Revista Ingeniería Biomédica
ISSN 1909-9762 / Volumen 11 / Número 22 / Julio-diciembre de 2017 / pp. 79-83
Universidad EIA-Universidad CES / Envigado, Colombia

# Process of Acquisition and Renovation of Biomedical Technology

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***Abstract* —** Inefficient use of resources in biomedical technology and low quality in the provision of health services, support the need to implement a process of acquisition and renovation of biomedical technology such as that set out in this Article. It also includes the recommended procedures within this process, which are intended to be standards for all the Institutions that provide Health Services in Colombia.

***Keywords* —** Acquisition of technology, Biomedical equipment, Renovation of technology.

## Proceso de Adquisición y Renovación de Tecnología Biomédica

***Resumen*—**El uso ineficiente de los recursos en la tecnología biomédica y la baja calidad en la prestación de servicios de salud, apoyan la necesidad de implementar un proceso de adquisición y renovación de tecnología biomédica como el establecido en este artículo. También incluye los procedimientos recomendados dentro de este proceso, los cuales están destinados a ser estándares para todas las instituciones que proveen servicios de salud en Colombia.

***Palabras clave* —**Adquisición de tecnología, equipo biomédico, renovación tecnológica.

## Processo de Aquisição e Renovação de Tecnologia Biomédica

***Resumo*—**O uso ineficiente dos recursos da tecnologia biomédica e de baixa qualidade na prestação de serviços de saúde, apoiam a necessidade de implementar um processo de aquisição e renovação da tecnologia biomédica como a estabelecida neste artigo. Também inclui os procedimentos recomendados dentro deste processo, os quais estão destinados a ser padrão para todas as Instituições que proveem Serviços de Saúde na Colômbia.

***Palavras-chave*—**Aquisição de tecnologia, Equipamento biomédico, Renovação tecnológica.

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DOI: https://doi.org/10.24050/19099762.n22.2017.1187

## I. Introduction

In Colombia, the problems generated by biomedical technology are increasing, because IPS are not acquiring this technology according to the needs of the population they serve, but based on the economic needs of the health institution, That makes the attention to the user is of low quality; For this reason it is necessary to improve the quality of the service provided through the conscious acquisition of the technology.

The current situation is worrisome, as Dr. Antonio Hernández states in a regional diagnosis of the Panamerican Health Organization (PAHO - OPS) "... in Latin American countries, the 50% of biomedical equipment is out of service or not in use. "; From the above, it can be said that the economic pressures of the Health Service Provider Institutions (IPS) and the rise of high technologies, leads to the purchase of unnecessary technology that in a very short time becomes obsolete; demonstrating in this way As inadequate hospital technological management decreases the quality of the service provided in relation to the cost-effectiveness of biomedical equipment [1].

In accordance with the above, the following article shows the summary of a project developed in order to propose a methodology to support the procurement process and technological renovation in any health provider institution; From which it is intended to improve the cost - effectiveness of biomedical technology, while increasing the availability of equipment and thus the quality of service.

## II. Methodology

In order to standardize and improve the current procedures for the acquisition and renewal of biomedical technology, the following methodological guide is proposed.

Fig. 1 shows the block diagram of the stages developed, referring to the recommendations and standards given by the World Health Organization (WHO), as well as the policies established by the Ministry of Health and Social Protection.

PHASE 1: within this stage is the procedure of evaluation of the installed biomedical technology, which allows to quantify the physical and functional state of the equipment, offering a reliable parameter for the rule out or relocation of these. At this phase, are taken into account criteria: technical (45%), clinical (30%) and economic (25%) suggested by the Ministry of Health and Social Protection [2].

PHASE 2: identification of the needs of technology acquisition, has been proposed in two ways:

1) *direct identification*: when staff present in the area detects the need to acquire a new technology, then they report to the process manager, who raises this need in the form of a project with the proper justification of said acquisition and the benefits of the same.

2) *Indirect identification:* when through the criteria and indicators of obsolescence, it is determined to exclude a biomedical equipment, reason why it is necessary to replace this technology; Although just like the previous one, requires that the needs project be developed.

Analysis and evaluation of the projects of needs: the projects are evaluated by the corresponding committee in clinical, technical and economic terms, and the equipment to be acquired is recommended.

