STUDY ON THE OPTIMAL METHODS AND METHODOLOGIES USED IN INTEGRATED MANAGEMENT SYSTEMS IMPLEMENTATION RESEARCH

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Abstract: *The research paper presents the methods and methodologies used in the research and processing of statistical data regarding the Integrated Management Systems implemented in the industrial branch.*

The defining characteristics of the difference between methods and methodologies are presented with an emphasis on the questionnaire, a tool used in obtaining information that presents a series of advantages in the research of social and economic events. The stages of the research process are through the questionnaire. They are presented and a review is made of the typical construction with an emphasis on experiences in the field regarding the structure and formulation of the questions, the aesthetics, but also the ways of interpreting and correcting errors that may appear in the elaboration of the questionnaire. Finally, the advantages and disadvantages of using the questionnaire in an online environment are presented

Keywords: *Research Methods, Methodologies, Research Optimization Integrated Management System)*

1. Introduction

The research represents the form of advanced knowledge from a rigorous perspective in which different methods and methodologies are used to reach de expected result [Bowen, 2005].

Solving a problem, theoretical or applied, needs a conceptual structure with the help of which the operationalization of the project built for this purpose can be achieved. A research project cannot be carried out without resorting to methods, tools, techniques, principles, or methodological rules [Zait and Spalanzani, 2006].

Following the application of various specific research methods and methodologies, data will be obtained, which to provide viable information, are processed in various forms with the help of specific programs for statistical data processing.

In any research study, methods and methodologies are used and their purpose is to find the element of novelty by identifying elements of necessity and opportunity since the planning of the study.

2. Research characteristics regarding methods and methodologies

Research generally begins by identifying a topic of interest or concern and then asking questions about it.

As [Hyland, 2016] states, research can answer the questions we care about, rarely is there just one answer or "truth" waiting to be revealed. While the research approach we take will tell us something about the topic we are studying, it is important to be aware of the assumptions we make when designing our

research and how we select our data collecting tools [Hyland, 2016].

The methodology is rather unprovable, something that teaches us to use specific methods and tools or class, and also to apply what we know to achieve the desired goal [Meeker, et al. 2014].

The research methodology defined by Dumitru Zait (2006) is a system of methods, procedures, techniques, rules, postulates, principles, and tools, as well as the related know-how engaged in the process of scientific knowledge [Zait and Spalanzani, 2006].

Qualitative and quantitative research methodologies and methods, states [Johnson, 2007] are often contrasted and presented as two opposing entities. However, many researchers have been interested in combining qualitative and quantitative methods to increase the breadth and depth of understanding of a phenomenon and corroborate knowledge [Johnson, 2007; Ott, 2015]. The integration of qualitative and quantitative methods refers to mixed methods research, which saw a prominent expansion in the early 2000s, although its history can be traced back to the 1950s [Pluye, 2012, Creswell, 2018].

Mixed method research is defined as a "*type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches"* [Johnson, 2007].

Over the years, it has been tried to combine several methods and methodologies to find the forms of scientific research, these being known as the concept of research-development, having the role of increasing the volume of knowledge, being a systematic activity using all the knowledge up to the present moment about man, culture, etc.

The classic system of classification of forms of scientific research includes three categories:

- Fundamental research;
- Applied research;
- Development research [Zait and Spalanzani, 2006].

Nowadays, mixed methods research has become popular in several disciplines, such as health [Hemsworth, 2005; Creswell, 2011] and social sciences [Tashakkori, Teddlie, 2010].

A mixed methods study should have at least two methodological components, one qualitative and one quantitative. Each component relates to at least one specific research question/objective, a research design, and data collection and analysis techniques [Pluye, P., Hong, 2014].

Therefore, methodology refers to how research is done, how we find out information about anything, how we can improve knowledge, and how we do mathematical modeling by offering solutions that scientifically motivate activities thus discovering links or legalities impossible to find in other ways.

2.1 Research methods

The method comes from the Greek "*metodos",* which can be identified by any element that prescribes a certain way of acting in research. In the strictly physical sense, the method consists of several techniques, rules, and principles for applying them and explaining the results obtained.

