A 2022 vision of offshore engineering professionals on the application of agile methodologies

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ABSTRACT
It has been observed the recognized effectiveness of the use of Agile Methodologies in Information Technology (IT) projects and the discreet application of these methodologies in Engineering projects. The present work aims to carry out a study of the use of Agile Methodologies in the design and manufacturing phases of offshore equipment, allowing the profile of the population most familiar with these methodologies to be drawn, as well as to seek information regarding their implementation. For the development of this study, a questionnaire elaborated with nineteen questions was sent to one hundred and seventy respondents, in addition to conducting interviews with seven of these respondents, which allowed, thus, to gather information about the area of activity, the level of education, the age, years of experience of the respondents, among other information, characteristics, and aspects. In conclusion, this study manages to draw a parallel between the use of Traditional and Agile Methodologies, indicating which are the most used and informing the perception of professionals regarding the use of these methodologies.

Keywords: Agile Methodologies, Traditional Methodologies, Questionnaire, Semi-structured Interviews, Offshore Equipment.

1 INTRODUCTION

The Oil and Gas industry suffered a market downturn in the first half of 2020, either due to the price dispute between Russia and Saudi Arabia, or due to the effects of the pandemic caused by COVID-19, impacting the drop in demand, driving the price of a barrel of oil, in futures contracts in the United States traded at negative values for the first time in the history of oil production [1].

On the other hand, the subsea installations sector, demanded by oil exploration operators, was pressured to reduce its fixed and operating costs, since its portfolio was considerably impaired, leading operators to a significant reduction in investments for the development of its exploratory fields, due to the prices of a barrel of oil at such low levels.

Faced with these facts, many projects on these oil routes were discarded, suspended, reassessed, or resized. Management for the design and manufacturing phases of offshore equipment generally follows the Waterfall Management method, with specific sequences and command and control structures developed and implemented to complete the project on time and within budgets. settled

down. As shown in Figure 1, the Waterfall Method focuses on a top-down, linear approach, where prior actions are rarely reviewed and lessons learned are typically not reviewed, researched, or acknowledged until the end of the project. A linear strategy is configured, a traditional strategy that consists of dependent sequential phases that are executed without feedback loops where the design solution is not disclosed until the final phase [2].

Figure 1 - Activity Flow in the Cascade Method
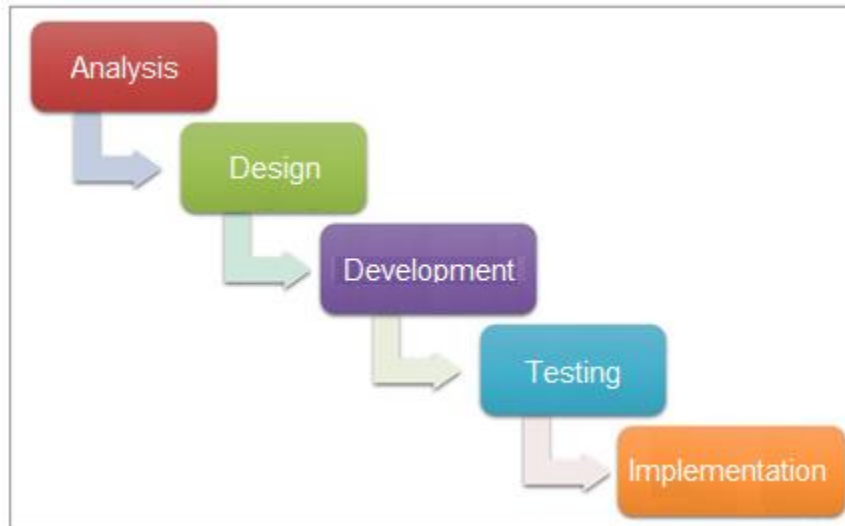
Projects that use Agile Methodologies may not follow this linear order, activities are performed continuously throughout the project, which means that each functionality is tested as it is developed. In other words, the project is not expected to be completed before testing and evaluations begin.

Although it is not an industry standard, Agile Methodologies were introduced and used in the Offshore Industry, however, with few reports and information on the use of these methodologies. Instead of a complete and complex process, Scrum, for example, which is an agile approach initially used for software development, is summarized as a visual framework of results, and which according to Kniberg [3], has some similarities with the Kanban system.

The Kanban system can be defined as an agile production or task management system that works visually and dynamically. With it, it is possible to organize the workflow in columns and cards, so that the whole team can visualize the flow from start to finish, and identify if there are bottlenecks or ways to optimize the process. So, instead of providing a detailed list containing all the tasks and activities that must be performed in a project, this is up to the project team. The team has the greatest clarity of needs and will know how to conduct the best way to promote the solutions that will solve your problem. The work is divided into a simple and lean list of results, ordering the list by priority and estimating the relative effort of each item. Figure 2 represents the stages of the flow of Activities in Agile Methodologies.

Figure 2 - Flow of activities in agile methodologies
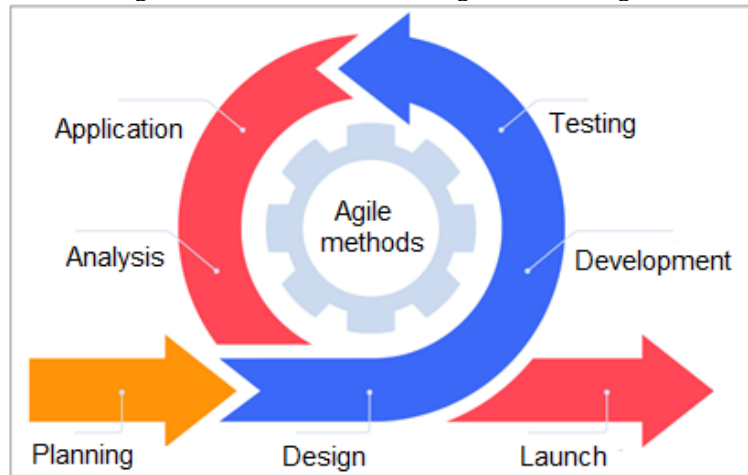
Considering the relevance that the theme, since it is quite relevant to the current scenario in the search Subsea Engineering and Construction companies have to adopt methodologies capable of contributing to the reduction of costs and increase the efficiency and deliveries of their teams.

In this way, the objective of this research is justified in carrying out a study of the use of Agile Methodologies and their impacts on the Offshore Industry, based on consultations with engineering professionals from companies in the Oil and Gas Sector. These objectives are directed to the following points:

- Identify the percentage and profile of professionals who are familiar with the use of Agile Methodologies in the design and manufacturing phases of offshore equipment;
- Evaluate the perception of these professionals regarding the advantages and disadvantages of the use of Agile Methodologies and Traditional Methodologies for the management of this type of project.

