Identifying the needs in the integration of disciplines in the hospital infrastructure management in Colombia

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Abstract — This paper presents an overview of the state of the art of Hospital Physical Asset Management for Health Service Institutions (IPS) in Colombia. These institutions have the need, within the requirements of the sector, to optimize the management of their physical asset as a fundamental part of the Strategic Plan of the Organization for the health services they provide, relying on disciplines that can be aligned to the Objectives, by Processes, Strategies and Policies of the providing health services institution. The international standards linked to such disciplines have generally evolved in organizations of production, manufacturing or energetic character and less on those organizations that provide services such as the hospital case. Therefore, the aim of this document is to identify and know the different management disciplines, as Building Maintenance Management (BMM) Facility Management (FM) and Asset Management (AssM), and the associated international standards (ISO 55000, UNE-EN 15221, UNE-EN 16646, ISO 31000) in order to meet the state regulations in the health field. That being the case, this review has established the main needs for the integration of management disciplines in the hospital infrastructure in the IPS in Colombia.

Keywords — Asset Management, Maintenance Management, Infrastructure, Clinical Engineering, Facility Management.

INTRODUCTION

Hospital physical asset may represent the most important investment for the IPS, hence engineering and architectural disciplines are fundamental to reform and transform the organizational structure in order to come to the aid of the patients recovery in the organizational climate and the community in general. In the case of hospital infrastructure, this represents the mission, values and principles of the organization, therefore it must be built, maintained and operated intentionally to achieve their specific objectives, working on the maintenance, the investments and the internal building management [1].

The term (Physical) Asset Management is a concept in development, so there is not yet an established definition, even less in the hospital sector. The use of this term for maintenance managers in the USA has been used to gain greater credibility in their activities. As maintenance was understood as a job without importance, the term "asset management" seems to be more appealing and professional, even though maintenance is a fundamental component in the asset management policy of the company. The term that we encompass in this study shows the evolution of the overall concept of physical asset management in enterprises [2].

Taking into consideration that the IPS are increasingly forced worldwide to seek a competitive advantage to get a foothold in the market, they should work on the optimization of their services, status and business continuity. To achieve this goal, we have checked that some IPS in Colombia are unionized to defend their corporate interests in the form of cluster health, this has favored that Colombia has 50% of the 43 best clinics and hospitals in Latin America [3].

Linking this study to the doctoral thesis of the main author, it has been considered the evolution of disciplines such as Facility Management, which is defined as "A management model of real estate asset of companies that aim to adapt them permanently to the organization and the companies personnel at the lowest possible cost, by integrating all the management responsibilities on those resources", according to the Spanish Society of Facility Management (SEFM) and International Facility Management Association (IFMA). This discipline has been focused on the physical asset management (infrastructure), which become more complex with the past of days and contain more technology, sparking a major competitiveness, cost, demand, health expectations, consumers’ safety and welfare, in addition to the environment. Considering that the institutions add new responsibilities and challenges in their work environments to the social purpose of the organization [4], the FM has a very wide scope of work, also aligned with the Strategic Plan of the Organization [5].

Moreover, due to the increase of the importance of the building maintenance, the BMM [6] has generated a growing awareness of the need to manage more effectively the building condition. Despite this, a great part of the maintenance is carried out in a context that does not create a fully integrated performance of the buildings management, and therefore buildings are not used as is due.
Instead, the AssM is defined as the "coordinated activity of an organization to generate value of the asset", being the definition of an asset as "an item, thing or entity that has a potential or actual value in an organization". In the case of physical asset, they assume an important role in the organizations, within the five types of assets (financial, human, intangible, information and physical) [7]. Physical asset must be managed throughout the lifecycle, covering processes such as design, construction, operation, maintenance and replacement of asset and infrastructure in order to maximize their value; leading the efforts to improve their performance, reduce their costs, extend their useful life and improve the return on investment of asset for the organization [8].

Several factors appear to distinguish hospitals from many other businesses. Firstly, they are facilities that are open 24 hours a day, 7 days a week; secondly, they offer particularly complex services; and, thirdly, an error in a hospital can cost a life. This hospital infrastructure must constantly update their assets in order to meet the highest technical and safety standards, even though this can bring about high levels of investment [9].