The research method represents the technique of gathering information to solve a problem, theoretical or applied, which needs a conceptual structure to reach the proposed result and goal [Zait and Spalanzani, 2006].

During the accumulation of knowledge, the clarification of knowledge we explain and justify the choice of certain methods in our research, and different researchers tend to often criticize and favor certain methodologies over others and consider those as uniquely legitimate or effective.

That is why, in research, we must take systems theory into account to be able to define from the planning phase the methods and methodologies we want to use, they must contain the following elements:

- Input parameters;
- State quantities (variables), controllable factors, and uncontrollable factors;

- Output parameters [Krosnick, 2018].

How the integration of SMI is carried out is a crucial element of the research and is based on the use of mixed methods [Creswell, 2017].

Nowadays, mixed methods research has become popular in several disciplines, such as health [Hemsworth, 2005; Creswell, Klassen, Plano, 2013] and social sciences [Tashakkori, 2010].

One of the collection techniques encountered for the information gathering method used in a large number of scientific research papers is the questionnaire technique. This consists in gathering information to identify interrelationships and statistical distributions for the indicators of a theoretical model and to extrapolate the conclusions obtained from a probabilistic sample to the level of the reference objective [Moser, 1967; Kerlinger, 1973; Costea, 1983; Bryman, 2008; Saunders, 2008; Mironeasa, 2010; Kristensen, 2010; Lazar, 2013].

2.2 The stages of the research process through the questionnaire

Some data attest that the questionnaire has been used since 1882, by Charles Letourneau, who is also the one who first launched a questionnaire worldwide. Later, other researchers also used questionnaires such as Powell J.W. in 1898; Kindl R, in 1903; Keller in 1903; Steinmetz S., and Thurnwald J. in 1906.

In 1986, the sociologist Schaefer defined the questionnaire as "a printed list of questions about how people think and act" [Baltasiu, 2007].

Another more recent definition given by Kirakowski (2000), specifies regarding the questionnaire that it is a: "method for eliciting, recording and collecting information" [Kirakowski, 2000].

The questionnaire is a complex and demanding technique, as its scope is given by the number of pages, the number of questions and answers, the way of formulating and interpreting the questions, the degree of difficulty of the answers, the extension of the explanations or definitions are important in the failure or success of the research [Nastasie, 2018].

A questionnaire is defined by Kirakowski (2000) as "a method for elucidating, recording, and collecting information" [Kirakowski, 2000]. Cătoiu (2002) states that research cannot be better in theory and practice than its questionnaire [Cătoiu, 2002]. A research plan that uses the survey technique includes the following stages:

1. Delimitation in time and space of the units to be surveyed;
2. Checking the degree of homogeneity of the general community;
3. Choosing or establishing the survey base;
4. Choice and definition of sampling units;
5. Choosing the type and selection procedure;
6. Establishing the periodicity of conducting the survey;
7. Establishing the observation plan which, as a rule, is richer than a total observation;
8. The choice of procedures for verifying the significance of the selected indicators and for extending the selection procedures to the entire ensemble [Nastasea, 2018].

In Rowley's (2014) research into the design and use of research questionnaires, he proposes a set of questions that any researcher should ask themselves when designing a questionnaire:

1. Why should I choose the questionnaire method in my research?
2. What types of questioning can be done through a questionnaire?
3. How do I decide what questions to ask?
4. How do I make sure that respondents answer my questions?
5. How long should it take to complete my questionnaire and how many questionnaires do I need for the study?
6. How can I select potential respondents?
7. What are the options for distributing my survey to maximize the quality and quantity of responses?
8. How do I prepare to analyze my survey data?

9. What analyzes are most likely to be useful to me?

10. How should I present my data? [Rowley, 2014].

The questions in a questionnaire, according to their form, are divided into several categories, as can be seen in figure 1:

1. Questionnaires with open questions;
2. Questionnaires with closed questions;
3. Mixed questionnaire (with both closed and open questions), [Lormore, 1994; Hair, 2007; Saunders, 2009].