2 MATERIALS AND METHODS

The research methodology adopted for the development of this work is based on the implementation of a Survey, of the Intersectional type, that is, its main characteristic is the collection of data from a given population. It is carried out in a single time interval, where even in the case of using a questionnaire, where the reception of the questionnaire responses occurs during days, or in the case of the interview, where these are also carried out during days, this interval is considered as unique. This is the most frequently used model [4-7].

This Survey uses closed questionnaires as a research instrument with simple random probabilistic sampling, where each unit of the population has an equal probability of selection to be part of the sample, and also, each element has a unique number associated and using table elements are extracted from random numbers, until the desired number of sample elements is reached. The

sampling frame will be companies that carry out projects and manufacture offshore equipment, with qualified professionals in these companies being the observation unit [8].

Figure 3 shows the flowchart of the process of making this research.

Figure 3 - Search process flow
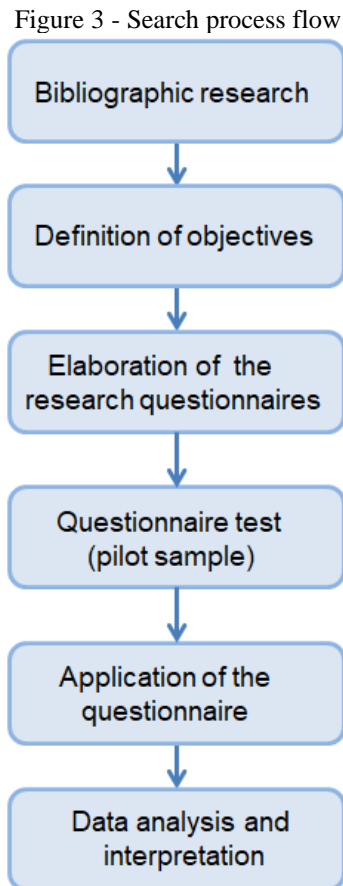
The limitations of this study are associated with the availability of data and the sources used for the collected data. This study assumes that data providers are providing legitimate information to be used in research and that overall, all data collected appears reasonable.

Conventionally associated with the social area, Survey research is, according to Babbie [4], particularly similar to the "census" type of research, where what differentiates the two surveys is that the "Survey examines a sample of the population, while the census generally implies an enumeration of the entire population. Some aspects, which will be addressed next, characterize a Survey, such as the purpose, model, sampling, variables, and instrument for collecting and analyzing data.

Research, according to Babbie [4] and Gil [9] can be classified into three purposes:

- Description – Aim to discover "the distribution of certain traits and attributes" of the population studied. One of the most significant characteristics of this type of research is the use of standardized data collection techniques;

- Explanation – Aim to explain the observed distribution. In this case, the researcher is concerned about why the distribution exists. The central concern of the research is to identify the factors that determine or contribute to the occurrence of the phenomena;
- Exploration – Aims to function as an exploratory mechanism, applied in a situation of the initial investigation of some theme, seeking not to let critical elements cease to be identified, presenting new possibilities that can later be worked on in a more controlled research.

As for the research technique employed, according to Figueiredo [10], the Survey type survey is one of the 14 types of research and thus defined by Bryman [5], "... *Survey* research entails the collection of data (...) in some units and usually at a single time juncture, intending to systematically collect a quantifiable dataset concerning several variables that are then examined to discern patterns of association."

2.1 PROBABILITY SAMPLING

According to Babbie [4], the principle that underlies probability sampling is that "a sample will be representative of the population from which it was selected if all members of the population have an equal opportunity to be selected for the sample." Although a sample is never perfectly representative, and there is a sample error, probability sampling seeks to reduce the impact of this error and typically generates more representative samples than other types of sampling, as it avoids selection biases. The main methods of this type of sampling are simple random sampling, systematic sampling, stratified sampling, and multi-step cluster sampling [4,5].

2.2 THE NEED FOR THE APPLICATION OF RESEARCH

The application *of the Survey* to a group of professionals of the Oil and Gas Market active in the phases of design and manufacture of *offshore* equipment has as its main motivation, the need to respond to the following concerns of this research project considering that the Agile Methodologies have been used for decades with efficiency and gains that justify their use, related to management in Information Technology (IT) Projects. Which are:

- What is the dimension, assumptions, and imagination of the professionals who work, directly and indirectly, in the *offshore segments* of Agile Methodologies and their applications?
- What will be the perception of professionals regarding the use of these Agile Methodologies in the management of projects in which they participate?

- Are there fundamental differences in Information Technology (IT) Projects when compared to offshore equipment manufacturing and assembly projects?

2.3 RESEARCH METHOD

As no similar research papers were found during the bibliographic research, original scientific work was sought. It is the application of a questionnaire that seeks to know the familiarization of a group of professionals with the Agile Methodologies, through the use of standardized data collection techniques. It was decided to perform a *Survey* survey, directly questioning a portion of the group members who wished to know this familiarization, and then, through quantitative and qualitative analysis, obtain the conclusions corresponding to the data collected.

2.4 PLATFORM FOR THE APPLICATION OF THE QUESTIONNAIRE

Ensuring to get a high number of respondents has always been a concern already raised in the research project, and the internet was the platform chosen for allowing the speed, reach, reliability, and randomness essential to the work. The choice and use of a professional website, already structured and specialized in the application of surveys (*surveys*), provided agility in sending the questions, monitoring the number of respondents, collecting answers, and analyzing the data obtained. In this way, and for free, *Google Forms was used* and recognized worldwide by the users of the large network.

The impersonality provided by an email containing an invitation to respond to a survey had two sides – positive and negative. It was necessary to elaborate a good text to stimulate the respondents to answer the questionnaire sent. On the negative side, the concern was that respondents would not click on the link that would direct them to the *online questionnaire*, for fear of being a long and demanding survey of too long. On the positive side, however, was the reduction of the possibility of "politically correct" answers, which were not the sincere opinion of the respondents.

In the text sent, it is clear that the identity of each respondent will be preserved electronically by the platform, that is, the information obtained through the participation of the respondent will not allow the identification of the person and that the disclosure of the mentioned information will only be made among the professionals who study the subject.

In research that covers data collection or contact with human (or animal) populations, ethics is linked to the adoption of moral principles or norms to carry them to direct the moral choices of behavior and relationship with others. According to Gray [11] the following ethical principles are fundamental and must be followed by every researcher, namely:

- Avoid harm to respondents;
- Ensure your informed and registered consent;

- Respect your privacy;

- Avoid mistakes.

The definition of universe or population, according to Gil [9] is a defined set of elements that have certain characteristics. The author defines the sample as the subset of the universe or population, through which the characteristics of this universe or population are established or estimated. Thus, the number of respondents for this survey was established between 100 and 170 respondents. Still, in Gil's view [9], building a questionnaire consists of translating the objectives of the research into specific questions. The answers to these specific questions will tailor the data required to describe the characteristics of the population surveyed or test the hypotheses that were constructed during the planning of the research.

