Master in Business & Technology

Agile, an Organizational Placebo

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In theory, there's no difference between theory

and practice; but in practice, there is.

—Jan L.A. Van de Snepscheut

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Abstract

We live in a rapidly changing world, this is making organizations look to alternative tools and techniques to manage their endeavours in order to survive in the market and generate an effective competitive advantage.

Projects are an essential part of any business, they live in an organizational environment and —usually, have some well-defined ways for their management. Agile is one of the most used approaches to manage projects, the software industry usually makes use of this type of methodologies or practices; Scrum being the most adopted one. The impact of agile, and Scrum, is leading organizations to use agile practices in areas other than software development.

The aim of this research is to generate sufficient reliable information towards better decision making regarding the adoption of Agile to manage projects and even entire organizations. To achieve such an objective, the research is based on comparative research and experimental design.

1. Context & Motivation

The accelerated adoption of agile has increased during the last 13 years, even more the last 3-5 years, it has caused organizations in sectors other than software development (e.g. banking, finance, HR) to adopt agile methodologies or practices, which are a trendy subject among organizations nowadays.

1.1. Problem Statement

Nowadays many people and entire organizations consider SCRUM as the only way to “be agile”. Due to the fact that SCRUM is lightweight and has become the de-facto practice in the software industry, many organizations simply adopt it because others did so. This in turn makes room for areas other than software to also adopt agile practices as an attempt to improve the generation and delivery of value.

Despite the increased adoption of agile, research shows that on several occasions it becomes "rigid" or —in time, less effective. As a result, teams may become less cohesive and generation of value either slows down or quality is cripled; making members of the organization doubt about the true value that agile provides (Suntinger Martin, 2020, p. 1).

Agile is about delivering —in theory, better products at a sustainable pace; while —in practice, accepting (and even encouraging) multiple failures during its adoption. Even though agile originated in the software industry, the generation and delivery of value involves the entire organization. This has made agile pioneers to generate alternative methods and/or practices to scale agile.

This research faces the problem of using SCRUM due to trendiness, and the general assumption that —by simply using it, organizations become more productive, without analyzing if agile practices actually suit the type of project and the resulting product or service.

1.1.1. Documentation & Praxis

The set of skills and knowledge necessary to manage projects is known as Project Management (PM); based on those skills and knowledge, there are several organizations which have created different processes and guidelines, known as PM Methodologies. Those methodologies provide official documentation (usually standardized) to spread the knowledge among practitioners and early adopters (both individuals and organizations).

Research suggests that most literature (official or not) compares Scrum with the Waterfall model (considered by many as obsolete) but not with other frameworks or methodologies. Similarly, most literature presumes that not-agile methods always have stages executed strictly one after the other in a linear basis. According to Blank (2013), "In contrast to traditional product development, in which each stage occurs in linear order and lasts for months, agile builds products in short, repeated cycles" (p. 9).

1.1.1.1. **Purpose & Adaptation.** The initial purpose for which a methodology was created (in the researcher's opinion), directly influences the generation and —most importantly, the interpretation of its documentation; while progressive adaptation to other purposes generates additional needs to properly apply such a methodology.

Research suggests that most organizations use agile practices to manage software projects, but it's not limited to that area (14th Annual State of Agile Report, 2020, p. 8). Scrum documentation states that it's purposed for developing complex products or addressing complex problems (The Scrum Guide 2017 p.3), not projects. In fact, it doesn't even mention what a project is, much less provides processes or tools and techniques to manage the different areas of a project, or an entire organization.

1.1.1.2. **Processes, or lack thereof.** All organizational activities can be described as processes, if we consider that a process to be requires an input, actions and output.

Scrum was created to put the agile values in practice, one of those values indicates to prefer people over processes.

In it's documentation, Scrum talks about "events" while in reality —according to the researcher, they are a set of rules and mandatory processes.

Research suggests that SCRUM doesn't provide specific processes (or precise information sources) to properly manage the different areas of a project; which in turn makes room for practitioners to —unknowingly, use tools and techniques which may well be used by "rigid" PM methodologies in a detailed manner.

This also enforces the need for scaling agile practices. Lean start-ups practice something called agile development, which originated in the software industry (Blank, 2013, p. 6).

1.1.1.3. **Paraphrasis.** The researcher considers that for a PM methodology to be effective and efficient, its documentation needs to be clear, precise, accurate and sufficiently understandable for practitioners across multiple industries and business areas.

In the case of SCRUM, the paraphrasing hides many similarities (even equalities) with "rigid" methodologies such as the Project Management Body of Knowledge (PMBOK), as well as activities and processes that have been used before.

1.1.2. Competitive Advantage

Technology goes beyond software development, it's important to know how PM methodologies and practices influence the entire organization and its different strategies, in order to quickly generate an effective competitive advantage. This section describes the most salient problems identified by the researcher, related with the adoption of SCRUM as a competitive advantage.

Project Management activities include the balancing of the competing demands for quality, scope, time and cost. The relationship among these factors is such that if any one of them changes, at least one other factor is likely to be affected.

1.1.2.1. **Scope & Time.** During this century, organizations have taken time more and more as an important indicator for the generation and delivery of value.

Scrum (and agility in general) encourages the quick generation of deliverables in relatively short periods of time while —at the same time, it provides multiple opportunities for changing the scope of the project.

Change is inevitable and it may come from different sources (e.g. stakeholders, changes in market, local or national policies), thereby requiring some type of control process. Without a well-defined process to control changes, the project scope could change drastically and rapidly (uncontrolled changes are often referred to as "scope creep"); therefore, affecting quality, time, cost or the overall satisfaction of the staff.

Scrum considers the design and development of a product as if every single piece of it is created in an assembly line; unexpected changes, however, break the continuity of the production line. What is worse, it merely provides an example of how to deal with change: adding items to the product or sprint backlogs; but it doesn't indicate how this could affect quality, time, cost and satisfaction.

Estimating is dependent upon having all of the facts ahead of time. The problem with agile implementations (like Scrum), originally designed to get a better handle on these unknowns, all too often hide the scope of complexity instead.

In reality, Scrum projects usually deal with change by simply adding more features to the product or sprint backlog, transforming projects into endless endeavours that —in time, leads an organization to stop growing and start shrinking, losing its competitive edge. The scope (and the team) suffers even more when —by definition, the scope changes while time and objective of the sprint remains the same.

1.1.2.2. **Quality.** In a project, quality is influenced by customers, stakeholders and procedures defined by the industry, sponsor or executing organizations. Thereby requiring management efforts.

Execution without planning is prone to failure (which is usually expected in agile environments); as a rule of thumb, the cost of prevention is usually lower than the cost of inspection. Knowing this, organizations do some quality planning before starting a project, using industry standards and organizational processes.

Scrum focuses on product quality rather than project or process quality (including communications), and relies only on inspection to control the quality of deliverables; and yet, it doesn't provide any guidelines to manage quality at any level whatsoever.

1.1.2.3. **Cost.** This subject is always taken into account when managing organizations and projects. Traditional PM methodologies usually provide precise information regarding Cost Management, which is something that Scrum simply lacks.

It's difficult to set a budget for a project in a changing environment and execute such a project without changing its budget. Budgeting (planning and controlling) becomes more difficult if we consider that changes may look simple from a customer perspective, but become drastic when those changes involve an implicit need to re-work, overwork or even throw away weeks of work (see also section 1.1.2.4 Employee Satisfaction).

As a result, prevention cost is partially reduced (i.e. for planning only); but appraisal, internal failure and external failure costs increase.

1.1.2.4. **Employee Satisfaction.** Every organization should care for their employees. In such an attempt, they may adopt agile practices in order to improve not just projects or accelerate delivery of value but also employee satisfaction (e.g. improve team morale or engineering discipline). Moving into agile is more than just adopting a methodology, it is an entire cultural change. The highest-ranked challenges to adopting and scaling agile are related to organizational culture (14th Annual State of Agile Report, 2020, p. 2).

The morale of the team is affected directly (in a negative way) when scope changes that may look simple from a customer perspective, become drastic by involving an implicit need to throw away weeks of work; but also by rework or overwork.

Events are used to "create regularity and to minimize the need for meetings not defined in SCRUM" (Schwaber & Sutherland, 2017, p. 9). Theoretically speaking, this is true; because there's no obvious need for more meetings when the framework itself already imposes many ones (up to 32 per month).

In reality, communications happen formally and on an ad-hoc basis, regardless of any predefined, mandatory time-boxed event. This causes in the staff the general sensation of having less time for working due to the increased amount of time for inspection and planning meetings.

Agile was about discipline, craftsmanship and professionalism. Business understands discipline, so business really likes Scrum (Uncle Bob, 2016). Research suggests that project execution teams often feel overwhelmed by the constant pressure and tight (and unrealistic) deadlines to produce deliverables with high degree of quality, acting as interchangeable cogs in a machine whose sole purpose is to churn through an assembly line of tickets. In short, the transparency that agile provides is often exploited as an opportunity for micromanagement.

1.2. Hypothesis

1.2.1.1. **Research shows that agile projects utilize many practices similar or equal to those used by rigid methodologies.** So, the researcher hypothesizes:

"The adoption of SCRUM due to its trendiness rather than an actual need generates a placebo response in modern organizations"

1.3. Research Questions

The researcher, according to experience and current state of the art, states the following research questions:

I. How agile actually is SCRUM?

II. Does SCRUM actually improve project communications?

III. Is agility a competitive advantage?

1.4. Research Variables

This research analyzes the following variables:

Table 1

Research Variables

Variable	Description
Agility Accuracy	Proximity of subjects to the Agile Manifesto
Rigid Proximity	Proximity between research subjects (i.e. the PMBOK and SCRUM)
Quality of Communications	Sense of quality perceived by execution teams (i.e. no management)
Quality of Deliverables	Sense of quality perceived by execution teams (i.e. no management)
Employee Satisfaction	Perceived by the whole project team

1.5. Objectives

1.5.1. Main

To provide organizations and the Project Management (PM) community sufficient and reliable information so they can make better decisions regarding the adoption of agile practices.

1.5.2. Secondary

To set the basis for a larger scope in order to extend the current research to a national or regional level in the future.

1.6. Scope

This research is intended to provide information about project management practices and methodologies, therefore it focuses on the two most used methodologies or practices: PMBOK and SCRUM (referred in this research simply as "research subjects").

In order to achieve the research objectives, it's necessary to gather information from documentary sources as well as from real-life endeavours or projects. Thus, the research involves two projects from two different organizations in two different locations (refer to Appendix D).

For the sake of diversity, and to fully cover both agile and rigid approaches for PM, the research ignores the industry to which each participating organization is classified (see Chapter 3 Methodology - Experimentation).

2. Theoretical Framework

This chapter reviews the relevant literature in the field of Project Management, in order to build a theoretical basis for this research.

Theories are formulated to explain, predict, and understand phenomena and, in many cases, to challenge and extend existing knowledge within the limits of critical bounding assumptions. The theoretical framework is the structure that can hold or support a theory of a research study, it introduces and describes the theory that explains why the research problem under study exists.

2.1. Project Management

Throughout the years, many organizations providing guidance and standardization have emerged, among the most known ones are the Project Management Institute (PMI, formally incorporated in Pennsylvania in 1969) and the Agile Alliance (created in 2001).

Project, programme and portfolio (p3) management is concerned with managing discrete packages of work to achieve objectives. The way work is managed depends upon a wide variety of factors (Association for Project Management, 2012, p. 20). The administration of a business influences the way in which we apply one or another methodology or technique to our projects. Likewise, norms or standardization practices at national or regional level can also influence how an organization manages its projects.

Projects bring together resources, skills, technology and ideas to deliver business benefits or to achieve business objectives. Good project management helps to ensure that these benefits or objectives are achieved within budget, within time and to the required quality (Office of Government Commerce UK, 2002). PM provides structure, focus, flexibility, and control in the pursuit of results (Bruce & Langdon, 2000, p. 6).

Management is about human beings. Its task is to make people capable of joint performance, to make their strengths effective and their weaknesses irrelevant. This is what organization is all about, and it's the reason that management is the critical, determining factor (Drucker, 2005, p. 23).

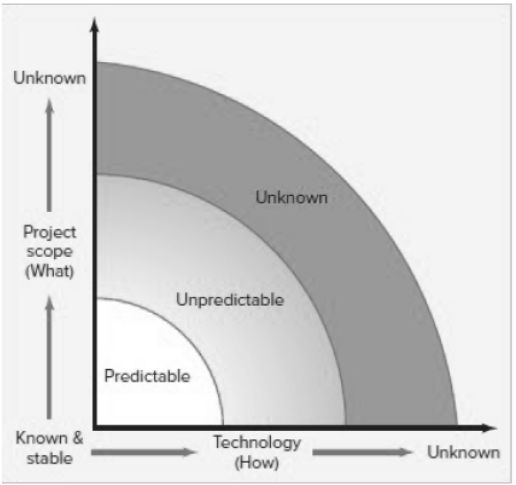
2.1.1. State of the Art

After WWII many organizations started to implement new and better ways to do their job, especially in the Information Technology and Communications industry. As a result, multiple methodologies and frameworks appeared and evolved. For many years, PM methodologies were based on processes, until the Agile Manifesto appeared back in 2001. Since then, project management methodologies and/or frameworks have been empirically classified as "agile" and "rigid"; during recent years the term "traditional" replaced "rigid".

Traditional project management focuses on thorough planning up front. Planning requires predictability. For plans to be effective, managers have to have a good understanding of what is to be accomplished and how to do it (Larson & Gray, 2021, p. 13). Unfortunately, not all projects enjoy good levels of predictability.

