Performance audit of a new hospital information system- case study of Triple Hospital Accounting System in Ibn Sina Hospital OEB-Algeria

تدقيق أداء نظام معلومات استشفائي جديد– دراسة حالة نظام المحاسبة الثلاثي في مستشفى ابن سينا بأم البواقي–الجزائر

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Abstract:

We aim through this paper to highlight the experience of the Algerian Ministry of Health in the implementation of a management system with "triple" accounting within hospitals. We have followed a pilot experiment on hospital public institutions to learn from EPH Ibn Sina/ OEB experience of the challenges facing the implementation of a new 3COH accounting information system in 2015. After four years of using this hospital information system, we returned to this hospital to assess the performance of the 3COH system, and this through an audit work that includes five parameters. Among the results of this research are two main problems that constrain the application of this new information system at the Ibn Sina hospital: the first is the poor combination of the efforts of the staff of the different services, despite the good design of 3COH software; the second, there is no enough feedback between health professionals and the finance and accounting department.

Keywords: performance audit, hospital information system/HIS, 3COH information system, Ibn Sina Hospital/ OEB, Algerian hospitals.

JEL Classification Codes: I1, M1.

ملخص:

نهدف من خلال هذه الورقة البحثية إلى إبراز تجربة وزارة الصحة الجزائرية في تطبيق نظام معلومات المحاسبة الثلاثية في المستشفيات. لقد تابعنا تجربة رائدة في تطبيق هذا النظام الجديد في المؤسسة الاستشفائية العمومية ابن سينا بأم البواقي، من أجل التعرف على التحديات التي تواجه تنفيذ نظام المعلومات المحاسبية الجديد، و ذلك في سنة 2015. بعد أربع سنوات من تطبيق هذا النظام، رجعنا إلى نفس المؤسسة الاستشفائية لتقييم نجاعة و فعالية هذا النظام، و ذلك من خلال مهمة تدقيق أداء ارتكزت على خمس مؤشرات. لقد توصلنا من خلال هذا البحث إلى وجود مشكلتان رئيسيتان تعوقان تطبيق نظام المعلومات الجديد في مستشفى ابن سينا: نقص تكاثف جهود موظفي الخدمات المختلفة في إنجاح تطبيق هذا النظام؛ لا توجد تغذية مرتدة كافية بين الممارسين الصحيين وقسم المالية والمحاسبة.

كلمات مفتاحية: تدقيق الأداء، نظام معلومات استشفائي، نظام المحاسبة الثلاثي الاستشفائي، مستشفى ابن سينا/أم البواقي، المستشفيات الجزائرية.

تصنيفات JEL : **I1, M1.**

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Introduction

In a context of permanent change, especially in the field of ICT, the company needed to develop policies to cope with these developments, with an emphasis on the information system, which can be considered as the mirror of the company. Information systems are vital to the operation and management of every organization (Aissaoui, 2014; Adeoti-Adekeye, 1997; Saleem, 1996; Holecki et al, 2018). The importance of the information system is not limited to for-profit companies; it is the cornerstone of any decision-making for both for-profit and non-profit companies, such as public institutions Hospital / EPH in Algeria (Aissaoui (a), 2017; Sheikhtaheri et al, 2014; Kozierkiewicz, 2014). This experience is certainly a major challenge, but it becomes a necessity for sound management: control of budgets, monitoring of assets and cost management (Bryan et al, 2008; Garg et al, 2005; Varonen et al, 2008). Its management cannot be envisaged without the use of the computer tool by means of a GIS (integrated management system) which allows, from a single input, to feed the three subsystems of accounting ... that's the main objective of the 3COH system (Aissaoui (b), 2017). Contractualization process, which is an old project of the Ministry of Health, could not be implemented due to the lack of sound management that allows control of all the parameters (Aissaoui (a), 2017; WHO/AFRO, 2008). The absence of such an information system is a handicap for decision-makers, be it at the micro or macroeconomic level: concerning the likely introduction of Contractualization process, the first handicap is that one cannot sell one product of which the cost is known with precision; the second handicap, we cannot build a clear and sustainable strategy that focuses on performance, efficiency and cost rationalization (Keskinkiliç et al, 2021; WHO 2016; Sammut, Ngoye, 2019).

