Evaluation of the Performance of the University Information Systems: Case of Moroccan Universities

M. Ayoub Gacim, Pr. Hicham Drissi, Pr. Abdelwahed Namir
Laboratory of Information Technology and Modeling (LTIM), Hassan II University, Faculty of Sciences Ben M'SIK Casablanca, Morocco

Laboratory of Research and Prospects in Finance and Management (LRPFG), Hassan II University National School of business and Management of Casablanca, Morocco

Laboratory of Information Technology and Modeling (LTIM), Hassan II University, Faculty of Sciences Ben M'SIK Casablanca, Morocco
{gacim.ayoub@gmail.com} {drissi.encgc@gmail.com} {abd.namir@gmail.com}

ABSTRACT: *The purpose of this paper is to develop a conceptual model of university information systems performance measurement. To do this we resorted to the choice of 3E-3P model. This model proposes a development under the spectrum of the systemic approach. The objective is to provide a tool to decision-makers in order to understand the dynamics of performance measurement. The model is based on a logic of decomposition of the global performance into three partial performances. The measurement is carried out at each pillar individually using a multi-criteria approach (MACBETH), and subsequently the consolidation of the three partial performances is carried out with the same multicriteria logic.*

Keywords: Information System, Performance, Multicriteria Modeling, University Information System

Received: 28 August 2019, Revised 20 December 2019, Accepted 29 December 2019

DOI: 10.6025/jism/2020/10/1/8-18

1. Introduction

The evaluation of performance in the current administrative context is unanimously recognized as an essential factor in steering administrations. To measure this performance, decision-makers have to use performance indicators. Regarding the definition of the indicators, it is possible to make a distinction in the literature between the standards and the usual methods of piloting by indicators. In the first case we find repositories like ITIL, COBIT, ... Their goal is primarily to provide a structure and tools tailored to professionals from a particular sector. The repositories are based on a benchmark principle of the best practices encountered on the possible widest range of companies. Repositories are often used in practice because they provide the elements to be measured and allow quick apprehension of performance system. The conventional indicators provided are useful and it is interesting to use some of them. However, as soon as it is a question of a particular case they are not sufficient and the

decision-maker must find how to enrich his performance measure. In the case of usual methods of piloting by indicators we can differentiate between sectorized methods from optimization methods. In most cases the indicators target an element or a type of system elements. One of the weaknesses of these approaches seems to us to be the absence of an overall indicator providing a visibility across the system. The multicriteria aspect and the interactions between the criteria are often not taken into account. In addition, the detail they provide, particularly in the definition of indicators not allowing an adequate adaptation to the particular case of the decision-maker. The question becomes, then, how, beyond the indicators used, the decision-maker can apprehend the performance as a whole. This article will be organized in four sections, (i) explanation and discussion of the problem, its nature and its difficulties, (ii) presentation and comparative study of the multicriteria methods available on the literature; (iii) construction and presentation of the model; (iv) interpretation and discussion of results; and the article will be closed with a conclusion and perspectives.

2. Problematic

You cannot approach the performance of an organization without integrating the dimension of its IS and especially when it comes to service activities such as academic universities. In this case the IS is more than a driving factor growing to a strategic factor. It is in this context that the notion of "global performance" appears. This multidimensional concept makes it possible to go from a financial representation of the performance to more global approaches including several dimensions. Numerous examples justify this finding, notably the use of the commercial margin in the evaluation of economic performance; ROI (return on investment) in the evaluation of the return on invested capital; Turnover rate in the assessment of social and human performance; The 360 ° method: as a tool allowing managers to be informed about the perception that their professional entourage have of the effectiveness of their behavior in contributing to their mission. Our analysis, which focuses on the assessment of the contribution of information systems to the performance of Moroccan universities, is surrounded by the heterogeneous nature of performance criteria. We have found it essential to use a multi-faceted and multi-criteria decision support tool to converge and align selected criteria. To further enhance Campbell's assumption of coverage of all criteria and to respond to cost optimization logic; total control of operations; and the constraint of time, it is considered appropriate to synthesize this reflection on three aspects of performance evaluation in this case: Economy, Efficiency, Efficiency.