Figure 1

Graphic representation of project predictability



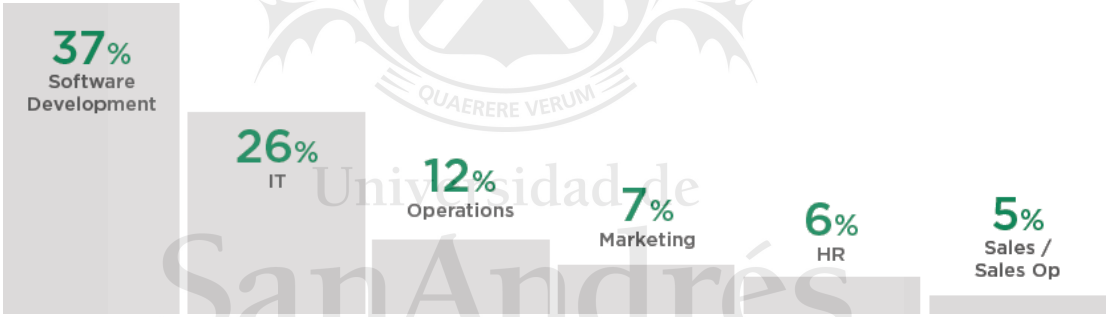
(Source: Erik W. Larson and Clifford F. Gray, 2021, p. 13)

Many projects have well-established scopes and use proven technology; when the scope and/or technology is not fully known, things become much less predictable. Such was the case of cancelled software projects in 1995 with an estimated spend value of $81 billion (The Standish Group, 1995). But, even in the agile era, projects do fail.

Agile methodologies and/or practices were created —essentially, to deal with uncertainty in an incremental, iterative way. During the last 3-5 years, organizations have been adopting agile more and more, not only for software development but in other areas as well (as shown in Figure 2) due to a variety of reasons (as shown in Figure 3).

Figure 2

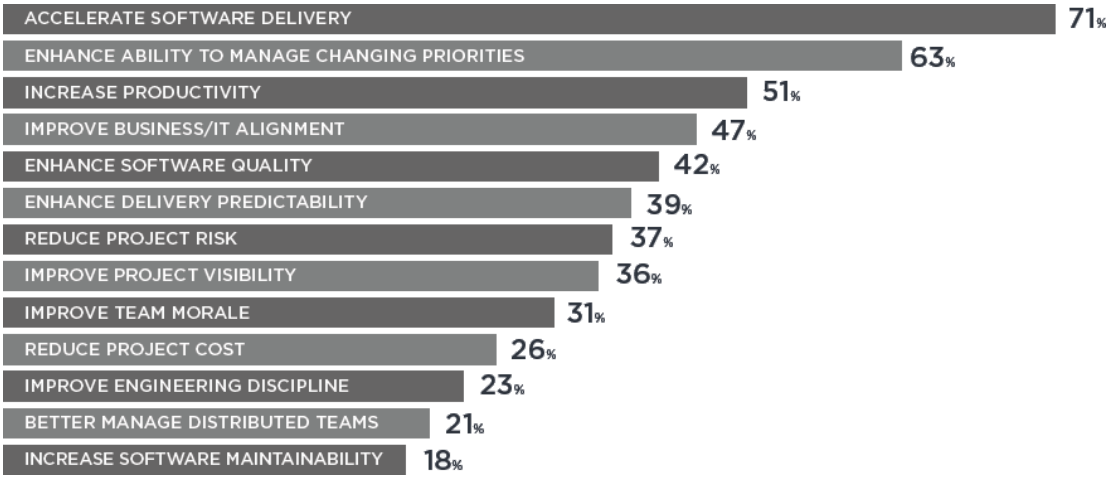
Areas of organization practicing agile



(Source: 14th Annual State of Agile Report, 2020, p. 8)

Figure 3

Reasons for adopting agile



(Source: 14th Annual State of Agile Report, 2020, p. 9)

2.2. What is a Project?

A project is a temporary endeavor undertaken to create a unique product, service or result (PMI, 2004, p. 5). Like most organizational efforts, the major goal of a project is to satisfy a customer's needs. Beyond this fundamental similarity, the characteristics of a project help differentiate it from other endeavors of the organization (Larson & Gray, 2021 p. 7).

2.3. Agility

Traditionally, many people, practitioners and literature treat the term "Agile" as a group of methodologies, some others, describe it as *a mindset* or *a way to do things*. According to the Agile Alliance, "Agile is the ability to create and respond to change", but also "It's really about thinking through how you can understand what's going on in the environment that you're in today".

The term “Agile” dates back to a 2001 conclave where Jeff Sutherland and sixteen other leaders in software development wrote up what has become known as the “Agile Manifesto”, which declares 4 main values:

- Individuals and interactions over processes and tools.
- Working software over comprehensive documentation.
- Customer collaboration over contract negotiation.
- Responding to change over following a plan.

2.4. SCRUM

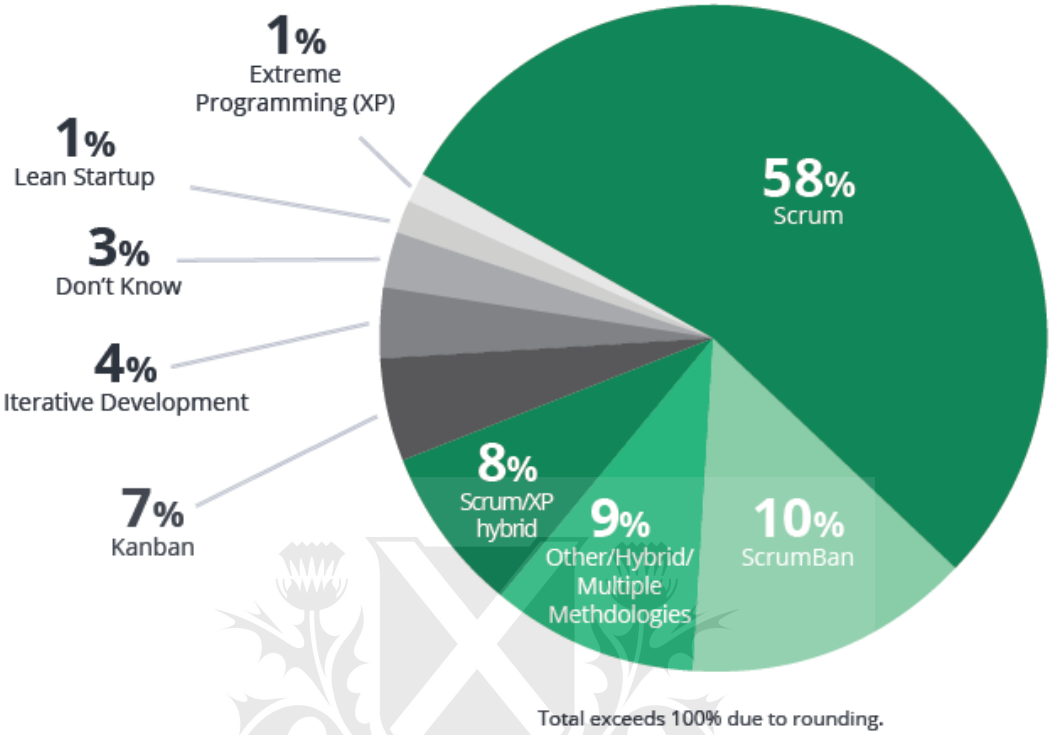
It was created by Jeff Sutherland and Ken Schwaber in 1993 to overcome the faults of the Waterfall method. Scrum is a framework built to put agile values into practice. There is no methodology (Sutherland, 2014, p. 19).

The widespread adoption of Scrum along with its light-weight documentation, has led practitioners (including its own inventor) to create different approaches to use the framework, like Scrum Patterns, proposed by Jeff Sutherland and the Scrum Patterns Group). What is a pattern? One simple definition is that a pattern is a repeatable applicable solution to a problem that arises in a specific context (Sutherland & Coplien, 2019, p. 41).

The impact of Scrum has led other business areas to start using it, making it the most agile methodology used nowadays. Additionally, the agile lifecycle market and related education is a profitable business (i.e. training towards certifications, like Effective Agile; and tools, like Atlassian). The expected revenue for agile application lifecycle management tools in 2017 was 1.1 million USD, mostly shared by few players in the agile tools market (Atlassian & HRB, p.2).

Figure 4

Scrum and related variants continue to be the most common agile methodologies



(Source: 14th Annual State of Agile Report, 2020, p. 10)

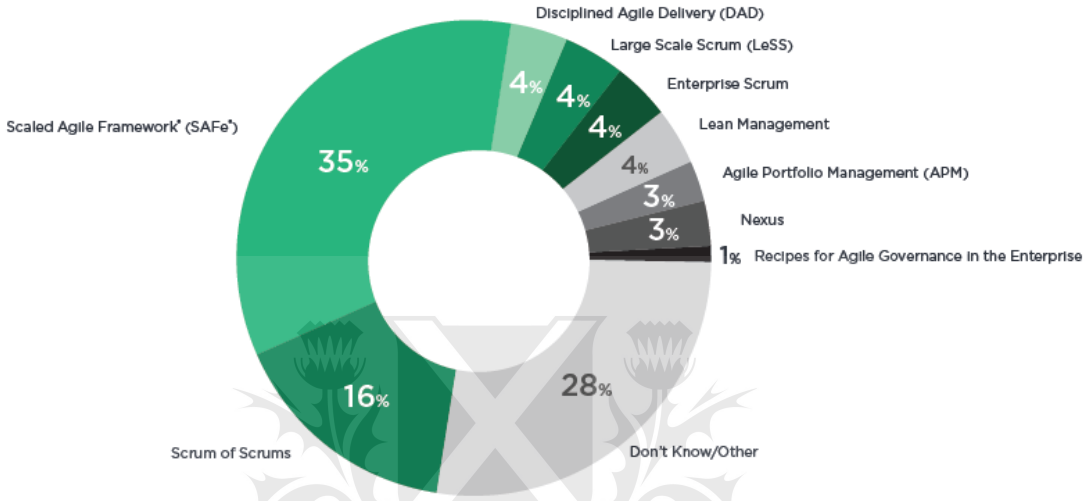
Experience shows that there are practitioners who have identified similarities between the *traditional* approach and the agile one. Such similarities have been analyzed by the Agile Alliance in order to generate commercial partnerships with other vendors, such as the Project Management Institute (PMI), in order to create agile versions of methodologies traditionally considered *rigid* (e.g. PMBOK, PRINCE2).

2.5. Trends

The impact of agility is leading organizations to scale it by using different methods and approaches, usually known as hybrid practices.

Figure 5

The Scaled Agile Framework (SAFE) is the most popular scaling method



(Source: 14th Annual State of Agile Report, 2020, p. 14).

Another trend is the use of Value Stream Management. VSM is the result of hybrid practices mentioned before, focused on quick delivery of value and it's proper management. It's expected a greater percentage of organizations to embrace VSM going forward, as understanding increases and tooling more capably enables the unification of the "concept to cash" value stream (VerisonOne Inc., 2020, p. 4).

Agile development practices impact many business functions outside of software development, so organizations need to expand agile thinking beyond the programming team to be most effective (Blank, 2017, p. 10).

2.6. The Placebo Response

Placebo is Latin for "I shall please", it is also the opening phrase of the Catholic vespers for the dead, from which the medical term, ironically enough, derived. The “placebo response” is the term used by medics, physicians and psychologists to describe the phenomenon in which “sham” treatments have the capacity to rally healing processes, sometimes of a dramatic nature, within patients (Anne Harrington, 1997, p1).

Since drug efficacy is measured as the difference between the response of the drug-treated group of patients compared to the response of the placebo-treated group of patients, understanding the placebo response is critical to evaluating drug efficacy. An unexpected or higher than normal placebo response can make it more difficult to detect efficacy in a clinical trial –even if the drug is actually effective (Tools4Patients, Understanding the Placebo Effect).

Since Beecher's pioneer article in 1955, this effect is recognised and cited in randomised clinical trials; medical articles as being on average 35% effective on the majority of symptoms (Boussageon R, Gueyffier F, Moreau A, Boussageon V. La difficile mesure de l'effet placebo [The difficulty of measurement of placebo effect]. Therapie. 2006 May-Jun;61(3):185-90. French. PMID: 16989117.).

2.7. Likert Scales

Likert scales are commonly used to measure attitude, providing a range of responses to a given question or statement (Jamieson, 2018, p. 1217). Likert scales are psychometric instruments in which the interviewees indicate their agreement or disagreement about an affirmation, item or reaction; and it’s done using a one-dimensional ordered scale (Bertram, 2008).

These instruments are usually recognized among the most used for measurement in social sciences (Cañadas and Sánchez-Bruno, 1998). This type scale emerged in 1932, when Rensis Likert (1903-1981) published a report in which he outlined how to use a type of instrument to measure attitudes (Likert, 1932; Edmondson, 2005).

The intermediate alternative. Among the topics studied in relation to the format, the studies that analyze the arguments for and against including an intermediate option (known as indecision or ambivalence option) among the answer alternatives stand out. These arguments are closely linked to central tendency and social desirability biases, as has been shown in several studies (Baka and Figgou, 2012; Johns, 2005).

2.8. Important Concepts

The following concepts are considered important for both the research and the understanding of this document.

2.8.1. Agile

Quick-moving, nimble, active (The Oxford Dictionary of Current English, 2021).

2.8.2. Good Practice

Good practice means that there is general agreement that the correct application of these skills, tools, and techniques can enhance the chances of success over a wide range of different projects (The PMBOK Guide 3rd ed., p 3).