1- Materials & methods

1-1 Identification of the population and the study area

It is a descriptive and analytical study that highlights a pilot experiment on EPH Ibn Sina/OEB on the implementation of a new 3COH accounting information system. The accommodation capacity of this establishment is 148 beds, divided on 3 major services (internal medicine 70 beds, surgical and medical emergencies 18 beds, and general surgery 60 beds). This establishment has 210 healthcare professionals and staff (see table 1).

Table (1): Human resources of the Ibn Sina Hospital

Specialty/ Affiliation	Doctors		Nurses	Public Health Laboratory	Pharmacy Laboratories + Pharmacists	Agents		Administrators	Drivers
	generalists	specialists				Full-time	Part-time		
Number	18	42	53	07	03	06	46	27	08

Source: statistics of the EPH management Ibn Sina / OEB Algeria, 2019

Through our case study on the EPH Ibn Sina/OEB, we were fortunate to be trained by the administrative staff during the first quarter of 2015. In addition, we were able to attend the application of this system for the first time in 2015; indeed, we were able to witness the transition from the old system to the new 3COH system. We conducted a survey in the second quarter of 2019 to gauge the effectiveness of this 3COH information system among health professionals and other non-health care providers. We distributed 138 copies of the stakeholder questionnaire at Ibn Sina Hospital (health professionals, administrative agents and others), and we recovered 126 copies, so the recovery rate is close to 91%. The survey questionnaire is organized in 5 axes and contains 14 questions. To facilitate the analysis, we opted for two possible answers on each question: effective or ineffective.

1-2 Performance indicators of HIS practice selected

We selected 5 performance indicators to gauge the functioning of the information system (Functional supportability, performance efficiency, compatibility, usability/learnability, reliability/maturity, safety/ no questioning). The 5 indicators contained 14 questions (see table 2).

Table (2): The five performance indicators selected

Indicator/ target	Questions
1. Functional supportability	A. The system offers support/ helps in decision-making; B. The system obeys legal information rules; C. The system helps to prevent medication errors.
2. Performance efficiency	A. The performance of the system is satisfactory: the system responds quickly to entries; B. The clinical documentation generated by the system addresses the time constraints demanded; C. Authentication time for system access is adequate.
3. Compatibility	A. The system predicts access to its data from other systems; B. The system can be integrated or connected to exchange information with other systems.
4. Usability/ Learnability	A. The system has manuals, tutorials, documentation for training and access to data and/or help online available; B. Browsing through the system is quick and standardized; C. The system offers adequate feedback to user for tasks performed.
5. Reliability/ Maturity	A. The system presents low rates of software maintenance calls; B. The system is reliable, stable and errors do not occur when it is being used; C. The corrections, improvements or updating of version do not cause instability in the system nor demand effort or excessive time.

Source: made by us

2- Results and discussion

2-1 Results

2-1-1 The HIS practice performance according of the opinion of the employees of the hospital

To get a general idea of the added value of this information system in the eyes of the various employees in the Ibn Sina / OEB hospital, we asked five questions about the performance of this system. The 5 questions relate directly to the 5 performance indicators chosen previously.

Table (3): The matrix of HIS practice performance

	Functional supportability	**Performance efficiency**	**Compatibility**	**Usability/ Learnability**	**Reliability/ Maturity**
Doctors/ Nurses	****	***	****	***	***
Laboratories/ Pharmacies	****	***	***	**	***
Administrators	****	****	****	***	***
Others	**	**	**	*	*

(*): low, (**): medium, (***): well, (****): very good

Source: made by us

We grouped the answers into 4 groups according to the affiliation of the various participants (doctor or nurse, laboratory or pharmacist, administrator agent, other) ... we received the following answers (see Table 3).

2-1-2 The results of performance indicators survey questionnaire

To get a clear idea of the added value of this information system in the eyes of the various employees in the Ibn Sina / OEB hospital, we asked specific questions, each set of questions can inform us about the chosen performance indicator (see table 2). Concerning the answers, we opted for a grouping of the answers of the 126 questioned without specifying the affiliation. We chose to put two probable answers for each question (effective / no effective), in order to facilitate the assimilation of the questions, and to give quick and direct answers for all the participants.