3. Positioning the Search

Our approach is then interpretative-constructivist. Interpretative in the sense that it uses the arrangement between two modeling approaches, as well as a field investigation for the determination of IS performance criteria in Moroccan universities. Subsequently a tree modeling of these performance criteria according to the above model 3E-3P presented, these on one hand. On the other hand, the constructivist aspect of our work stands out in mathematical modeling, MACBETH in essence and the results will be explained below. To provide a tool for reconstructing the reality of measuring the overall performance of IS in Moroccan universities. Our modeling proposal is to explain the overall performance in three areas (technical, professional and process). Subsequently articulate these with the contributions and knowledge of the literature on the overall performance of IS.

4. Choice of the Multicriteria Method

The ambition stemming from our mathematical modeling can be summed up in two essential points. First, we proposed a suitable multicriteria model and examine its empirical validity. Then check the overall performance of the IS in the Moroccan university. Thus several models and theories were founded in the object. The table below summarizes the existing methods and their propertie.

Following a bibliographic study and a comparison between the different multicriteria methods we opted for the two methods AHP and Macbeth. They have properties like the simple operating principle; the mathematical consistency and the binary comparison principle that makes the evaluation work practical. Our final choice will focus on the Macbeth method given the accessibility of the software. It facilitates the translation of the decision-makers perception and his appreciation of the performance in order to elicit his reasoning model.

5. Construction of the Performance Measurement Model

The approach taken at the level of performance measurement as explained above is based on a multi-criteria concept in order to take into account the different factors influencing performance. Also, the logic of decomposition of the notion of global performance

Method	Author	Consistency	Criteria	Software
AHP	SAATY SCHARLIG TKINDT BILLAUT	Analytic hierarchy process relies on the hierarchical structure of the problem consisting of goal levels, criteria, and alternatives. For more details on multicriteria decisions [15].	Tangible or Intangible	EXPERT CHOICE
MACBETH	BANA E COSTA ET VANSNIK	An approach to measure attractiveness through a catagory-based evaluation technique [1].	Tangible or Intangible	M-MACBETH
TOPSIS	HWANG AND YOON	A multi-attibute decision-making technique (MADM) in which alternatives are ranked according to their distance between the ideal and negative ideal solution [9].	Tangible	TOPSIS SOLVER
THE STUDY OF NON-DOMINANCE	BARICHARD COLLETTE SIARRY	Consists of dismissing dominated solutions. We say that a solution S1 dominates a solution S2 in the sense of n criteria if the performance of S1 is at least equal to the performance of S2 on the n criteria and strictly superior on one criterion.	Tangible	
PROMETHEE	BRANS MARESCHAL	Preference Ranking Organization Method for Enrichment Evaluations: the principle is to use the flow of classification, that is to say the power of an action compared to others [4].	Tangible or Intangible	PROMCALC
MAUT Methods	FISHBURN KEENEY DYER	Multi-Attribute Utility Theory: is seeks to define a utility function that summarizes all criteria [6].	Tangible	LOGICAL DECISIONS
ELECTRE	ROY	Elimination and choice translating reality and its variants which consists of constituting a core of action that outclasses the others. The core is the set of actions that are not outperformed by any [14].	Tangible or Intangible	ELECTRE IS

Table 1. Multicriteria method comparaison

into components must be taken into account in order to facilitate the notion of measurement. But there remains the problem of consolidation of the partial measures carried out. Hence the adoption of a hierarchical concept that makes it possible both to perform partial measurements separately and at the same time to allow an aggregation of the components of the performance into a single global dimension. The overall performance structure is composed of three pillars (3P) essential to know Processes, professionals and the technical platform [13]. Each pillar consists of a set of criteria that respect the representatively of the triplet (3E), economy, efficiency and effectiveness [12]. The tree structure then becomes of the following form:

6. Operation of the Measurement Model (Basic Principle)

The overall performance and the three pillars are evaluated on the basis of a P1 to P5 scale. P5 is the highest performance value and P1 is the lowest performance value. The measurement tool used in our approach as previously stated is the MACBETH multicriteria tool. The choice was justified and discussed in the section (comparative study between MC methods ...). View the many benefits it presents in our case. The measurement principle is based on an aggregation of the three partial components of the performance into a global measure [8]. It is the same for measuring the performance of each component based on its criteria [8]. It is a sequential iterative process that allows dissociated and individually realized evaluations but at the same time that will take into consideration each other to contribute to the overall judgment [7].

7. Analysis and Interpretation

After engagement of the evaluation process with the help of experts using the M-MACBETH software, we obtained the results

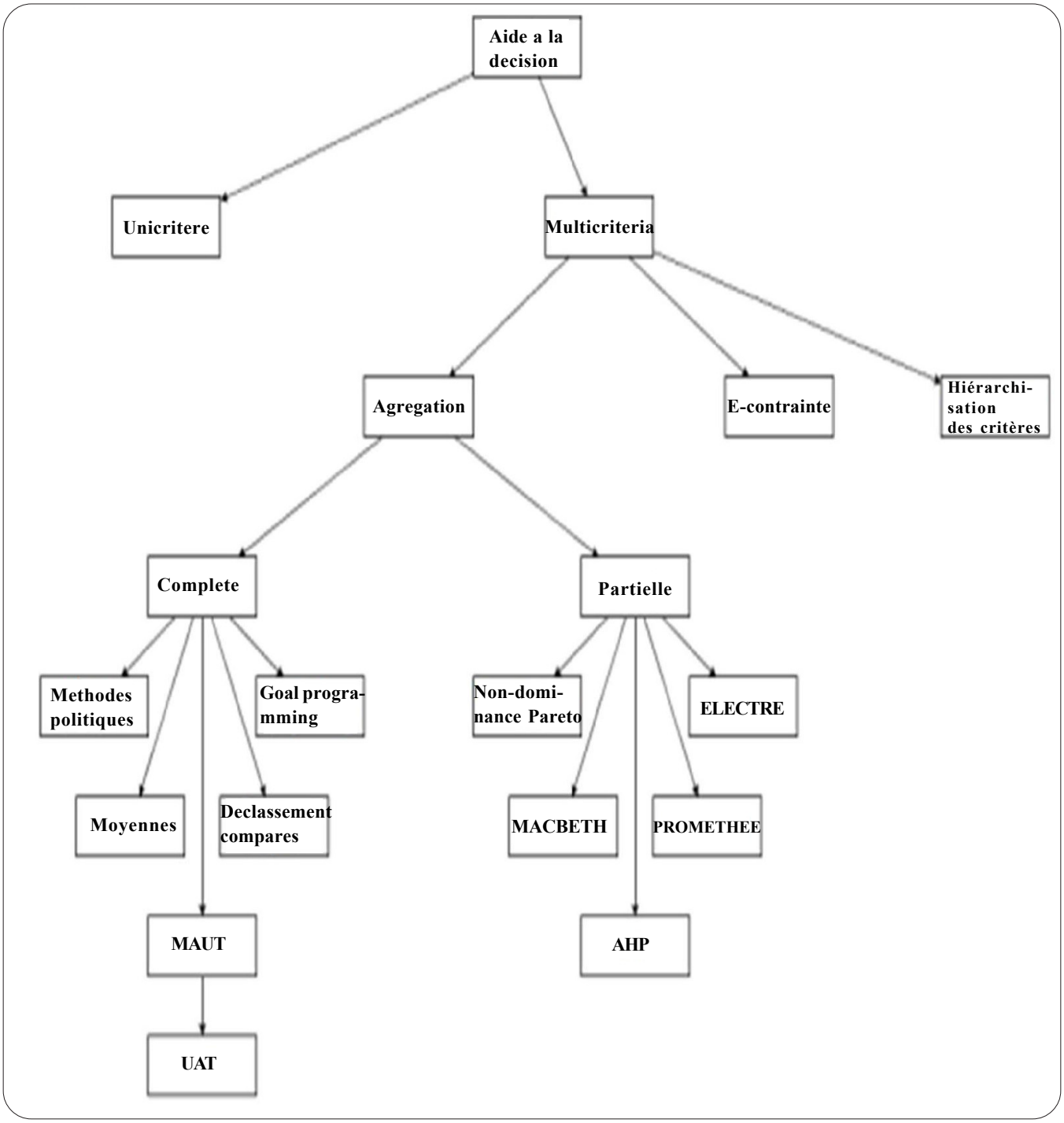

Figure 1. Categorization of decision support methods

of the partial evaluations. We then injected them to re-evaluate the overall judgment that allowed us to obtain the final value of the overall performance. Below is a summary of the results obtained through the study of the performance of the two universities chosen by our team.

2.1 Case number I: Hassan the first University

The result obtained after measuring the performance of the first pillar (P1: .....) Based on its criteria.

