumed the existence of a significant relationship between these variables, the

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results are as follows:

Table 4: Correlation test

		Development of scientific research	Communication of scientific information	Research visibility	University rankings	Valorization of research
Development of scientific research	Pearson Correlation	1	,178**	,094	,422**	,368**
	Sig. (bilateral)		,001	,087	,000	,000
	N	336	336	336	336	336
Communication of scientific information	Pearson Correlation	,178**	1	,200**	,224**	,265**
	Sig. (bilateral)	,001		,000	,000	,000
	N	336	336	336	336	336
Research visibility	Pearson Correlation	,094	,200**	1	,274**	,330**
	Sig. (bilateral)	,087	,000		,000	,000
	N	336	336	336	336	336
University rankings	Pearson Correlation	,422**	,224**	,274**	1	,547**
	Sig. (bilateral)	,000	,000	,000		,000
	N	336	336	336	336	336
Valorization of research	Pearson Correlation	,368**	,265**	,330**	,547**	1
	Sig. (bilateral)	,000	,000	,000	,000	
	N	336	336	336	336	336

**. The correlation is significant at the 0.01 level (two-way).

Source: *Authors*

The table above shows that:

The analysis of the relationships between the mediating variables and (the explanatory / to be explained) variables, allows us to conclude that we have a positive (Pearson's correlation>0) and significant (p-value<0.05) correlation, except for the relationship between the variable "development of scientific research" and the variable "visibility of research", where the (R=0.094) and the (p-value =0.087). Thus the correlation is positive but not significant.

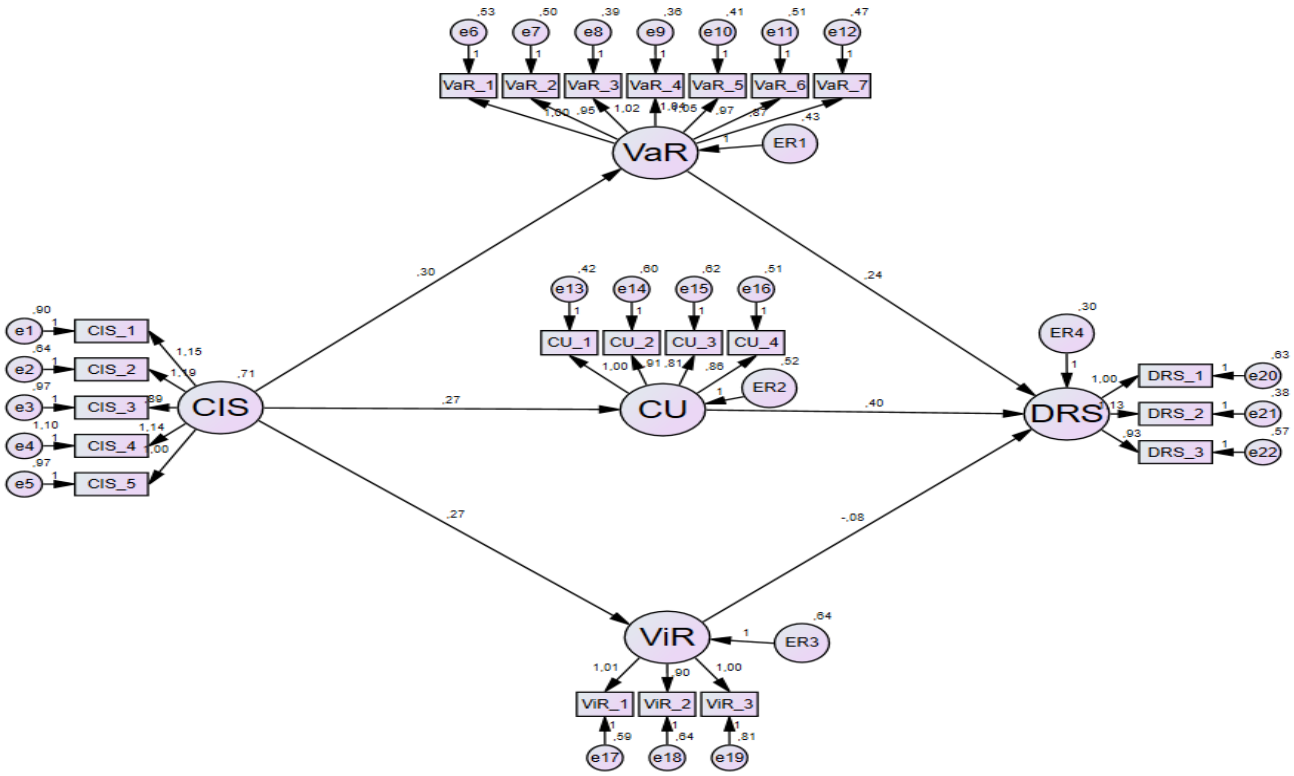
correlations analysis of different variables cannot confirm or invalidate the research hypotheses For this reason, we proceed with the analysis of the modeling results to confirm the nature of the relationship that links all of the variables in the study.

We can then move on to structural equation modeling analysis.

4.2 Structural equations modeling results

In this step, we will try to relate the "explanatory" variables and the variables "to be explained" in a structural equation model. The items introduced in the model are those validated with the exploratory factorial analysis (varimax rotation) and with the convergent and discriminant validity.

