Factors that could be considered on Information Systems research works

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Abstract: Many Information Systems research works have been developed and that type of research will continue, without doubt. Starting from a documental study, this work proposes some factors that could be considered on such studies, trying to collaborate with researchers developing research works on Information Systems. Proposed factors are related to research topics, research process or methodology, context and information source.

Keywords: Information Systems research.

1 INTRODUCTION

At the present time, several studies related to Information Systems (IS) can be found in literature. This studies are presented in books, articles in business journals, proceedings, IS specific journals, etc. This fact reflects the diversity of research in IS area. The amount of this research studies is rapidly and constantly increasing due to the improvement of technology, the development of new knowledge in this area and the continuous changes of organizations and their environment, to which organizations must adapt in order to perdure.

Nevertheless, when doing research on IS, several issues must be taken into account, such as which aspects need to be considered, how to arrange the structure of the work, how to perform the research process, which operating process of the data should be defined, etc. Since this is not always an easy and quick task, this study proposes a set of factors that should be pondered on the development of IS related research works, in an attempt to find some basic rules for the execution of this sort of labour that may facilitate its later study.
This proposal is based on a study developed by the authors about the characteristics of research works in the IS area. They considered as focus of study specialized journals in the IS area, specifically Journal of Strategic Information Systems, developing analysis of the articles published during 2002 to 2003.

2 PROPOSED FACTORS

This study allowed to establish the following factors to consider:

2.1 To define the topic of the research

Making a quick revision of the articles published in specialized journals in the area of the Information Systems (IS) it is possible to realize a variety of considered topics, such as: (i) Concepts computing (nets, algorithms, architectures, computing processes, operative systems, programming languages, etc.); (ii) Concepts of data (databases, security of data, etc.); (iii) Development concepts of IS (development methodologies, technical of development, considerations for the development, etc.); (iv) Concepts of IS projects management (considerations about management, teams work, etc.); (v) Concepts related to IS area, it inside the organizational structure (it structure, its functions, the participants’ roles, it importance, training, etc.); (vi) Concepts related to organizational aspects (strategy, culture, structure, competitiveness, human resources, organizational learning, innovation, management change, etc.); (vii) Concepts related to social aspects (them related to ethic, legality, economy, culture, geography, ethnic group, politics, teaching, etc.). In addition to, is possible to divide each one topics in a variety subtopics. Therefore, a first consideration to considered is the context or extend of the research works related to IS that need develop. That is, to settle down if it will be considered a wide universe of study (where it can be a variety of topics that they point to different areas related with IS, as the signal ones), or it will be considered a more reduced universe (being centered in a context or specific environment, considering an area in particular), in which case it would be necessary to define possible subtemas to carry out the corresponding analysis. This way, for example, if he/she wants himself to work in the specific area of Strategic Information Systems, it would be necessary to define possible particular subtemas for this area, as alignment strategy of business/estrategy of information systems, information systems and competitive advantages, inter-organizational information systems, among others.

2.2 To define the way of developing the research process

To establish the form of developing the research process it is considered:

2.2.1 To define the research focus

To allows to be getting a general vision of will be the research process. Vessey, Ramesh y Glass [4] they give a classification of the possible research focuses is
descriptive, evaluative and formulative. However, it has been considered necessary to
develop a modification to that outlined by this authors in relation with the descriptive
focus, like you can appreciate in the chart 1.

<table>
<thead>
<tr>
<th>Focus</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive</td>
<td>Description of some study element, being possible to distinguish two cases:</td>
</tr>
<tr>
<td></td>
<td>• Description of some study element that corresponds to a observable reality (for example the evolution or use of the information systems in a certain organization).</td>
</tr>
<tr>
<td></td>
<td>• Description of some study element that doesn't correspond to a observable reality (for example beliefs or opinions).</td>
</tr>
<tr>
<td>Evaluative</td>
<td>Componentes evaluation considered in the study. It can be evaluative-deductive, evaluativo-interpretive, evaluativo-critical, or some other evaluative focus.</td>
</tr>
<tr>
<td>Formulative</td>
<td>Formulation of something, such as models, methods, algorithms, rules, concepts, etc.</td>
</tr>
</tbody>
</table>

Chart 1. Research focus

2.2.2 To define the research type
It allows to settle down more detailedly on what it will consist the research process.
To establish the investigation types it has been considered that outlined by Sierra [3],
around the types of doctoral thesis (to see chart 2).