PHASE 3: priorizatiton of technological acquisition: priority is given to the needs projects, based on: epidemiological profile of the institution, contingency plan, cost / benefit ratio, classification of equipment, operating conditions and investment.

PHASE 4: Technological renewal process: seeks improvement in the quality of the service, through the proper management of installed biomedical equipment, in order to plan the timely renewal of the technology based on the guidelines established in PHASE 1 And obsolescence criteria and indicators.

The criteria and indicators of obsolescence: allow to re-evaluate the equipments that obtained low scores in PHASE 1 to make objective and quantifiable decisions that justify the withdrawal of a equipment.

PHASE 5: Acquisition protocol: Once the technology has been prioritized, this stage will establish the contractual requirements for the purchase of new technology. Recommendations are made regarding the design of the contracts, which should include: Application of operating manuals (user and technical in Spanish), a month of testing, training and guarantees, conditions for the final disposal of the equipment and the technical conditions of Transfer, delivery and commissioning of the equipment.

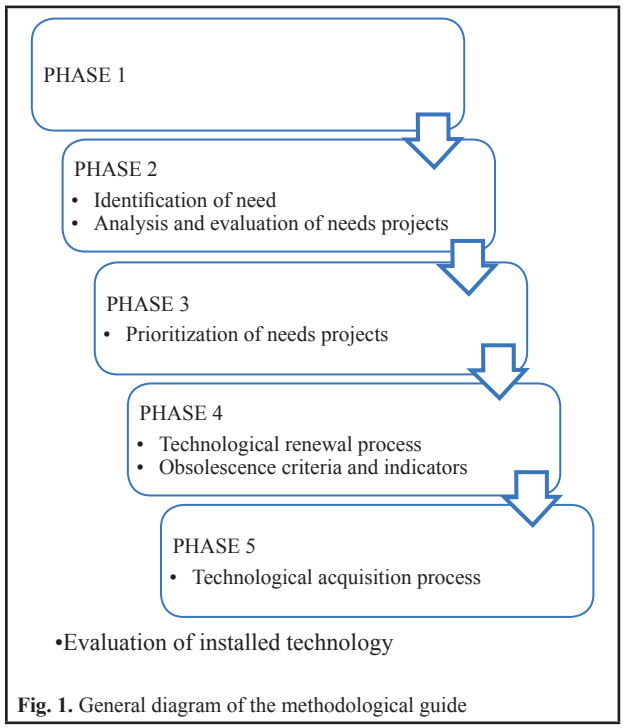


**Fig. 1.** General diagram of the methodological guide

## III. Results

A methodological guide was designed that obeys each of the items mentioned in the methodology and is represented in Fig. 2.

1) *Evaluation of installed biomedical technology:* this evaluation seeks to determine the functional physical state of the equipment installed in the institution, to support decision making for replacement and therefore its acquisition. It is desirable that the evaluation be carried out periodically and that the results be updated in the same way. The variables established for each technical, clinical and economic criteria are shown in Tables 1, 2 and 3, respectively [3, 4].

2) *Analysis of needs:* needs for biomedical technology are associated with those essential equipment in a hospital for optimum performance in relation to the services offered; Are divided into: replacement (replacement of equipment that is not in optimal conditions), update (improvement of technology in the service) or new technology (not existing in the institution). These needs are due to an institutional development strategy.