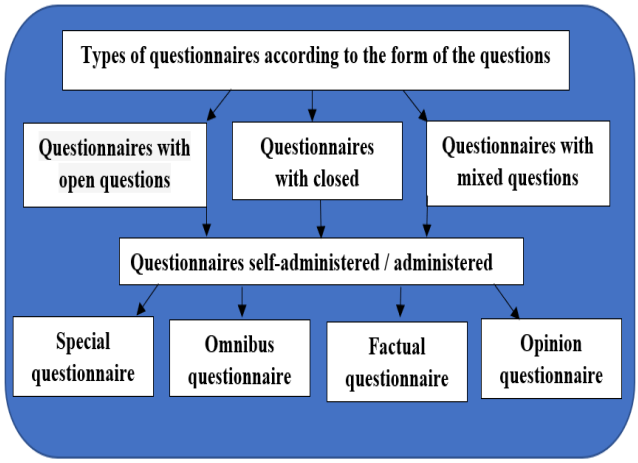

Figure 1: *Types of questionnaires according to the form of the questions*
[Lormore, 1994; Hair, 2007; Saunders, 2009]

2.3 Questions used in making the questionnaire

The construction of the questionnaire should be consistent with the intended data analysis. The objective of the questionnaire and the hypotheses (quantitative) and/or research questions (qualitative) should be guided by the plan for the analysis of the resulting data after completion.

Before building a questionnaire, you must:

1. Have clear objectives and assumptions;
2. Have a list of variables and objects;
3. Have differentiated question sections [Siniscalco, 2005].

Therefore, the research objectives and/or hypotheses determine how the questionnaire should be organized and which variables (constructs/correlates) in the form of questions should be included.

There are some general rules in making the questions in the questionnaire:

a. Clear objectives in writing the questions;
b. The language in which it is carried out should be simple;
c. The concepts of the questions should be clear;
d. The justification of the questions to be explainable;
e. The response options are appropriate;
f. The questions should be as short and to the point as possible;
g. Only one question at a time;
h. Sentences to be affirmative;
i. The questions should not require mathematical calculations;
j. Keep questions short and clear;
k. Avoid referring to questions [Siniscalco, 2005; Riccucci, 2010; Wright, 2011].

2.4 General aesthetics of the questionnaire

In the study of Yaddapanapudi (2019), it is shown that the qualitative level of a survey is largely dependent on the design of the questionnaire used and the format of the questionnaire must be agreed upon by the respondent, because a questionnaire that is pleasant at first sight has every chance of being completed by the respondent that one who does not have a pleasant appearance at first sight [Yaddanapudi, 2019].

Several researchers such as Rattray (2007); Sinha (2013); Bolarinwa (2015); Tsang (2017); Dongare (2019) argue that once a questionnaire is developed it must be controlled/validated by a group of respondents [Rattray, 2007; Sinha, 2013; Bolarinwa, 2015; Tsang, 2017; Dongare, 2019]. It is important to ensure that there is sufficient controlled activity during the development of a new measure.

Ideally, the questionnaire should be piloted on a smaller sample of intended respondents, but with a sample size sufficient to carry out a systematic evaluation of its performance. Item

analysis is a way to control a questionnaire [Rattray, 2007].

The development of the questionnaire should take into account: what the questionnaire should measure; what type of results and what are the metrics; how can I generate profit from the questionnaire [Bolarinwa, 2015].

2.5 Correcting questionnaire errors

The need to pre-test and correct possible errors is emphasized by Backstrom (1963), he states that "no amount of intellectual exercises can replace, in fact, the testing of a measuring instrument such as the questionnaire" [Backstrom, 1963].

In developing the questionnaire, an error can also creep in, which can be corrected with the help of pretesting techniques. Thus, by viewing the answers received, problems that the researcher did not anticipate when he developed the questionnaire can be solved. As Reynolds (1993) describes, pretesting (or pilot testing) is a very important stage in the development of a questionnaire, which determines the potential effectiveness of the questionnaire, and this is done before mass distributing the questionnaire to the target population [Reynolds, 1993].

When additional checks are made, the possibilities of interpreting the questions, interpreting the unnecessary questions, and detecting the questions that correspond to the largest number of answers are also followed. Pretesting a questionnaire can be divided into two important areas:

- Individual pretesting of questions;
- Verify the general design [Oppenheim, 1996].

If the target population is very small, then it would be impossible to carry out a pretest of a questionnaire on subjects that could then be used as a response rate in the experiment [Malhotra, 1999].