<table>
<thead>
<tr>
<th>Classification</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>According to their width</td>
<td>Monographic, Panoramic</td>
</tr>
<tr>
<td>According to their temporary reach</td>
<td>Historical, Current</td>
</tr>
<tr>
<td>According to their relationship with the practice</td>
<td>Basic, Applied</td>
</tr>
<tr>
<td>According to their nature</td>
<td>Empiric, Theoretical, Methodological, Critical-evaluatives,</td>
</tr>
<tr>
<td>According to their character</td>
<td>Descriptive, Comparative, Relate them, about causes and effects, replication</td>
</tr>
<tr>
<td>According to their sources</td>
<td>Primary, Secondary, Mixed</td>
</tr>
</tbody>
</table>

Chart 2. Types of Research

2.2.3 To define the research method
It allows to specify what study mechanisms they could be used in the development of the research work. Vessey, Ramesh and Glass [4] give a classification types of research methods. However, if you analyze it, you can appreciate that it similar to the classifications mentioned in the point 2.2 (concretely, to the “research nature”). Therefore, this classification will be considered to define the possible research methods, being the following ones: (i) Empiric, (ii) Theoretical, (iii) Methodological, and (iv) Critical-evaluative.
2.3 To define sources of information to mention

This point is refereed to have clarity about types of information sources that it can be mentioned, independent of the format in that are (to see chart 3). The value of the information sources resides, according to Desantes-Guanter and Lopez [1] in “their authenticity and in their truthfulness”. For this reason important to know their author and their credibility, at the same time that the “originality and scientific value.” In this sense, Eco [2], it give importance to first hand sources, mentioning that these are those that contain the direct original information about the studied topic, and information sources of second hand those that correspond to interpretations or they are based on these.

<table>
<thead>
<tr>
<th>Type</th>
<th>Subtype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference literature</td>
<td>Encyclopedias, Dictionaries, Treaties manuals and texts, Monographs, collective Works.</td>
</tr>
<tr>
<td>Periodic publications</td>
<td>Dictionaries and annuals, Magazines, Bulletins, Series, statistical Annuals.</td>
</tr>
<tr>
<td>Gray literature</td>
<td>Records of congresses, Thesis, Norms, Patents, Translations, research Reports, Research projects, Pre-publication, Manuscripts, Reprints.</td>
</tr>
<tr>
<td>Other printed sources or not</td>
<td>Manuscripts, written documents, and artistic, archaeological, etnographic objects; Multimedia and microforms.</td>
</tr>
</tbody>
</table>

Chart 3. Classification of Sources of Information

2.4 To define research environment

This point is refereed to define the context and extend or level under study of the research. The classification of the research environment has been defined considering to Vessey, Ramesh and Glass [4], but making some important modifications. The proposed classification is appreciated in the chart 4.

<table>
<thead>
<tr>
<th>Type</th>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization Level</td>
<td>Society level</td>
<td>The study does not consider an organization context, but, for example, at a sectoral, national, international level, etc.</td>
</tr>
<tr>
<td></td>
<td>Organizations in general</td>
<td>The study considers organizations in a general sense, without considering an or several in specific form.</td>
</tr>
<tr>
<td></td>
<td>Two or more non related organizations</td>
<td>The study considers two or more specific organizations that don't maintain some type of organizational bond, alliance or cooperation among them.</td>
</tr>
</tbody>
</table>
### Two or more related organizations

The study considers two or more specific organizations that maintain some type of organizational bond, alliance or cooperation among them.

### Organizational

The study only considers a specific organization.

### Work teams

The study considers to work teams, of the same or different organization.

### At individuals' level

The study considers individuals, without caring the organization to which you/they belong (what interests to study is its experience or opinion in the matter that is studied).

<table>
<thead>
<tr>
<th>Matter of study (what is studied)</th>
<th>Organizational aspects</th>
<th>Aspects related to the internal function/services of IS/IT</th>
<th>Aspects related with external services of IS/IT</th>
<th>Projects</th>
<th>Aspects computing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The study is centered in aspects of organizational interest, as strategy, its structures, culture, competitiveness, acting, knowledge/learning, resources, capacities, use given to the technology, legislation, regulation mechanisms, etc.</td>
<td>The study is centered in aspects to with the function or services (internal of the organization) of IS/IT, such as planning, organization, management, control, resources, etc.</td>
<td>The study is centered in aspects related to services of external IS/IT of the organization.</td>
<td>The study is centered in considerations in the development of projects (planning, management, organization, control)</td>
<td>The study is centered in concepts or elements computing, such as data models, algorithms, etc.</td>
</tr>
</tbody>
</table>

**Chart 4. Environment of the Research**

#### 2.5 To define the structure that can present the development of the work

In general form the works should present the following structure:
i. **Headed:** Title, name authors, institution of authors' origin, summary or abstract (Spanish and/or English as is necessary), key words.

ii. **Body:** it Considers the points that compose the development of the work, for this study it will be considered from the introduction until the conclusions.

iii. **Final:** Gratefulness (if there are them), appendixes (if there are them) and references.

However, the structure can vary according to the research focus that is used:

1. **According to descriptive focus:** (i) Heading; (ii) Body (Introduction, conceptual Development, Description of the organization in study, Conclusion); (iii) Final.