The first emails inviting to participate in the survey for professionals working in the Oil and Gas Sector occurred on October 27, 2022, and closed on November 9, 1922 Table 1 presents the nineteen questions proposed to the respondents.

Table 1 - Questionnaire applied to respondents

#	Questions	Answers
1	What is your role currently?	1- Designer; 2- Engineering Assistant; 3- Engineer; 4- Coordinator; 5- Manager
2	What is your area of expertise currently?	1- Engineering; 2- Project Management; 3- Operations; 4- Manufacturing
3	What is your education level?	1- High School; 2- Graduate; 3- Postgraduate; 4- Master; 5- Doctorate+
4	What is your age?	1- 20 to 30 y/o; 2- 30 to 40 y/o; 3- 40 to 50 y/o; 4- 50 to 60 y/o; 5- 60+ y/o
5	What is your experience in the design and manufacturing phases of subsea equipment?	1- Up to 3 years; 2- 3 to 5 years; 3- 5 to 10 years; 4- 10 to 15 years; 5- 15+ years
6	Have you ever worked on a project that was managed using the traditional methodology?	1- Yes; 2- No; 3- I don't know
7	What is your level of understanding of traditional project management? Ex.: Waterfall.	1- None; 2- Basic; 3- Intermediate; 4- Advanced; 5- I don't know
8	Have you ever worked on a project that was managed using Agile Methodologies?	1- Yes; 2- No; 3- I don't know
9	What is your level of understanding about project management using Agile Methodologies? Ex.: Kanban, Scrum, Lean, SMART, Extreme Programming (XP), Agile, Tuckman, etc.	1- None; 2- Basic; 3- Intermediate; 4- Advanced; 5- I don't know
10	Which agile methodology used for project management have you had contact with?	1- Kanban; 2- Scrum; 3-Lean; 4-SMART; 5- Extreme Programming (XP); 6-Agile; 7- Tuckman; 8- None
11	Regarding your perception and implementation of Agile Methodologies in project management, do you believe that this practice contributes to reducing the costs associated with variations or changes?	1- Yes; 2- No; 3- I don't know
12	Regarding your perception and implementation of Agile Methodologies in project management, do you believe that this practice contributes to reducing the costs associated with schedule delays?	1- Yes; 2- No; 3- I don't know
13	Regarding your perception and implementation of Agile Methodologies in project management, do you believe that this practice contributes to reducing the costs associated with quality rework compared to traditional management methods?	1- Yes; 2- No; 3- I don't know
14	Regarding your perception and implementation of Agile Methodologies in project management, do you believe that this practice contributes to reducing the costs associated with security incidents with loss of time compared to traditional management methods?	1- Yes; 2- No; 3- I don't know
15	Is the mindset of the organization you work in aligned with agile values and principles?	1- Yes; 2- No; 3- I don't know
16	Do your managers measure KPIs (Key Performance Indicators or Indicators Key Performance) during project management using traditional methodology?	1- Yes; 2- No; 3- I don't know
17	Do your managers measure KPIs (Key Performance Indicators or Indicators Key Performance) during project management using Agile Methodologies?	1- Yes; 2- No; 3- I don't know
18	As for your perception, do you believe that your managers confuse agility with speed?	1- Yes; 2- No; 3- I don't know
19	Errors are obviously not desired, but when they occur, does the organization where you work register, critically analyze and, when necessary, take action to prevent them from occurring again?	1- Yes; 2- No; 3- I don't know

Table 2, below, presents the data provided by the *Google Forms site* and control of invitations sent:

Table 2 - Survey Respondent

E-mail monitoring.	
E-mails sent	170
E-mails answered	155
Not answered	15

2.5 SEMI-STRUCTURED INTERVIEWS

Probably, in some questions asked by the Questionnaire to the respondents, there may be some doubts, especially when they are related to project management using Agile Methodologies, such as *Kanban*, *Scrum,* Lean*, SMART,* Extreme Programming *(XP),* Agile*, and* Tuckman.

Thus, the semi-structured interview is proposed, in which the researcher presents himself in front of the respondent and presents him with questions, to obtain the data that interest the researcher and that are not always clear in the questionnaire. The researcher considers that the semi-structured interview is a form of social interaction; a form of asymmetric dialogue, in which one of the parties seeks to collect data and the other presents itself as a source of information [12].

In the view of Zanella [13], the semi-structured interview follows a script created by the researcher but does not bind him in the sequence of the questions, without the need to rigidly obey the interview script, providing freedom to the new questions that arise during the interview, to enable the collection of new information that may be relevant.

Twenty professionals related to the projects of Construction and Assembly of offshore equipment were chosen. The interviews were conducted via *the Google Meet* platform or *by WhatsApp*, for about 30 minutes, using the same rules defined by ethics, that is, following the premises established in the Questionnaire and endorsed by the ethical principles established by Gray [11].

The stage of seeking professionals in this area of Oil & Gas (*offshore*) who know not only the activities performed but also the corporate processes that involve project management, being this stage challenges the work, considering the difficulty of acceptance of some professionals afraid to expose information about their companies.

In this way, the interviews and the invited characters are kept in absolute secrecy, extracted fragments of these speeches where a qualitative approach was adopted in the research from a constructivist perspective, precisely because it allows to characterize the ontological assumption in which they refer to the nature of the reality of the subject who is being researched that the discourse on the social-technical reality is a construction that can be progressively revealed in the interaction of the researcher/researcher.

The analytical description, definitions, critical evaluations, and categorization of these interview fragments and supported by qualitative and quantitative results should provide a direction as to the applications of Agile Methodologies in the management of industrial projects and *offshore equipment*. The idea is to highlight the specific knowledge of the interviewee in the art of Engineering linked to offshore activities. Therefore, the literature consulted offers partial support to the analysis of the discourses of the research participants [14-16]. Table 3 presents the questions applied to the selected respondents.

Table 3 - Semi-structured questionnaire applied to the selected respondents

| #	Perguntas
20	The experience of using Agile Methodologies in projects was rarely mentioned by respondents. What do you believe may have contributed to this?
21	The expressive majority of respondents reported having the perception that the implementation of Agile Methodologies in project management contributes to reducing the costs associated with variations or changes, to reduce the costs associated with delays in the schedule and to reduce the costs associated with quality rework compared to traditional management methods. However, respondents reported using more traditional methodologies in their projects. What do you believe motivates organizations to use more traditional methodologies and not Agile Methodologies?
22	Is there currently any movement by you or your organization for the use of Agile Methodologies in project management? If so, could you inform what are the methodologies?

3 RESULTS AND DISCUSSIONS

3.1 EVALUATION OF THE QUESTIONNAIRE

This chapter has presented the answers and the results obtained by the questionnaire applied during the research conducted with professionals of the Oil and Gas Market in the *offshore* segment as reported in the previous chapter. The percentage of respondents was almost 92%.