2.8.3. Ambivalence

Simultaneous and contradictory attitudes or feelings (such as attraction and repulsion) toward an object, person, or action (Merriam-Webster, 2020).

2.8.4. Precision & Accuracy

Accuracy is how close a measured value is to the actual (true) value. Precision is how close the measured values are to each other (Math Is Fun, 2017).

2.8.5. Quality & Grade

Quality and grade are not the same. Quality is “the degree to which a set of inherent characteristics fulfill requirements”. Grade is a category assigned to products or services having the same functional use but different technical characteristics (PMBOK Guide 3rd ed, p.180).

2.8.6. Holistic View

The definition of a holistic view was that all aspects of people's needs, psychological, physical and social, should be taken into account and seen as a whole (National Board of Health and Welfare, 1976). During the last 10 years of the 19th century this concept was progressively adopted as a philosophy among non-medical organizations.

2.8.7. Voice of the Customer

A planning technique used to provide products, services, and results that truly reflect customer requirements by translating those customer requirements into the appropriate technical requirements for each phase of project product development (Project Management Body of Knowledge, 3rd ed. p.379).

2.8.8. Framework

A supporting structure around which something can be built (Cambridge Dictionary, 2020).

2.8.9. Rationalism vs. Empiricism

Due that empiricism is the base in which SCRUM was created, the researcher considers the following concepts as very important, thus, this section includes several concepts from different information sources.

The dispute between rationalism and empiricism concerns the extent to which we are dependent upon sense experience in our effort to gain knowledge. Rationalists claim that there are significant ways in which our concepts and knowledge are gained independently of sense experience. Empiricists claim that sense experience is the ultimate source of all our concepts and knowledge (see Stanford Encyclopedia of Philosophy, 2017, for more details).

The Intuition/Deduction Thesis: Some propositions in a particular subject area, S, are knowable by us by intuition alone; still others are knowable by being deduced from intuited propositions.

The Innate Knowledge Thesis: We have knowledge of some truths in a particular subject area, S, as part of our rational nature.

The term "empiricism" is vague in at least two ways. It lacks precision as to scope, tending to become broader and broader until everyone is an empiricist. Furthermore, it is ambiguous, since it covers such a great diversity of kinds; one need mention only conventionalism, constructionism, sensationalism, scientific empiricism (logical positivism), fictionalism, operationism, and the various forms of empirical realism (Cornelius Benjamin, 1954, p. 171).

2.8.10. Standard

A level of quality (Cambridge Dictionary, 2020).

2.8.11. Paraphrasis

To repeat something written or spoken using different words, often in a humorous form or in a simpler and shorter form (Cambridge Dictionary, 2020).

2.8.12. Mindset

A mental attitude or inclination (Merriam-Webster, 2020).

2.8.13. **Assessment**

The act of judging or deciding the amount, value, quality, or importance of something, or the judgment or decision that is made (Cambridge Dictionary, 2021).

2.8.14. **Nuisance Factors**

Factors that may affect the measured result, but are not of primary interest (NIST/SEMATECH e-Handbook of Statistical Methods, http://www.itl.nist.gov/div898/handbook/, 2021).

2.8.15. **Statistical Significance**

The significance level or alpha level is the probability of making.

2.8.16. **Prevention Cost**

Prevention Cost is the cost of planning and executing a project so it's error-free or within an acceptable error range.

2.8.17. **Appraisal Cost**

Appraisal Cost is the cost of evaluating processes and their outputs to ensure quality (PMI, 2004).

2.8.18. **Internal Failure Cost**

Internal Failure Cost is the cost incurred to correct an identified defect before the customer receives the product (PMI, 2004).

2.8.19. **External Failure Cost**

External Failure Cost is the cost that relates to all errors not detected and corrected before delivery to the customer (PMI, 2004).

3. Methodology

This chapter discusses the subjects and variables studied and how the research was designed, along with used methods and/or instruments. Additionally, a brief description of the rationale for selecting a mixed research design is included.

3.1. Research Design

The study approached the research questions from a qualitative-experimental research design perspective. The research was conducted using comparisons between research subjects (i.e. Project Management methods, traditional and agile); surveys to verify assessments and measure employee satisfaction; and one experiment to support findings and measure collected data against real-live projects.

The reason behind selected research methods (i.e. comparative, survey, experimentation) is that —according to the researcher, they present opportunities to systematically analyze and describe research variables from both theoretical and practical standpoints.

There is a story that at the height of Mao Zedong's cultural revolution in China, the fields of one village were being attacked by swarms of locusts. The villagers turned to Mao's little red book for guidance, but nothing he wrote seemed to fit except one sentence: "In absence of any directive, people should devise their own solutions!" (Keiki and Adi Bhote, p. 3).

In mixed-methods research, one methodology's results assist in developing or informing the results of another. Descriptive research seeks to depict what already exists in a group or population; they don't try to measure the effect of a variable; they seek only to describe it.

Table 2

Design of the research

Method	Inputs	Outputs	Description
Comparative	- Agile Values - Scrum guide - PMBOK guide	- Assessments on agility and relative rigidity	Comparison of official documentation using the holistic and head-to-head approaches.
Survey	- Agile Values - Assessments on agility and relative rigidity	- Validation of the assessments	Using an audience to validate assessments from comparative research.
Experimentation	- Research variables and sub-variables - Nuisance factors - Measurements	- Statistical probabilities of higher quality outputs	Measurement of variables in the field (i.e. real-life projects)

3.2. Comparative Research

Arun Maiya (2009) indicates that "given multiple sets (or groups) of documents, it is often necessary to compare the groups to identify similarities and differences along different dimensions" (p. 840). Similarities between two documents (each captured from a different source) can be used to infer a non-obvious association between them and/or their sources.

Comparisons for this research use a rigid subject as a point of reference, because —in this case, it provides an already organized set of groups and subjects (known as Knowledge Areas). Additionally, taking a rigid subject as a reference helps to analyze the whole spectrum between agile and rigid.

3.2.1. Holistic Approach

This approach is related to the analysis of an object as a whole (U. of Washington Writing Center, 2015), in this case a set of practices frequently used to manage projects.

The comparison identifies similarities and differences between research subjects by determining how accurate they are with respect to the agile values and assesses their significance. Values for comparison are set using a 1-5 Likert scale (refer to Table 8).

3.2.2. Head-to-Head Approach

This approach allows us to organize ideas and concepts using important points of comparison rather than a whole subject of analysis (U. Washington Writing Center, 2015).

The comparison identifies similarities and differences between conceptual topics that compose each research subject and assesses their significance. Topics are gathered from official documentation provided by subjects' creators or vendors. Values for comparison are set using a 5-item Likert scale (refer to Table 8).

3.3. Experimentation

Observing a system or process while it is in operation is an important part of the learning process, and is an integral part of understanding and learning about how systems and processes work (Montgomery 2013, p. 1).

To really understand cause-and-effect relationships in a system, you must deliberately change the input variables to the system and observe the changes in the system output that these changes in the inputs produce (Montgomery 2013, p. 1).

In line with Montgomery, the experiment is composed of two different projects: the first one lives within an agile organization and is to be managed using a rigid methodology; the second one is an in-progress project switching the management style to agile (more precise, SCRUM).

The three basic principles of experimental design are randomization, replication and blocking (Montgomery 2013, p. 12). Experiments usually require multiple runs (i.e. replication), due to the fact that this experiment use relatively long-term projects (i.e. 6 months or more) of different types (i.e. certification and construction), it is limited to just one run, which in turn limits replicability. However —and due to the nature of both projects, replicability is reflected on a monthly basis (the defined frequency of data gathering for the experiment).

Blocking is a design technique used to improve the precision with which comparisons among the factors of interest are made. Often blocking is used to reduce or eliminate the variability transmitted from nuisance factors. Nuisance factors for this experiment are: type of project, experience with the research subjects, procurement management, risk management, population's demographic data.

The experiment aims to analyze the difference between the response of a rigid project (i.e. the drug-treated group) and an agile one (i.e. the placebo-treated group); but also to help answer the research questions. For sake of comparison, the period of time for data collection is limited to 9 months (the estimated duration of the 1st project). The execution of the 1st project started in April 2019, while the 2nd one in November 2018.

Groups of variables analyzed in the experiment include: communications, deliverables and satisfaction; values are set by each project team using a 1-5 Likert type scale (see Table 8). Each group holds several variables, described next in Table 3.

Table 3

Variables analyzed by means of experimentation

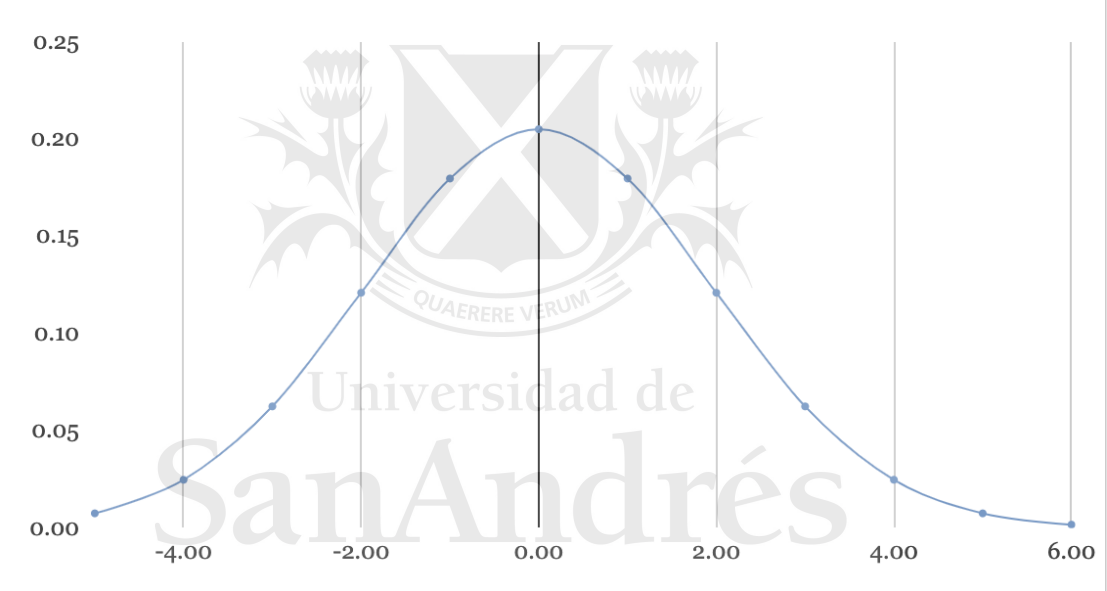
Group	Variable	Description
Communications	Preset events	Predefined by methodology/framework
	Non preset events	Defined by the project team
	Preset channels	Predefined by methodology/framework
	Non preset channels	Defined by the project team
Deliverables	Preset review events	Predefined by methodology/framework
	Non preset review events	Defined by the project team
	Overall perceived quality	Perceived by the project execution team
Satisfaction	Active presence in planning	Perceived by the project execution team
	External influences	Perceived by the project execution team
	Visibility	Perceived by the management team and/or sponsor

Non preset communication events are defined for both projects to be an average of 22 per month, because experience shows that these events are where project-related communications happen the most; additionally, had-hoc events are difficult (if not impossible) to measure.

Due to the fact that all surveys use a 1-5 Likert type scale with an intermediate alternative, we can safely assume that values less than 3 produce a negative effect, while values greater than 3 produce a positive effect. Therefore —and for sake of analysis, the Likert values are given positive and negative equivalent values; thus, creating a z-scale suitable to use in the analysis of data (i.e. normal distribution depicted in Figure 6) with a minimum desired value of 1 (which in is equivalent to 4 or 'high degree' in the Likert scale) and a significance level of 0.05 or 5%.

Figure 6

Normal Distribution for the Likert scales



The analysis of data by means of the z distribution requires setting a statistical hypothesis (H_0) and an alternative one (H_1). Table 4 describes the hypothesis included in the experiment.

Table 4

Statistical hypotheses for the experiment

Null (Ho)	Alt. (H1)	Description
$\mu_1 = 1$	$\mu_1 < 1$	Agile quality of preset communication events is 1 (i.e. high degree)
$\mu_2 = 1$	$\mu_2 < 1$	Agile quality of preset communication channels is 1 (i.e. high degree)
$\mu_3 = 1$	$\mu_3 < 1$	Agile quality of deliverables is 1 (i.e. high degree)
$\mu_4 = 1$	$\mu_4 < 1$	Satisfaction of participating in planning is 1 (i.e. high)
$\mu_5 = 1$	$\mu_5 < 1$	Satisfaction of external influences is 1 (i.e. high)
$\mu_6 = 1$	$\mu_6 < 1$	Satisfaction of project visibility is 1 (i.e. high)

3.3.1. Project 1 - Stop Being Agile

The main goal of the first project was to gain a technology certification that would represent a competitive advantage for the sponsor organization (refer to Appendix D), but also a requirement to be able to sell in the market.

Table 5

Structure of the whole team for Project 1 Rigid (P1)

#	Team	Role	Seniority
1	Management	Sponsor	n/a
1	Management	Project Manager	Senior
1	Execution	Team Leader	Expert
3	Execution	Developer	Jr.

The project was divided into 6 phases: discovery, planning, learning and practice, simulations, certification tryouts, and team certification.

Figure 7

Phases for P1 Rigid

Due to the fact that projects are part of organizational efforts, there are some mandatory processes defined by the sponsor organization (refer to Appendix D), in this case the mandatory processes include: (a) a weekly report of progress from the Team Leader to the Project Management and/or C-Level, (b) cost management is out of the scope of the experiment, (c) knowledge measurement T&T as well as actual measurements are private, (d) procurement management is up to the C-Level and out of the scope of the experiment.