2. **According to evaluative focus:** (i) Heading; (ii) Body (Introduction, Theoretical framework, hypothesis Development, Description of the research process, Results and Analysis of data, Discussion of results, Conclusion); (iii) Final.

3. **According to formulative focus:** In this case they are distinguished three kind of works: (i) works that starting from the theoretical development can formulate something, (ii) works that first starting from a theoretical development, then they study a certain observable reality where the considered theoretical aspects are presented, and finally they can formulate something related to that studied, and (iii) works that starting from a theoretical development that then is validated applying it in some reality observable. The general structure for each case can be the following one:

   - **Works type 1:** (i) Heading; (ii) Body (Introduction, Theoretical framework, Formulation of something, implications, Conclusion); (iii) Finals.
   - **Works type 2:** (i) Heading; (ii) Body (Introduction, Theoretical framework, Description of reality observable, Formulation of something, Implications, Conclusion); (iii) Finals.
   - **Works type 3:** (i) Heading; (ii) Body (Introduction, Theoretical framework, Formulation of something, Description reality observable, Description research process, Results, Discussion, Implications, Conclusion); (iii) Finals.

4. **How run the process of research development**

   They have been considered three aspects: the focus, the type, and the research method.

   2.6.1 **The case of the research focus**

   The research focus has been classified in three types: descriptive, evaluative, and formulative.

   The **descriptive focus**, it can be developed running, first, a conceptual development, where the concepts involved in the study are presented (being indicated the revised literature). From this conceptual frame to expose the observable reality that will study, being centered in describing what already interests according to the concepts
presented; and starting from the above-mentioned to obtain the conclusion of the study.

**The focus evaluative**, it can be developed making the following steps: (i) A theoretical development, where the concepts are exposed involved in the study. It settling down the conceptual basic frame on which the work will be developed, being indicated the literature that has been revised; (ii) The hypothesis definition, those that can mention at the serie time that the related concepts directly with them are exposed previous step; or to outline them in a special section, after the theoretical development; (iii) The description of the research process, that is determined by the subtype of research method that is used, being possible to point out in general form, some aspects to consider: participants' Description in the study (and tasks that develop) or reality that is observed, Mensurations that are made (explanation of what is wanted to measure and approaches used to make the mensurations), Collection of data, Results and Analysis of data; Discussion of results, Conclusions.

**The focus formulative.** As it has already been mentioned it is possible to distinguish three kind of works under the focus formulative. However, the three kind can consider in the treatment of the work some or all the following aspects: (i) Theoretical framework, where the concepts involved in the study are exposed, settling down the conceptual frame base on which the work will be developed, being indicated the literature that has been revised, (ii) Description of observable reality that is study object, it means organizational level that one studies, being indicated the aspects that are of interest for the study, (iii) Formulation of something, where starting from the conceptual frame, of the reality observable, the formulation is developed of those is the objective of the study, being able to be questions to foment the research in the studied area, extension of concepts, work methods, advance and/or recommendations on what is studied, models, a conceptual frame to be considered in the practice and in future related works in order to study, etc., (iv) Description of the research process, where it is indicated the made mensurations, the means for which the collection of data, the period of used time was obtained and to who it was considered for the obtaining of the data, (v) Setting of results, starting from which you can develop a correction of what has been formulated previously. If it is the case you can develop a statistical analysis of the data, (vi) Implications of the work, those that can be theoretical, directive, practical, or for future researchs, (vii) Conclusions obtained starting from the development of the work.

### 6.2.2 The case of the research type

The research kind that allows to define some considerations on how to develop the research process, and is related to the “nature of the research” (according to the used classification, to see chart 2), referring to the empiric, theoretical, methodological, and critical-evaluative subtypes. Of the mentioned the empiric one is the most common in the scientific research works, so the attention will be centered in it, being described some considerations in the following point.
2.6.3 The case of the research method
As it mentioned, the attention will be centered in the empiric research method. The works that are made using this research method present similarities in their development. However, they differ mainly in two aspects: in the kind of reality that it observes (real or created) and in the form in that it makes the observation of this reality (simple observation, experiment, documental analysis and application of surveys).

i. Empiric research method - simple Observation. The simple observation seeks, according to Sierra [3], “to obtain data by means of the senses, of a reality as it is naturally or it takes place spontaneously, and it can or not to use technical instruments.” It is common, however, that in the works in that the simple observation is used as procedure of study of the reality, be also used analysis of documents, surveys and interviews to make out this study.

ii. Empiric research method–Experiments. The experiments, according to Sierra [3] “they cause, they control or they manipulate the reality or observed phenomenon somehow” It is common that one creates “something” that causes a certain reality (a game of business simulation, a hypothetical web place, etc.) in order to studying the behavior, reactions and involved people's opinions.

iii. Empiric research method–documental Analysis and surveys. In this procedure, according to Sierra [3] “an indirect study of the empiric reality is made, either through documents, in documental observation, and through questions to involved people.”