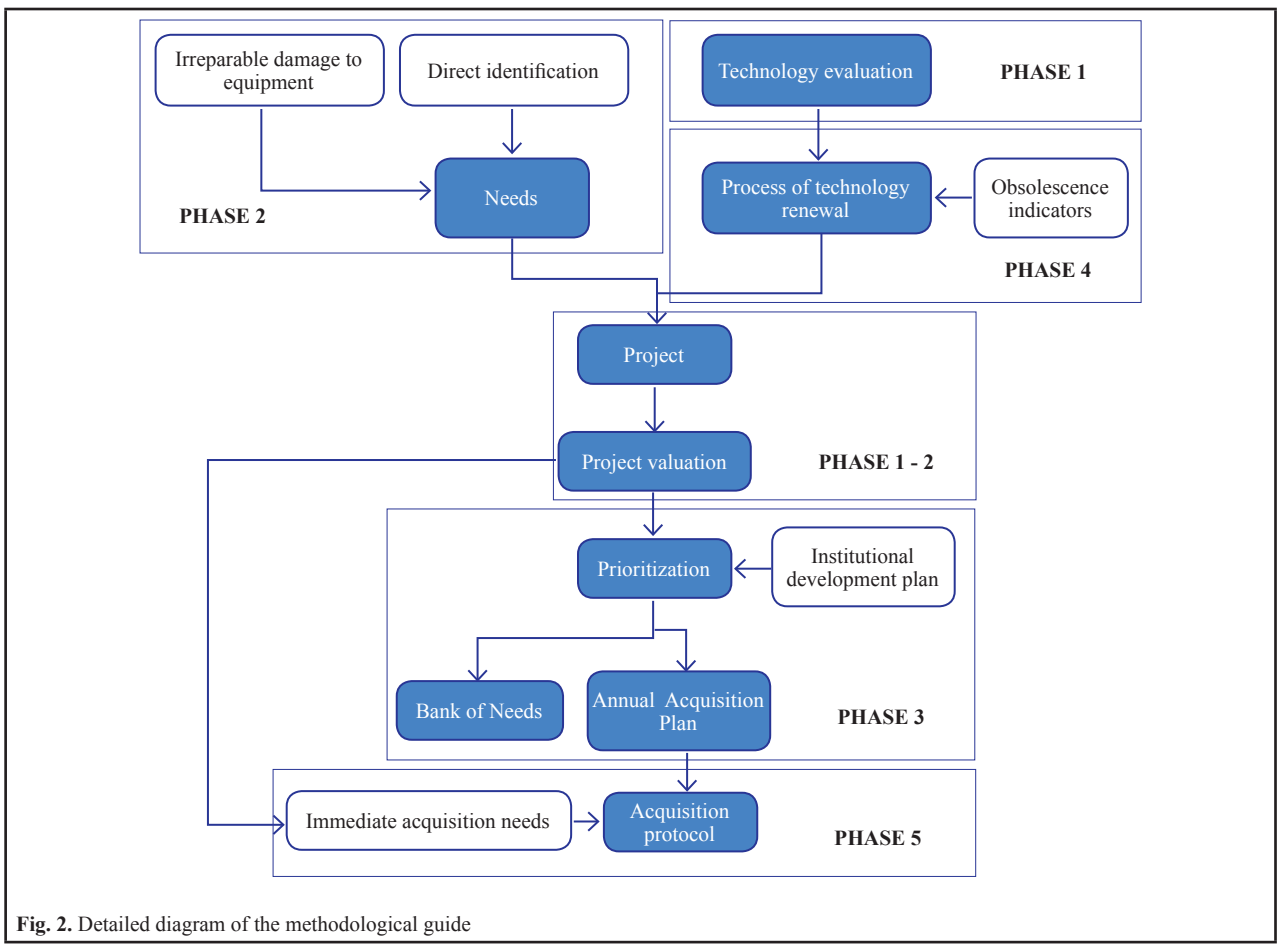


**Fig. 2.** Detailed diagram of the methodological guide

3) *Prioritization of projects:* Once the project has been analyzed and approved, it is referred to the prioritization committee whose purpose is to establish a hierarchical order of the projects and define those that will make up the Annual Acquisition Plan PAA for the following year, and Which will be taken to the Bank of Needs.

Each project is weighted based on the criteria shown in Table 4.

**Table 1.** Technical variables, with score and percentage assigned

| TECHNICAL EVALUATION 45 % | | |
|---|---|---|
| **Technical variables** | **Score** | **Percentage** |
| Electrical safety of biomedical equipment | 8 | 22 % |
| Number of corrective VS preventive maintenance | 7 | 19 % |
| Verification of technical specifications. | 6 | 17 % |
| Availability | 5 | 14 % |
| Support for spare parts, supplies and qualified staff | 4 | 11 % |
| Useful life | 3 | 8 % |
| User manual, service and quick guides in Spanish | 2 | 6 % |
| Reporting of adverse events and incidents | 1 | 3 % |

**Table 2.** Clinical Variables defined with assigned percentage

| CLINICAL EVALUATION 30 % | |
|---|---|
| **Clinical variables** | **Percentage** |
| Equipment status | 20 % |
| Clinical reliability | 20 % |
| Usability of the equipment | 20 % |
| Need for training | 20 % |
| Risk associated with use | 20 % |

