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A Study Case to Explore Procedures and Tools Used for the Evaluation of ICT Investments.

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***Abstract*—Previous studies suggest that decision makers in organizations lack a structured methodology or a well-defined framework for evaluating their investments in Information and Communication Technologies (ICTs) by integrating tangible and intangible benefits. This paper deals with this problem by exploring procedures and tools used by decision makers in a Nicaraguan logistics services company for their evaluation of tangible and intangible benefits obtained from their investments in ICTs. For this end, a study case methodology was applied by reviewing internal documentation and conducting interviews with three key decision makers in order to obtain from three different perspectives (operational, technological, and business) information that was later comparatively analyzed. This study illustrates real life practices for the evaluation of ICT investments in a company and contributes with evidence of the lack of documented procedures and tools for the evaluation of these investments, as well as of the existence of practices for said evaluation that focus mainly on tangible benefits and limit the estimation of intangible benefits to subjective judgements.**

Keywords— Evaluation of ICT investments, study case, evaluation procedures and tools, key decision makers, tangible and intangible benefits.

I. INTRODUCTION

Investments in Information and Communication Technologies (ICTs) can represent an extremely expensive and time-consuming exercise for firms [2], [4], [10], [17], [23], [25], [27]; therefore, decision makers (those involved in decision making regarding ICT investment projects) must justify the required big budgets and significant efforts and demonstrate that the desired results are being yielded [2], [5], [23]. However, even though the implementation of ICT investment projects can provide firms with both tangible and intangible benefits, there exists a gap in their evaluation in view that decision makers lack a structured methodology or a well-defined framework that would enable them to analyze said investments by integrating both tangible and intangible factors and, consequently, they tend to focus their analysis on quantifiable economic benefits without taking into account those of intangible nature [1], [7], [16], [24]. A tangible benefit is one that directly affects the organization's bottom line, and it can be measured directly and assigned a monetary value. An intangible benefit has an indirect impact on the organization's productivity and performance, and it cannot be measured directly or quantified easily in terms of money, time, or frequency, or by using mathematical equations [12], [18], [21], [26]. Therefore, a tangible benefit is easily quantifiable while an intangible benefit is difficult to measure, thus decision makers seem to focus their analysis of their ICT investments on the quantifiable economic benefits obtained and to evaluate intangible benefits based mainly on subjective judgements such as support to decision-making or ease of use [17].

Whereas analyzing tangible benefits will provide information on what and/or how much a firm has gained with the implementation of ICTs, it will not allow to comprehend the extent of their impact in the business [13] taking into account that said technologies support and help to improve the performance in the operations of a firm in a multidimensional fashion; therefore, a detailed evaluation of the contribution of ICTs to firms' operations requires multidimensional measurements that must integrate both tangible and intangible factors [12] by using adequate procedures and tools. Therefore, it is important for an organization to verify whether their procedures and tools used for the evaluation of their ICT-IPs achieve to integrate the analysis of both tangible and intangible factors.

In Nicaragua, in the year 2005, a survey [15] conducted to small and medium enterprises (PYMEs, for their acronym in Spanish) revealed that ICTs had a positive impact on process flexibility, work productivity, profitability, sales, and production costs. It also revealed that PYMEs were aware of the importance of using ICTs to achieve success and that they had a clear interest in improving their access to said technologies. The study, however, did not develop on procedures and/or tools decision makers would use to evaluate their investments in ICTs. A study [11] conducted in the year 2015 analyzed information gathered from the perceptual perspective of active employees of companies based in Nicaragua, in private and public sectors, in connection with the

existence of procedures to evaluate benefits obtained from the implementation of ICT investments in their organizations. The study concluded that one part of the employees polled perceived that such evaluation procedures existed and took into account both tangible and intangible benefits, and another part perceived that only tangible benefits were evaluated. This split result left open the question of whether decision makers actually define procedures and tools that integrate both tangible and intangible factors to evaluate their ICT investments.

The purpose of this study is to deal with said open question by following a study case design so as to explore procedures and tools used by decision makers for their evaluation of tangible and intangible benefits obtained from investments in ICTs in the Operations Department of the company *Max Bucardo Logistics*[1]. For this end, interviews with key decision makers (KDMs) were conducted and internal documentation was reviewed in order to obtain evidence on whether their procedures and tools integrate both tangible and intangible factors and thus illustrate any existing gap in their evaluation of their ICT-IPs. The company is a logistics operator headquartered in Managua, the capital city of Nicaragua, dedicated to providing transportation and distribution services, as well as handling of goods, parcels, and merchandise within the national territory and from/to other countries. The company was selected for this study because it has strategically implemented in their processes (*e.g.*, packaging and distribution management processes) the use of ICTs, which has allowed them to expand their range of services. Additionally, the company has a well-defined organization, which made it easy to identify the key decision makers to contact for the conduction of the study.

This paper does not aim to assess the studied organization from an approach on the use of good practices in their ICT-IP evaluations (such as those described in PMBOK – Project Management Body of Knowledge; PRINCE – Projects in Controlled Environments; ITIL – Information Technology Infrastructure Library; etc.). Therefore, even though it is considered that the use of good practices contributes to the execution of said evaluations, assessing their use is not the purpose of this study.

This paper is organized as follows: Section I presents an introduction to the study; Section II presents the literature review; Section III presents a description of the methodology used for this work; Section IV presents the results of the study case; Section V presents a comparative analysis of said results, Section VI includes a discussion; Section VII presents conclusions of the study and recommendations for future work. Appendix I shows a glossary of terms used in this study.

II. Literature Review

This section reviews past studies related to methods and techniques proposed for evaluating ICT investments from an approach on tangible and intangible elements.

A. *On Methods and Techniques for Evaluating ICT Investments.*

Some methods and techniques proposed in the literature for evaluating ICT investments from an approach on tangible elements include:

- Return On Investment. There are three commonly used methods based on return on investment: net present value, discounted cash flow, and payback period. Such methods are designed to measure the hard, quantitative, monetary impact of capital investment. Methods based on return on investment are generally regarded as more theoretically correct and practically feasible approaches to capital investment appraisal. Such methods are also commonly accepted in many organizations as the standard basis for selecting capital investment projects [24]. Methods based on return on investment are considered as capital budgeting techniques that provide a single score or statistic by which to assess the investment (or compare competing investment options) [19].