The ISO 55000 standard [10], preceding of the PAS 55 British Standards Institution (BSI), provides an overview of asset management and the systems of asset management through common practices that can be applied to the widest range of asset and organizations across different cultures. The ISO 55000 enables an organization to achieve its objectives through the effective and efficient management of its asset. Applying an asset management system ensures that these goals can be achieved consistently and with sustainability over the time. This standard is associated with others as the UNE-EN 16646, offering the vision of maintenance in the physical asset management, the UNE-EN 15221-1: 2012 for Facility Management, and the ISO 31000 for Risk Management in all the operations within the organizations.

Considering this is a sector with a great deal of responsibility, it should focus on achieving Operational Excellence (OPEX), that according Amendola [11] it is the pursuit of conducting business in a way that improve continuously the quality of goods and services, trying to achieve competitive superiority from the core of the company "Processes – People – Technology - Networks". Though, within these factors there are three pillars of OPEX: • Planning and Production Control • Manufacturing process (or services) • Operational Effectiveness of People, Processes and Physical Asset Management as it can be seen in Figure 1.

The first hurdle that companies have not implemented a Business Continuity Planning (BCP) face is the lack of knowledge about this and the magnitude of the effort, and the second difficulty is overcome budget to run it. Within corporations must be sized to BCP as safe and not as an expense "must be taken to not use it sometimes, but the day that required the company will succeed" [12].

![Figure 1: Core of the organization on OPEX.](image)

**Objectives**

Given the above mentioned, the proposed objectives of this study are to conduct a literature search on standards, disciplines, buildings or infrastructure and international health organizations that are involved in the proper management of the hospital infrastructure for its contextualization in Colombia. Then, evaluate and analyze the gathered data taking into account the model of the IPS in Colombia, identifying the needs that IPS present in order to integrate disciplines and international standards for the infrastructure management in Colombia.

**Methodology**

To meet the objectives described above, the procedure involves a literature search as the first step in the process of scientific research, through access to scientific literature in digital databases, selecting the right terms for the drafting of the study considering those latest and relevant references related to the topic addressed. This allows to capture information about science and technology, select and analyze it, in order to make decisions identifying which countries has been investigated, which authors have written about and in what areas they have worked the selected topics.

Scopus is today one of the best tools for bibliometric studies and scientific production assessments, inasmuch it encompasses a multidisciplinary vision of science and integrates all relevant sources for basic research, applied research and technological innovation through patents, sources of Internet of scientist content, free access scientific journals, congresses and conferences reports. This search tool is not only unique for its updated daily content with more than 3,000 journals, but also as the sole basis that brings the right tools, such as: profile author profile institution, cites tracker, analyzer h and index scientific journals [13].
The three initial search equations used in the database took into account the disciplines "Asset Management", "Facility Management" and "Building Maintenance Management" associated with building management, infrastructure and organizations physical asset; performing them in individual equations, finding a sum of 127,555 results adding the three initial equations.

However, these are too many results to make a reliable analysis, for that reason a more precise equation was undertaken and new particular searches were carried out in each discipline linking them to the rest of the terms, such as "building, hospitals, Healthcare, World Health Organization (WHO), Pan American Health Organization (PAHO), Joint Commission International (JCI) and the international standards", obtaining 20 different equations with positive solutions that added the amount of 1,648 results, and then a final search combining the disciplines “Asset Management AND Facility AND Building Maintenance”, resulting in 63 documents as well as the defined criteria as shown in Table 1.

Table 1 Results of the search equations (Authors)

<table>
<thead>
<tr>
<th>Search Equation</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Management (AssM)</td>
<td>122,385</td>
</tr>
<tr>
<td>Facility Management (FM)</td>
<td>15,407</td>
</tr>
<tr>
<td>Building Maintenance Management (BMM)</td>
<td>1,706</td>
</tr>
<tr>
<td>AssM AND ISO 55000</td>
<td>10</td>
</tr>
<tr>
<td>AssM AND ISO 31000</td>
<td>3</td>
</tr>
<tr>
<td>AssM AND Hospitals</td>
<td>11,4</td>
</tr>
<tr>
<td>AssM AND Healthcare</td>
<td>90</td>
</tr>
<tr>
<td>AssM AND WHO</td>
<td>19</td>
</tr>
<tr>
<td>AssM AND PAHO</td>
<td>5</td>
</tr>
<tr>
<td>AssM AND Joint Commission Int.</td>
<td>2</td>
</tr>
<tr>
<td>AssM AND Hospitals AND FM</td>
<td>26</td>
</tr>
</tbody>
</table>

After gathering the data of these equations, the authors who have written about hospital physical asset management internationally are analyzed. The findings provide an overview of the number, location and volume of production of those authors who do research in this field, as well as international organizations that work on biomedical equipment management, industrial equipment management and infrastructure management, plus studies conducted to the health sector, since most of work done so far has focused on the production, manufacturing and energy sectors.