**Table 3.** Economic variables defined with score and percentage assigned

| ECONOMIC EVALUATION 25 % | | |
|---|---|---|
| **Economic variables** | **Score** | **Percentage** |
| Cost of maintenance vs. Cost of acquisition | **2** | **50 %** |
| Cost of maintenance vs. Replacement cost | **2** | **50 %** |

**Table 4.** Criteria for Evaluation of Projects

| CRITERIA | SCORE | PERCENTAGE |
|---|---|---|
| Epidemiological profile | 6 | 29 % |
| Contingency plan | 5 | 24 % |
| Cost/ benefit relation | 4 | 19 % |
| Classification of equipment | 3 | 14 % |
| Investment | 2 | 10 % |
| Operating Conditions | 1 | 5 % |
| **TOTAL** | 21 | 100 % |

4) *Renewal of biomedical technology:* For the process of technology renewal, it is necessary to carry out two steps (not necessarily simultaneous):

a) Dismiss the equipment.

b) Assessment of the technology to be acquired.

The rule out of biomedical equipment: it is an analytical process that is performed to support the decision to remove a biomedical equipment from an institution, taking into account the useful life of the equipment, its obsolescence and the level of risk for those who use or operate it.

The useful life of the equipment corresponds to the time during which the equipment, due to its technical and functional characteristics, can be in operation without any setback. As for obsolescence, it does not imply that the equipment does not work, but, due to the technological and scientific advances and the needs to be supplied in the institution, the equipment is outdated for such tasks. Also considered in this process are the costs of both preventive and corrective maintenance and the operation costs of the technology, since these are due to the fact that it is not feasible to continue with the operation of the equipment.

If the equipment doesn't comply with the performance evaluation values an adjustment or correction process must be carried out, if after that it is still not complying with the standards, a decision must be taken to withdraw without the need to apply the following steps of the Analysis. In addition, if the equipment is not operating within the technical specifications given by manufacturer, it will not be safe for patient or operator.

5) *Acquisition of biomedical technology:* For the acquisition of biomedical equipment, it is important to formalize the process by means of a contract that is structured in such a way as to be beneficial for both parties.

In the acquisition process is important to take into account following recommendations [5]:

a) Avoid being one of the first institutions that acquires a new model: the initial requirements for the purchase of technology mentioned in Phase 2 must be taken into account, within which a referent is requested; That is to say the experience of another institution that is using the technology that is wanted to acquire.

b) Check the opinion of others: it is very important to acquire a biomedical equipment, ask doctors and engineers of other hospital institutions, bear in mind prestige of the brand and observe the operation of equipment already installed (month of proof). This will allow an adequate purchase.

c) Do not buy if you do not have the authorization of the medical area that will use the equipment.

d) Do not buy equipment, which can not maintain: that is, there are equipment with affordable purchase prices, but with high maintenance costs [6].

## IV. Discussion

The application of this methodological guide was carried out in a hospital institution of level III of the city of Cali, at the moment of the presentation of this article it wasn't possible to implement the whole of the guide since the chosen institution like pilot doesn't had a concise and updated baseline of information of installed equipment; Which has generated that the process of validation of the methodology extends in the time to allow to make the measurement.

## V. Conclusion

IPS is proposed to create an institutional needs bank, which will allow the collection of projects that are not included in the annual procurement plan; As well as being a basis in cases of need for immediate acquisition so that they go directly to the contractual stage of the acquisition process.

The design of the process of evaluation of installed biomedical technology, based on national statutes allows the adaptability of the methodology to any health institution of the country.

The methodology for rule out biomedical equipment based on obsolescence criteria and the corresponding legislation permit an objective basis for the renewal of these equipment.

Establishing the prioritization criteria of the acquisition projects will permit the institution to determine which equipment will be included in the acquisition plan for the next year, and which according to qualification become part of the needs bank.

For the acquisition process recommendations were made to the contractual phase of the purchase, and a contract model for biomedical equipment was proposed.

## Acknowledgment

The authors are grateful to the administrators, managers, heads of staff of the maintenance departments and the heads of services of the health institutions taken as a model, for the support provided without which it would be impossible to achieve this project.

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