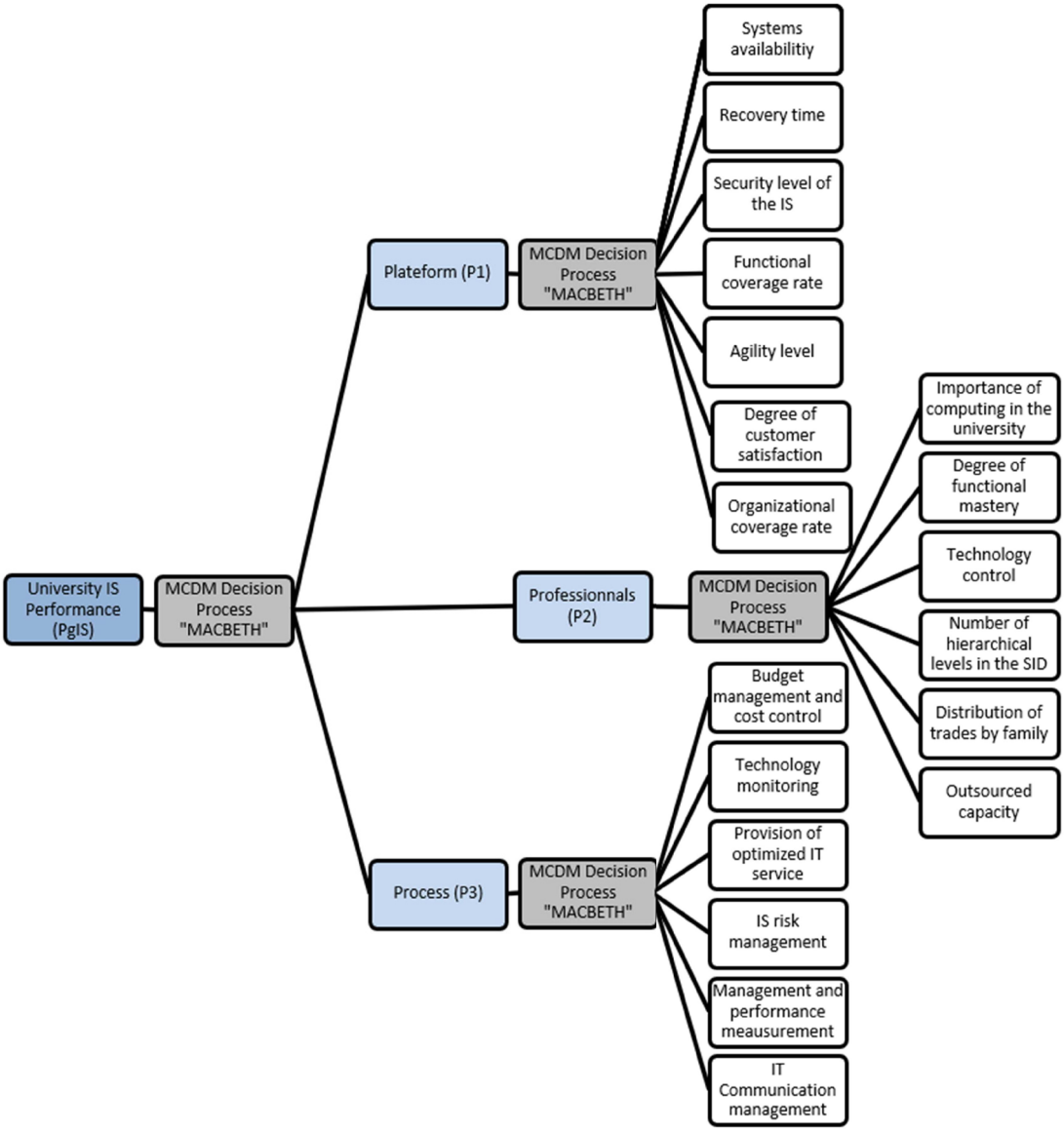

Figure 2. Tree of the performance measurement model

Table des cotes

Options	Global	N1	N2	N3	N4	N5	N6	N7
[toutes sup]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
op 2	82.67	100.00	90.00	76.92	35.00	100.00	100.00	100.00
op 3	73.49	70.59	70.00	46.15	100.00	70.59	81.25	85.00
op 1	45.96	0.00	100.00	100.00	0.00	88.24	62.50	70.00
op 4	39.78	47.06	35.00	15.38	85.00	35.29	12.50	35.00
op 5	19.10	23.53	0.00	0.00	70.00	0.00	0.00	0.00
[toutes inf]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poids :		0.2653	0.0204	0.2245	0.1837	0.0612	0.1429	0.1020

Figure 3. Performane of Pillar 1

The extract from the summary shows that: the performance of the first pillar is at level 2/5. The tendency of evolution is towards level 3/5. The result obtained after measuring the performance of the second pillar (P2: .....) Based on its criteria.

Table des cotes

Options	Global	N1	N2	N3	N4	N5	N6
[toutes sup]	100.00	100.00	100.00	100.00	100.00	100.00	100.00
op 3	88.88	100.00	100.00	100.00	50.00	52.63	86.67
op 4	62.87	23.53	76.47	76.47	25.00	100.00	100.00
op 2	54.75	88.24	23.53	52.94	75.00	26.32	73.33
op 1	38.57	64.71	0.00	41.18	100.00	0.00	53.33
op 5	20.12	0.00	47.06	0.00	0.00	78.95	0.00