- Cost-Benefit Analysis. This analysis tries to overcome the problem of methods based on return on investment by finding some surrogate measure for intangible costs or benefits, which can be expressed in monetary terms. The approach attempts to deal with two problems: (1) the difficulty of quantifying the value of benefits that do not directly accrue to the investor in the project, and (2) the difficulty of identifying the benefits or costs that do not have an obvious market value or price (*i.e.*, intangible factors). Therefore, the cost-benefit analysis method is useful where the costs and benefits are intangible, but the method requires the existence of a broad agreement on the measures used to attach a value to the intangibles [24]. Cost benefit analysis is also based on using money as a metric for combining many factors, some of which are distinctly non-monetary in origin [19].

- Return On Management. In this approach all measures of productivity use the simple ratio of output/input. Management's output is defined as management's value-added, which is everything left after subtracting all the direct operating costs from the value added due to direct labor. The advantage of methods based on return on management is that they concentrate on ICT's contributions to the management process. The disadvantage is that the residual assigned as the value added by management cannot be directly attributed to the management process [24]. Return on management is based on a value added approach that isolates the management added value and then divides this by the management cost [20].

- Information Economics. This is a variant of cost-benefit analysis, tailored to cope with the particular intangibles and uncertainties found in information systems projects. However, the decision making process used in this methodology is based on a ranking and scoring technique of intangibles and risk factors associated with

[1] The name of the company has been modified to maintain the confidentiality agreed with the sources.

the ICT investment. It identifies ICT performance measures and uses them to rank the economic impact of all the changes that introduction of the ICT generates in an organization's performance. Here, also, surrogate measures are often used for most intangibles and risk factors that are hard to estimate. The strength of the Information Economics method is that it links the quantification and comparison approaches with qualification approaches. Some limitations are that it does not deal with the mechanism but only with its outcomes, and that it focuses on simple, idealized settings that can be modeled with applicable mathematical models, often requiring many simplifying assumptions [24]. This method is based on a composite approach as it combines several fundamental measures to get a "balanced" overall picture of value/investment return. It may also be *ad hoc* as in conventional weighted ranking. Even where the structure is predetermined, different weighting and scoring schemes may be used to alter the balance of the factors affecting the decision. The ultimate output of this method may be a single number score [19].

Some methods and techniques proposed in the literature for evaluating ICT investments from an approach on intangible elements include:

- A holistic approach by simulation. The approach consists of a number of steps that aim to transform an ill-defined problem into a set of generic, replicable actions that drive the evaluation effort. Such an approach is needed to codify experience and ideas, and to facilitate structuring, planning, and monitoring of future efforts. This approach is mainly targeted to business change scenarios where ICT applications and computer networks play an integral part. It is also suitable for investments that are expected to yield intangible and/or indirect benefits as opposed to hard or strategic ones [3].
- Multi-criteria analysis. This analysis is mainly directed to assessing the acceptability and the value of ICT projects in the public sector, especially when the projects feature the qualitative value along with the monetary one. The approach is based on the possibility of recombining the following three ICT projects public value assessing methodologies: the American Value Measuring Methodology, the French MAREVA (méthode d'analyse et de remontée de la valeur), and the German WiBe (Wirtschaftlichkeitsbetrachtung). The analysis features the value acceptability threshold as an indicator of improvements in case of the implementation of a project and as a tool for eliminating projects whose contribution to value is too low [8].
- Examination of intangible outputs such as innovation. This approach involves further analysis of the impact of information technology on innovation output. This includes an examination of unique time periods, returns to ICT capital in ICT-using versus ICT-producing industries, and the contribution of ICT to highly valued, blockbuster innovations [9].
- Identification of difficulties –which may include intangible aspects– before and after adopting technologies. This method consists of identifying risks and difficulties of adopting technologies in an organization so as to detect opportunities for organizational improvement by developing activities that enable users to obtain better skills in the context of adopting advanced technologies [16].

Other methods for evaluating ICT investments are described as follows:

- Multi-objective, multi-criteria: This method attempts to develop a general measure of utility, defined as the satisfaction of an individual's preferences. It is based on the belief that people's behavior is determined to some extent by the feeling that their preferences are recognized. This method is probably most applicable to complex projects that attempt to meet the needs of many different users and where the benefits are intangible. Using this method enables exploring the value of a set of system proposals in terms of relative preferences for different system features [39]. The multi-objective, multi-criteria method is a semi-subjective method for appraising the value of different outcomes in terms of the decision makers' own preferences [24].
- Value Analysis: It emphasizes the value that ICTs provide to a firm, rather than costs. The method is based on the following three assumptions: (1) Innovation is value driven and not cost driven: (2) intangibles can be identified and subjectively assessed but rarely measured accurately, as surrogate measures are often used to satisfy the requirement for most inputs, and (3) individuals driven by cost and those driven by effectiveness will inevitably clash. The analysis begins with the observation that most successful innovations are based on enhancing value added rather than on cost savings. A multi-stage iterative process starts with a prototype system. Rather than developing extensive specifications, the analysis provides simple models that can be expanded and modified until all complex aspects of the problem are included. Users are asked to provide the analyst with feedback on the values and limitations of the solution obtained from the prototype. The main difference between other ICT evaluation methods and value analysis is that the former methods directly aim at a final solution, while the latter uses an evolutionary process to get to a "satisfiable solution" which may be further improved [24]. With this method the value of the technology implemented rather than its cost is first assessed. This involves a careful study of exactly what the proposed technology will do and how the new functionality will affect the business [20].
- Critical Success Factors: This method explores the potential value of information systems involving

comprehensive interviews with key managers to obtain their views about the business mission, objectives, and current problems. It invites the analyst to explore together with executives the factors that are, in their opinion, critical to the success of the business, in particular the factors important for the functions or activities for which the executives are responsible. The executives can rank issues into levels of importance [24].

B. *The Existing Gap of Empirical Evidence from the Perspective of Decision Makers.*

The literature reviewed proposes methods and techniques for evaluating ICT investments by approaching tangible or intangible elements, and it analyzes cases where ICT investments are evaluated based on tangible benefits obtained [6], [14], [22]. However, the literature seems to lack of a systematic analysis on evaluations conducted based on intangible benefits.