Table (4): The answers on performance indicators survey questionnaire

Indicator/ target	**Questions**	**Answers**	
		effective	**ineffective**
1. Functional supportability	A	120	06
	B	98	28
	C	46	80

2. Performance efficiency	A	121	05
	B	95	31
	C	101	25
3. Compatibility	A	82	44
	B	93	33
4. Usability/Learnability	A	100	26
	B	75	51
	C	48	78
5. Reliability/Maturity	A	38	88
	B	53	73
	C	45	81

Source: made by us

2-1-3 Presentation of the Triple Accounting Hospital Information System / 3COH

The Ministry of Finance was instructed at the meeting of the Inter-Ministerial Council on October 21, 2008 to set up a computerized accounting system in collaboration with the Ministry of Health, Population and Hospitals Reform/MHPHR (JORADP (a), 2007). This computerized system of management accounting within hospitals, aims to provide a homogeneous and integrated accounting system; financial accounting, budgetary accounting and cost accounting. Inspired by the Financial Accounting System (SCF, law no. 07 of 25/11/2007), the accounting system for hospitals was specifically developed for the needs of Algerian hospital establishments, as part of the project to implement a computerized management accounting within hospitals (JORADP (b), 2007).

A. The main objectives of the triple accounting system / 3COH

A decision support system, that contribution to heritage valuation, a better understanding of the reality of the annual activity in terms of revenue and expenditure, and knowledge of the costs of activities (MSPRH(a), 2013). A permanent monitoring system, which allows the management of the institution to have a follow-up, in real time, of its commitments and budgetary availabilities (MSPRH(a), 2013; De Morais et al, 2016; Sammut and Ngoye, 2019). A clear and transparent management system eliminates input errors and delays in the transmission of results, by implementing a real-time processing system, without redundant information. A system of anticipation will allow an a priori control of the budgetary availabilities. A flexible system, it allows the calculation of the operation's costs of the services on a monthly basis. A system that allows for benchmarking, it allows comparative studies to be made between homogeneous hospital structures. A system that produces hospital indicators at the micro and macro level, it allows the production of basic management indicators (number of admissions, number of days, average duration of patient stay, average occupancy rate beds, costs, etc.) (Khalifa, Alswailem, 2015; MSPRH(a), 2013; Kirigia, Barry, 2008). A system that requires group work, which promotes within each institution the cooperative work among the various services by sharing a

common data base, accessible (in safe conditions) and usable by all (WHO/AFRO, 2008; MSPRH(a), 2013).

B. The general organization of the 3COH system

The hospital accounting system called 3COH consists of three intricately interwoven components: financial accounting/ commercial or patrimonial; budgetary accounting/ public or administrative; cost accounting/ analytical accounting (MSPRH(a), 2013). This system is fed from transactions entered by users on the basis of vouchers. These transactions are typically entered in auxiliary modules where they are recorded in specialized journals (journal for the entry of medicines stock, journal of invoices for the purchase of office supplies, journal of acquisitions of fixed assets, etc.). In general, these transactions are accompanied by their accounting distribution which is their accounting translation in terms of debits and credits accounts.

2-2 Discussion

2-2-1 Presentation of the Triple Accounting Hospital Information System

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C. Basic functions and features

The 3COH software aims to take charge, in an integrated way, of the management of the accounting information system of hospitals. A support for the general accounting system: management of the chart of accounts, inputting of records, production of basic documents such as general balance, general ledger, general journal and even financial statements (balance sheet, income statement, cash flow statement, etc.). A processing procurement and supply operations: this includes (managing supplier records, managing and monitoring contracts and agreements, issuing and managing purchase orders, recording and accounting for receipts, processing invoices purchases, commitments and budgetary liquidations, etc.). A monitoring consumption of stored goods and services: taking account of service demands, deliveries to services (one-off deliveries, deliveries on endowments, prescriptions deliveries with patient identification), delivery to third parties other than services, monitoring of consumption by service, by article, by article families, etc. A complete management of all types of stocks: medicines, food products, cleaning products, spare parts, consumables, etc. Processing of various movements inputs, outputs, reintegration, and regularization with accounting automatic generation of accounting entries. An asset management: acquisitions, amortization, reforms, disposals, etc. Automatic depreciation calculation with automatic breakdown of depreciation charges by service. The calculation of the cost of the services provided. From the values extracted from the general accounts (including depreciation) and the physical data imported from the services, the system determines the cost of the services delivered by the institution. Production of monthly financial statements and various management indicators relevant to the management of the institution (Bryan et al, 2008; Short et al, 2004; Saleem et al, 2005).