[toutes inf]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poids :		0.2500	0.1945	0.3056	0.0833	0.1389	0.0278

Figure 4. The performance of the first pillar is at level 2/5

The extract from the summary shows that: the performance of the second pillar is at the level 3/5 with a tendency of evolution towards the level 4/5. The result obtained after measuring the performance of the third pillar (P3: .....) Based on its criteria.

Table des cotes

Options	Global	N1	N2	N3	N4	N5	N6
[toutes sup]	100.00	100.00	100.00	100.00	100.00	100.00	100.00
op 2	80.14	25.00	85.71	100.00	75.00	50.00	100.00
op 3	65.16	50.00	57.14	57.14	50.00	100.00	75.00
op 1	52.96	0.00	100.00	85.71	100.00	0.00	50.00
op 4	42.33	100.00	28.57	28.57	25.00	75.00	25.00
op 5	16.05	83.33	0.00	0.00	0.00	25.00	0.00
[toutes inf]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poids :		0.1707	0.0244	0.2195	0.1220	0.0732	0.3902

Figure 5. The performance of the second pillar is at level 2/5

The extract from the summary shows that/ the performance of the second pillar is at level 2/5 with a tendency of evolution towards level 3/5. The result obtained after measuring the overall performance (PG: .....). From its components (the three pillars, $P1, P2, P3$).