References [1], [7], [16], and [24] agree in that current evaluation methods which are commonly accepted do not provide with procedures to guide decision makers in the analysis of intangible benefits, and they focus on quantifiable economic benefits without taking intangible benefits into account. A recent study [11] dealt with this assumption by analyzing information gathered from the perceptual perspective of active employees of companies based in Nicaragua, in private and public sectors, in connection with the existence of procedures to evaluate benefits obtained from the implementation of ICT investments in their organizations. While this study contributed with empirical evidence from the perceptual perspective of active employees about the existence of evaluation procedures in their organizations, it did not provide sufficient evidence to determine if decision makers actually define –and use– procedures and tools to evaluate their ICT investments by integrating both tangible and intangible factors.

Accordingly, this paper can be positioned as an instrument to gather evidence from the perspective of decision makers of procedures and tools they actually use for the evaluation of their ICT investments, and thus contribute to reduce the existing gap of empirical evidence on whether decision makers take into account both tangible and intangible factors.

III. METHODOLOGY

This section presents a description of the methodology used for this work.

A. *Preparation for the Study.*

An introductory e-mail message was sent to the General Manager (GM) of *Max Bucardo Logistics* followed by a short phone conversation to briefly describe the objectives and implications of the study and to settle a meeting for a more detailed presentation.

In the initial meeting the scope and objectives of the study were presented to the GM and the necessary authorization was requested to access internal documentation related to the implementation and evaluation of their ICT investment projects (ICT-IPs). Authorization was also requested to contact key personnel that would help to obtain information/documentation relevant to the study.

It was proposed to the GM to focus the study on their Operations Department in view that this is directly involved in the logistics services the company provides and is therefore considered to be the most active internal consumer of ICTs. The GM accepted the proposal and suggested that the most adequate Departments to include in the study –besides the Operations Department– were the ICT Department, due to their role in delivering technological services and implementing new technologies to support the operations, and the General Management Department, due to their role in defining general strategies and guidelines in the company. The heads of these Departments were selected for the required interviews, with the exception of the General Management Department for which the Vice-General Manager was assigned with the representation for this exercise.

Copies of the questionnaire to use in the interviews and of the list of internal documentation to require were provided to the GM via e-mail for his review. Finally, it was confirmed that upon completion of the study the results would be presented to the GM including comments and recommendations for improvement. The GM granted authorization to proceed with the study and notified each KDM requesting their collaboration. The interviews with the KDMs were held between October 2017 and January 2018. During this same period any pertinent documentation available that was not presented or provided during the interviews was obtained via e-mail from the interviewees.

B. *Key Decision Makers Selected for Interviews.*

The study focused on the Operations Department of the company *Max Bucardo Logistics* (OD-MBL). The key decision makers selected for the interviews were the Chief Operations Officer (COO), the Chief Information Officer (CIO), and the Vice-General Manager (VGM). Their main responsibilities are described below based on the observation of their activities during the visits to the company and their general descriptions of activities they perform provided in the interviews. Their positions in the company's organization chart are shown in Appendix II.

KDMs have been classified for this study as Operations Leader, Technology Leader, or Business Leader. The Operations Leader is the person who leads the company's operational strategies and can provide information for the study from that perspective. The Technology Leader is the person who leads the company's technological strategies and can provide information for the study from that perspective. Finally, the Business Leader is the person who leads the company's business strategies and can provide information for the study from that perspective.

- *Chief Operations Officer (COO).* Head of the Operations Department. Capacity for this study: Operations Leader. Responsible for coordinating the

TABLE I
QUESTIONNAIRE USED AS A GUIDE FOR THE INTERVIEWS AND CLASSIFICATION OF QUESTIONS

Classification	No.	Questions
Administrative procedures	1	On average, how many times per year do you invest in Information and/or Communication Technologies (ICTs) in the Operations Department of Max Bucardo Logistics (OD-MBL)?
	2	What is the procedure defined for decision-making regarding ICT investments in OD-MBL, and who participates in it?
	3	When you decide to implement an ICT investment project (ICT-IP) in OD-MBL, who and how defines the results to expect from its implementation?
	4	What is the procedure defined for implementing an ICT-IP in OD-MBL, and who participates in it?
Frequency of evaluation	5	How often do you evaluate tangible benefits obtained from an ICT-IP implemented in OD-MBL?
	6	How often do you evaluate intangible benefits obtained from an ICT-IP implemented in OD-MBL?
Evaluation procedures	7	What is the procedure defined for evaluating tangible benefits obtained from an ICT-IP implemented in OD-MBL, and who participates in it?
	8	What is the procedure defined for evaluating intangible benefits obtained from an ICT-IP implemented in OD-MBL, and who participates in it?
Record keeping	9	Do you keep records of tangible benefits obtained from an ICT-IP implemented in OD-MBL, and what does that record include?
	10	Do you keep records of intangible benefits obtained from an ICT-IP implemented in OD-MBL, and what does that record include?
Evaluation tools	11	What tools do you use to evaluate tangible benefits obtained?
	12	What tools do you use to evaluate intangible benefits obtained?

Source: The Author.

daily operations of the company; formulating, executing, and implementing operational and technological strategies for delivering services to clients; executing and implementing the operational directives defined by the General Management; analyzing together with the CIO all ICT requirements raised by external clients and presenting proposals to the General Management; presenting monthly reports to the Management Group on activities and projects executed in/by OD-MBL.

- *Chief Information Officer (CIO).* Head of the ICT Department. Capacity for this study: Technology Leader. Responsible for planning, coordinating, implementing, and managing the strategy of use of ICTs in the company; analyzing ICT requirements raised by external or internal clients and presenting proposals to the General Management; contacting and dealing with external suppliers of ICT goods/services; presenting monthly reports to the Management Group on activities and projects executed in/by the ICT Department.

- *Vice-General Manager (VGM).* Deputy of the General Management Department. Capacity for this study: Business Leader. Responsible for controlling the execution and implementation of the directives defined by the General Manager and the Board of Directors; formulating, executing, and implementing financial strategies; making decisions on ICT investments related with internal processes; granting authorization to proceed with the implementation of ICT-IPs; assisting in the implementation of specific types of ICT-IPs; keeping personal notes on each manager's performance in general terms; conducting separate briefings with CIO and COO to review the performance of ICT-IPs implemented; executing other functions assigned by the General Manager; replacing the GM in case of absence.