3.1.1 Question 1 – What is your role currently?
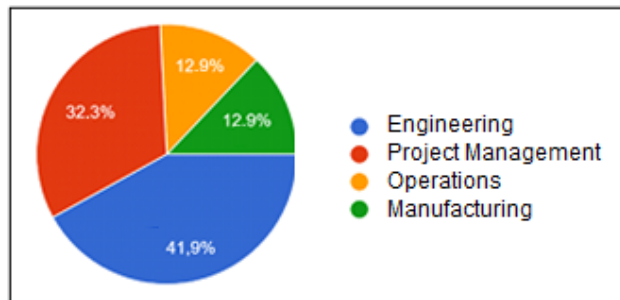
Figure 4 - Question 1
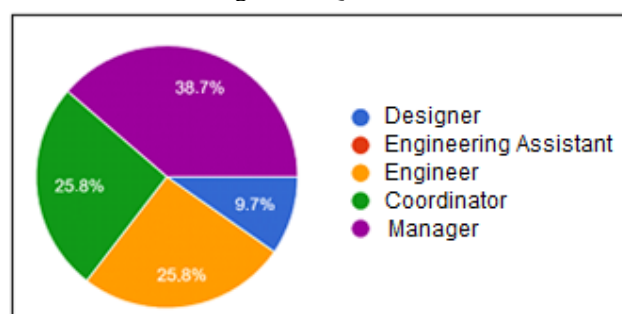
This first question aims to decompose the universe or the Profile of the Respondents into five groups, to enable the analysis of each of the other questions, on the experience of the respondents. Figure 4 shows a significant percentage of managers, totaling 38.7% of respondents. The group of Coordinators and Engineers had the same number of respondents, totaling 25.8% each. In smaller

numbers, the group of Designers had 9.7% of respondents. In this first analysis, it can be seen that the respondents have, in their majority, a managerial function, being managers and/or coordinators, totaling a percentage of 64.5% when added.

### 3.1.2 Question 2 – What is your area of expertise currently?

Figure 5 - Question 2

This second question aims to identify the areas of activity, divided into four groups. Figure 5 shows a significant percentage of respondents working in Engineering, totaling 41.9%. The respondents who work in Project Management total 32.3%. Operations and Manufacturing had the same number of respondents, totaling 12.9% each. By the numbers presented in the answers obtained by this question, it can be affirmed that the Managers and Coordinators are working, in their majority, in Engineering and not in Project Management. Such assertions are confirmed in the literature consulted [17,18].

3.1.3 Question 3 – What is your education level?

Figure 6 - Question 3
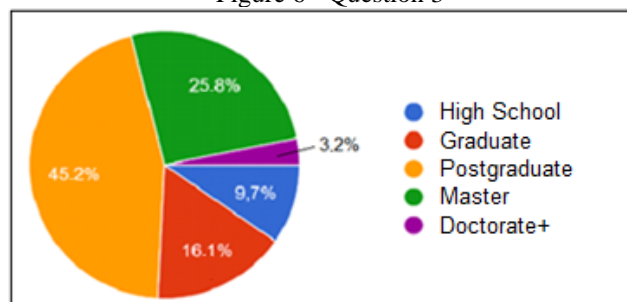
This third question had as its main objective, to identify the level of education divided into five groups. Figure 6 shows that the largest group is postgraduates, 45.2% of the total respondents. Almost half of the group of postgraduates, 25.8%, is the group of respondents with a master's degree. The

group of respondents with higher education corresponds to 16.1% of the respondents. In smaller numbers, there are the groups with high school and doctorate, being 9.7% and 3.2% respectively. From the numbers presented in the answers obtained to this question, it can be affirmed that the respondents have good schooling, totaling 71% with post-graduation and/or master's degrees. This fact is relevant considering that new technologies require professionals attentive to knowledge involving informatics and electronic instrumentation aiming at continuous online and *one-time* monitoring. Organizations are looking for new ideas, new tools, and new methodologies for the present and the future, especially in the area of Oil & Gas [19-21],

3.1.4 Question 4 – What is your age?
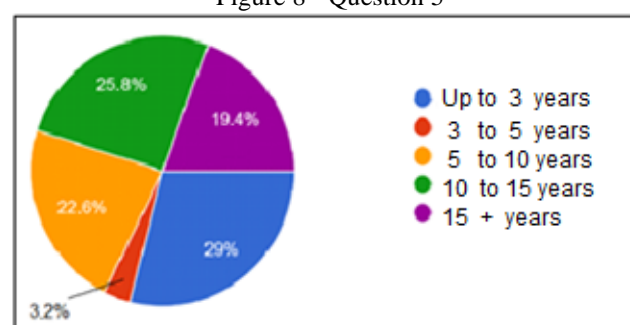
Figure 7 - Question 4
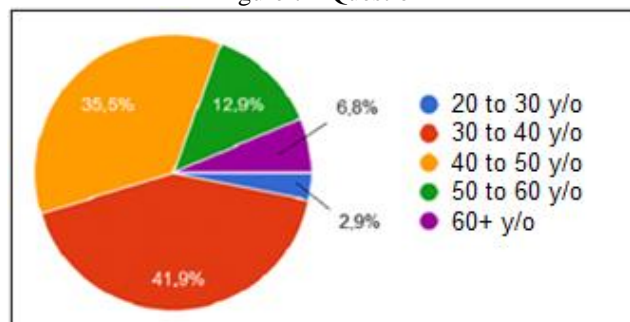
Figure 7 identifies that there is mostly a more senior group of people, aged between 30 and 50 years, corresponding to 77.4% of the respondents. The age of professionals in the area of Engineering is portrayed in IPEA (Institute of Applied Economic Research) by Maciante and Araújo [22].

3.1.5 Question 5 – What is your experience in the design and manufacturing phases of subsea equipment?
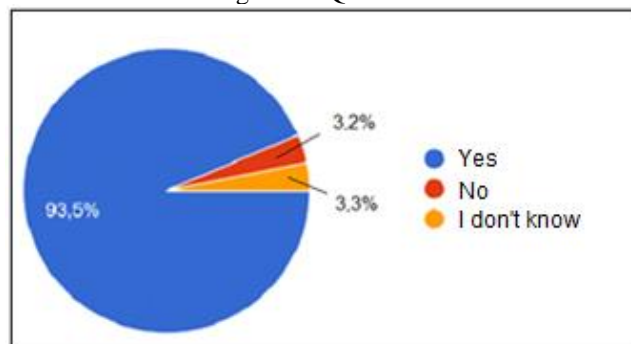
Figure 8 - Question 5

This fifth question aims to identify the time of experience, divided into five groups. Based on Figure 8, it is noted that the group of respondents with experience of 10 to 15 years is slightly larger than the group of those with 5 to 10 years of experience, being 25.8% and 22.6% respectively. At the other end, about 1/3 of the respondents and totaling 29%, is the group that has up to 3 years of experience. Therefore, in line with the answers to the previous question, it can be concluded that the respondents have great experience acting in the Oil and Gas Market, totaling 45.2% of those who have been working for more than 10 years in this sector. Therefore, this information confirms that the sample interviewed is composed of experienced professionals, especially when referring to underwater activities.

