Project time: Time management method for software development projects-analytical summary

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Project time: Time management method for software development projects-analytical summary

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Abstract. This article presents the results of the research project: "Time Management Method for Software Development Projects", where a method was used to calculate the time spent on a software development project from its preparation phase until the delivery of it, applying the best practices of the PMBOK 5th edition, the RUP methodology and the estimation metric per Use Cases, so that companies and people dedicated to this activity, execute the project time estimation and carry out an effective programming of their activities. The proposed method consists of six phases: preparation, initiation, planning, development, testing and delivery, where inputs, activities, tools, roles and output artefacts are defined, allowing time to be calculated in each phase. The validation of the method was carried out through of the expert judgment technique, obtaining a favorable result that shows the degree of acceptance of it. According to the evaluation, the method provides a level of precision in the estimates of time, defines activities that provide a basis for estimating, planning, executing, monitoring and controlling the research project, as well as an appropriate logical sequence of activities.

1. Introduction

The world is constantly changing, and organizations must quickly react to projects that help them achieve their objectives [1-3], for this, the effective management of the project is necessary to ensure that the project meets the objectives and is developed within a budget and estimated time [4].

Project acceptable management is the process by which the development of an acceptable system is planned and controlled at a minimum cost and within a specific period of time. The mismanagement of the project has consequences such as unmet or unidentified needs, uncontrolled change in project scope, cost overruns and delays in delivery [1].

The Project Management Institute (PMI) created the Project Management Fundamentals Guide (PMBOK® Guide), a recognized standard in the project management profession [6], a global standard that provides guidelines, techniques and tools for project management.

As stated by [7], the adaptation of the project fundamentals specified in the PMBOK guide to apply them to some software development methodologies can ensure that the project has a good planning and scope management through the structure of the breakdown of work, monitoring, control and closure, delivering a software product that meets the needs of the client, in the estimated time.

Likewise, the application of PMBOK processes seeks to improve communication between the project manager and the client in order to perform a good collection of requirements and mitigate the imprecision in the interpretation of the client's needs and the software product developed that, most of time, it does not meet the expectations of the client due to the planning of the scope of the project, which will subsequently affect the variables of time, cost and quality, as established [8].

The integration of the PMBOK guide with a software development methodology such as RUP allows us to demonstrate that the union of these two methods guarantees the implementation of best practices, both to carry out project activities and to administer and supervise them, as established in [9] when it is applied successfully in a financial institution.

Time management is one of the areas of knowledge proposed by the PMI and is considered one of the main reasons why a project fails for example: the development time, the programmers do not define them or that they tend to be very optimistic or that they use all the time assigned to them or that the estimated time is not extended by the change of scope, etc. [10].

Knowing that the time factor is one of the main causes of the failure of software development projects, the design of a method called Project Time for time management in software development projects is presented, integrating the PMBOK guide 5th edition, the Rational Unified Process RUP methodology and the metric estimation for use cases.

The validation of the method was carried out by means of the expert judgement technique, demonstrating the relevance of its creation.

2. Methodology

The design of this research is non-experimental, quantitative, according to the classification given by Sampieri R. in the book Methodology of research, this approach: "Use data collection to test hypotheses, based on numerical measurement and statistical analysis, to establish patterns of behavior and to test theories"**¡Error! No se encuentra el origen de la referencia.**.

2.1. Sample

The type of sampling used for the development of the research was non-probabilistic convenience sampling. The selected sample of Research Groups is equivalent to 34% of the software development Groups in the country, recognized with status in the Colciencias convocation 781-2017, equivalent to 14 Research Groups in the National scope.

The selected sample of Software Development Companies is equivalent to 1.82% of the companies registered in the "*Plataforma Compite 360*" in Colombia, sector: information and communications, subsector: Development of computer systems, computer consulting and related activities and computer development activities in the national area, equivalent to the participation of 13 companies.

3. Project time method

The Project Time method was carried out taking into account what was proposed in the good practices guide PMBOK 5th edition, the RUP methodology and the metrics for estimating use case points.

This research is based on the Time Management knowledge area which consists of taking into account all the processes necessary to achieve the completion of the project on time.

The RUP methodology was also taken as a reference, which is characterized by its iterative and incremental nature, its focus on architecture and its guidance in use cases [11]. Finally, the Use Case Point (UCP) method is based on the traditional Function Points.