These leaders were selected for the interviews due to their knowledge of and involvement in the definition and implementation of strategies, procedures, and technologies in the OD-MBL, as well as for their capability to provide adequate support for the conduction of the study and relevant information/documentation that would help to identify the procedures and tools they use for the implementation and evaluation of ICT-IPs in said Department.

C. Description of the Interviews.

Semi-structured interviews were individually conducted face to face with the KDMs. Each interview was recorded with the previous authorization of the interviewee, and notes were also taken to remember details of the interview and to promote the discussion of comments made by the interviewee that were considered significant for this study. This helped to augment the basis for the posterior analysis of the information gathered.

After obtaining the General Manager's authorization to proceed with the interviews, each selected key decision maker was contacted by the interviewer via an e-mail message containing: a) a description of the scope and objectives of the study, b) a description of the information expected to be obtained from the specific KDM, c) a proposal of date and time for the meeting, d) copy of the questionnaire to use in the interview, and e) the list of internal documentation to require from the specific KDM. Each selected key decision maker was also requested to prepare any additional documentation that they considered important to support their answers.

The day of the meeting, before initiating the interview, the interviewer explained again the objectives of the study and confirmed the authorization granted by the General Manager to proceed with the same. The interviewer then requested authorization to record the interview (with a positive response in all cases) and promised to handle confidentially all information obtained during or after the interview by any means. It was also explained to the interviewees that the results of the study would be presented to the GM objectively and without constituting any evaluation of their performance.

Each interview was conducted using as a guide the questionnaire shown in Table I, which consisted of twelve questions that were classified based on their relationship with

TABLE II
LIST OF DOCUMENTS REQUESTED FROM THE INTERVIEWEES

Documents	Requested from	Purpose of request
Company's organization chart	Business Leader	To identify the scope of action/influence of the selected KDMs in the company's hierarchy.
Job descriptors	Business Leader	To confirm the scope of action/influence of the selected KDMs in defining, implementing, and evaluating ICT-IPs in OD-MBL.
General procedures manuals	Business Leader/ Operations Leader	To understand any procedure(s) established by the General Management Department/Operations Department for defining, implementing, and evaluating ICT-IPs in the company/OD-MBL.
Internal reports on results expected from the implementation of ICT-IPs	Business Leader/ Technology Leader/ Operations Leader	To gather evidence on whether *ex ante*[a] analyses are conducted from business/operational/ technological perspectives to define what results are expected from the implementation of ICT-IPs in the company/OD-MBL, and whether both tangible and intangible factors are taken into account.
Internal reports on benefits obtained after the implementation of ICT-IPs	Business Leader/ Technology Leader/ Operations Leader	To gather evidence on whether *ex post*[b] analyses are conducted from business/operational/technological perspectives to evaluate the results of the implementation of ICT-IPs in the company/OD-MBL, and whether both tangible and intangible factors are taken into account.
Internal reports on evaluations of ICT-IPs implemented	Business Leader/ Technology Leader/ Operations Leader	To gather evidence on any type of evaluation conducted from business/operational/technological perspectives on the implementation of ICT-IPs in the company/OD-MBL.
ICT acquisitions history	Technology Leader	To determine the frequency of purchases of ICT equipment/services.
ICT-specific procedures manuals	Technology Leader	To understand any procedure(s) established by the ICT Department for defining, implementing, and evaluating ICT-IPs in the company/OD-MBL.

Source: The Author.
[a]An *ex ante* analysis is an analysis based on predictions.
[b]An *ex post* analysis is an analysis based on results.

specific topics of interest for the study. The interviewer was free to introduce additional questions in order to obtain clarification or supplementary information about the desired topics.

The concepts used in this study for "tangible benefit" and "intangible benefit" were explained to each interviewee. The interviewer explained that a "tangible benefit" is one that can be measured directly and assigned a monetary value, and that an "intangible benefit" is one that cannot be measured directly or quantified easily in terms of money, time, or frequency, or by using mathematical equations.

D. Internal Documentation Required for Review.

Table II shows the list of documents requested from each interviewee in their capacities of Operations Leader, Technology Leader, or Business Leader and the purpose of each request. This documentation would generally help to understand how the organization functions and to identify existing records and tools used in the evaluation of their ICT-IPs. Each interviewee was also requested to provide any additional documentation that they considered important to support their answers.

E. Procedure for Interpretation of Results.

The results of this exploratory study were interpreted following the procedure shown in Fig. 1 in order to formulate conclusions on the existence of procedures and tools used by the analyzed Departments to evaluate the benefits obtained from their ICT investments in OD-MBL. First, conclusions were formulated from the analysis of the interviews with the KDMs; then, conclusions were formulated based on the review of the available internal documentation; finally, a comparative analysis was conducted on these findings in order to formulate the conclusions of the study in terms of the existence of procedures and tools for the evaluation of tangible and intangible benefits obtained from the implementation of ICT-IPs in OD-MBL.

IV. RESULTS OF THE STUDY CASE

This section presents the results of the study case.

A. Interviews with Key Decision Makers.

All three KDMs were individually interviewed using as a guide the questionnaire shown in Table I. Additional questions were also introduced by the interviewer when it was necessary to obtain additional clarification or supplementary information. Next is the information gathered with the interviews summarized by following the classification of questions shown in Table I.

1) Administrative Procedures.

All interviewees agreed in that the frequency of ICT investments in OD-MBL depends on the needs of the Department or on requirements raised by the external clients. They also agreed in that there are no documented procedures for decision-making regarding said investments, but there is a Management Group constituted by all managers of the company who discuss the available options for ICT investments and decide which is the most convenient.

Both the COO and the CIO see themselves as a team to analyze requirements and prepare proposals in connection with new investments in ICTs, unlike the VGM who indicated that even though all managers participate in decision-making, it is the VGM and the CIO who participate the most. All KDMs agreed, however, in that only the General Management (whether the GM or the VGM) can grant authorization to proceed with the implementation stage of an ICT-IP.

Regarding the definition of expected results from the implementation of an ICT investment in OD-MBL, all

interviewees agreed in that each Department (the Departments analyzed in this study, which are: Operations Department, ICT Department, and General Management Department) make their own definition of the same in different terms and at different times. They also agreed in that there are no documented procedures for implementing an ICT-IP in OD-MBL. There was no consensus as to who participate in the implementation stage.