3.3.2. Project 2 - Start being agile

The main goal of the second project is to build a house (which is a relatively small project in the construction area), its sponsor is the owner of the house (refer to Appendix D) and used the PMBOK to manage the project.

Due to the fact that the project is in progress, there are several phases already completed (activities are described in Table 7), the remaining work is managed by switching the PM style to Scrum. Data is collected using surveys applied to the Execution Team (i.e. the construction crew).

Table 6

Structure of the whole team for Project 2 Agile (P2)

#	Team	Role	Seniority
1	Management	Sponsor / PM	Expert
1	Execution	Foreman	Senior
4	Execution	Worker	Senior

Foreman has a mid-level knowledge of the PMBOK based on experience from previous projects working with the same PM/Sponsor. Construction workers don't know about any PM methodology but also have worked with the same PM/Sponsor on multiple projects prior.

Table 7

Activities for P2 Agile

Activity	Not Started	On Hold	In Progress	Done
Planning				✳
Demo Prep				✳
Demolition				✳
Excavation				✳
Concrete				✳
Pre backfill				✳
Framing			✳	
Roof			✳	
Plumbing			✳	
Windows		✳		
Electrical			✳	
A/V				✳
House wrap				✳

Activity	Not Started	On Hold	In Progress	Done
Insulation			✳	
Drywall			✳	
Exterior stone			✳	
Exterior case work	✳			
Laundry/furnace room flooring			✳	
Hardwoods			✳	
Tile	✳			
Cabinets			✳	
Plumbing -hang sinks			✳	
Interior doors				✳
Millwork				✳
Interior painting			✳	
Stone Counters			✳	
Schedule Buffer			✳	
Decks			✳	
Interior doors- hang & hardware				✳
Appliances				✳
Plumbing			✳	
Electrical			✳	
Bathroom Glass			✳	
Garage	✳			
House Cleaning		✳		
Moving In		✳		

The frequency of communication events within the execution team were preset (by the SCRUM framework) to be once a day (i.e. the Daily Scrum) plus another event once a week (i.e. the Sprint Retrospective); planning event(s) were up to the PM/Sponsor only, and the time of each sprint was set (by the Sponsor) to 1 week.

3.4. Surveys

The Oxford Dictionary of Statistical Terms begins with a broad definition of surveys: "An examination of an aggregate of units, usually human beings or economic or social institutions" (Dodge 2010, p. 398). Sometimes "surveying" is defined as obtaining information through asking questions, in line with the German word for survey: befragung. Dalenius (1985) recalls that observations are to be done according to a measurement process.

Initial assessments from both comparison approaches are used here to create two separate surveys: Agility Accuracy (refer to Appendix A) from the holistic comparison and Rigid Proximity (refer Appendix B) from the head-to-head comparison. A third survey is used to gather data from experimentation (refer Appendix C).

Groups of variables measured by means of experimentation represent additional surveys based on perceived quality of elements, applied to project teams and they are: Quality of Communications, Quality of Communication Channels, Quality of Deliverables, Employee Satisfaction. Responses for all surveys use a 5-item Likert type scale, described in Table 8.

Table 8

Interpretation of values for surveys using Likert scales

Survey	Value	Interpretation
Agility Accuracy	1	Very inaccurate
	2	Inaccurate
	3	Undecided
	4	Accurate
	5	Very accurate
Rigid Proximity	1	Not close at all
	2	Barely close
	3	N/A but use similar or same T&T
	4	Very close
	5	Virtually the same
Quality of Communications, Channels, Deliverables and Satisfaction	1	Very low degree
	2	Low degree
	3	Acceptable
	4	High degree
	5	Very high degree

The Agility Accuracy survey is comprised of only 4 items (corresponding to 4 values), the Rigid Proximity survey is composed of 45 assessments grouped in 9 areas, and the experimentation survey is composed of 12 items.

3.5. Population

This study's population consists of 2 groups: a group of 20 people who have had management experience with both subjects (i.e. SCRUM and PMBOK) and 2 participant organizations.

The Agility Accuracy and Rigid Proximity surveys are applied to the first group, the rest are applied to members of the project teams participating in the experiment mentioned above.

3.6. Information Sources

Table 9

Main	Secondary
Experimentation	Industry Reports
Surveys	Scientific Books
Expert Judgment	Journals & Articles

4. Comparative Research & Assessments

The fact that methodologies have existed for more than a decade means that several of them have a common basis: processes. Schwaber and Sutherland (2017) —for example, indicate that SCRUM is a process framework (Aguile Guide p. 3); while the PMBOK conglomerates its knowledge areas into groups of processes (Project Management Institute [PMI], 2013, p.47) and RUP (Rational Unified Process) —by definition, is a process.

There are several PM methodologies, for this research the selected subjects for comparison are the PMBOK (rigid) and SCRUM (agile); document versions selected are 17 and 3 respectively. By selecting relatively old versions of the subjects' official documentation, the researcher aims to justify that the use of tools and/or techniques described or provided by selected subjects is not new.

4.1. Holistic Comparison

As described previously in section 3.4.1, the holistic approach is related to comparing the subjects (i.e. SCRUM-17 and PMBOK-3) as a whole. This section includes a summary of each subject, noting important points that are used later on for comparison and assessment (U. of Washington Writing Center, 2015, p, 1). For purposes of this research, the holistic comparison is based on two main areas: Agility and Project Management.

4.1.1. SCRUM and Agility

Jeff Sutherland indicates that even as late as 2005 "most software development projects were using the Waterfall method", he invented SCRUM to overcome the faults presented by such a method and to put the agile values into practice (Sutherland, 2014)

4.1.1.1. **Individuals and interactions over processes and tools.** Indicates that people —in an agile environment, are more empowered than processes; however, the 2017 SCRUM Guide clearly states that it is “a process framework”, while the 2020 guide indicates that processes are part of what fits the framework. As a matter of fact, processes are always present in our organizations, some are even mandatory (e.g. when preparing for the ISO 9001 certification), others belong to specific business areas.

Table 10

SCRUM processes and their activities

Event / Artifact	Activities
Cancelling a Sprint	- Review of *done* deliverables - Re-estimation of product backlog items
Sprint Planning	- Forecasting - Time and effort estimation - Deliverable building definition - Delivery planning
Sprint	- Capacity projection - Performance measurement
Daily SCRUM	- Work planning - Inspection - Forecasting
Sprint Review	- Inspection - Demonstration - Q&A - Market review - Review of timeline, budget and capabilities
Sprint Retrospective	- Sprint Inspection - Improvements Identification and Planning

4.1.1.2. **Working software over comprehensive documentation.** For a team to know how to create a product, they need to know what that product is supposed to do when it or it's constituent parts are finally created. To that effect, SCRUM provides an "ordered list of everything that is known to be needed in the product" (The Scrum Guide 2017 p.15 Product Backlog) as well as "the set of Product Backlog items selected for the Sprint, plus *a plan* for delivering the product Increment" (The Scrum Guide 2017 p.16 Sprint Backlog).

4.1.1.3. **Customer collaboration over contract negotiation.** It indicates that collaboration should be preferred over negotiation. The SCRUM framework indicates that the role of Product Owner (PO) may represent a committee or the needs of stakeholders, also that people who want to change the Product Backlog artifact must address (The Scrum Guide 2017 p.6) or convince (The Scrum Guide 2020 p.15) the Product Owner.

4.1.1.4. **Responding to change over following a plan.** Makes obvious that agility assumes that every single product is created in a rapidly changing environment, without following a plan. To that effect, the SCRUM-17 framework prescribes that "The work to be performed in the Sprint is *planned* at the Sprint Planning" (The Scrum Guide 2017 p. 10 Sprint Planning) as well as a daily event in which "the Development Team *plans* work for the next 24 hours" (The Scrum Guide 2017 p. 12 Daily Scrum). The SCRUM-20 framework prescribes that "Sprint Planning initiates the Sprint by laying out the work to be performed for the Sprint. This *resulting plan* is created by the collaborative work of the entire Scrum Team" (The Scrum Guide 2020 p 8 Sprint Planning).

4.1.2. PMBOK and Agility

The Project Management Institute created a guide (as an ANSI standard then evolved it as an ISO one) for Project Management as a profession. Such a guide is named —creatively enough, the Project Management Body of Knowledge Guide (or simply known as the PMBOK).

4.1.2.1. **Individuals and interactions over processes and tools.** Even though the PMBOK identifies and describes several processes to "organize and manage the project team" (PMBOK 3rd Ed. p. 199 Project Human Resource Management), it also indicates that "Project management is accomplished through the application and integration of the project management processes" (PMBOK 3rd Ed. p. 8 section 1.3 What is Project Management?).

4.1.2.2. **Working software over comprehensive documentation.** For a team to know how to create a product, they need to know what that product is supposed to do when it or it's constituent parts are finally created. To that effect, the PMBOK identifies and describes several processes to "ensure that the project includes all the work required, and only the work required, to complete the project successfully" (PMBOK 3rd Ed. p. 103-122 Chapter 5 Project Scope Management).

4.1.2.3. **Customer collaboration over contract negotiation.** The PMBOK identifies and describes several processes to "ensure timely and appropriate generation, collection, distribution, storage, retrieval, and ultimate disposition of project information" (PMBOK 3rd Ed. p. 221-236 Chapter 10 Project Communications Management); among those processes exist one that "refers to managing communications to satisfy the needs of, and resolve issues with, project stakeholders" (PMBOK 3rd Ed. p. 235 Section 10.4 Manage Stakeholders).

4.1.2.4. **Responding to change over following a plan.** The PMBOK-3 identifies 9 knowledge areas (i.e. Integration, Scope, Time, Cost, Quality, Human Resource, Communications, Risk and Procurement), for each one of them it identifies and describes processes used to generate a subsidiary plan. The sum of all the subsidiary plans is known as the Project Plan. Within those processes, there's one named "Change Control".

4.1.3. **SCRUM and Project Management**

4.1.3.1. **Purpose**. SCRUM-17 indicates that its purpose is "developing, delivering and sustaining complex products" (The Scrum Guide 2017 p. 3 Purpose of the Scrum Guide); it also states that within it people can "address complex adaptive problems" (The Scrum Guide 2017 p. 3 Definition of Scrum).

4.1.3.2. **Definition of Project.** SCRUM does not provide any definition of "project", it merely mentions projects when describing what a Sprint is; specifically, it states that "Each Sprint may be considered a project" (The Scrum Guide 2017 p. 9 The Sprint) or —more recently "Each sprint may be considered a short project" (The Scrum Guide 2020 p. 8 The Sprint).

4.1.4. **PMBOK and Project Management**

4.1.4.1. **Purpose**. The primary purpose of the PMBOK Guide is to "identify that subset of the Project Management Body of Knowledge that is generally recognized as good practice" (PMBOK 3rd Ed. p. 3 Section 1.1 Purpose of the PMBOK Guide). Additionally, it "provides and promotes a common lexicon for discussing, writing, and applying project management" (PMBOK 3rd Ed. p. 3 Section 1.1 Purpose of the PMBOK Guide).

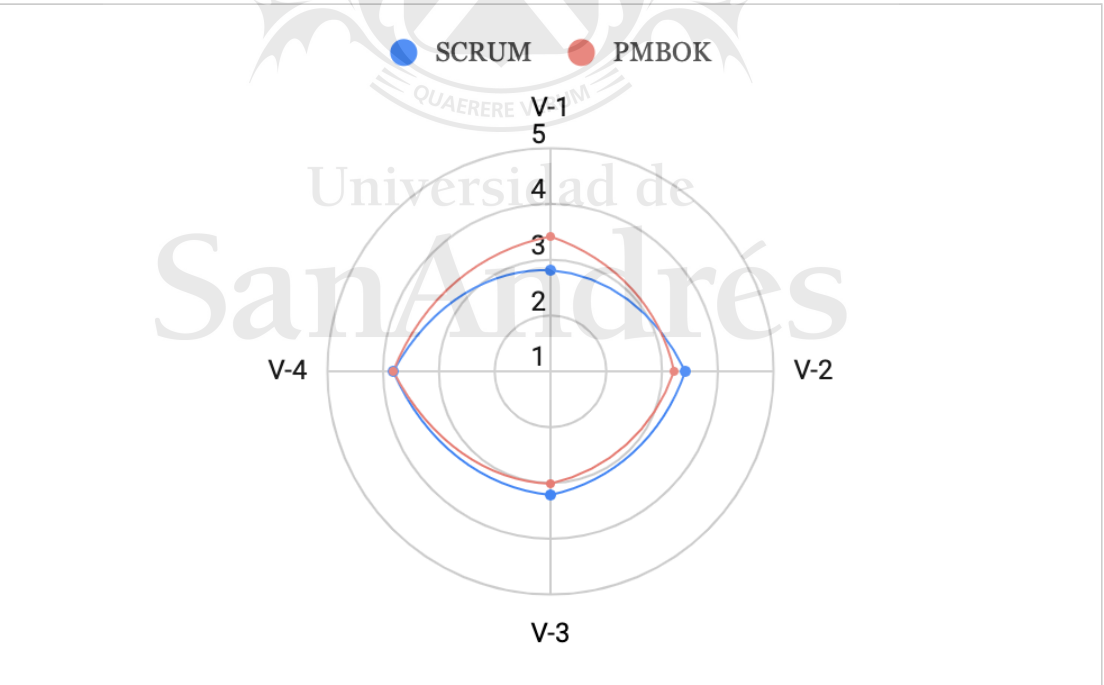
4.1.4.2. **Definition of Project.** The PMBOK from its 3rd to 6th editions define a project as "a temporary endeavor undertaken to create a unique product, service, or result" (PMBOK 3rd Ed. p. 5 Section 1.2; PMBOK 4th Ed. p. 5 Section 1.2; PMBOK 5th Ed. p. 3 Section 1.2; PMBOK 6th Ed. p. 4 Section 1.2.1).