According to the above the method consists of six main phases which are: Preparation, Initiation, Planning, Development, Delivery. Each phase describes the processes to be developed, for which inputs, activities, tools, roles and output artefacts are defined, the Figure 1 presents process to be developed for which the inputs, activities, tools, roles and output artefacts.

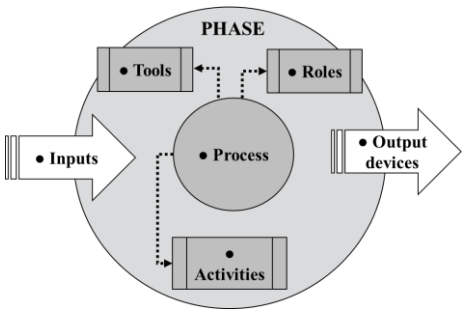

Figure 1. Each phase presents processes to be developed, for which the inputs, activities, tools, roles and output artefacts.

3.1. Structure of the method

3.1.1. Preparation phase. Figure 2 and Figure 3 shows the components of this phase.

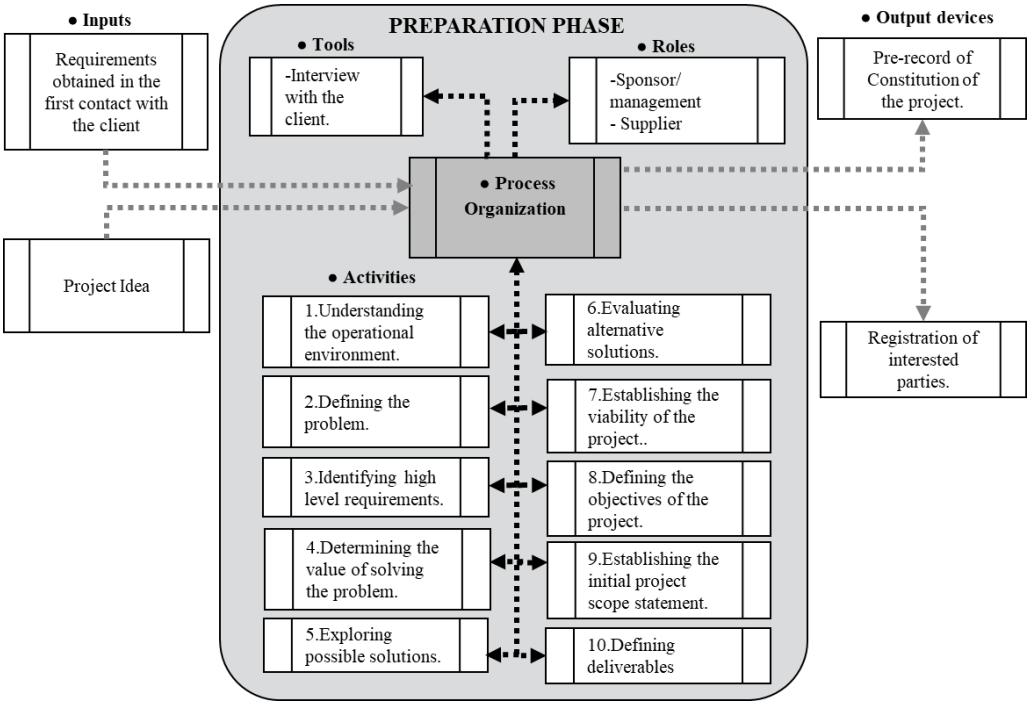

Figure 2. First process of the preparation phase with their respective inputs, activities, tools, roles and output artefacts.