2) Frequency of Evaluation.

The COO and the CIO agreed in that both tangible and intangible benefits obtained from the implementation of an ICT-IP are evaluated every month with the Management Group. The VGM indicated that such evaluation takes place at the end of the year.

3) Evaluation Procedures.

The COO indicated that procedures for the evaluation of both tangible and intangible benefits obtained from the implementation of ICT investments are defined. However, all interviewees agreed in that said procedures are not documented. The CIO and the VGM indicated that such evaluation is made in general terms, without detailing tangible and intangible benefits. The COO indicated that tangible benefits are evaluated in terms of fixed/variable expenses and economic gain, and intangible benefits are evaluated in terms of fulfillment with delivery time, quality of service, and guarantee. The COO and the CIO agreed in that all managers participate in the evaluation procedures. The VGM indicated that spontaneous feedback from external clients and results of customer satisfaction surveys conducted by the Commercial Department are also used for evaluation purposes.

4) Record Keeping.

All interviewees agreed in that no official records are kept in connection with tangible/intangible benefits obtained from ICT-IPs implemented in OD-MBL. The COO indicated that even though there is no official documentation on said benefits, all necessary information to prepare it is available in their systems and databases. The CIO indicated that even though there is no official documentation, they keep track of said benefits in terms of level of compliance with requirements. Finally, the VGM said that he keeps personal notes on each manager's performance in general terms, which he uses for his own evaluations.

5) Evaluation Tools.

The COO, the CIO, and the VGM indicated that the tools they use for the evaluation of tangible benefits obtained from an ICT-IP implemented in OD-MBL are Microsoft Excel, documentation on purchases made (used to compare with additional income that may be reported by OD-MBL), and briefings, respectively. The COO and the CIO indicated that there are no tools available for the evaluation of intangible benefits. However, the COO and the VGM agreed in that customer surveys (directed to external clients) are used to obtain information for this type of evaluation, and this information can also be obtained by using a Management Control Platform, according to the COO. A summary of the answers given by each interviewee in connection with each question is shown in Appendix III.

B. *Review of Documentation.*

Table II shows the list of documents requested from each interviewee. Each interviewee was also requested to provide any additional documentation that they considered important to support their answers. Table III reflects the existence of documentation requested from interviewees classified under the following criteria:

- *Existent and official:* Documentation exists and is officially recognized and controlled in the organization.
- *Existent but unofficial:* Similar documentation exists but is not specific and/or officially recognized or

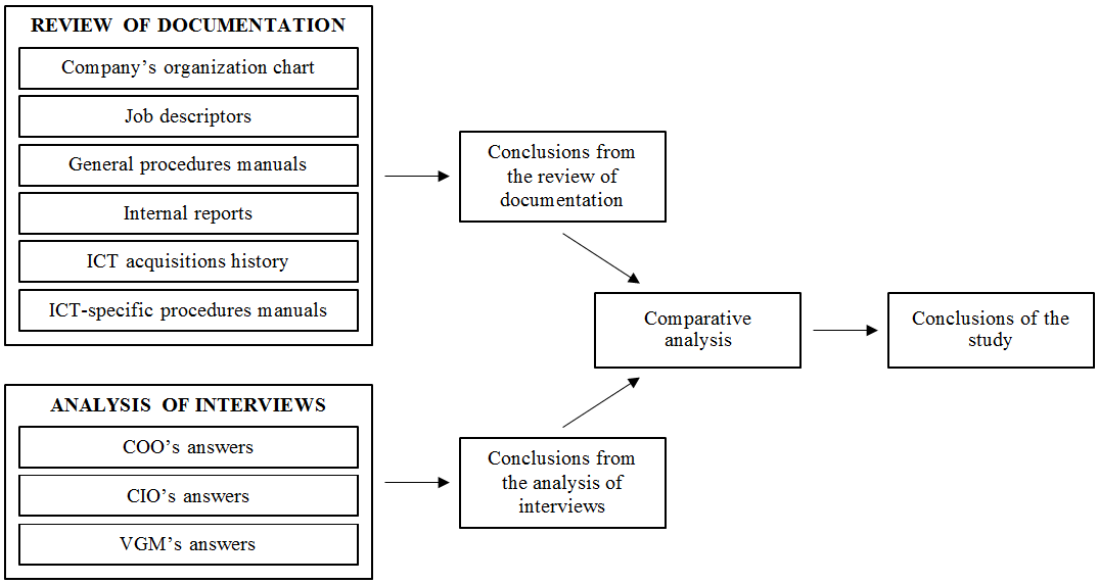

Fig. 1. The procedure followed in this study for the interpretation of results.

TABLE III
EXISTENCE OF DOCUMENTATION REQUESTED FROM INTERVIEWEES

Documents	Existent and official	Existent but unofficial	Inexistent
Company's organization chart	X		
Job descriptors		X	
General procedures manuals			X
Internal reports - Results expected from implementing ICT-IPs		X	
Internal reports - Benefits obtained from implementing ICT-IPs	X		
Internal reports - Evaluations of ICT-IPs implemented		X	
ICT acquisitions history	X		
ICT-specific procedures manuals			X

Source: Analysis of documentation provided by interviewees.

controlled in the organization. Its format and use are limited to the interviewee's standards and needs.

- *Inexistent:* No evidence was provided to support the existence of documentation.

No evidence was provided on the existence of official or non-official manuals of general or ICT-specific procedures regarding the evaluation of ICT investments in OD-MBL. Only the company's organization chart, internal reports on benefits obtained after the implementation of ICT-IPs in OD-MBL, and ICT acquisitions history were proven to be documentation that is officially recognized and controlled in the organization.

The company's organization chart was provided by the general management and is of general use and knowledge in the company. It has been adapted in Appendix II to show only the positions related with the Departments that are relevant to this study: Operations Department, ICT Department, and General Management Department.

The internal reports on benefits are prepared mainly based on the calculation of economic profit obtained as a result of the implementation of a specific ICT-IP, and on the information gathered from external clients of their estimation of benefits they have obtained after being affected by a specific project. The economic profit is calculated based on additional income and/or reduction of expenses/losses. The information from external clients is obtained and documented as part of a post implementation follow up conducted via telephone and/or e-mail.