Table des cotes

Options	Global	N1	N2	N3
[toutes sup]	100.00	100.00	100.00	100.00
op 3	85.76	81.82	100.00	76.92
op 2	84.41	100.00	57.14	100.00
op 1	46.49	45.45	35.71	53.85
op 4	46.06	36.36	71.43	30.77
op 5	0.00	0.00	0.00	0.00
[toutes inf]	0.00	0.00	0.00	0.00
Poids :		0.0909	0.3636	0.5454

Figure 6. The overall performance is at the 3/5 level

The excerpt of the summary shows that: the overall performance is at the 3/5 level with a trend towards level 2/5.

2.2 Case number II: IBN ZOHR University

MaThe result obtained after measuring the performance of the first pillar (P1: .....) Based on its criteria.

Table des cotes

Options	Global	N1	N2	N3	N4	N5	N6	N7
[toutes sup]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
op 3	93.14	92.31	70.00	100.00	100.00	100.00	81.25	85.00
op 2	75.25	100.00	90.00	47.06	35.00	88.24	100.00	100.00
op 4	54.70	61.54	35.00	64.71	85.00	35.29	12.50	35.00
op 1	30.36	0.00	100.00	35.29	0.00	70.59	62.50	70.00
op 5	21.02	30.77	0.00	0.00	70.00	0.00	0.00	0.00
[toutes inf]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poids :		0.2653	0.0204	0.2245	0.1837	0.0612	0.1429	0.1020

Figure 7. The performance of the first pillar is at the level 3/5

The extract from the summary shows that: the performance of the first pillar is at the level 3/5 with a tendency of evolution towards the level 2/5. The result obtained after measuring the performance of the second pillar (P2: .....) Based on its criteria.

Table des cotes

Options	Global	N1	N2	N3	N4	N5	N6
[toutes sup]	100.00	100.00	100.00	100.00	100.00	100.00	100.00
op 3	88.88	100.00	100.00	100.00	50.00	52.63	86.67
op 2	77.28	88.24	23.53	126.67	75.00	26.32	73.33
op 4	59.87	23.53	76.47	66.67	25.00	100.00	100.00
op 1	36.18	64.71	0.00	33.33	100.00	0.00	53.33
op 5	20.12	0.00	47.06	0.00	0.00	78.95	0.00
[toutes inf]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poids :		0.2500	0.1945	0.3056	0.0833	0.1389	0.0278

Figure 8. The performance of the second pillar is at the level 3/5

The extract from the summary shows that: the performance of the second pillar is at the level 3/5 with a tendency of evolution towards the level 2/5.The result obtained after measuring the performance of the third pillar (P3: .....) Based on its criteria.

Table des cotes

Options	Global	N1	N2	N3	N4	N5	N6
op 2	106.60	180.00	85.71	100.00	75.00	50.00	100.00
[toutes sup]	100.00	100.00	100.00	100.00	100.00	100.00	100.00
op 3	80.52	140.00	57.14	57.14	50.00	100.00	75.00
op 1	52.96	0.00	100.00	85.71	100.00	0.00	50.00
op 4	42.33	100.00	28.57	28.57	25.00	75.00	25.00
op 5	10.36	50.00	0.00	0.00	0.00	25.00	0.00
[toutes inf]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poids :		0.1707	0.0244	0.2195	0.1220	0.0732	0.3902

Figure 9. The performance of the second pillar is at level 2/5

The extract from the summary shows that: the performance of the second pillar is at level 2/5 with a tendency of evolution towards level 3/5.The result obtained after measuring the overall performance (PG: .....). From its components (the three pillars, P1, P2, P3).