4.1.5. Comparison of Concepts and Assessment

For this comparison, the research assumes that any methodology or set of practices won't comply with the agile values at 100%. Participants rated each assessment (from 1 to 5) based on their knowledge and experience, taking into consideration that this is a holistic comparison. The Agility Accuracy variable shows how close to the agile values a subject is (refer to Appendix A).

Figure 8

Graphic representation of the average Agility Accuracy



4.1.5.1. **1st Value and SCRUM.** By definition, SCRUM was designed to work with processes. In fact, it is a "a process framework" (The Scrum Guide 2017 p.3 Purpose of the Scrum Guide); meaning that "various processes… can be employed within…" (The Scrum Guide 2017 p.3 Scrum Definition).

Processes, by any means, are and always will be part of every organization; people empowerment is a completely different concept and does not necessarily require a framework or methodology to put in practice. Furthermore, Scrum provides processes cleverly named "events" and "artifacts", as well as rules; which are —in fact, mandatory (see Table 10) and claims to produce more efficient and cohesive teams by simply using them. As a result, organizations and practitioners fall into believing that —by using agile, they are reducing or even eliminating processes (i.e. a placebo response).

4.1.5.2. **1st Value and the PMBOK.** The PMBOK is very clear and straightforward when it indicates that its structure includes groups of processes. It's remarkable, though, that it also indicates that "the project management team is responsible for determining what is appropriate for any given project" (PMBOK Guide, p3 Purpose of the PMBOK Guide).

Non practitioners (as well as early ones) think that all processes from the PMBOK (and traditional methodologies, actually) are mandatory, as a result, this methodology is —even nowadays, considered "rigid". It's important to note that those processes, tools and techniques are mandatory for certification purposes only (i.e. the Project Management Professional certification). In real-life projects, however, organizations indeed could decide which processes, tools and techniques are necessary for any project whatsoever.

4.1.5.3. **2nd Value and SCRUM.** Most organizations that work on a project-basis generate a more-or-less description of what the resulting product is supposed to do as a whole, as well as for the constituent parts known at the beginning of every project. Such descriptions are usually documented and distributed using electronic documents (e.g. spreadsheets, gdocs) and/or ticket systems (e.g. Jira, Mantis, Redmine).

In real-life projects, SCRUM's Product and Sprint Backlog artifacts reflect —in documents or ticket systems, what a product or its constituent parts are supposed to do. Furthermore, those documents or tickets are usually needed and created before starting to develop the deliverables for every sprint (and actually are the result of a planning process).

4.1.5.4. **2nd Value and the PMBOK.** The PMBOK identifies and describes a process to develop a deliverable-oriented decomposition of the work to be executed (i.e. the Work Breakdown Structure). The WBS represents the total scope of the project; however, the standard also describes a process for change control (e.g. impact analysis), allowing the project scope to be updated when necessary (in an organized manner).

In real-life projects, multiple levels of the WBS —more importantly the lowest ones (known as working packages), are reflected also in documents and/or ticket systems (e.g. gSuite, Jira).

4.1.5.5. **3rd Value and SCRUM.** The fact that SCRUM requires stakeholders to address or convince the Product Owner to change the product backlog —according to the researcher, involves some sort of negotiation. Moreover, SCRUM states that the "scope may be clarified and *re-negotiated*"; by simple logic, a re-negotiation implies that an initial one already happened.

Real-life experience has shown that most projects actually start with negotiations between vendor and customer(s), and —for sake of legality, there's usually one or more contracts involved during the life-cycle of a project (e.g. construction, online services) as well as NDAs and other supporting documents (e.g. hand-off documents, product manuals, safety rules). Additionally, when there are new requirements that increase the scope of the project (specially after execution), vendors are in need of re-negotiate for the additional time and effort they require to create the new deliverables (specially if there's a previous contract) .

4.1.5.6. **3rd Value and the PMBOK.** The standard describes processes for managing Communications as well as Stakeholders, enhancing the ability of persons to operate synergistically while limiting disruptions during the project. This —according to the researcher, provides a more realistic scenario for collaboration; while other areas such as Integration and Procurement, help to keep the project aligned to contractual needs. Therefore, the PMBOK is closer to the 3rd value than SCRUM.

4.1.5.7. **4th Value and SCRUM.** SCRUM prescribes a fixed event for planning before each sprint (The Scrum Guide 2017 p.10 Sprint Planning) and another one in which "the Development Team plans work for the next 24 hours" (The Scrum Guide 2017 p.12 Daily Scrum) or "...adapt the Sprint Backlog as necessary, adjusting the upcoming *planned* work" (The Scrum Guide 2017 p.9 Daily Scrum). As a result, SCRUM makes room for planning on a daily basis; which in many cases ends-up being a way of reporting and control over the team and their activities rather than actual planning.

Early adopters of Scrum think that planning is not necessary. In reality, there's always a plan, maybe a small one (i.e. for the upcoming sprint), but there's always planning before execution.

Table 11

Planning sessions in SCRUM during a year

Sprints		1 Year
Weeks	Monthly	**Total**
1	4	**48**
2	2	**24**
3	1.33	**16**
4	1	**12**

4.1.5.8. **4th Value and the PMBOK.** The PMBOK defines between 9 and 10 knowledge areas, for which it prescribes individual plans (i.e. between **9** and **10**).

Contrary to what many people think of the PMBOK, it doesn't state anywhere that the Project Plan must be complete before starting a project and that it's fixed (i.e. not change-able). In fact, the project plan is update-able, most of the processes' outputs include updates to it.

4.2. Head-To-Head Comparison

This comparison considers a rigid methodology (i.e. the PMBOK) to provide a context and then compares key points instead of concepts. Due to the fact that both subjects are different (and SCRUM doesn't really provide much details), the key points of comparison that are important for this argument are the knowledge areas (KA) described by the PMBOK.

Selected 9 KA are part of the 3rd version of the PMBOK because it's one of the most antique versions of it and they simply represent —according to the researcher, a good way to identify and classify the overall group of activities and/or processes involved in a project.

Additionally, due to the trendiness of SCRUM, the comparison (and the whole research, actually) considers any type and any size of project rather than just software projects.

Participants for this part of the research are members of different organizations located in Ecuador, all of them with knowledge and experience with both subjects. Each participant was provided with a full list of knowledge areas, processes and T&T along with assessments from the research (refer to Appendix B). Assessments are validated by participants when they compare processes based on their experience and give a proximity value to each one of them, making 5 validations for 44 processes (220 in total).

Table 12 shows the average values of proximity for each knowledge area, Appendix B shows detailed values for all processes within each KA as well as tools and techniques. The value for the PMBOK is set to 5 because it's considered as the rigid subject.

Table 12

Average values of proximity to the rigid subject (i.e. the PMBOK)

Value	PMBOK	SCRUM
Average	**5.00**	**3.99**
Integration	5.00	4.43
Scope	5.00	4.40
Time	5.00	4.67
Cost	5.00	3.00
Quality	5.00	3.67
Human Resource	5.00	3.75
Communications	5.00	4.50
Risk	5.00	4.33
Procurement	5.00	3.17

From the comparison and assessment validation, we can realize that even though the agile subject doesn't describe specific processes, organizations actually use several which are part of the rigid one (plus the ones provided by Scrum or any other agile method or practice), and both use them in a cyclical manner. Similarly, many of the tools and techniques provided by the rigid subject are also used in scrum-based projects, expert judgment and information systems being the most used tools by both.

There's planning after all when using the agile subject —in fact, the sprint backlog artifact is also a plan, project teams usually follow a plan, the planning process is very frequent (see Table 11) and planning activities are mostly the same.

Agile teams are actually managed not only by themselves but also by additional roles (e.g. PM, DM, Team Leader) and/or additional organizations (e.g. sponsors, staffing, off-shoring) plus the use of organizational processes managed by other areas (e.g. HR, Finance, C-Level). Actually, the only part for which a scrum team is indeed self-managed is the one in which developers are the only ones entitled to decide how to achieve the sprint goal.

The rigid subject provides multiple alternatives and guidance regarding how to manage all the different aspects of a project, while the agile one provides predefined roles and groups of processes named "events" (shown in Table 10).

The definition of "done" is a vague concept which simplifies what most projects care about regardless of the methodology: the verification and acceptance of deliverables (for which inspection is a technique common to both subjects).

Most of the activities for scope management are the same. In fact —and contrary to most beliefs, the rigid subject actually allows updates to the project scope; providing guidance as well as tools and techniques (T&T) to control changes, while the agile one is limited to negotiations within the team.

The agile subject allows scope changes within the sprint without considering the impact of those changes, making room for practitioners to simply add items to the backlog and/or move them to the next sprint without any type of analysis. This —as a result, makes the agile subject prone to scope-creep.

Either agile or rigid, hierarchical is still the most-used way of decomposing the constituent parts of a product. In fact, most agile projects decompose a product using “epics” and “user stories” (mostly due to the impact of Behaviour Driven Development in the software industry) which are indeed still hierarchical.

A project phase has similar and even the same characteristics of a sprint. Although the WBS from the rigid subject is usually hierarchical, it has different representations and allows phase overlapping, while the agile one requires a sprint to start after another (pretty much like the cascade model).

The rigid subject adapts to different work periods while the agile one merely provides an example. This makes room for practitioners to use techniques such as point-based estimations for the duration of activities, which in most cases end-up representing days within the sprint.

Even though there are predefined roles in the agile subject, there are processes from the rigid subject being used in agile projects for planning human resources, including the generation of additional or supporting roles as well as staffing.

Surprisingly, the agile subject provides little to none references or guidance regarding developing the skills of the team; instead, it focuses on improving their interactions. Similarly, it doesn’t provide references or guidance regarding procurement management.

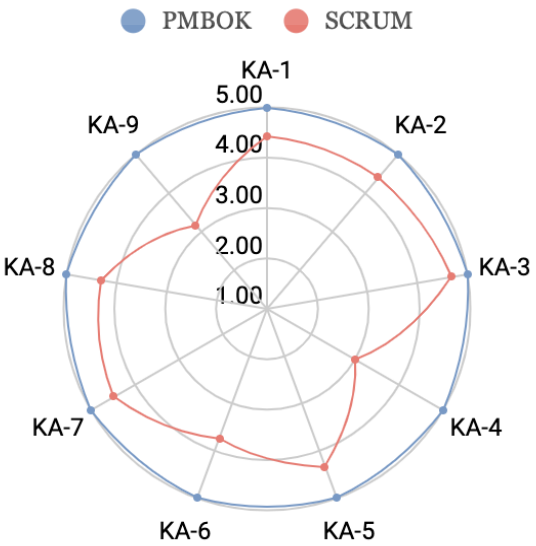
The agile subject focuses more on information availability and reporting rather than communications. The simple use of the framework or a specific event doesn't guarantee effective communications; in fact, communication among team members happens mostly outside the events.

Inspection is considered by the rigid subject as a tool or technique to perform Quality Control (as well as for other processes). The agile subject relies heavily on inspections, as a matter of fact, inspections is the only tool or technique actually provided by it; any other tool or technique is up to the project team and/or participating organizations.

In short, we can see that scrum events and artifacts are actually very close to processes, tools and techniques from what is considered by many as a "rigid" methodology. Additionally, the higher values from the agile subject are those for planning and control. Finally, the rigid subject —contrary to most beliefs, indicates that the project management team is responsible for determining what is appropriate for any given project instead of applying good practices uniformly on all projects.

Figure 9

Graphic representation of proximity to the rigid subject (i.e. the PMBOK)



5. Experimentation Results

The experiment measured the quality of the key aspects of a project, regardless of the type, allowing for data analysis and interpretation from real-life experience. This chapter shows analytical results of experimentation along with an interpretation of them.

Table 13 shows the results of the statistical analysis using a value of 1 (equivalent to 4 in the Likert scale or *high degree*), a statistical significance of 0.05 for both agile and rigid projects. Appendix C, instead, shows the range of data collected during 9 months along with their respective calculations of the p value (see Montgomery, Design and Analysis of Experiments 8th ed.).