D. Implementation of the 3COH system

The system is based on the use of management software 'triple hospital accounting' or, more simply 3COH. In addition to purely accounting management, this software ensures the management of all the management systems of the establishment: procurement and Supplier Relationship Management, inventory management, asset Management, billing system, consumption management, budget monitoring, finance management, general compatibility, cost accounting, financial state, dashboards (MSPRH(b), 2013). Beyond the

technical dimension of the implementation of a management accounting system, this project will introduce within the institutions concerned a new management mode based on parameters such as: real-time management, collaborative work, the flow of information, transparent management (Ponçon, 2000; WHO/AFRO, 2008; Kirigia, Barry, 2008). In this approach, everyone is concerned: the hospital director interested in the management indicators and the dashboards required to manage the organization; the accountant concerned with checking the consistency and reliability of the data; controller who is responsible for ensuring compliance with regulations and procedures; IT specialists (who have now become managers of the information system), who must ensure data security and confidentiality while ensuring optimum performance of the hardware and software tools for which they are responsible; the pharmacist who wishes to know, in particular, the state of the stocks, the control of expiry dates and to ensure optimal management of her service; the administrator who will have elements relating to the costs of the activities. As a result, everyone will have to contribute to the construction of this common good, which will benefit both the establishment and the people who feed it, use it, exploit it or ensure its maintenance and sustainability (Short et al, 2004; Saleem et al, 2005).

2-2-2 Analysis the results of performance indicators survey questionnaire

We have arranged the answers for each question on a column, and the set of columns is the figure that represents the performance indicator.

A. Functional supportability

The system is an effective support for decision-making up to 95%, we can say that it has consensus on the positive contribution of this system for the majority of the participants in this establishment. The system follows accepted standards and guidelines recognized by all employees. This response concerns 78% of employees. Who responded non-effective (22%), turns to the ambiguities of the training manual and use. The real problem, according to our audit, is the low level of economic agents (catering, transport fleet, security, etc.).The system can prevent errors and medical errors, the actual response to 37% (see figure 1). Although it is a hospital information system, it is a management accounting system more than a medical information system. At present, this system does not include a signalling card for these serious adverse events. We can say that this information system revolves around the managerial decision than the medical decision, and that focuses on all the medical and non-medical services that make up the hospital (Kortteisto et al, 2012; Garg et al, 2005; Varonen et al, 2008).