3.1.6 Question 6 – Have you ever worked on a project that was managed using the traditional methodology?
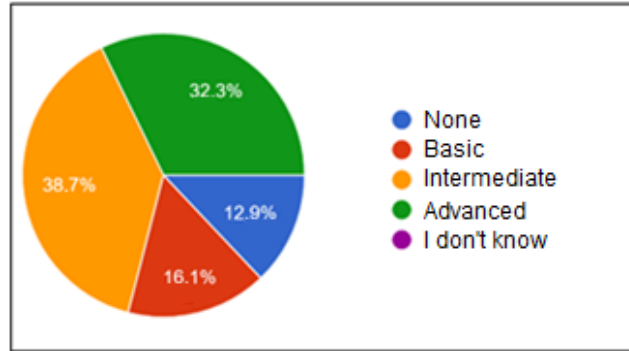
Figure 9 - Question 6

The answer to Question 6 (Figure 9) indicates that almost all of the respondents, 93.5% have worked on some project that was managed by the traditional form of management. These facts are ratified mainly when they refer to the development and application of *software* in the area of Engineering [18, 23].

### 3.1.7 Question 7 – What is your level of understanding of traditional project management? Ex.: Waterfall?

Figure 10 - Question 7

This seventh question (Figure 10) aims to delve a little deeper into respondents' knowledge of traditional project management, in this case, Waterfall management. By the percentages obtained, one can notice a certain balance between those who have intermediate and advanced understanding. The sum of these two groups obtained a significant 71%. On the other hand, about 1/3 of the respondents have no understanding or basic understanding, totaling 29%.

3.1.8 Question 8 – Have you ever worked on a project that was managed using Agile Methodologies?
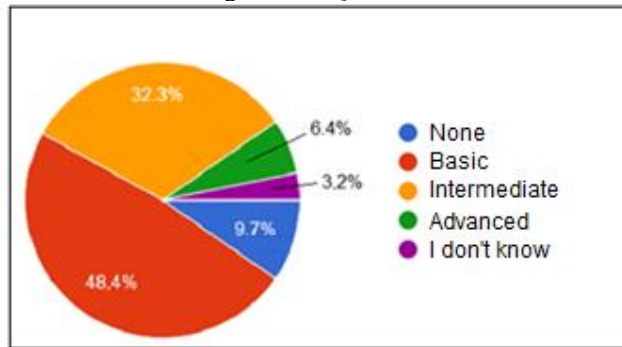
Figure 11 - Question 8
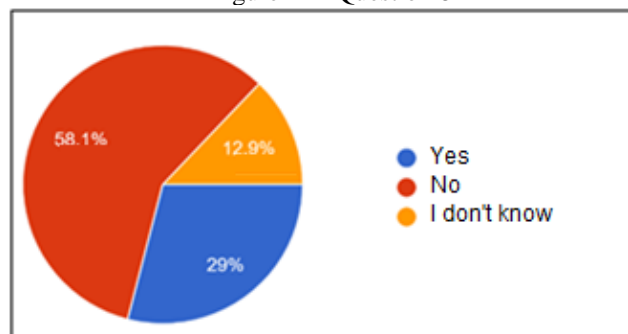
This eighth question (Figure 11) aims to understand, in a general and open way, the experience of the respondents regarding the use of Agile Methodologies in project management. As expected and corroborating with the scarcity of material available on the subject of this research, there is a high percentage of respondents who have never worked on a project that has been managed using Agile Methodologies, of the order of 58.1%. The number of 12.9% of those who said they did not know is also high. Almost 1/3 of the respondents, a total of 29%, said they had had experience in some project that was managed with some agile methodology.

3.1.9 Question 9 – What is your level of understanding about project management using Agile Methodologies? Ex.: Kanban, Scrum, Lean, SMART, Extreme Programming (XP), Agile, Tuckman, etc.?
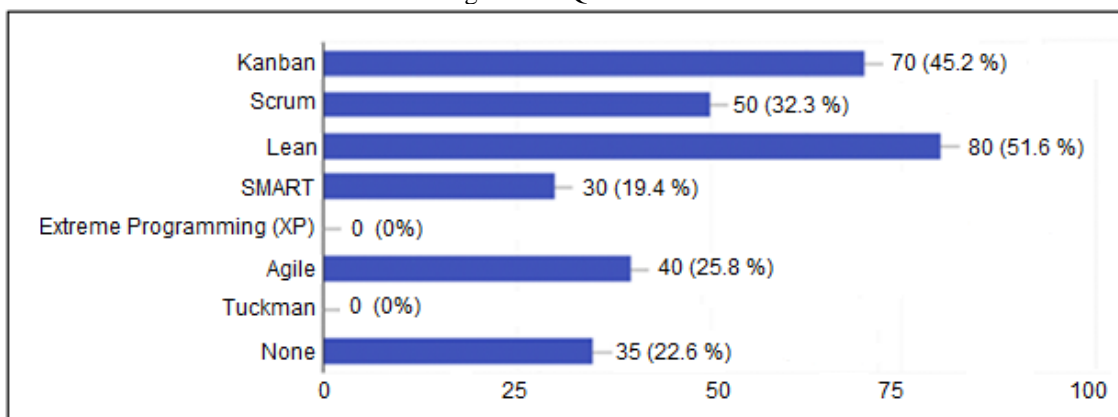
Figure 12 - Question 9

The ninth question, represented by Figure 12, aims to understand, in a direct and closed way, the level of understanding of the respondents regarding the use of some Agile Methodologies in project management, cited in the questioning itself. Almost half of them reported having a basic level of understanding. About 1/3 responded to have the intermediate level. Only a small group of 6.4% of respondents reported having an advanced level of understanding. The group of respondents who do not have any understanding added those who do not know how to inform a total of 12.9% of the respondents. These results confirm the results of the previous questions.

3.1.10 Question 10 – Which agile methodology used for project management have you had contact with?
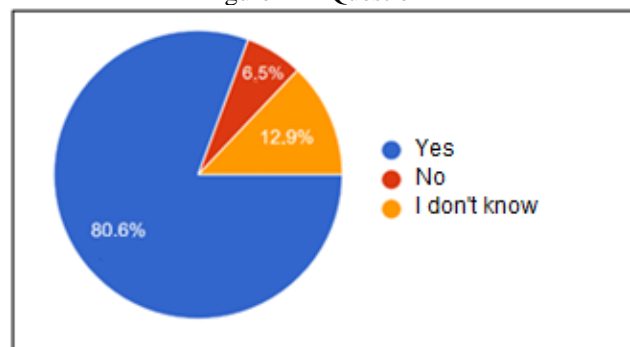
Figure 13 - Question 10

The tenth question provides a good illustration as shown in Figure 13 of the respondents' contact with the Agile Methodologies, and the *Lean* Methodology is the one with the largest number of respondents, totaling 80 (51.6%) signs of use. *Kanban also had significant signaling, with 70 (45.2%) respondents, followed by* Scrum *and* Agile*, marked by 50 (32.3%) and 40 (25.8%) respondents,* respectively. Those who said they had not had contact with any of the Agile Methodologies mentioned, totaled 35% of the respondents. *Tuckman* and *Extreme Programming* (XP) did not get any usage citations.