Likewise, the international health organizations that are responsible for recognizing, promote, regulate and investigate in order to reach levels of quality in health services, "WHO, PAHO and JCI"; and finally, keywords of the clinical maintenance sector: "Hospitals, Healthcare, Building and Infrastructure" that reduce the results to an adequate amount of documents that facilitate its study.

All this information represents a theoretical basis, which has gone through an evaluation and analysis process that shed light on the needs that the organizations present for the proper infrastructure management with the current international standards. Thus, we proceed to make the adaptation to the colombian hospital environment, being necessary to have a wide view of the IPS in Colombia; how the physical asset management is carried out in the institutions, what the typical organizational structure is like, as well as the human management responsible for the maintenance and heritage, and the integration of the bioengineering area with the rest of the entity.

During the completion of the development of this study and due to the preliminary results at the time, the Universidad Pontificia Bolivariana has financed this research project to carry out (through a web application to manage surveys) a Diagnosis of the State of Hospital Physical Asset Management in the IPS (as a pilot in the Aburrá Valley) based on the ISO 55000.

RESULTS

In summary, once done the analysis and the evaluation of the information obtained from the literature search of such documentation, we get the results that lead to establish the main needs in the integration of the disciplines of hospital infrastructure management in Colombia. As a result of this study, the hospital infrastructure management is not aligned with the international standards nor with disciplines such as AssM, FM and BMM. Another point worth mentioning is the lack of knowledge and training of the personnel working in hospital infrastructure in such disciplines.

Moreover, this study reveals the existence of incompatibilities between departments, leaders and organizational structure to achieve objectives; besides, the processes and methodologies used currently by the IPS are confused and do not allow to maintain properly the infrastructure considering it a world-class service.

Additionally, there is a visible lack of integrated systems with adequate tools that lead to make objective decisions in order to manage the hospital infrastructure in a proper way. This shows that the physical asset hospital management does not work in conjunction with such
asset life cycle. It related studies [14], it is proposed that the Asset Management and Facility Management intertwine in the physical asset (infrastructure) with Operation and Maintenance Service of Building Maintenance Management.

Thus, these three disciplines (AssM, FM and BMM) are complementary with each other in quest of the accomplishment of the objectives of the organization, as shown in Figure 2.

This work reveals certain shortcomings that IPSs in Colombia present in order to manage their infrastructure. Likewise, it has been identified that disciplines such as AssM, FM and BMM are highly related to infrastructure management, and that the international standards associated with these (ISO 55000, EN 15221, EN 16646, ISO 31000) are required to align infrastructure management to the objectives of the institution, through the processes, policies and strategies previously planned. Physical asset management is the best way to reach the proper management of the asset lifecycle, in order to accomplish and back up the objectives, strategies and policies that lead to the Operational Excellence of the organization.

Being relevant to think about the development of a methodology for managing infrastructure based on physical asset management, facility management and maintenance management for hospital entities, aligned with international standards (ISO 55000, EN 15221, EN 16646, ISO 31000), seeking to reach a compromise from the administrative management to the workers in order to cover the found needs in the Colombian context, also supported by those ones coming from the IAM, IFMA.

Given these points, this study and further researches will aim at coming up with information that complement advanced training in universities, training of future professionals in hospital engineering, and also the development of information for the doctoral thesis of the main author, in search of the development of methodologies that lessen the IPS needs for a proper infrastructure management.

This work is aligned with what it has been done by the research group GIBIOING (Universidad Pontificia Bolivariana), based on the PAS 55, and developed from the approval of the legal requirements, national and international accreditation and the recommendations coming from the WHO, PAHO, the Joint Commission International and the Ministry of Social Protection, for its implementation in Colombia [15].

CONFLICT OF INTEREST
The authors declare that they have no conflict of interest.

REFERENCES