**Figure (1): Functional supportability of HIS/3COH**
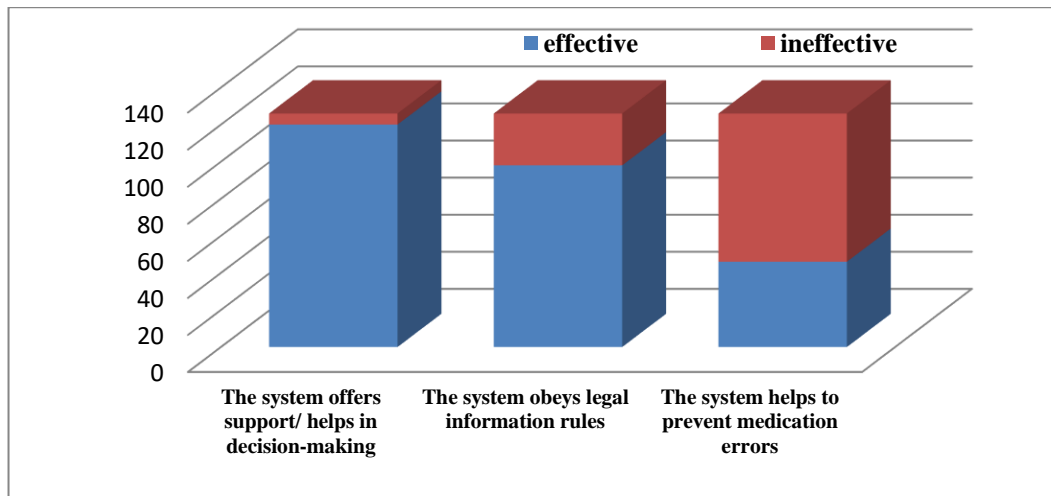
B. Performance efficiency

About the multiple managerial requirements of the different departments, the effective response was 96%. This answer can tell us about the effectiveness of the software, which can respond to you in record time.About clinical information that obtained in a timely manner, the actual response was up to 75% (see figure 2). According to the responses of health professionals, this system is very efficient, and the quality of this information depends exclusively on the quality of the inputs.Concerning the actual duration of access to information from this system is acceptable; the effective answer on this question was 80%.If we assemble the answers on the effectiveness of this system, we can say that the soft of the system is efficient enough for the majority of the answers (Garg et al, 2005; Alpay et al, 2000; Davis, 1989).

**Figure (2): Performance efficiency of HIS/3COH**
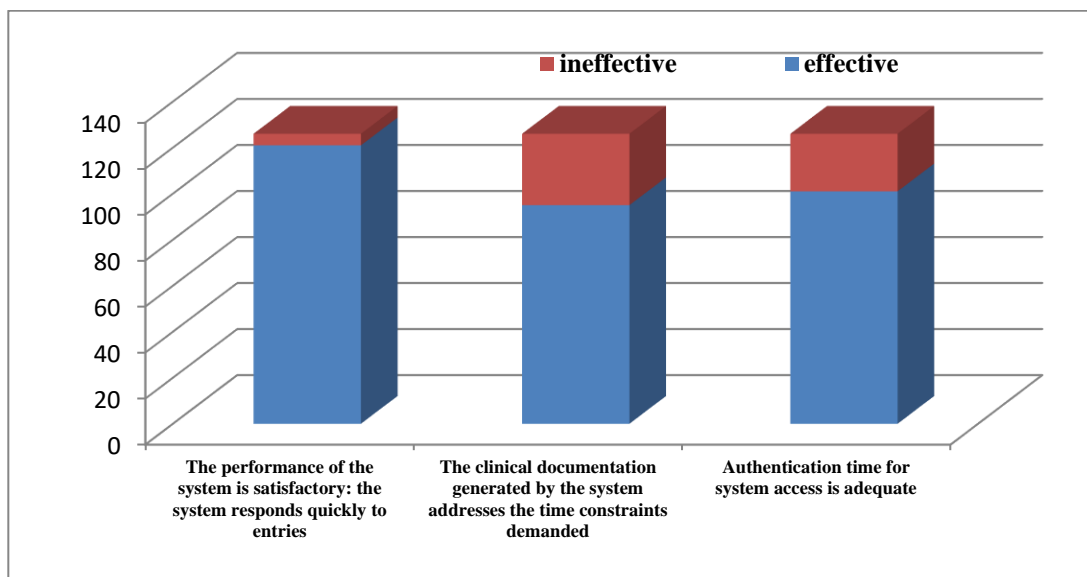
C. Compatibility

Regarding access to 3COH data from other systems, we obtained 65% of the effective responses, the remaining 35% confirmed the near absence of the auxiliary systems or the non-connection of the auxiliary systems to the main system. Concerning the second question, this is related to the connectivity and exchange of the 3COH system and other existing systems. We obtained 73% of the effective responses, confirming the connectivity and exchange of the 3COH system and the other systems, in effect for the majority of employees(see figure 3).We can say that the connectivity and exchange of the 3COH system and the other existing systems are quite acceptable, but can do better to connect the low-connection systems, like the emergency and home service that are overwhelmed 24/24 and 7/7 days (Kortteisto et al, 2012; Varonen et al, 2008; Hayrinen et al, 2008).