There is no doubt that the *Lean,* Kanban*, and Scrum* Methodologies are the most used in the management of Engineering projects, however, in the literature consulted there are few articles or theses directly related to the Oil and Gas area, related to offshore processes and equipment. Some works with the *Lean Methodology are cited* [17, 24, 25].

3.1.11 Question 11 – Regarding your perception and implementation of Agile Methodologies in project management, do you believe that this practice contributes to reducing the costs associated with variations or changes?
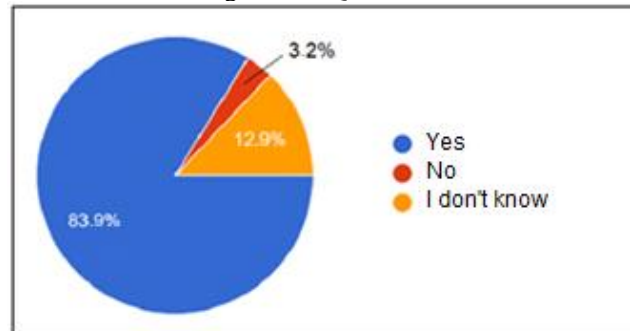
Figure 14 - Question 11

The answer to Question 11 (Figure 14) indicates that a significant number of respondents, about 81%, believe that the implementation of Agile Methodologies in project management can contribute to reducing the costs associated with variations or changes in scope. This indication, in a way, is very positive in the perception of the use of Agile Methodologies being very positive to the respondents, because, as analyzed in Question 8 (Figure 11), there is a high percentage of respondents informing that they have never worked on a project that has been managed using Agile Methodologies. Corroborating, therefore, with this "feeling of positivity" regarding the use of Agile Methodologies.

The methodologies have been used in other industrial activities aimed at reducing costs [18, 26]. When applied in manufacturing projects or assembly of oil and gas equipment by reducing the response time, modifications, and inspections via remote, it will certainly reduce the cost.

3.1.12 Question 12 – Regarding your perception and implementation of Agile Methodologies in project management, do you believe that this practice contributes to reducing the costs associated with schedule delays?

Figure 15 - Question 12

The analysis is similar to the previous question. Figure 15 shows that the respondents confirm that the use of Agile Methodologies to contribute to the reduction of costs associated with delays in the project or activity schedule is very positive. These assertions are by the works published in the bibliographic references [18, 26].

3.1.13 Question 13 – Regarding your perception and implementation of Agile Methodologies in project management, do you believe that this practice contributes to reducing the costs associated with quality rework compared to traditional management methods?
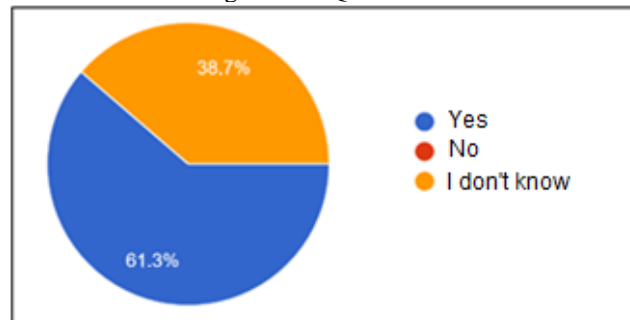
Figure 16 - Question 13
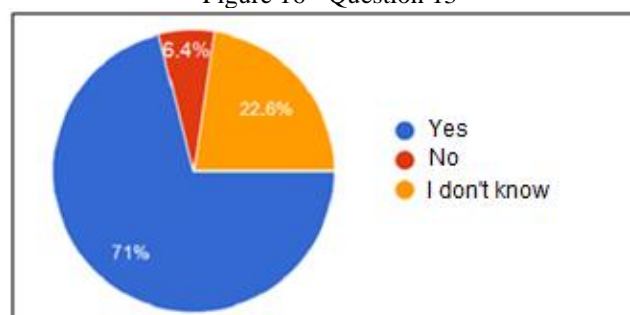
The respondents, as shown in Figure 16, confirm that the use of Agile Methodologies contributes to reducing the costs associated with quality rework. The reduction of rework occurs with the use of Agile Methodologies in work environments [23, 27].

3.1.14 Question 14 – Regarding your perception and implementation of Agile Methodologies in project management, do you believe that this practice contributes to reducing the costs associated with security incidents with loss of time compared to traditional management methods?
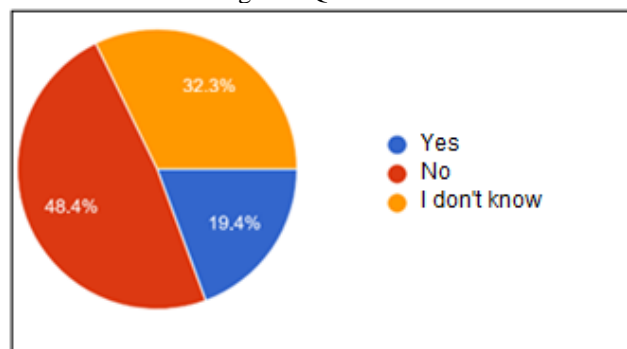
Figure 17 - Question 14

The respondents, as shown in Figure 17, confirm the use of Agile Methodologies to reduce the costs associated with security incidents with loss of time and productivity.

3.1.15 Question 15 – Is the mindset of the organization you work in aligned with agile values and principles?

Figure - Question 15

Before analyzing the results of Question 15, it is worth addressing the meaning of the *word mindset*, which is an English word meaning "mentality" or "mental configuration." It is the way a person thinks and faces life's challenges. Thus, the *mindset* determines how the individual reacts to the most diverse situations that happen daily, whether they are favorable or not. It is verified that almost half of the respondents, as shown in Figure 18, reported that the organization in which they work is not aligned with agile values and principles.

It is a very expressive number because it refers to a psychological predisposition that occurs in a person or a social group. This is a very important topic, because it affects the worker and, directly or indirectly, ends up affecting the Team, the Project, and the Company. Many organizations that have promoted these mindset changes in their processes, based on Agile Methodologies have been evaluated about performance [28, 29].