The pre-test can be used in a limited way only for testing the questionnaire alone or it can be used for the entire data collection process and even the first steps to analyzing the questionnaire [Galtun, 1967].

Regarding industrial questionnaire responses, two important studies, one by Lee (2008) shows response rates in his studies to be between 15% and 30%, and the other study by Bell (2018) shows a rate of response of 37%, from where it can be concluded that a rate of 20% can be considered a good rate, De Vaus (2013) shows that he obtained a lower response rate [Lee, 2008; De Vaus, 2013; Bell, 2018).

As can be seen, the response rate is very low, so pretesting can be used in a limited way thus considering even an analysis of the process of gathering information and even the first steps to analyze the responses [Galtun, 1967].

The above idea is supported and completed by Perdue (1986), the latter completed with the idea of doing a pre-test after intervening in the questionnaire, to ensure that the changes are the desired ones and that they have no new errors [Perdue, 1986].

There is ample evidence in the studies of Saris (2014) showing that there are differences between the variables, and the methods of applying the validation according to the country where the questionnaire is applied [Saris, 2014].

An interesting study by Salomone (2008) shows a very good response rate (response rate exceeded 60%) compared to the studies mentioned above. This response rate was made possible by addressing and identifying the respondent. For each organization, a request was made for the questionnaire to be completed by the quality manager or a person responsible for integrated management systems, or a person subordinate to them, and before sending the questionnaires for completion, the person responsible for quality management was contacted [Solomon, 2008].

2.6 Research sampling

Research sampling is described by Ardilly (2006) as consisting of two methods:

1 – The exhaustive method consists in contacting and investigating all possible

respondents who are part of a population. As a disadvantage of these methods are: a) very high costs that exceed the possibilities of a researcher; b) long time for research; c) as information is collected, other respondents can be added to the initial respondents.

2 – The survey method is the extraction of a sample from the total possible number of respondents and the generalization of the results for the entire family of respondents. For this method, the difficulty is represented by the criteria for choosing the sample for which the study is to be done, the solution would be to choose a random sample [Ardilly, 2006].

Emmel (2013) states that the larger the sample, the more accurate the survey results are [Emmel, 2013].

Nastasiea (2018) describes the problems facing the field of surveys, namely:

1. Non-response rate and response time;
2. Preservation of anonymity;
3. The "always more" requirement;
4. Protection of strategic data of organizations;
5. Relevance of the information [Nastasea, 2018].

The non-response rate is a common problem in any research. The manner of their manifestation can be various (omitting the responsibility for certain questions and abandoning the completion of the questionnaire), and when we develop the questionnaire, we must also consider this problem [Yaddanapudi, 2019].

Non-answers can be:

- Partial non-answers to certain questions in the questionnaire;
- Total non-responses due to the absence of the company manager, refusal to cooperate, inability to participate in the investigation, and change of company headquarters [Nastasiea, 2018]. To solve the problems with non-responses, the risks must be analyzed from the questionnaire design stage and adjusted in such a way that the influence on the response rate is as high and precise as possible [Dongare, 2019].

2.7 Data collection using the internet

Considering that technology has advanced a lot and digitalization is knocking on the door and is used in all organizations and public institutions when collecting information for a study, the questionnaire sent via the Internet is used on a large scale.

The advantages of sending questionnaires via the Internet are supported by several researchers due to the advantages:

- Low cost;
- Speed of dispatch [Fink, 2015; Callegaro, 2015; Dillman, 2017; De Leeuw, 2018].

Disadvantages of sending the questionnaire over the Internet also has some disadvantages, such as the number of wrongs, unserviceable or non-existent e-mail addresses Swoboda (1997), but also accidental deletion of e-mail, entry into spam, server failure, Dillman (2009), Vaske (2011). These latter disadvantages are with a lower degree of occurrence [Swoboda, 1997; Dillman, 2009; Vaske, 2011].

Several researchers such as Dillman (2009), Cornicelli (2011), Lesser (2011), Sexton (2011), Graefe (2011), and Simon (2012) support the use of internet questionnaires using a mixed method, that is, after sending the questionnaire for the researcher to contact the respondent for a courtesy call, thus increasing the chances of receiving an answer to the sent questionnaire [Dillman et al., 2009; Cornicelli, 2011; Lesser, 2011; Sexton, 2011; Graefe, 2011; Simon, 2012].