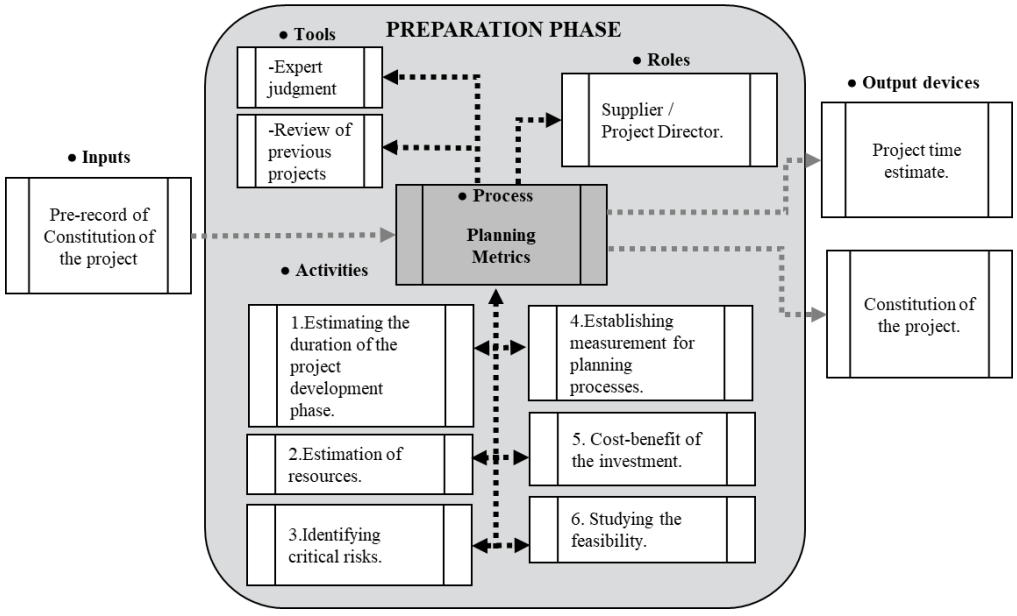

Figure 3. Second process of the preparation phase with their respective inputs, activities, tools, roles and output artefacts.

3.1.2. Initiation phase. Figure 4 and Figure 5 shows the initiation phase with its respective components.

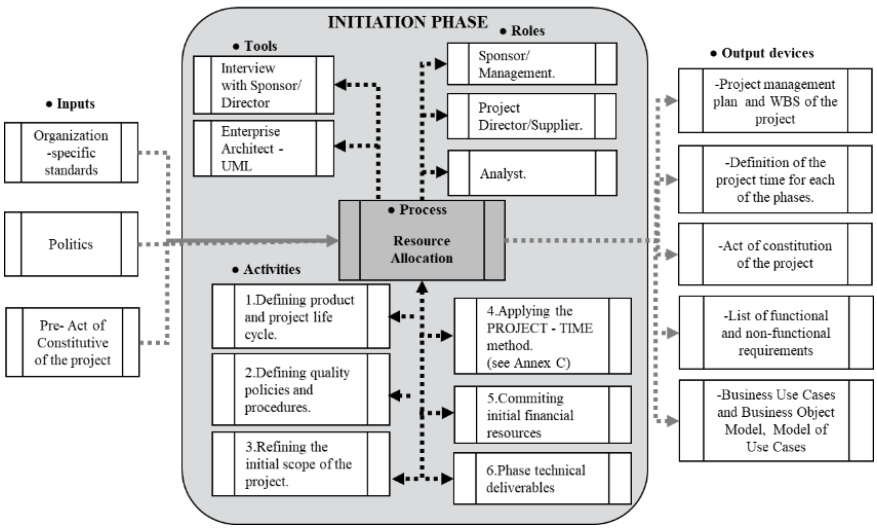

Figure 4. First process of the initiation phase with their respective inputs, activities, tools, roles and output artefacts.

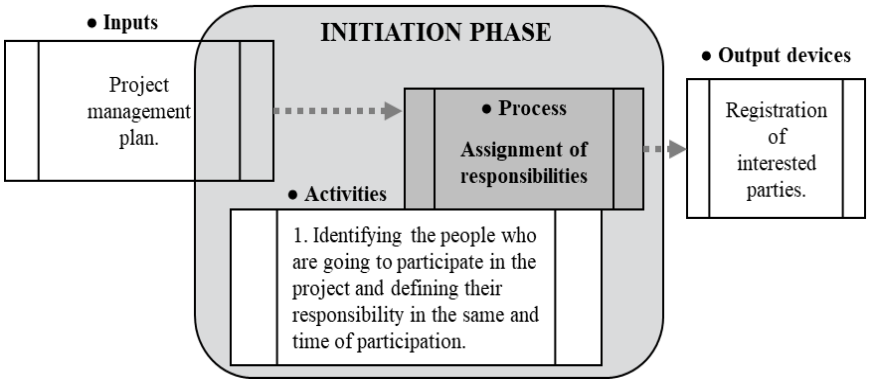

Figure 5. Second process of the initiation phase with their respective inputs, activities and output artefacts.

3.1.3. Planning phase. Figure 6, 7, 8, 9, 10, 11 and 12 shows the planning phase. The planning phase has two processes, where the first process presents six activities, where each of them presents inputs, tools, roles, and outputs.