3.1.16 Question 16 – Do your managers measure KPIs (Key Performance Indicators or Indicators of Key Performance) during project management using traditional methodology?
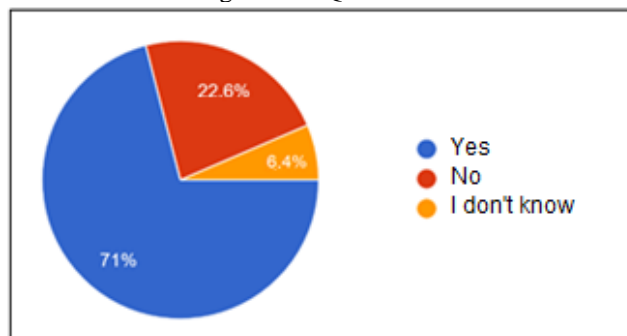
Figure 19 - Question 16

Figure 19 shows that just over 2/3 of respondents reported that their managers measure KPIs during project management that uses the traditional methodology. It is worth mentioning that the measurement of KPIs helps to promote the improvement of the performance of the teams, increasing efficiency, improving the decision-making capacity, and providing the greatest alignment of goals.

3.1.17 Question 17 – Do your managers measure KPIs (Key Performance Indicators or Indicators of Key Performance) during project management using Agile Methodologies?
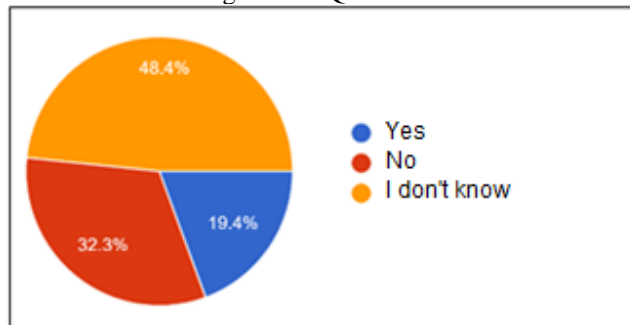
Figure 20 - Question 17

Almost half of the respondents, as shown in Figure 20, reported not knowing if their managers measure KPIs during project management that use Agile Methodologies. About 1/3 reported that KPIs are not measured and a smaller share, 19.4% of respondents, said they are measured. These figures express a lack of clarity in the understanding and use of these methodologies, as well as the scarcity in the dissemination of information to project participants.

3.1.18 Question 18 – As for your perception, do you believe that your managers confuse agility with speed?

Figure 21 - Question 18
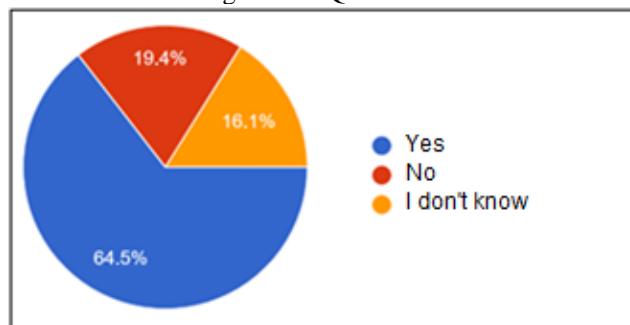
About 2/3 of the respondents, as shown in Figure 21, reported having the perception that managers do confuse agility with speed. The other respondents did not know how to inform, or yet, that managers do not confuse agility with speed. Being agile has nothing to do with having speed or not. To be agile is to deliver sustainable, high-quality, value-based results.

3.1.19 Question 19 – Errors are obviously not desired, but when they occur, does the organization where you work register, critically analyze and, when necessary, take action to prevent them from occurring again?

Figure 22 - Question 19
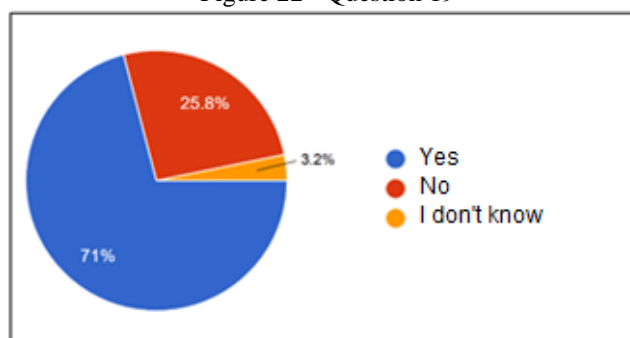
Just over 2/3 of the respondents, as shown in Figure 22, reported that their organizations record, critically analyze and take action so that errors do not occur again.

3.2 SEMI-STRUCTURED INTERVIEWS

Semi-structured interviews are understood as a flexible interview model, and a previous script can be used. However, allowing the respondent and the interviewer to ask questions outside of what had been planned. With this, the dialogue becomes more natural and dynamic.

Invitations for semi-structured interviews were sent to twenty respondents. However, only six agreed to "spend more of this time" in a conversation of about thirty minutes. To structure the interviews, the following questions were asked:

3.2.1 Question 20 – The experience of using Agile Methodologies in projects was little mentioned by the respondents. What do you believe may have contributed to this?

Respondent A: It is not yet a widely used methodology in the Brazilian market, so there is still a certain level of mistrust about its applicability and effectiveness in projects. I believe this factor will be overcome in time.

Respondent B: Companies that cannot organize themselves, with structured programs, for the application of Agile Methodologies and leaders who always prefer to work in the way they are accustomed to, without experimenting with new forms of management.

Respondent C: I believe the company is looking for project managers with previous successful experiences in similar projects. Because they were executed with previous methodologies and because we always have very tight deadlines for execution, I believe that few managers can fit a cultural change throughout the project. In addition, I do not see in the project structures, people specialized in agile methodologies with the scope to make it happen, to change processes little by little, until maturity and reliability are gained so that managers can change the *mindset*.

Respondent D: The main reason is the lack of transparency in the process, which has a direct correlation with communication*, setups*, and waste reduction, among others. Top management prefers to use traditional methodologies.

Respondent E: The main factor is the lack of depth in the studies of Agile Methodologies. Few *successful cases* in sectors other than technology, with this, managers are afraid to risk the use of a new methodology.

Respondent F: The Agile Methodologies although they are proven useful and known to project managers, most of the time the previous experience of this manager induces him to

follow the same paths of past experiences that have been successful. At the end of the day, if there is no "*open mind*" condition of the management group at the top of that industry or segment, Agile Methodologies will hardly be used.

Respondent G: The methodology is not employed on a large scale or in its entirety (only a few *frameworks*, for example) in construction engineering projects.

3.2.2 Question 21 – The expressive majority of respondents reported having the perception that the implementation of Agile Methodologies in project management contributes to reducing the costs associated with variations or changes, decreasing the costs associated with schedule delays, and decreasing the costs associated with quality rework compared to traditional management methods. However, respondents reported using traditional methodologies more in their projects. What do you believe motivates organizations to use traditional methodologies more and not Agile Methodologies?