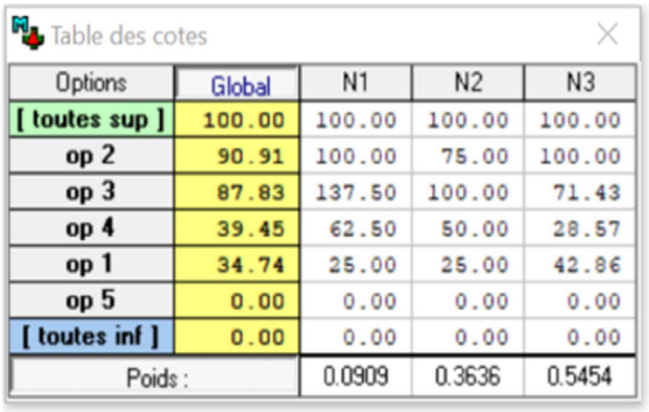

Figure 10.

The extract of the summary shows that: the overall performance is at level 2/5 with a tendency of evolution towards level 3/5.

8. Summary of the Results

The two tables below are the results of the evaluation work of our case study.

The synthesis mentioned above is the result of the analysis of the data resulting from the multi-criteria modeling object of the mobilization of the MACBETH tool.

				Level of performance		Trend of performance (prospective development)			Global Level of performance		Trend of performance (prospective development)	
Title of the criterion	Criteria code	Performance by criterion	**Pillars**	performance	Judgment value	performance	Judgment value		performance	Judgment value	performance	Judgment value
Systems availabilitiy	P11	2	Platform (P1)	2	82,67	3	73,49	**GP UHP**	3	85,76	2	84,41
Recovery time	P12	1										
Security level of the IS	P13	1										
Functional coverage rate	P14	3										
Agility level	P15	2										
Degree of customer satisfaction	P16	2										
Organizational coverage rate	P17	2										
Importance of computing in the university	P21	3	Professionals (P2)	3	88,88	4	62,87					
Degree of functional mastery	P22	3										
Technology control	P23	3										
Number of hierarchical levels in the SID	P24	1										
Distribution of trades by family	P25	4										
Outsourced capacity	P26	4										
Budget management and cost control	P31	4	Process(P3)	2	80,14	2	65,16					
Technology monitoring	P32	1										
Provision of optimized IT service	P33	2										
IS risk management	P34	1										
Management and performance meausurement	P35	3										
IT Communication management	P36	2										

Table 2. UHP Evaluation Data

Title of the criterion	Criteria code	Performance by criterion	Pillars	Level of performance		Trend of performance (prospective development)			Global Level of performance		Trend of performance (prospective development)	
				performance	Judgment value	performance	Judgment value		performance	Judgment value	performance	Judgment value
Systems availabilitiy	P11	2	Platform (P1)	3	93,14	2	75,25	GP UIZ	2	90,91	3	87,83
Recovery time	P12	1										
Security level of the IS	P13	3										
Functional coverage rate	P14	3										
Agility level	P15	3										
Degree of customer satisfaction	P16	2										
Organizational coverage rate	P17	2										
Importance of computing in the university	P21	3	Professionals (P2)	3	88,88	2	77,28					
Degree of functional mastery	P22	3										
Technology control	P23	3										
Number of hierarchical levels in the SID	P24	1										
Distribution of trades by family	P25	4										
Outsourced capacity	P26	4										
Budget management and cost control	P31	4	Process(P3)	2	106,6	3	80,52					
Technology monitoring	P32	1										
Provision of optimized IT service	P33	2										
IS risk management	P34	1										
Management and performance meausurement	P35	3										
IT Communication management	P36	2										

Table 3. UIZ evaluation data

The first table represents the summary of all the criteria of Hassan Premier University.

While the second table represents the summary of all the criteria of IBNOZOHR University.

Thus these tables demonstrate the level of performance of each field by generating both the trend and the judgment value following the evaluation of the three main pillars (P1 platform P2 professional P3 process) across all criteria. To visualize and compare the level of the current performance with that planned we consider useful and meaningful the use of the radar graphic representation and this to estimate the trend of the performance.