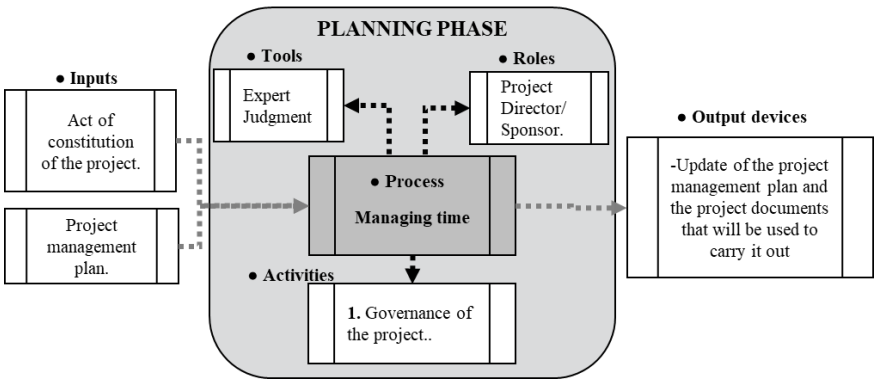

Figure 6. Process Managing time with their first activity with respective inputs, tools, roles and output artefacts.

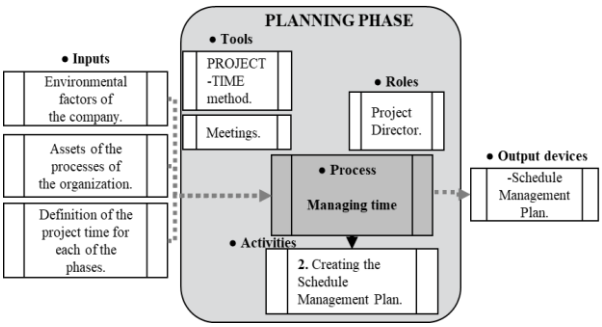

Figure 7. Process managing time with their second activity with respective inputs, tools, roles and output artefacts.

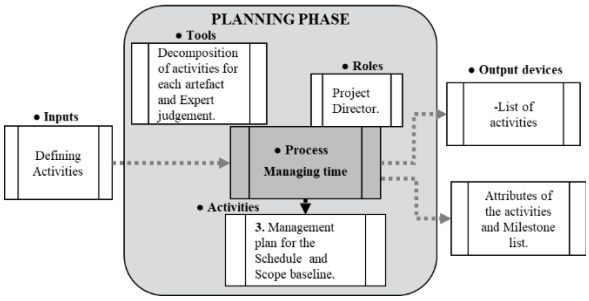

Figure 8. Process managing time with their third activity with respective inputs, tools, roles and output artefacts.

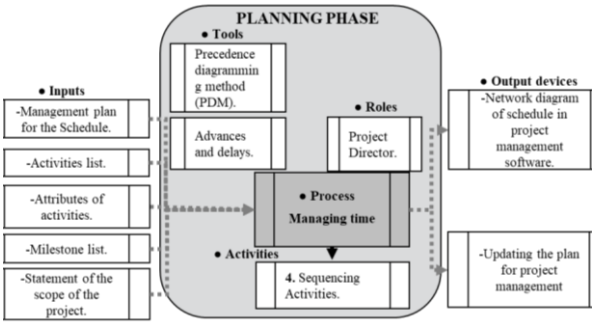

Figure 9. Process managing time with their fourth activity with respective inputs, tools, roles and output artefacts.

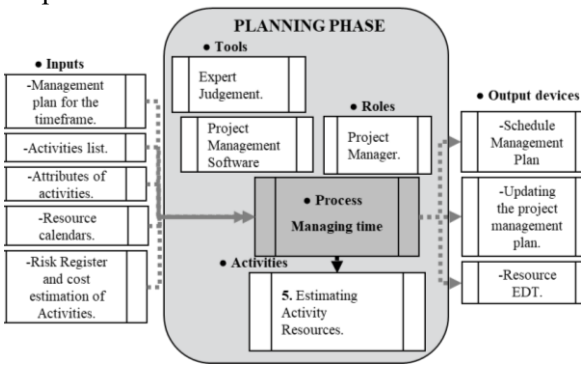

Figure 10. Process managing time with their fifth activity with respective inputs, tools, roles and output artefacts.