Table 13

Results of data analysis

Quality of Preset Communication Events (QLTY-PCE)				
Is 1 or high degree (Likert 4)		$\|H_o\| \mu = 1$	$\|H_o\| \mu < 1$	$\alpha = 0.05$
	Average	LOC	Z-Test	Result
Agile	1.33	95.00%	0.000000000	Reject
Rigid	1.44		0.000000000	Reject
Quality of Preset Communication Channels (QLTY - PCC)				
Is 1 or high degree (Likert 4)		$\|H_o\| \mu = 1$	$\|H_o\| \mu < 1$	$\alpha = 0.05$
	Average	LOC	Z-Test	Result
Agile	1.73	95.00%	0.000000000	Reject
Rigid	1.92		0.682269973	Fail to Reject
Quality of Deliverables (QLTY - DIL)				
Is 1 or high degree (Likert 4)		$\|H_o\| \mu = 1$	$\|H_o\| \mu < 1$	$\alpha = 0.05$
	Average	LOC	Z-Test	Result
Agile	1.47	95.00%	0.000000000	Reject
Rigid	1.52		0.000000000	Reject

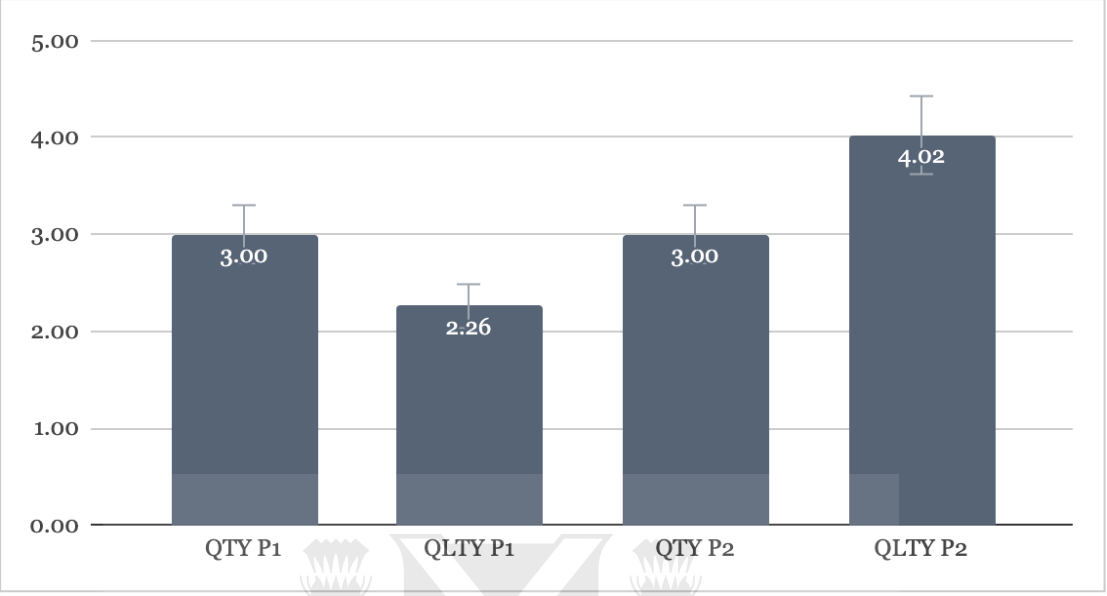
Active presence in planning (APP)				
Is 1 or high degree (Likert 4)		$\|H_0\| \mu = 1$	$\|H_0\| \mu < 1$	$\alpha = 0.05$
	Average	LOC	Z-Test	Result
Agile	1.87	95.00%	0.000000000	Reject
Rigid	1.20		0.000000000	Reject
External influences				
Is 1 or high degree (Likert 4)		$\|H_0\| \mu = 1$	$\|H_0\| \mu < 1$	$\alpha = 0.05$
	Average	LOC	Z-Test	Result
Agile	1.73	95.00%	0.000000000	Reject
Rigid	1.36		0.000000000	Reject
Project Visibility				
Is 1 or high degree (Likert 4)		$\|H_0\| \mu = 1$	$\|H_0\| \mu < 1$	$\alpha = 0.05$
	Average	LOC	Z-Test	Result
Agile	2.00	95.00%	0.000000000	Reject
Rigid	2.00		0.000000000	Reject

Based on the analytical results of the experiment, we can clearly see that the result of the Z-Test (i.e. the p value) for each subject is zero except for the Rigid QLTY-DIL. A value of p = 0.000 means there's no statistically significant possibilities to gather a value higher than the average for each subject if the true mean is actually 1 (or 4 in the Likert scale).

In case of the Rigid QLTY-PCC (the only one which failed rejection), we can see in Figure 10 that the quantity is the same in both cases but the perceived quality of the rigid one is 1.76 points lower than its agile counterpart.

Figure 10

Quality and quantity of communication channels for P1 and P2



Both projects were executed by two different organizations. Regardless, communication channels are virtually the same; preset or not.

Table 14

Communication channels used in selected projects, P1 don't use voice because it was executed during COVID-19 Lockdowns, therefore remotely

Project 1 - Rigid (P1)		Project 2 - Agile (P2)	
Preset	Non Preset	Preset	Non Preset
Slack	Zoom	Voice	Voice
Corporate e-mail	Whatsapp	Whatsapp	Whatsapp
G-Meet	G-Meet	Personal e-mail	Personal e-mail
Zoom	Personal e-mail	Phone calls	Phone calls
	Phone calls		

By taking a look at Figure 11 and 12, we can interpret that despite the fact that the quality of communication channels in P1 is relatively low compared to P2, the quality of its communications is higher than P2 by 0.77 points.

Figure 11

Perceived quality of overall communications for P1 Rigid (AVG 4.37)

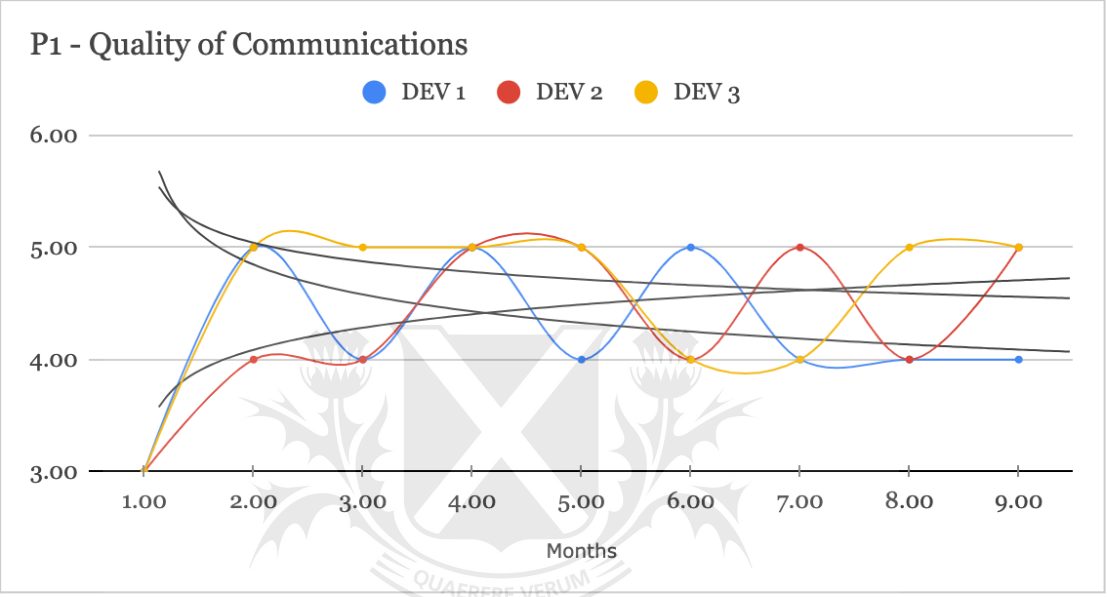
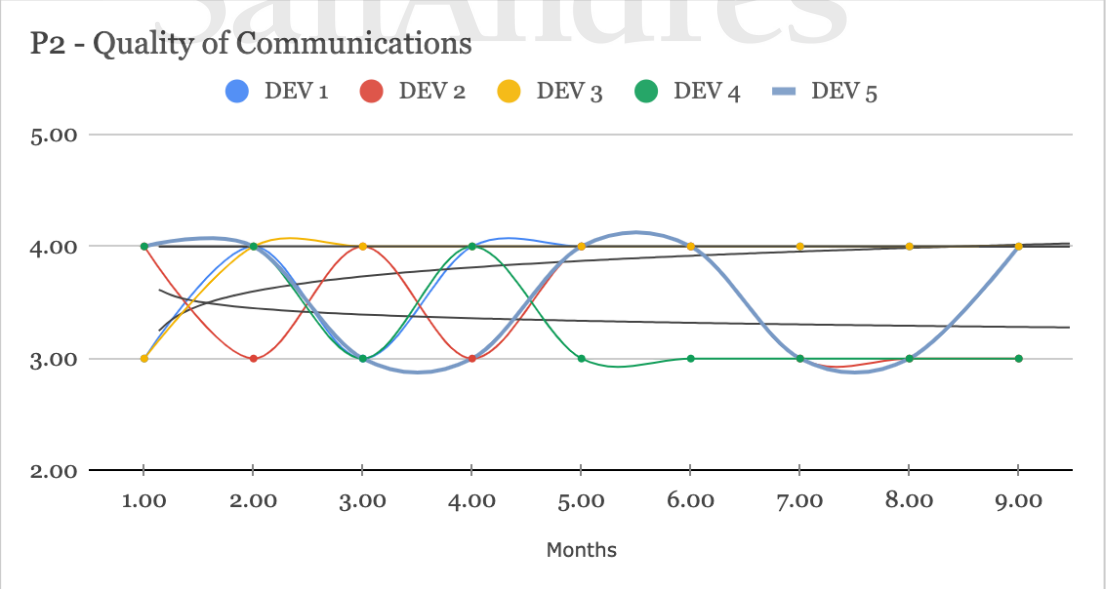


Figure 12

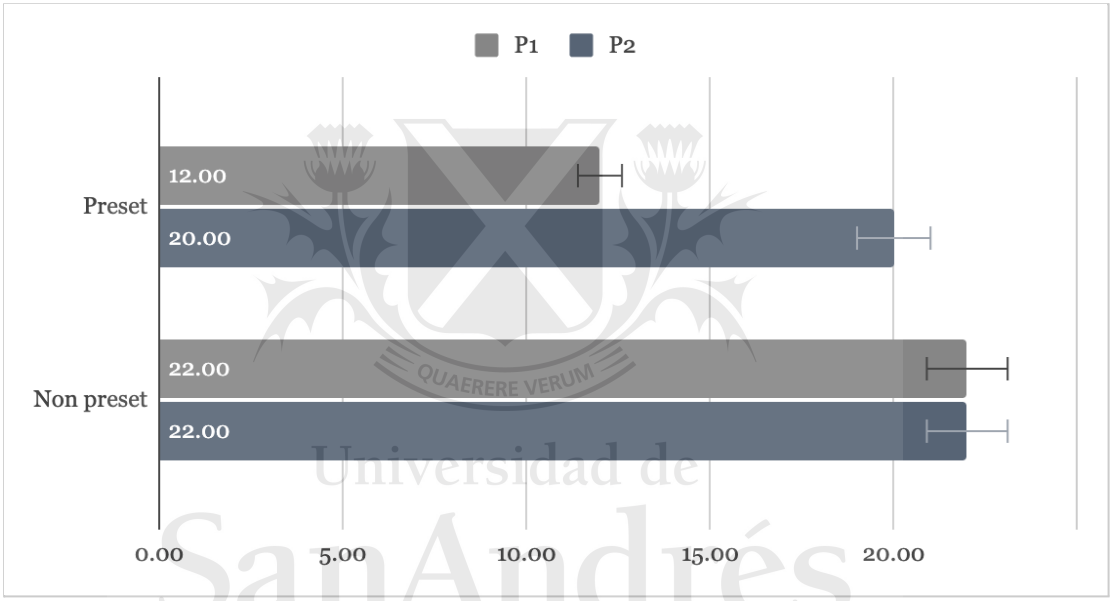
Perceived quality of overall communications for P2 Agile (AVG 3.60)



By taking a look at Figure 13, it becomes obvious that despites the quantity of communication events, channels and their quality; quality of communications was still higher in P1 than P2. If we consider that P2 had more preset communication events, we can then conclude —and therefore **answer research question II**, that communications in P2 were not significantly improved by the sole use of an agile methodology or framework.

Figure 13

Quantity of communication events for P1 and P2



When analyzing Figure 14 and 15, we can see a difference of 0.73 points between the two subjects; being deliverables of P1 of a perceived quality higher than P2. However; we must consider that even though SCRUM events involve all "developers", not just everybody perceives them in the same way and, similarly, not just everybody can be empowered by simply switching PM management or organizational styles (read more in Chapter X Conclusions and Recommendations).