All ICT acquisitions require authorization from the VGM, and they are documented by the ICT Department as part of their established procedures. This documentation was presented[2] by the CIO detailing dates, amounts, and types of purchase, among other data. Contact information of ICT suppliers is also available in said Department in both electronic (e-mail directory) and printed (invoices, quotations, etc.) formats. Job descriptors were not yet available as they were still in process under the responsibility of the Human Resources Department as part of a requirement from the General Management Department. Only drafts of this documentation were available; however, these were not presented to the interviewer.

[2] In line with the confidentiality agreed with the sources, this documentation was only reviewed *in situ*. No copies thereof were obtained as it was not required for this study.

The results expected from the implementation of ICT-IPs in OD-MBL are not detailed in official reports. Instead, each KDM writes in a notebook information of the expected results without taking into account any official format or requirement for a posterior report to General Management. Information regarding periodical evaluations of ICT-IPs implemented in the company/OD-MBL is documented in this same fashion.

No documentation was provided or presented additionally to that requested from each interviewee as shown in Table II.

V. COMPARATIVE ANALYSIS

The information gathered with the interviews with KDMs and the information resulting from the review of documentation available is subjected to a comparative analysis in terms of the existence of procedures and tools for the evaluation of tangible and intangible benefits obtained from the implementation of ICT-IPs in OD-MBL. Table IV presents conclusions from the analysis of the interviews with the selected KDMs and from the review of the documentation requested. These conclusions are summarized by following the classification of questions shown in Table I.

Even though the implementation of ICT-IPs in OD-MBL is the result of a planned strategy, no consensus is sought by decision makers on what benefits should be expected and they are thus free to reach their own definitions. Moreover, decisions on the implementation and evaluation of said investments are made on a circumstantial basis without following official standard procedures.

The results of the evaluation of benefits obtained from the implementation of ICT-IPs in OD-MBL are reflected mainly in terms of economic profit as part of the official reports of the monthly meetings held by the Management Group. Reports which are specific to the evaluation of said investments only exist as unofficial documents separately prepared by each KDM and reflecting tangible benefits in economic terms and intangible benefits in terms of performance and quality.

There are no official records in which benefits of tangible nature obtained from the implementation of ICT-IPs in OD-MBL are specifically differentiated from those of intangible nature. Additionally, there are no manuals of general or ICT-specific procedures for evaluating said investments. The existing official evaluation reports are limited to the calculation of benefits in terms of economic profit from the KDMs' own

TABLE IV
CONCLUSIONS FROM THE ANALYSIS OF INTERVIEWS AND FROM THE REVIEW OF DOCUMENTATION

Classification	Analysis of interviews	Review of documentation
Administrative procedures	Planning and execution of ICT investments in OD-MBL depend on requirements of said Department or external clients. Procedures for decision-making are not documented. Each Department analyzed in this study defines benefits expected from their own perspective and for their particular use.	There is official documentation of the company's organization chart and ICT acquisitions. Job descriptors are available only in drafts. There are only unofficial reports of ex ante analyses on benefits expected from the implementation of ICT-IPs in OD-MBL. Manuals of general or ICT-specific procedures for evaluating said investments do not exist in any form.
Frequency of evaluation	Benefits obtained from the implementation of ICT-IPs in OD-MBL are evaluated in the monthly meetings of the Management Group.	There are official reports of ex post analyses on benefits calculated mainly on economic profit. There are only unofficial reports of evaluations of ICT-IPs implemented in OD-MBL.
Evaluation procedures	Procedures on how to evaluate ICT-IPs implemented in OD-MBL are not documented. Tangible benefits are evaluated in economic terms, and intangible benefits are evaluated in terms of performance and quality.	There are official reports of ex post analyses on benefits calculated mainly on economic profit. There are only unofficial reports of evaluations of ICT-IPs implemented in OD-MBL.
Record keeping	There are no official records with specific information of tangible/intangible benefits obtained from the implementation of ICT-IPs in OD-MBL. Departments analyzed in this study keep track of said benefits from their own perspective and for their particular use.	There are official reports of ex post analyses on benefits calculated mainly on economic profit.
Evaluation tools	There are no official tools for specifically evaluating intangible benefits obtained from the implementation of ICT-IPs in OD-MBL, and those used for evaluating tangible benefits vary per each Department analyzed in this study.	Manuals of general or ICT-specific procedures regarding the evaluation of ICT investments in OD-MBL do not exist in any form.

Source: Answers of interviewees and information provided by interviewees on documentation requested.

perspective and for their particular use, and the existing tools used for said evaluation are limited to the analysis of tangible benefits while neglecting the analysis of intangible benefits.

VI. DISCUSSION

This study illustrates real life practices in connection with the evaluation of ICT-IPs by conducting a study case in a Nicaraguan logistics services company. It gives an example of ICT-IP evaluation procedures that fail to integrate both tangible and intangible benefits and focus mainly on the measurement of tangible factors such as those related with economic profit. Specifically, the study case provides evidence that there exists a gap that should be addressed in the way the studied organization conducts their ICT-IP evaluations.

While all interviewees agreed in that a comprehensive analysis of their ICT investments should integrate both tangible and intangible benefits, their current procedures do not appear to address this adequately. None of the KDMs interviewed provided proof that their current procedures would promptly be adapted for that end. This represents an opportunity for improvement in their evaluation procedures and tools so as to also include the analysis of intangible benefits in order to obtain a more detailed and realistic multidimensional measurement of the contribution of their ICT-IPs to their processes and activities.

Even though this paper did not aim to assess the studied organization from an approach on the use of good practices in their ICT-IP evaluations, it provides information that suggests that good practices are being used in the execution of said evaluations taking into account that the effectiveness of their projects is periodically supervised to satisfy the business' needs and that related information is in fact documented for follow-up by KDMs. However, although good practices are used in the execution of ICT-IP evaluations in the studied organization, they seem to be ignored when defining the extent of the evaluations since these do not reach deep into the intangible benefits obtained and remain superficial dealing mainly with benefits of tangible nature.

The results of this study are limited to the analysis of interviews with selected KDMs and to the review of various documents available related to the ICT-IP evaluation procedures of a specific organization. All information and documentation provided/presented by the interviewees was considered authentic and complete. Given the exploratory nature of the study, the small sample size (one single case) was acceptable; however, a larger sample in future research would support the generalizability of the findings and thus determine whether the detected gap exists in the ICT-IP evaluation procedures of other organizations.