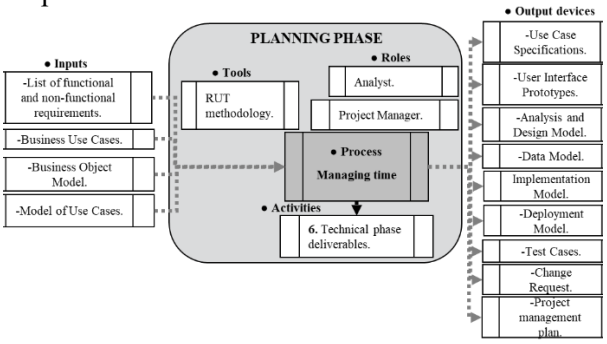

Figure 11. Process Managing time with their sixth activity with respective inputs, tools, roles and output artefacts

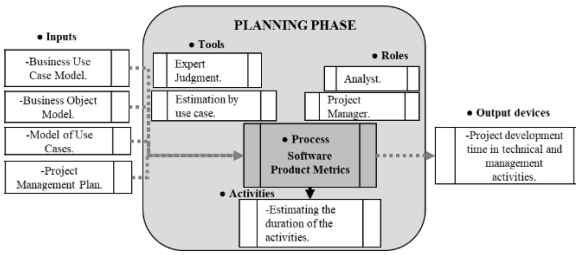

Figure 12. Second process of the planning phase with their respective inputs, tool, roles, activities and output artefacts.

3.1.4. Development phase. Includes monitoring and control, development and testing processes. See Figures 13 and 14.

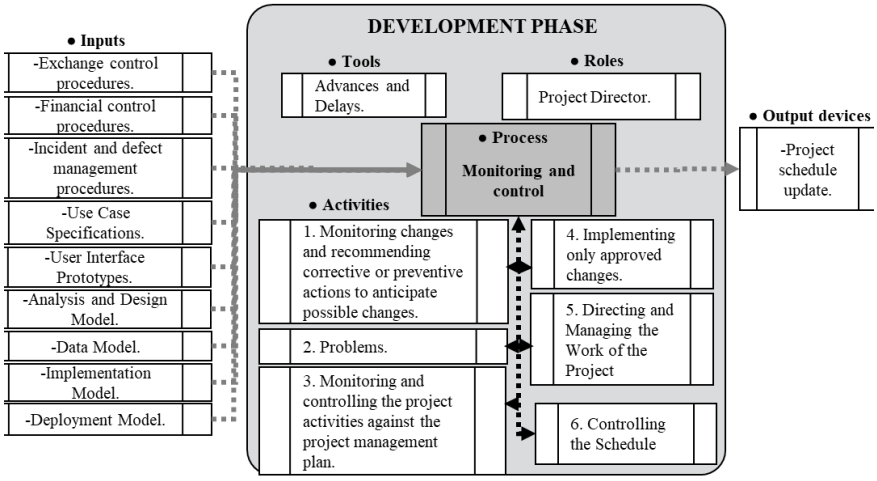

Figure 13. First process of the development phase with their respective inputs, tool, roles, activities and output artefacts.

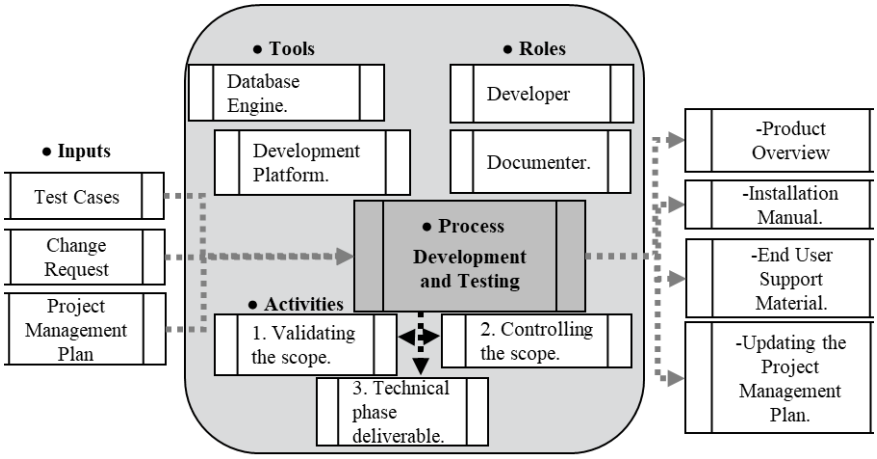

Figure 14. Second process of the development phase with their respective inputs, tool, roles, activities and output artefacts.