Figure 14

Perceived quality of deliverables (by the execution team) for P1 Rigid (AVG 4.37)

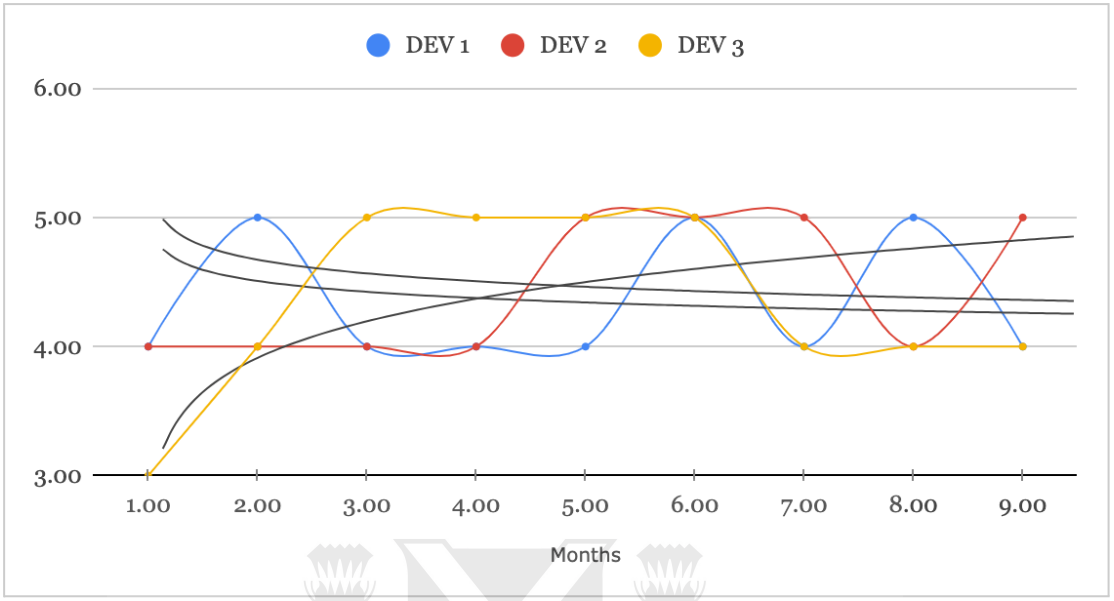
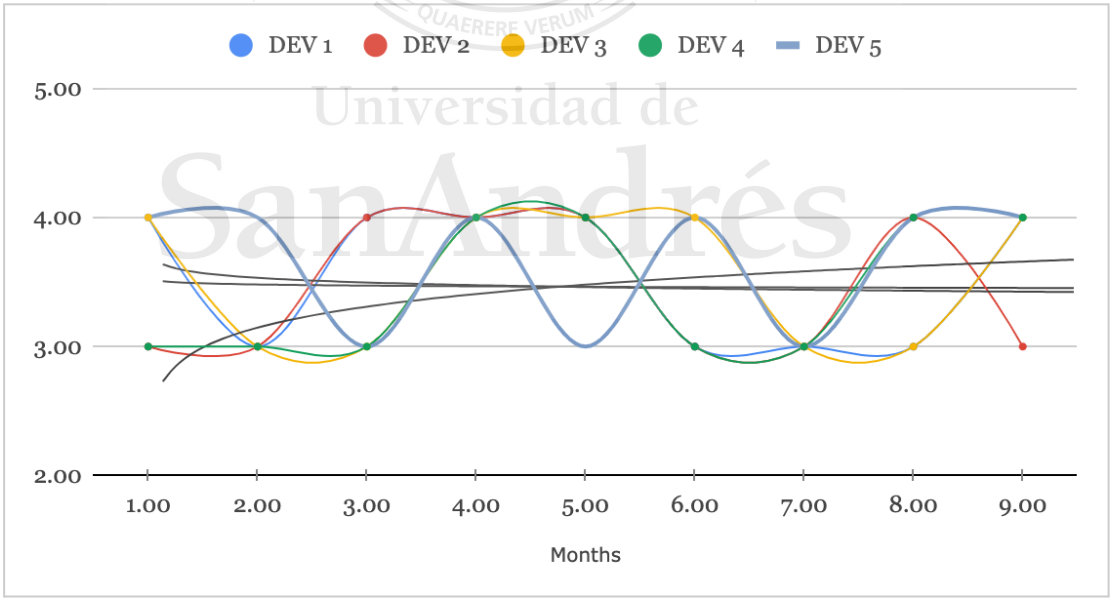


Figure 15

Perceived quality of deliverables (by the execution team) for P2 Agile (AVG 3.51)

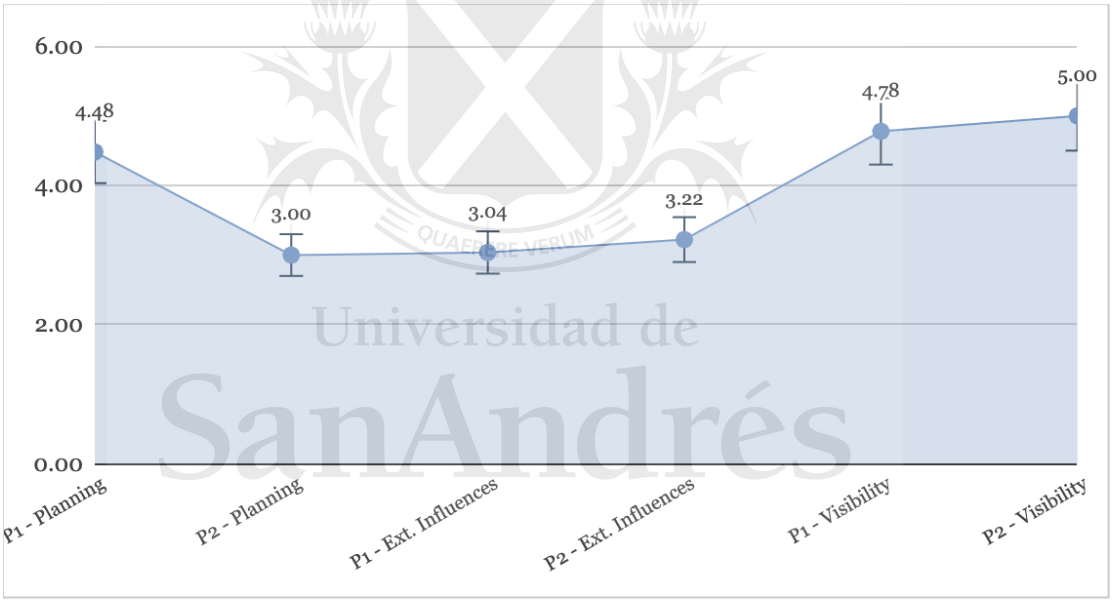


When analyzing Figure 16, we can clearly see that the most satisfied stakeholders are the ones related to project visibility. During ad-hoc conversations, the researcher got to know that the participation of management and/or C-level in P1 was not always constant, which explains the lower values in the results.

In the case of P2; due to its nature, external influences (i.e. from management or C-Level) are minimal and —when they happened, are mostly due to changes in the market (e.g. when the price of cement increases, the Sponsor decided to use less-quality mortar formula for specific deliverables).

Figure 16

Perceived satisfaction for P1 Rigid and P2 Agile



6. Conclusions & Recommendations

This research proposes a reference and structure for a bigger, broader research in the future. It also aims to help organizations and the PM community with information for better decision making. As a final step the research questions as defined in the first chapter are examined in the current chapter, and recommendations for practice are given.

As any other research, the current research involves certain limitations. Based on these limitations, topics for further research are identified.

6.1. Research Questions

As defined in the first chapter, the central and only hypothesis of the current research is:

"*The adoption of SCRUM due to its trendiness rather than an actual need generates a placebo response in modern organizations*"

In order to accept or deny such a hypothesis and structure the research, a decomposition of the main problem has been applied, resulting in several research questions. In this section, a reflection is given on each of the research questions, which -according to the researcher, reflects close enough what the hypothesis rises; therefore accepting it.

6.1.1. How agile actually is Scrum?

By taking a look at the results from the research, we could say that SCRUM is not very agile after all; but we could also say that the PMBOK is not so rigid after all. As it has become evident for many agile practitioners, there is no clear and standardized definition of "agile", which in turn makes it difficult to conceptually classify whether a methodology or framework is agile or not.

The general conclusion of the research regarding this question is that Scrum (and any other PM methodology) is as agile as the organization that uses it is. By agile I mean light-weight but comprehensive product documentation instead of ticket-based conversations, craftsmanship of the necessary tools and techniques to do the work necessary in time with a high degree of quality.

6.1.2. Does Scrum actually improve project communications?

Based on the results from the research, the researcher concludes that the simple fact of using Scrum (or any framework or methodology, actually) does not necessarily improve communications within a project or an organization.

What actually improves communications is a mixture of positive attitude, tolerance, learning to listen, consistent body language and about understanding the emotion and intentions behind the information.

6.1.3. Is agility a competitive advantage?

Based on results from the research, the researcher concluded unequivocally that agility is not a competitive advantage. It's just trendy.

Agile requires discipline (Uncle Bob, 2016, The Future of Programming). Scrum is a mechanism of control and reporting, rather than a framework or methodology to manage projects, much less it represents any real competitive advantage.

Nowadays, there is a general consensus that the frequent delivery of value is an important part of a good competitive advantage. The frequency of delivery is actually a decision, regardless of the methodology. Not just every single project could be treated as agile and presume to deliver something every week or every month, especially if there's a ton of meetings in the middle.

6.2. Limitations

As any other research, the current research involves certain limitations. The amount of project management methodologies and frameworks is relatively high. The current research provides a frame of reference to compare PM methodologies, but doesn't include all of them.

Another limitation regarding the scope of the research is that the vast amount of information available regarding the field of Project Management makes the audience reluctant to participate in surveys that cover the whole scope of a methodology or framework.

An important limitation regarding experimentation. Projects' information was subject to approval from the sponsors, and not available in its entirety.

6.3. Recommendations

During the course of this research, knowledge is gained in the field of PM and its integration within the organizational model. Based on this experience, several recommendations can be made.

6.3.1. Mindset

Strive for success, not for failure. Success often instead of failing often. If you need to create a plan and your plan will deliver value, it's ok to do it..

6.3.2. A process is not the devil

Process is not a synonym of mandatory. An organization defines a process as mandatory or not according to its needs and/or strategies. When a process is mandatory, it doesn't mean that you won't enjoy it. After all —if you are using Scrum, you are already using and participating in mandatory and time-boxed events.

Remove "organizational fat" from your processes, remove entire processes if necessary. That will make you more agile than simply adopting a methodology or framework.

6.3.3. Selection Criteria

Think twice about using Scrum (or agile) upfront for any project whatsoever. Before starting a new endeavour, research about your options to properly manage it, compare them, analyze them then decide what to use. If you work with multiple projects from multiple different customers, it could be a good idea to generate a standardized selection criteria, or even a process.

6.3.4. Communication

Improve communication skills of the entire organization, do it constantly. Many projects have a lot of back-and-forth communications using comments in online systems like Jira. Encourage communication among human beings rather than systems.

If you decide to use mandatory communication processes (or "events"), make them effective and enjoyable, and analyze their effectiveness. That will give you insight to make decisions toward communication improvements and employee satisfaction. Remember, a daily systematic questioning is not communication, rather, it's the very definition of interrogatory.

By improving communication skills within the organization, you'll improve communications with your customers and providers.

6.3.5. Competitive Advantage

Find the middle-point between organization and methodology; in which the methodology adapts to your organization, or vice versa if the situation requires it. That will make you more agile than simply adopting a methodology or framework.

The frequency of delivery is actually a decision, consider this when planning your project, either if you do it upfront or not. Communications with your customers should give you enough information to decide the frequency of delivery as well as changes on it.

By frequent delivery I don't mean to avoid planning, either at the beginning or during a project. In fact, it is a cyclic endeavour in several methodologies.

Quality could (and should) be planned rather than just inspected. Many start-ups avoid this step and start creating products and services upfront. Remember that the cost of preventing errors is lower than the cost of fixing them. The mixture of high degree of quality in products and services, plus the proper and dynamic frequency of delivery will also help in strategic positioning.

Documents do exist —and always will, use them wisely. Record your failures, workarounds and tools and techniques so others know what to do and/or what to use if the same scenario occurs in the future. Welcome the generation of documents upfront if your project requires it, remember that projects are not only related to software, complex endeavours could require proper documentation so as all stakeholders know what the product is about and the complexity of its constituent parts. Welcome the use of supporting tools to generate documents about your projects and products, like voice records, voice-generated had-hoc documents or video-recorded knowledge-sharing sessions.

Measure the satisfaction of your staff; by that I mean measure it numerically or statistically; one-to-one sessions based on "how do you feel" type of questions and without any measure is not enough. Remember: what is not measured can't be improved. Listen to your staff, especially the senior staff, because they are usually experts in their field and know better from experience than from a trendy practice. A group of satisfied and encouraged people will increase the chances for a good competitive advantage.

Create an agreement for changes in scope (which actually change the cost baseline[s]) so as the project team and customers or sponsors can easily create a program or portfolio. In this way we can deliver frequently (as agility wants) without drastic changes and avoiding the waste of time, effort, resources and even deliverables. That in turn will create a good working climate for all stakeholders (including investors or sponsors).

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https://youtu.be/ecIWPzGEbFc?t=3817.