VII. CONCLUSIONS OF THE STUDY AND RECOMMENDATIONS FOR FUTURE WORK

This study case focused on the Operations Department of a Nicaraguan logistics operator to explore procedures and tools used for their evaluation of tangible and intangible benefits obtained from investments in Information and Communication Technologies (ICTs). For this end, interviews with key

decision makers (KDMs) were conducted and internal documentation was reviewed. It was found that, even though significant use of ICTs is made in the logistics processes of the company, the selected KDMs lack official procedures and tools for evaluating their ICT investments by analyzing benefits of both tangible and intangible natures. Instead, each KDM defines and implements their own procedures and tools by limiting their evaluation to the analysis of tangible benefits while neglecting the analysis of intangible benefits. The study case helped to illustrate an existing gap in the evaluation of ICT investments, where tangible benefits remain as the main focus of analysis and intangible benefits are superficially analyzed based mainly on subjective judgements. This study may be replicated in other companies with the aim of obtaining more information on how decision makers conduct their evaluations of their ICT investments, and whether they integrate benefits of both tangible and intangible natures. A further analysis may also provide information on the causes and the extent of impact of the lack of procedures and tools for the use of decision makers on their evaluation of intangible benefits obtained from said investments.

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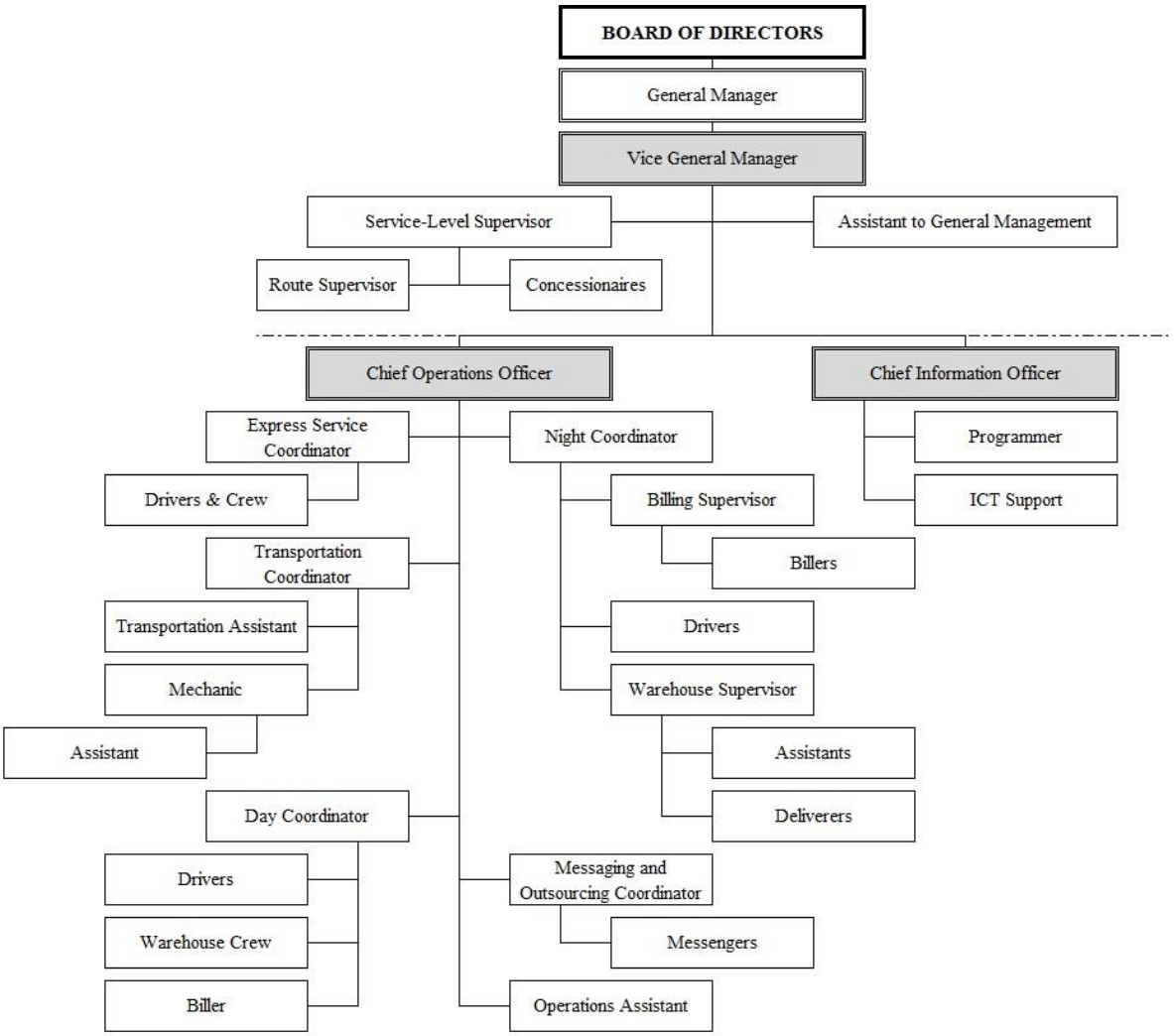
APPENDIX I

Glossary of terms used in this study.

Abbreviation /Acronym	Meaning	Definition
CIO	Chief Information Officer	Head of the ICT Department of the company subject to this study.
COO	Chief Operations Officer	Head of the Operations Department of the company subject to this study.
GM	General Manager	Head of the General Management Department of the company subject to this study.
ICT	Information and communication technology	Technology related to hardware and/or software dedicated to the storage, retrieval, processing, transmission, and distribution of information.
ICT-IP	Information and communication technology investment project	An investment project involving information and communication technology.
KDM	Key decision maker	Any person in a company who is directly responsible of making essential decisions regarding a specific ICT investment project in accordance with the strategy developed therefor.
OD-MBL	Operations Department of Max Bucardo Logistics	A division of the company subject to this study which is specialized in coordinating the daily operations that are required for delivering services to clients.
PYME	Acronym in Spanish for "**P**equeñas **y M**edianas **E**mpresas" (Small and Medium Enterprises)	Small or medium-sized enterprises in terms of volume of income, value of the patrimony, and number of workers. The abbreviation "SME" is used by international organizations such as the World Bank, the United Nations and the World Trade Organization.
VGM	Vice-General Manager	Deputy of the General Management Department of the company subject to this study.