3 Results and discussion

3.1 Analysis methods

As Roman Stan (2013) describes, to obtain certain data in research, 3 statistical methods are used by many researchers worldwide (Roman Stan, 2013). These methods are carried out by:

- Through a face-to-face interview;
- By phone;

- By filling in the questionnaires/forms individually, on the Internet, or by e-mail. An analysis of the strengths, weaknesses, opportunities, and threats (SWOT) of the three methods described by Florina (2013) was carried out in table 1, to identify the best method for carrying out the future study [Roman Stan, 2013].

Table 1. *Strategy analysis of the strengths, weaknesses, opportunities, and threats of the three methods*

Method name	Strengths	Weaknesses	Opportunities	Threats
Face-to-face interview	• Physical interaction; • You can observe the respondent's non-verbal behavior; • Higher response rate; • Ensuring personal answers, without the intervention of other people; • Ensuring answers to all questions; • Studying more complex problems.	• High cost; • Long time to identify respondents; • Impossibility of consulting some documents to formulate the answer; • The difficulty in accessing those who are included in the sample; • Failure to ensure anonymity.	• Physical interaction and establishing links for new research; • Deeping some research problems.	• The possibility of irritating the respondent and refusing to complete filling out the questionnaire.
By phone	• Data with good quality; • Little influence on the respondent.	• Requires a large number of respondents; • Very short questionnaire (10 minutes of contact with the respondent).	• Establishing relationships for future research.	• Refusal to answer the questionnaire.
Individual completion on the Internet or e-mail	• Low cost; • Speed of gathering information; • The possibility of studying some information and providing accurate information; • Possibility of a more detailed analysis of the question.	• Lower response rate; • The list of respondents is very large; • Incorrect e-mail addresses.	• Obtaining documented information; • Time to complete the study is very short.	• The possibility of non-responses

Following the analysis of the strategies of strengths, weaknesses, opportunities, and threats, a logical scheme was created, figure 1, for the application of the easiest method to apply and implement, with the collection of answers in a very short time, with the lowest costs.

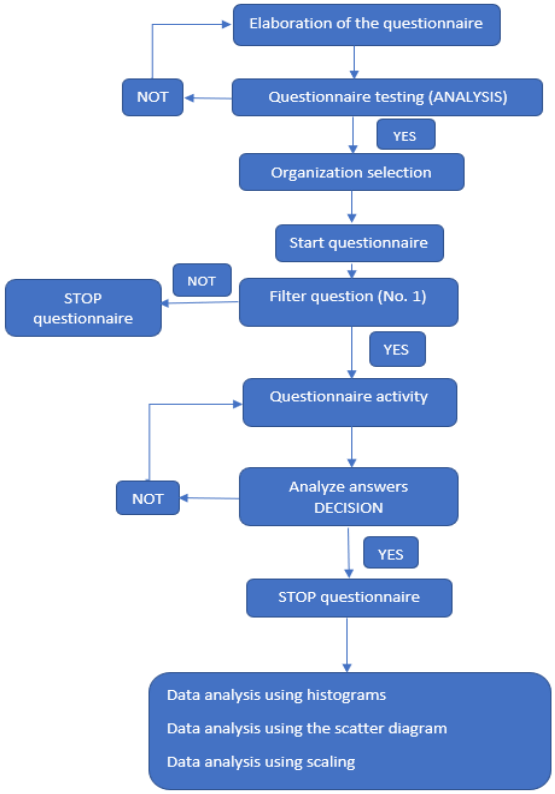

Figure 2: *Logical scheme of the questionnaire*

3.2 Discussion

To reach the proposed objectives, a combination of the three methods was analyzed to be able to reap the benefits of strengths and opportunities and try to improve weaknesses and threats.

Questionnaires can generate very important data if the researchers know how to use the information, combine the research methods, the method of developing the questionnaire, and last but not least the methods of gathering information with the help of the questionnaire.