2.7 What operating one can give to the obtained data
In this point it is considered important the three aspects that are described:

2.7.1 Mechanisms of gathering of data (observation)
You can classify in:

i. Simple direct observation. According to Sierra [3], it is “the inspection and study made by the investigator, by means of the use of their own senses, especially of the sight, with or without help of technical mechanisms, of the things and facts of scientific interest, as they are or they take place spontaneously. In the time in that they happen and with arrangement to the demands of the scientific research.”

ii. Experimental observation. The experiments, Sierra [3] mentions “they cause, they control or they manipulate the reality or observed phenomenon somehow.”

iii. Documental observation. The documental and methodical observation, Sierra [3] mentions, it is based fundamentally on establishing previously the empiric variables and the categories on those that it is necessary to pick up information. Once this is established it is revised the available documentation systematically, in order to finding the data that are needed.
iv. Observation by means of survey. It consists, according to Sierra [3], in “the obtaining of data by means of the interrogation to the members of the society.” The observation for survey has a basic instrument that is the questionnaire that according to the same author, it is “a group of questions, prepared carefully, about the facts and aspects that interest in an research for its answer for the population (or its sample) to that the undertaken study extends.” Three classes of questionnaires exist: the simple questionnaire, the interview, and the scales sociometrics.

2.7.2 Made mensurations
Some important considerations about the made mensurations are the following ones: (i) The mensuration instruments can be adapted of other authors' previous studies, or designed specifically for the work that is; (ii) to make the mensurations you can use scales type Likert; (iii) In the works whose research method is empiric-experiment it should be mentioned the number of times that the measurations were made and the moment of each one of them.

2.7.3 Analysis made to the data
In this stage the data have already been classified and tabulated, beginning the analysis stage, where according to Sierra [3] “the charts have to be analyzed, it means, studied in their different elements and aspects. This in order to the consequences that can be deduced from them according the purpose of the research and to the hypotheses that has been sought to verify.” It is possible to make two kind of analysis of data: (i) an analysis “simple”, in the way that the data are analyzed directly of the obtained results, developing an interpretation of them, and (ii) a statistical analysis, where statistical techniques are used to make the corresponding analysis, where each author uses the one that considers better for the work and data that it tries.

3 CONCLUSIONS
A research work, in general, and particularly on topics related with information systems, it requires to go by a meticulous development process. This study has considered that the form in that this process is developed is determined by three aspects: the focus, the type and the research method. The research focus allows to have a general vision about the research process, because it indicates what it is hoped to make in the research (description, evaluation, or formulation something), and also help to determine the general structure that can consider the research process, the one that is different according to the focus that is. The research type gives a detailed information about the characteristics of the research process, because it allows to know: the extension and temporary reach of what is investigated, the relationship with the practice, the nature and the character of the research, and the considered information sources. The research method refers to the research kind according to its nature (empiric, theoretical, methodological, and critical-evaluative).

It is important to define the considered environment, because this establishes the context or level under study. The environment has been classified in two types, one
related to the organizational, and other level related to the study matter. This classification (and the subclasificación of each one of them) it allows a bigger clarity about two important aspects: (i) who is being studied (organizational level), and (ii) what is studied (study matter).

In the research development what is studied can be used primary, secondary or mixed sources of information with. However, the primary sources are the most important because they contribute direct information of what is being studied. It can give a bigger trust of the obtained results.

In the empiric researchs, the obtained data have a crucial role, where they should be considered the mechanisms of gathering of data, mensurations, and analysis made to the data. The mechanisms of gathering of data are used according to the empiric research method that is used. For a better observation of the reality it is advisable, if it is possible, to use more than a mechanism, it enriches undoubtedly the observation. The made mensurations require the design of clear and appropriate mensuration instruments, according to the defined research environment, and the kind of people (positions, experience, level of studies, etc.) that they can be considered in the mensuration. The analysis make to the data is an aspect of extreme importance in an empiric research, where it can be make a simple analysis of the data starting directly of the obtained results, but it is necessary to develop a statistical analysis of these so that the research is supported by the validations and corresponding testing. This allow a level of security and trust bigger than the results and obtained conclusions.

For the development of this study a revision and analysis of research works in the IS area has been made, leading to the formulation of factors to be considered when performing this type of works. Nevertheless, a validation of the proposed factors is planned, by requesting researchers of this area to consider the use of such factors in their research works, in order to confirm if they jit their needs and if it possible to perform such research guided by the factors proposed by the authors.

As final conclusion you can mention that this study proposes a group of aspects that is convenient to be considered in the development of research works about the topic of the information systems that you/they can constitute a guide for people that want to develop research works in the area.

REFERENCES