Figure (3): Compatibility of HIS/3COH
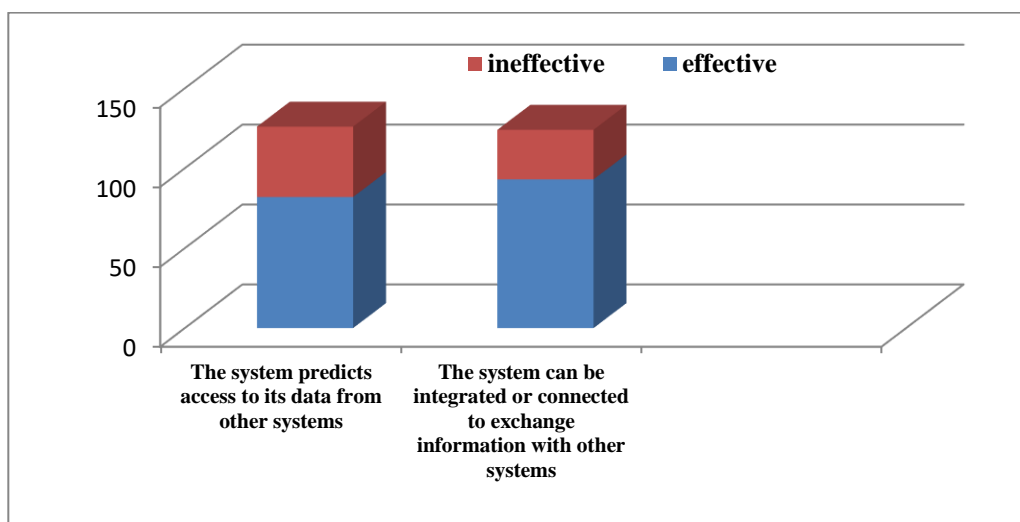
Source: Made by us

D. Usability/learnability

Regarding the existence or availability of manuals and media to access the data, and operate the system... We received 80% of the actual answers, even the remaining 20%, the emphasis is on the clarity of the manuals and not availability. Regarding easiness of navigation on the system, we received 59% of the actual responses. We looked at the cause of the difficulties encountered in navigating the system, according to the employees, the problem is the low level of non-administrators in finance and accounting.Concerning the existence of comments on the tasks carried out, the answers on this question are 38% effective (see figure 4). The real problem lies in the assimilation of comments and not the existence of comments. There were two main problems with this indicator: the first is the low level of a few employees; the second lies in the ambiguity of some comments in user manuals (Davis, 1989; Short et al, 2004; Saleem et al, 2005).

Figure (4): Usability of HIS/3COH
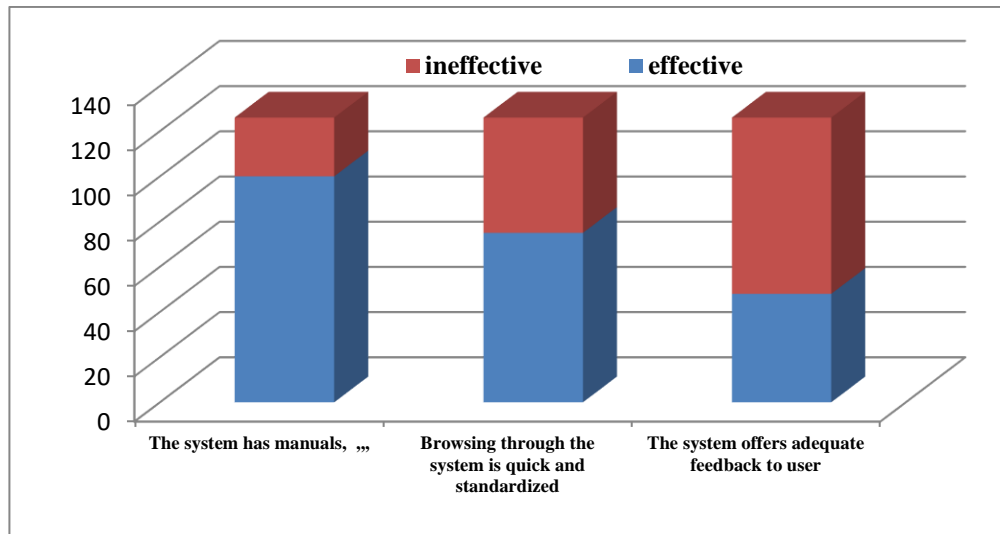
Source: Made by us

E. Reliability/ maturity

Regarding maintenance calls, we received 70% of responses ineffective. According to employees, this rate is high because it is the first year of its use. The system reliable, stable and errors do not occur when used... we have recorded 42% effective. We can confirm that there are many gaps, especially in its first year of use. The influence of corrections and improvements on the stability of the system (see figure 5). Practically 36% of respondents confirm this hypothesis, as they confirm the problems that face the implementation of this system in its first year of use. We can confirm the many shortcomings that face the use of this system in its first year of existence (Varonen et al, 2008; Short et al, 2004; Bryan et al, 2008).