Figure 2: Research Model



Source: *Authors*

4.2.1 Measurement quality of the model's assessment

Table 5: Measurement quality and fit index

Index Name	Values for the independent model
Chi-deux	606,729
Degrees of freedom (p)	203 (0,000)
Chi-square/ddl (normalized Chi-square)	2,989
Standardized RMR	0,131
GFI	0,860
AGFI	0,826
PGFI	0,690
RMSEA (p)	0,077
NFI	0,800
CFI	0,856
CAIC (saturated model)	947,585 (1724,729)

Source: *Authors*

The above table indicates that the structural model has a very good fit for the results of the different indices calculated to measure the quality of the causal model, namely: Chi-square=606.729, normalized Chi-square=2.989, CMA=0.131, GFI=0.860, AGFI=0.826,

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PGFI=0.690, NFI=0.800, CFI=0.856 and RMSEA=0.077. The majority of these indices are at a level considered acceptable by the standard. The absolute and comparative fit quality indices (GFI, AGFI, NFI, CFI) are therefore good compared to the standard. The RMR index shows that the fit quality of the causal model is good.

According to the result of the GFI indicator, the model created, manages to explain more than 78.2% of the variability of the variables to be explained (86% of the changes in the variables to be explained can be explained by changes in the explanatory variables).

According to the AGFI results, applying the model to another random sample would explain about 82.6% of the information.

Thus, according to the RMSEA coefficient, the expected average difference in the total population is close to the norm (7.7%), which is considered an acceptable result.

We now turn to the analysis of the parameter estimates of the causal model.

4.2.2 Analysis of parameter estimations

We move on to analysis the estimation of the parameters of the causal model in order to study the significance of the links and to validate the hypotheses. The following table presents the results of Student's T-test and significance.

Table 6: Result of Parameter Estimates of Causal Links

			Estimate	S.E.	C.R.	P	Label
Valorization of research	<---	Communication of scientific information	0,295	0,057	5,144	***	Accepted
University rankings	<---	Communication of scientific information	0,272	0,063	4,328	***	Accepted
Research visibility	<---	Communication of scientific information	0,275	0,072	3,822	***	Accepted
Development of scientific research	<---	Valorization of research	0,242	0,062	3,89	***	Accepted
Development of scientific research	<---	University rankings	0,399	0,069	5,799	***	Accepted
Development of scientific research	<---	Research visibility	-0,081	0,054	-1,513	0,13	Rejected
CIS_5	<---	Communication of scientific information	1				
CIS_4	<---	Communication of scientific information	1,144	0,114	10,07	***	Accepted
CIS_3	<---	Communication of scientific information	0,892	0,097	9,226	***	Accepted
CIS_2	<---	Communication of scientific information	1,192	0,107	11,115	***	Accepted
CIS_1	<---	Communication of scientific information	1,149	0,11	10,49	***	Accepted
VaR_1	<---	Valorization of research	1				
VaR_2	<---	Valorization of research	0,952	0,083	11,469	***	Accepted
VaR_3	<---	Valorization of research	1,023	0,082	12,465	***	Accepted
VaR_4	<---	Valorization of research	1,035	0,081	12,73	***	Accepted
VaR_5	<---	Valorization of research	1,052	0,084	12,514	***	Accepted
VaR_6	<---	Valorization of research	0,973	0,084	11,548	***	Accepted
VaR_7	<---	Valorization of research	0,87	0,078	11,164	***	Accepted
CU_1	<---	University rankings	1				
CU_2	<---	University rankings	0,911	0,088	10,297	***	Accepted
CU_3	<---	University rankings	0,814	0,084	9,67	***	Accepted
CU_4	<---	University rankings	0,862	0,083	10,406	***	Accepted
ViR_3	<---	Research visibility	1				

ViR_2	<---	Research visibility	0,9	0,1	9,005	***	Accepted
ViR_1	<---	Research visibility	1,007	0,111	9,029	***	Accepted
DRS_1	<---	Development of scientific research	1				
DRS_2	<---	Development of scientific research	1,134	0,129	8,783	***	Accepted
DRS_3	<---	Development of scientific research	0,925	0,11	8,386	***	Accepted

Source: *Authors*

The results of the final model are very satisfactory, we accept the results and present the validation of the assumptions.

Table 7: Summary of Hypothesis Testing of the Theoretical Model

	Assumptions	**Validation**
H1	Assumptions regarding the direct and positive link between the communication of scientific information and mediating variables	Accepted
H1a	When researchers communicate enough about their research, they have more visibility.	Accepted
H1b	The deployment of scholarly communication and information system allows a better valorization of the scientific research results	Accepted
H1c	The scholarly communication of scientific information has a positive impact on the universities ranking.	Accepted
H2	Assumptions regarding the direct and positive links between the three mediating variables and the development of scientific research	Accepted
H2a	Visibility is a factor that has a positive influence on the development of scientific research	Rejected
H2b	The valorization of research is a factor that exerts a positive influence on the development of scientific research	Accepted
H2c	The ranking of universities is a factor that has a positive influence on the development of scientific research.	Accepted

Source: *Authors*

5. Summary and conclusions:

Few studies mention the direct impact of scholarly communication and information devices on scientific research dynamic. The results of our study provide significant information and contributions to the literature and practice in this subject, it highlights various aspects and has shown that scholarly communication and information can have an influence on the development of scientific research. Moreover, the present research makes a theoretical contribution by focusing on the role of mediating variables (research visibility/university rankings and research valorization) as mediating influencing factors between the communication of scientific information and research development.

Although several studies has already dealt with the direct influence of these factors on the variable to be explained in a unidimensional way, the mediating effects of these different factors on research development has not been examined. this study contributes to understund the mechanisms of scholarly communication and information devices 1) by setting up a conceptual model to explain how the communication of scientific information influences the development of research, 2) by testing the model on a sample of three Moroccan universities chosen on the basis of several criteria 3) by drawing conclusions that can serve as a starting point for new research.

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