3.1.5. Test phase. Includes monitoring and control processes, and testing, as shown in Figure 16 and Figure 17.

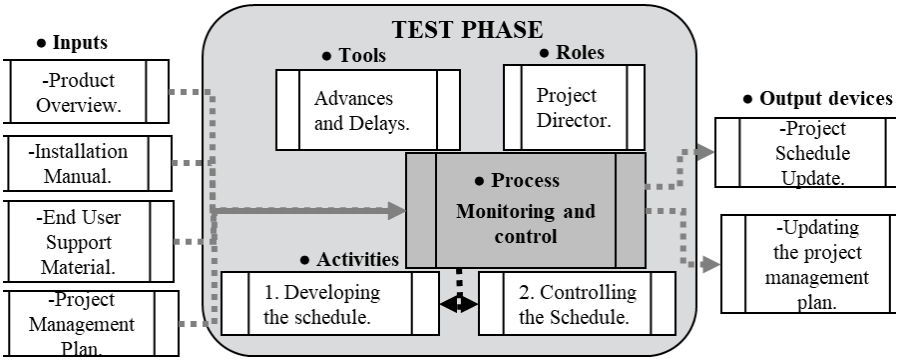

Figure 15. First process of the test phase with their respective inputs, tool, roles, activities and output artefacts.

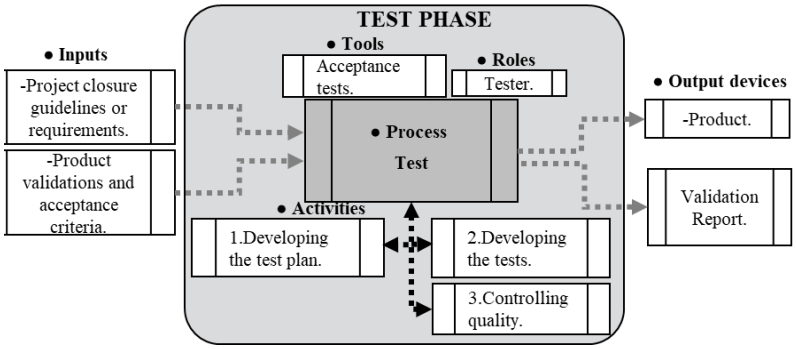

Figure 16. Second process of the test phase with their respective inputs, tool, roles, activities and output artefacts.

4. Validation of the method

4.1. Results of the validation

The result of the validation of the method is reflected after tabulating the information from the evaluation sheet completed by the selected experts, 6 professional software developers from companies nationwide. See Table 1.

Table 1. Validation results.

Expert	Scoring	Criteria
1	103	Very good
2	128	Very good
3	136	Excellent
4	108	Very good
5	145	Excellent
6	116	Very good

4.1.1 Validity of the method. In accordance to the evaluation of the 6 experts selected, a "Very good" result was obtained on the PROJECT TIME Method, according to the 5 levels of evaluation proposed. According to the experts' appreciation, the method provides a level of precision in time estimates, defines activities that provide a basis for the estimation, planning, execution, monitoring and controlling of research project, as well as a logical and appropriate sequence of activities.

A statistical average of 122.6 was obtained among the 6 data of the experts; this assessment allows to leave open the possibility of improving certain criteria for future research and which in turn raises new possibilities on the estimation of time and the use of traditional methodologies.

5. Conclusions

From the survey conducted, it was concluded that the companies and/or research groups that apply a software development methodology in their processes do not have a clear definition of the type of methodology, whether agile or traditional, in addition to the companies in the region of Norte de Santander, Colombia, which were surveyed, this trend became evident.

In each phase of the method, a percentage was assigned to estimate the project time as follows: preparation (15%), initiation (10%), planning (20%), development (40%), testing (9%) and delivery (6%), taking as a reference the good practices of the PMBOK 5th edition, the success factors of the CHAOS report for 2013 and the estimation metrics for Use Cases.

The PROJECT TIME method provides a web application that systematically obtains the percentage of effort that must be allocated for the development of a software project from its preparation phase to the project closure phase, resulting in the number of man-hours required during the execution of the project, and in turn allows the amount of human resources that will be involved in each phase to provide the project execution time in months.

The research provides a database of national research groups that deal with any of the following lines of research: software engineering, software development or software construction, which becomes a strategic component for the research group CICOM of the University of Pamplona, as it identifies the 40 research groups with their respective categorization in Colciencias as a strategy for the creation of knowledge networks and strengthening of collaboration indicators.

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