Figure (5): Reliability of HIS/3COH
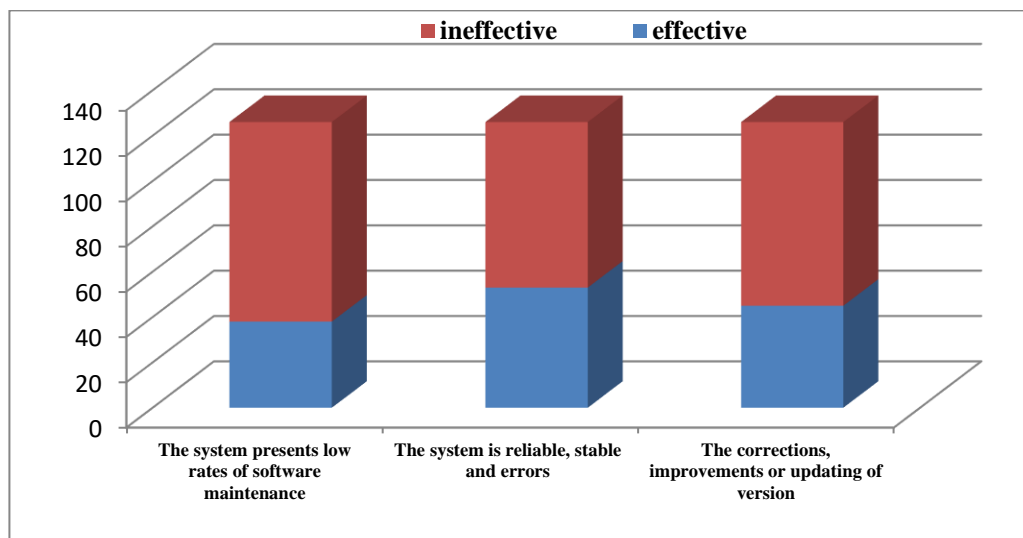
Source: Made by us

The main problem with the implementation of this new information system currently in the Ibn Sina / OEB hospital is the inadequate training of the accounting staff in this structure despite the good design of the 3COH software. There are managers who neglect the importance of this information system, because information is not flowing well between these services and the accounting and finance department (Aissaoui, 2014; Bańkowska, 2016; Dubowitz et al, 2011). So we must make all the players aware of this system and the affair of all, especially the medical team who must play the game. We found a virtual absence of the classical information system before the application of the 3COH system. The transition from one weak system to another is easier than a transition from nothingness to a fairly efficient system (Hourani et al, 2021; McMillan et al, 2015; Murray et al, 2016).We observed weaknesses in the application of this system, especially in the first year. The proper use of this system requires continuous training for the accounting and finance staff on the one hand, and on the other hand, raising awareness among all the participants of the participatory approach concerning the collection of inputs and the use of outputs (Ostrovsky and Barnett , 2014; Ford et al, 2019; Sammut and Ngoye, 2019). Information from this system will lapse if the outputs of this system are not taken into account, by those responsible for these structures at the micro and macro level (WHO/AFRO, 2008; Kirigia and Barry, 2008; Wamai, 2009).

Conclusion

The mission of the hospital is to provide the care necessary for the well-being of the patient. If health is priceless, as health professionals remind us each time, in return, it generates costs that must be estimated and counted, in order to have an idea of the past and project ourselves towards to come up. The main objective of providing public hospitals with a new accounting information system; is to improve the readability and traceability of information from this 3COH system, in order to make reliable and effective decisions.

The fact remains that the implementation of this system presents several problems, which freeze its correct application. These problems can make the information less credible. The constraints faced by its application are due to the human factor and not to software. A participatory approach that brings together the opinions and proposals of all employees is welcome. In addition to the administrative framework, the medical team has a fairly important role in terms of the quantity and quality of the medical data to be processed. This medical framework can help accounting and financial officers to understand the functioning of services with complex tasks, such as emergencies, obstetrics, etc

The continuous training of the agents in charge of the proper functioning of the 3COH system, as well as an awareness of all the actors of the hospital, at each opportunity which arises... is a guarantee of performance of the hospital management in the years to come.

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