Respondent A: Ditto the previous answer. The Brazilian market is still extremely conservative regarding the inclusion of new methodologies in a practical way in the professional day-to-day. The Oil and Gas market specifically has a conservationist nature about new processes, but this has been changing over the last few years, with the creation of development area of digitalization projects and the application of artificial intelligence, however, we are still in our infancy and the applications in the sector are still timid. Likely, new project management methodologies are also suffering the same effect.

Respondent B: Certain industries or companies may not have realized the gains from applying Agile Methodologies. Either because they did not have the time, knowledge, and/or culture conducive to this application, or because the techniques were applied in the wrong way.

Respondent C: As in the previous answer, I believe that there is a lack of at least one experienced leader in Agile Methodologies in the projects, to guide, with a clear scope of prioritization, of process changes. In addition, training is often given to the leaders and in a more superficial way to more junior teams. In addition, Agile Methodologies, such as *Lean*, focus a lot on not starting until all the information is complete. In most projects, we need to work with preliminary information, which changes a lot throughout the project. For this to happen, we should either have greater detail in the *Bid/Tender* phase or we should have a longer deadline for project elaboration. In more detail, in the *Bid/Tender phase*, we have very preliminary premises and information. Throughout the project, when detailing *a design* of a suction pile, for example, we can verify that the size and weight

required would be larger, by a geotechnical condition or by changing loads (not detailed in the *Bid* phase). This will entail rework or even a change of methodology or vessel to install.

Respondent D: Traditional methodologies are more tried and better accepted in projects of great complexity. The PMBOK® Guide, for example, manages to have a wide application of its techniques in the projects. Applying Agile Methodology in large projects is the biggest challenge today, of the amount of interface it has. It is one thing to apply a new tool, a *software* using Agile Methodology... Another thing is to apply in an EPCI project with a thousand people involved, with fifty interface areas.

Respondent E: Many factors can contribute to following traditional methodologies. The first is to work in the comfort zone and with that, they do not seek a new methodology, even knowing that in the "traditional", we often do not deliver the "ideal" product and are out of time. Getting out of your comfort zone means studying deeply about a new methodology and risking its implementation. If the company does not have a culture that allows for this risk, a new methodology will not be applied. Another factor that impacts the execution is the overload of day-to-day work. As already mentioned, a lot of study is needed, in addition, time is needed to plan how it will be implemented.

Respondent F: Although there is consensus on the contribution of Agile Methodologies, traditional methods are the "comfort zone" of professionals with more experience and, naturally, they tend to follow the old way of management. The degree of complexity, deadlines, and business dynamics of the projects can lead the Manager to use his previous experience in solving each problem, day after day, instead of an evaluation of the current method employed (traditional) *versus* Agile Methodologies.

Respondent G: The culture of the company, high inertia to modify protocols and processes of the company, lack of opportunity for certain scopes, lack of mastery of the subject, high demand and low availability of resources to invest time in a new management methodology since the traditional one also works, among others.

3.2.3 Question 22 – Is there currently any movement of yours or your organization for the use of Agile Methodologies in project management? If so, could you tell us what the methodologies are?

Respondent A: There is a partnership with the company Leidos to apply Agile Methodology in the digitization process. Another methodology used on a large scale by the company is the LEAN method. The Scrum method has also been mentioned a few times within the company, but I am unaware of its effective application.

Respondent B: Yes, holding daily *meetings of Office Floor Management* with fifteen minutes of duration, to allow the rapid processing of information, with a focus on problem-solving. It is not, however, an official methodology and is organized in a structured way within the company, that is, each department chooses or not to make use of this technique.

Respondente C: *Lean*, OKR (*Objectives and Key Results*, *Kanban* e *Scrum*.

Respondent D: Not at the moment.

Respondent E: Positive. I've been applying some Scrum rituals to a specific project. We have daily meetings to map possible obstacles that are preventing the sequence of work and meetings with the client at the end of each *sprint*, to verify that the "product" is following the expected way. In addition, activities are being measured to calibrate the duration of subsequent *sprints and adjust the final delivery time to the customer.*

Respondent F: Not at the moment.

Respondent G: The sprint methodology was used to develop a procedure automation tool with a third party. Many steel structure projects also use a *sprint-like* philosophy to arrive at an (often unknown) solution piecemeal, in stages, rather than finalizing a complete project (with documentation) without being sure it covers all scenarios.

The content analysis of the fragments obtained in the semi-structured interviews conducted with selected respondents reveals that:

- Most project leaders prefer to work in their comfort zone, that is, with the techniques already known and with which they are accustomed, without experimenting with new forms of management;

- Traditional methodologies are more accepted by global managers based on their vision of immediate results to meet the objectives to be achieved in the short term. The excuse is that traditional techniques are more reliable and are validated in the design market. Such assertions are accepted in the works of Oliveira and Pedron [18] and Santos Soares [23];

- Agile Methodologies encounter barriers in the Company's own technical culture, as well as great inertia to modify procedures and protocols already established over time. Generally, such facts are associated with the lack of opportunity for certain scopes, the lack of mastery of the subject, the high demand, and the low availability of resources to invest time in a new management methodology since the traditional one also works properly;

- The daily meetings with about 15 minutes of duration focused on a specific case, to allow the rapid processing of information, seems to be a way in Agile Methodologies;

- The Brazilian market in the route of equipment in the production of Oil and Gas is still extremely conservative regarding the inclusion of new methodologies in a practical way in the professional day-to-day, however, the application of artificial intelligence, intelligent instrumentation, and new software can modify this conservative profile.

4 CONCLUSIONS

Based on the research carried out it is concluded that:

- The final result indicates that most of the professionals in the sample have a management or coordination position. It is, therefore, a group with a managerial function and with experience of more than 10 years in the performance of projects that are the object of this research. It is also possible to conclude that almost all respondents have experience in projects managed the traditional way and, just over half (58.1%), reported having experience in projects managed using Agile Methodologies. Within this universe of use of Agile Methodologies, *Lean,* Kanban*, Scrum,* and *Agile* were the most cited, respectively;

- With percentages above 80%, the respondents stated that they believe that the implementation of Agile Methodologies contributes to reducing the costs associated with variations or scope changes in projects, as well as contributing to the reduction of costs associated with schedule delays. Contrasting with these expressive numbers, almost half of the respondents stated that the organization in which they operate is not aligned with agile values and principles.

- It is understood that with this result the initial objective of the work was achieved, since it was possible to identify, in the context of the sample, the use of Agile Methodologies in Subsea Engineering companies;

- However, it can be seen that this use occurs almost intuitively that part of the employees, and not as a clear guideline of the organizations, which still recommends the use of a traditional form of project management.

- This information contributes to encouraging future researchers to gather and catalog the practices and methodologies that most benefit employees and organizations, which types of projects and methodologies are most used, and in what way.

- Having the awareness that each project has particular demands, will help to understand, that at all times, methodologies are sought that will assist in project management and hardly a methodology will be used just to help us be agile. **It's good to be fast, but it's better to be agile.**

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