APPENDIX II

Organization Chart[a] of Max Bucardo Logistics.



Source: General Management Department of Max Bucardo Logistics.
[a]Adapted to show only the positions related with the Departments that are relevant to this study, which are: Operations Department, ICT Department, and General Management Department. The Human Resources Manager and the Commercial Manager (not shown in the image above) are in the same hierarchical level than the COO and the CIO.

APPENDIX III

Summary of answers given by each interviewee in connection with each question.

Questions	Answers		
	Operations Leader (COO)	Technology Leader (CIO)	Business Leader (VGM)
1. On average, how many times per year do you invest in Information and/or Communication Technologies (ICTs) in the Operations Department of Max Bucardo Logistics (OD-MBL)?	Not defined. Frequency of investments depends on the needs of the Department or requirements from external clients.	Not defined. Frequency of investments depends on the needs of the Department or requirements from external clients.	Not defined. Frequency of investments depends on the needs of the Department or requirements from external clients.
2. What is the procedure defined for decision-making regarding ICT investments in OD-MBL, and who participates in it?	Procedures are not documented. Each requirement is analyzed by CIO and COO to prepare proposal and present it to Management Group: Human Resources Manager, Commercial Manager, CIO, COO, VGM, and GM. VGM executes financial analysis, CIO and COO review their budgets, and if proposal is accepted, GM grants authorization.	Procedures are not documented. All managers meet every month. When an ICT investment is required the ICT Department analyzes the requirement and presents a proposal, COO provides feedback, all managers discuss on the available options and select the most convenient. Finally, VGM grants authorization for any required purchase.	Procedures are not documented. Decisions are made depending on the type of need, whether for the continuous improvement of internal processes or by the demand of a client. All managers participate, but mainly VGM and CIO. Decisions on ICT investments related with internal processes are generally taken by VGM.
3. When you decide to implement an ICT investment project (ICT-IP) in OD-MBL, who and how defines the results to expect from its implementation?	COO and his team define expected results in terms of fulfillment of the client's requirements and execution time of operations.	Results to expect are defined "on the run" by the affected parties in general terms, without specifically emphasizing on tangible or intangible benefits.	Results to expect may be defined at the time of preparing a budget.
4. What is the procedure defined for implementing an ICT-IP in OD-MBL, and who participates in it?	Procedures are not documented. An analysis is conducted on requirements for implementation. Human Resources Manager, Commercial Manager, CIO, COO, VGM, and GM participate in the implementation of an ICT-IP in OD-MBL.	Procedures are not documented. CIO and COO participate in the implementation of an ICT-IP in OD-MBL.	Procedures are not documented. CIO, COO, and user beneficiaries participate in the implementation stage. Depending on extent of impact expected, Commercial Manager and/or the VGM may also participate in the process. If an ICT-IP will be implemented to fulfill a client's requirement, all managers participate.
5. How often do you evaluate tangible benefits obtained from an ICT-IP implemented in OD-MBL?	The evaluation of tangible benefits obtained is included in monthly reports.	Every month all managers meet and discuss results.	Evaluations are generally made at the end of the year.
6. How often do you evaluate intangible benefits obtained from an ICT-IP implemented in OD-MBL?	The evaluation of intangible benefits obtained is included in monthly reports.	Every month all managers meet and discuss results.	Evaluations are generally made at the end of the year.
7. What is the procedure defined for evaluating tangible benefits obtained from an ICT-IP implemented in OD-MBL, and who participates in it?	Procedures are defined, but not documented. Evaluations are conducted in terms of fixed/variable expenses and economic gain. All managers participate.	Procedures are not documented. Each manager of the affected Departments presents report with general information on results, without necessarily distinguishing intangible benefits. All managers participate.	Procedures are not documented. Cost-benefit is always estimated. Evaluations are grosso modo without detailed measurements. Spontaneous feedback from external clients is also used for evaluation purposes.
8. What is the procedure defined for evaluating intangible benefits obtained from an ICT-IP implemented in OD-MBL, and who participates in it?	Procedures are defined, but not documented. Evaluations are conducted in terms of fulfillment with delivery time, quality of service, and guarantee. All managers participate in this evaluation.	Procedures are not documented. Each manager of the affected Departments presents a report with general information on results obtained, without necessarily distinguishing intangible benefits. All managers participate.	Procedures are not documented. Evaluations are grosso modo without detailed measurements. Spontaneous feedback from external clients and results of customer satisfaction surveys conducted by the Commercial Department are also used for evaluation purposes.
9. Do you keep records of tangible benefits obtained from an ICT-IP implemented in OD-MBL, and what does that record include?	No. However, information is available to calculate tangible benefits obtained in terms of fixed and variable expenses.	No. Results are tracked by the ICT Department in terms of level of compliance with requirements.	No. VGM keeps personal notes on each manager's performance in general terms.

Continuation of APPENDIX III

Summary of answers given by each interviewee in connection with each question.

Questions	Answers		
	Operations Leader (COO)	Technology Leader (CIO)	Business Leader (VGM)
10. Do you keep records of intangible benefits obtained from an ICT-IP implemented in OD-MBL, and what does that record include?	No. However, information is available to estimate intangible benefits obtained in terms of fulfillment with delivery time, quality of service, and guarantee.	No. Results are tracked by the ICT Department in terms of level of compliance with requirements.	No. VGM keeps personal notes on each manager's performance in general terms.
11. What tools do you use to evaluate tangible benefits obtained?	Microsoft Excel to track cost, management, and distribution indicators in terms of time, effectiveness, and performance. Customer surveys conducted by the Customer Service Department also used to obtain information.	Documentation on purchases made is used to track amount of investment and compare it with additional income that may be reported by OD-MBL.	Separate briefings with CIO and COO are conducted to review tangible benefits obtained.
12. What tools do you use to evaluate intangible benefits obtained?	No tools available for this end. However, Management Control Platform and customer surveys conducted by the Customer Service Team are used to obtain information.	No tools available for this end.	Customer satisfaction surveys conducted by the Commercial Department.

Source: Analysis of interviews with KDMs.