For the fruition of the data as Rowley (2014) wrote, the researcher must ask himself some questions when designing the questionnaire taking into account all disturbing factors for the greatest possible accuracy of the data obtained, the questions are:

1. What data collection method should I use in my research?
2. What types of questions can be developed to obtain conclusive information?
3. How do I decide what questions to ask?
4. How do I make sure that respondents answer my questions?
5. How long should it take to complete my questionnaire and how many questionnaires do I need for the study?
6. How can I select potential respondents?
7. What are the options for distributing my survey to maximize the quality and quantity of responses?
8. How do I prepare to analyze my survey data?
9. What analyzes are most likely to be useful to me?
10. How should I present my data? [Rowley, 2014].

Analyzing the advantages described by [Fink, 2015, Callegaro, 2015; Dillman, 2017; De Leeuw 2018] and the disadvantages described by [Swoboda 1997; Dillman 2009; Vaske, 2011] also compared with the SWOT analysis that was carried out in table 1, it was found that there is a major risk of non-response [Swoboda, 1997; Dillman, 2009; Vaske, 2011 Fink, 2015; Callegaro, 2015; Dillman, 2017; De Leeuw, 2018].

To solve this risk, the target person will be contacted in advance so they can find out conclusive answers, to avoid non-answers. Researchers' questionnaire must be guided by the closed question strategies of [Desai, 2019] mixed [Delarue, 1977; Durant, 2000], and open [Desai, 2019; Mellenbergh, 2008] to be an attractive questionnaire for the respondent and to extract valuable information.

A very important aspect that must be taken into account [Rattray, 2007; Sinha, 2013; Bolarinwa, 2015; Tsang, 2017; Dongare, 2019] is related to the control factor, that is, the validation of the questionnaire by a group

of experts before being tested on a small group of respondents.

All questionnaire validations should be considered and supported by several researchers such as questionnaire face validity [Gobbens, 2021], construct validity [McDowell, 2006], content validity [Taber, 2018], and criterion validity [McDowell, 2006; Camp, 2018; Gobbens, 2021].

To make information gathering more efficient, researchers [Dillman et al., 2009; Cornicelli, 2011; Lesser, 2011; Sexton, 2011; Graefe, 2011] support the use of the mixed method, that is, after sending the questionnaire the respondent was contacted for a courtesy call, thus increasing the chances of receiving a response to the sent questionnaire.

The concrete studies of [Salomone, 2008 and Simon, 2012] show that to obtain a high percentage of responses, the manager responsible for quality was contacted, a courtesy call was established and then the questionnaire was sent for completion, more for each organization a request was made that the questionnaire is completed by the quality manager or a person responsible for the integrated management systems or a person subordinate to them.

To avoid the problems of non-responses, the researchers' studies were thoroughly analyzed [Salomone, 2008; Dillman et al., 2009; Cornicelli, 2011; Lesser, 2011; Sexton 2011; Graefe 2011; Simon, 2012; Nastasia, 2018; Yaddanapudi, 2019; Dongare, 2019] and it was determined that the best method is to initially contact the respondents to establish courtesies, explain the objective of the study and the time required for completion and if the respondent agrees to complete.

4 Conclusions

The collection of information must keep up with new trends, given that technology has advanced and the digitalization process is used by both organizations and economic agents around the world.

All the analyzes carried out above will have a major benefit on the vision of researchers or future researchers about new modern research methods and methodologies, thus they will obtain qualitative and quantitative answers, reduce research costs, the time for collecting information will be short and the risks of non-response will be diminished. Thus, the chances of obtaining conclusive information increase the chances of success with low cost, low time, and abundant information to complete the study.

To obtain all these benefits, researchers must use, combine, and analyze the best methods for the desired study.

The need and opportunity for this study include all coherent research practices in which a researcher or research team studying integrated management systems combines all elements of this study using qualitative and quantitative information necessary for any study.

By using questionnaires in studies of integrated management systems, researchers can combine the three methods presented, the latter generating very important data if the researchers know how to use the combination of these methods and improve the collection of information. Continuous improvement must also be implemented in research, thus optimizing the methods and methodologies used in research and finally, all these changes bring benefits to researchers by reducing research time, reducing costs, and obtaining valuable information needed for any study.

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