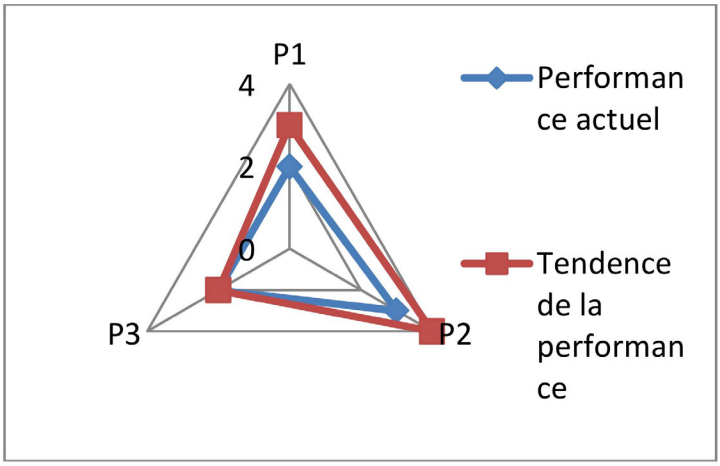

Figure 11. The trend of the performance

From the graphical representation of the UHP's radar, we observe an upward trend in the overall performance of the information system. Our observation shows that this has important long-term evolution prospects.

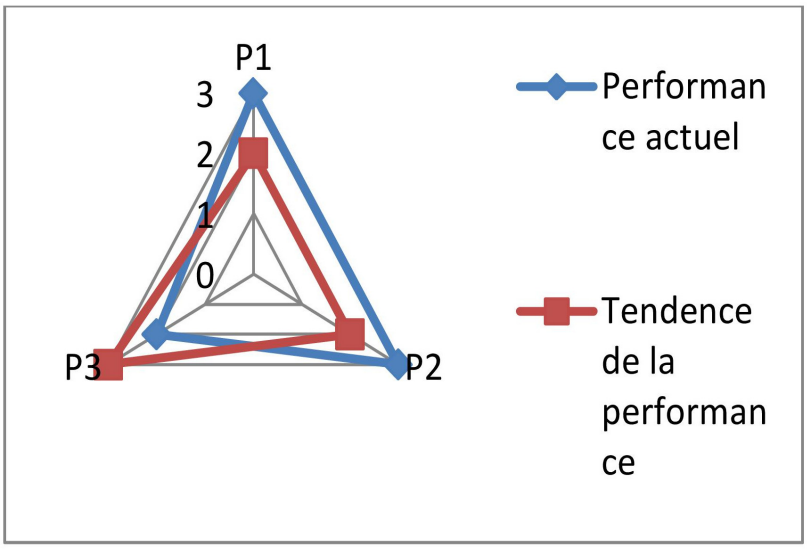

Figure 12. The overall performance of the information system

From the analysis of the graphical representation of the radar of the UIZ, we note a downward trend in the overall performance of the information system. Our observation demonstrates a limitation of evolution and long-term control.

9. Conclusion and Perspectives

From By way of conclusion, the results obtained show that the management of information systems within the universities in our sample is beginning to be structured. But it still lacks efficiency given the results obtained in terms of the mobilization of the means put at their disposal.

Thus results-based management and performance is very embryonic at the level of information systems. Two recommendations seem to us to be crucial: the generalization of multicriteria evaluation in all Moroccan universities; give more importance to the SI function in the organization chart and in the strategic decisions of all university bodies: university councils, school councils, scientific committees. The insufficiencies deciphered by our multicriteria model, motivates us to propose research perspectives for more supervision to this problematic. We intend to update the multicriteria evaluation model periodically and permanently on other research projects. The performance indicators recommended at the end of this research work will be proposed in the form of a balanced scorecard in an article that links the SI to management control.

Our research, being limited in time, the interviews could not cover all the entities. The evaluation questionnaire was sent to the manager of the SI as well as the presidents of the universities and to a panel of project managers. Only the answers and information from the interviews with the members of the universities Hassan first of Settat and that of IBNOZOHR in Agadir were sufficiently complete and exhaustive. The totality of the results of the evaluation of the SI cannot be published in detail because of their confidential nature. Only the general features of the multicriteria model have been addressed.

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