Appendix A

Agility Accuracy

AGILE VALUE	PARTICIPANT	SCRUM	PMBOK
	Average:	3.30	3.35
1. People over processes			
	Manager de Procesos	2	4
	Jefe de Tecnología	3	3
	CEO	3	4
	Civil Engineer	3	3
	Leader de Desarrollo	3	3
2. Products that actually work over documenting what that product is supposed to do		3.4	3.2
	Manager de Procesos	4	3
	Jefe de Tecnología	3	3
	CEO	3	4
	Civil Engineer	4	3
	Leader de Desarrollo	3	3
3. Collaborating with customers over negotiating with them		3.2	3
	Manager de Procesos	3	3
	Jefe de Tecnología	4	3
	CEO	3	3
	Civil Engineer	3	3
	Leader de Desarrollo	3	3
4. Responding to change over following a plan		3.8	3.8
	Manager de Procesos	3	5
	Jefe de Tecnología	5	3
	CEO	3	4
	Civil Engineer	5	4
	Leader de Desarrollo	3	3

Appendix B

Rigid Proximity

KNOWLEDGE AREA / PROCESS	PMBOK-3	SCRUM-17	
	5.00	4.06	
INTEGRATION		4.43	
Project Charter	Formally authorizes a project or a project phase.	3	N/A
Provides important information about the project (e.g. purpose, resources, management approach).		Organizations usually have templates and a shared storage to share the same information.	
There's usually one or more documents (e.g. contracts, SWOs) to authorize a project or a phase.		Same	
There's usually one or more supporting documents (e.g. NDAs).		Same	
Organization decides which document(s) to use (if possible).		Same	
T&T: selection methods, PM and organizational processes, information system(s), expert judgment.		Same. Organizational processes are always present, ticket-based and time-tracking systems, online drives, experts are part of the team (i.e. senior roles).	
Preliminary Project Scope Statement	Provides a high-level scope narrative.	4	Product Backlog
Removed in the 4th edition.		Early versions of the Product Backlog.	
		Organizations usually have one or more documents describing the whole product result of a project, specially complex products.	
T&T: PM and organizational processes, information system(s), expert judgment.		Same. Organizational processes are always present, ticket-based and time-tracking systems, online drives, experts are part of the team (i.e. senior roles).	
Project Management Plan	Actions to define, prepare, integrate, and coordinate.	5	Sprint Planning / Backlog
Results in a PM plan that is updated and revised.		Each sprint has a goal, a design and flexible plan.	
Phases could be handled as sub-projects.		Sprints could be handled as small projects.	
T&T: PM and organizational processes, information system(s), expert judgment.		Same. Organizational processes are always present, ticket-based and time-tracking systems, online drives, experts are part of the team (i.e. senior roles).	
Direct and Manage Execution	Executing the work defined.	5	Sprint
		Part of the sprint.	
T&T: PM and organizational processes, information system(s), expert judgment.		Same. Organizational processes are always present, ticket-based and time-tracking systems, online drives, experts are part of the team (i.e. senior roles).	
Monitor and Control	Monitor and control project work	5	Events
		All events except the sprint itself but mostly the Daily Scrum.	
T&T: PM and organizational processes, information system(s), expert judgment, performance measurement techniques (e.g. earned-value).		Same. Earned-value techniques are also used in agile projects, organizational processes are always present, ticket-based and time-tracking systems, online drives, experts are part of the team (i.e. senior roles).	
Integrated Change Control	Requests, approving and controlling changes.	5	Events
Includes deliverables and process assets.		"each event is a formal opportunity to inspect and adapt something"	
T&T: PM and organizational processes, information system(s), expert judgment.		Same. Organizational processes are always present, ticket-based and time-tracking systems, online drives, experts are part of the team (i.e. senior roles).	
Close Project	Formally close the project or a phase.	4	Sprint Review / Retrospective
Close project or phase.		Close sprint. Doesn't really consider the end of a project.	
Deliverables from one phase are usually reviewd for completeness and accuracy.		Inspection of deliverables and the team, improvements plan.	
Administrative and contract closures.		n/a	
T&T: PM and organizational processes, information system(s), expert judgment.		Same. Organizational processes are always present, ticket-based and time-tracking systems, online drives, experts are part of the team (i.e. senior roles).	
		Con: due to its nature, there are cases in which a project seems endless.	
		Con: in fact, it doesn't consider the end of a project, only the sprint.	

SCOPE		4.40	
Scope Planning		5	Framework

KNOWLEDGE AREA / PROCESS	PMBOK-3	SCRUM-17	
Provides guidance on how the scope will be defined, documented, verified, managed and controlled.		Pre-defined by the framework: sprint planning and backlogs.	
Enables creation, maintainance and approval of the WBS.		Enables the creation and maintanance of product and sprint backlogs.	
Specifies formal verification and acceptance of deliverables.		Definition of "done"	
Specifies how requests for changes to the scope will be processed.		Negotiations between Product Owner and Development team.	
Real-life projects usually have a phase or stage for planning or feasibility before starting the project.		Same	
T&T: expert judgment, templates, forms, standards.		Same	
Pro: the fact that it provides a process for planning makes it adaptable to any organization and projects of any type and size.		**Con:** the organization adapts to it.	
Scope Definition		4	Framework
Greater specificity because more information about the project is known.		Updates to the product and/or sprint backlogs.	
Many organizations tend to detail a product as much as possible since the beginning, specially complex products (e.g. interest swap trading).		Same	
T&T: product analysis, alternatives identification, expert judgment, stakeholder analysis.		Same	
Create WBS	Deliverable-oriented decomposition	5	Sprint Backlog
Usually hierarchical.		Usually described as a "user stories" and "epics", but still hierarchical.	
Represents the work specified in the current scope.		Same	
Multiple ways of representation (e.g. through work packages, by phase).		Most organizations stick to "user stories" and "epics".	
T&T: templates, decomposition, information systems.		Same. Decomposition is usually reflected in ticket-based systems (e.g. Jira).	
Pro: allows phase overlapping.		**Con:** a sprint must start after another (aint that like the cascade model?).	
Scope Verification		5	Empirical
Formal acceptance of the scope.		Many agile projects include a "grooming" or "backlog refinement" process in which formal acceptance is set.	
		There's usually a review and acceptance from Product Owner(s) and other stakeholders (e.g. team leader, sponsor).	
T&T: inspection		Same	
Scope Control		3	Empirical
Applying actions defined in planning.		Negotiations with Product Owner is the only defined way to change the scope of both backlogs.	
Controlling the impact of changes.		Undefined. Usually based on organizational processes.	
T&T: change control system, variance analysis, replanning.		Same. Ticket-based systems usually have features to track changes and show variance charts (e.g. burdown), all software projects use a semantyc versioning system (usually git).	
		Con: several practitioners simply add items to the product backlog or move activities to the next sprint without analyzing the impact.	

TIME		4.67	
Activity Definition	Identifying specific activities	5	Sprint Planning
T&T: decomposition, templates, Rolling Wave Planning, expert judgment, planning component.		Same	
Activity Sequencing	Identifying and documenting dependencies	5	Sprint Planning

KNOWLEDGE AREA / PROCESS	PMBOK-3	SCRUM-17	
Logical relationships among activities.		Identified dependencies are usually in ticket-based systems during all events (including refinement and/or scrum of scrums) but mostly during sprint planning.	
T&T: PDM, ADM, network templates, determination.		Same. Dependencies are usually set using information systems (e.g. Jira uses ADM).	
Activity Resource Estimating	Estimating type and quantities of resources	5	Sprint Planning
Estimating resources (i.e. persons, equipment or material) and quantities of each.		Same	
T&T: expert judgment, alternatives analysis, published estimating data, PM software, bottom-up estimating.		Same	
Activity Duration Estimating		4	Sprint Planning
Estimating the number of work periods		Usually estimated in "points", which in most cases reflects in working days.	
		Many agile projects include a "grooming" or "backlog refinement" process.	
T&T: expert judgment, analogous estimating, parametric estimating, three-point estimates, reserve analysis.		Same. Burndown charts are usually based on parametric estimating.	
Pro: adaptable to different work periods.		**Con:** non-adaptable, activities are supposed to be of 1 day or less.	
Pro: detailed T&T allows real adaptation to any size of project.		**Con:** lack of details makes people think they are agile (i.e. placebo response).	
		Con: lack of detailed T&T makes people stick to the poker cards becasue they saw others using it.	
Schedule Development		4	Sprint Planning
Analysis, including constraints		Sprint Planning	
Iterative process.		Same	
		Many agile projects include a "grooming" or "backlog refinement" process.	
T&T: network analysis, critical path method, schedule compression, what-if analysis, resource leveling, critical chain method, PM software, calendars, leads and lags adjusting, schedule model.		Most organizations stick to expert judgment and ticket-based systems.	
		Con: lack of details makes people think they are agile (i.e. placebo response).	
		Con: lack of detailed T&T makes people stick to the poker cards becasue they saw others use it.	
Schedule Control	Controlling changes	5	Sprint and Product Backlogs
Managing the actual changes as they occur.		Negotiations with Product Owner.	
T&T: progress reporting, change control system, performance measurement, variance analysis, charts.		Same. Progress reporting is performed daily, at the end of the sprint, additional meetings and using time-control systems (e.g. clockify).	
		Change control is usually a feature of ticket systems, all software projects use a semantic versioning system (usually git) for controlling changes.	
		Performance measurement is empirical; usually measured in speed units or "burndown", using pre-defined techniques provided by the ticket system.	

COST		3.00	
Cost Estimating		3	N/A
Approximation of the costs of resources.		Undefined. Relies on organizational processes.	
Cosiders various costing alternatives (including that one used by SCRUM-based projects).		Usually estimated in $ per hour per resource.	
Considers enterprise environmental factors and organizational process assets (e.g. policies, templates).		Other costs are always present (e.g. PC's, electricity, rent) and considered by all organizations when budgeting a project.	
T&T: analogous estimating, determine resource cost rates, bottom-up estimating, parametric estimating, PM software, vendor bid analysis, reserve analysis, cost of quality.		Same	

KNOWLEDGE AREA / PROCESS	PMBOK-3	SCRUM-17	
Pro: considering enterprise environmental factors and organizational process assets makes it adaptable to any organization.		**Con:** it's a framework, the organization adapts to it.	
Pro: considering various costing alternatives makes it adaptable to projects of any type and size.		**Con:** doesn't provide any T&T except that what is "observed".	
		Con: the only resources actually considered are the scrum roles.	
Cost Budgeting	Establishing a total cost baseline.	3	N/A
Aggregates the estimated costs of individual activities.		Most organizations establish a total cost baseline based on what is known so far about the product (e.g. per sprint or milestones).	
T&T: cost aggregation, reserve analysis, parametric estimating, funding limit reconciliation.		T&T are not provided. Organizations usually use T&T based on the expertise of their staff/departments (e.g. financial, accounting).	
Cost Control	Controlling changes to the budget.	3	N/A
Ensuring requested changes are agreed upon.		All organizations have at least one process for controlling the budgeting of projects.	
Managing the actual changes when and as they occur.			
Monitoring cost performance.			
T&T: change control system, performance measurement analysis, forecasting, project performance reviews, variance management.		Same	
Pro: "when and as they occur" makes clear that it's adaptable and agile.		**Con:** doesn't really cosider the cost of projects.	
QUALITY		4.33	
Quality Planning	Quality standards	5	Sprint Planning
Identifying quality standards.		Mostly during sprint planning.	
Define how to satisfy quality standards.		Mostly during sprint planning.	
T&T: cost-benefit analysis, benchmarking, design of experiments, cost of quality, additional quality planning tools.		Same. The use of one or another T&T varies according to the application area.	
Quality Assurance	Applying quality activities	3	N/A
Ensure that the project employs all processes needed to meet requirements.		Undefined. Assumable as "part of the sprint". Reporting happens daily.	
T&T: same as planning, quality audits, process analysis, same as quality control.		Same. The use of one or another T&T varies according to the application area.	
Quality Control	Monitoring specific project results	5	Daily SCRUM / Sprint Review
Determine results comply with quality standards.		Part of the sprint.	
Identify ways to eliminate causes of unsatisfactory performance.		Part of the sprint.	
T&T: cause and efect diagram, control charts, flowcharting, histogram, pareto chart, run chart, scatter diagram, statistical sampling, inspection, defect-repair-review.		T&T are not provided but in reality organizations use several of the same described in the PMBOK. Charts and diagrams are usually provided by ticket-based systems and/or systems purposed for quality control.	

HUMAN RESOURCE		3.75	
Planning		4	Framework / Sprint Planning
Identifying and documenting project roles, responsibilities and reporting relationships.		Pre-defined roles. Reporting relationships are unexistent.	
		Reporting relationships are usually set by participant organizations.	
Creating the staffing plan.		At least one of the participant organizations is reponsible for this at the beginning of a project, further staffing needs are handled during planning and additional events.	
T&T: organization charts and position descriptions, networking, organizational theory.		Same	
Aqcuire Project Team		3	N/A
	Obtaining human resources.		Undefined. Assumable as "part of the sprint", usually up to HR and senior roles.

KNOWLEDGE AREA / PROCESS	PMBOK-3	SCRUM-17	
	Project management team may or may not have control over team members selected.		Same
	T&T: pre-assignment, negotiation, acquisition, virtual teams.		Same
Develop Project Team		3	Events
	Improving competencies and interaction.		Focuses on interactions.
	Enhances project performance.		During all events but mostly during sprint review and retrospective.
	Improve skills of team members.		Undefined. Usually set by organizational efforts.
	Improve trust and cohesiveness among team members.		Sprint retrospective, daily scrum (?)
	T&T: general management skills, training, team-building activities, ground rules, co-location, recognition and rewards.		Same
Manage Project Team	Performance, feedback, issues, changes	5	Events
	Tracking performance.		Daily scrum, sprint review.
	Resolving issues.		Daily scrum, retrospective.
	Coordinating changes.		All events.
	T&T: observation and conversation, performance appraisals, conflict management, issue log.		Same. Issue logs are usually represented in online documents or HRMS.
COMMUNICATIONS		4.50	
Planning		3	Framework
		Pre-defined by events and artifacts.	
Determining information and communications needs of stakeholders (e.g. need-to-know).		Based on organizational processes usually managed by HR and additional roles (e.g. Delivery Managers).	
T&T: requirements analysis, communications technology.		Same	
Pro: Considers enterprise environmental factors.		**Con:** does not considers enterprise environmental factors.	
Information Distribution	Information availability	5	Framework
	Making information available to stakeholders in a timely manner.		Pre-defined by events and artifacts.
	T&T: communications skills, information gathering and retrieval systems, information distribution methods.		Same. Gathering and retrieval systems are usually online drives and comments in ticket-based systems.
Performance Reporting		5	Events
	Involves the collection of baseline data, and distribution of performance information.		Collection is performend during daily scrum, sprint review and retrospective.
			Distribution happens during the same events plus any other organizational process or event (usually on a need-to-know basis).
	T&T: information presentation tools, information gathering and compilation, status review meetings, time reporting systems, cost reporting systems.		Same. Many organizations use separate information systems for accounting and/or finance.
	Pro: when we know the needs we can plan our meetings schedule with accuracy and efficiency.		**Con:** due to additional events for distribution of information, the total number of meetings is high.
Manage Stakeholders		5	Events
	Satisfy communication needs and resolve issues.		All events.
	T&T: communication methods, issue logs.		Same. Issue logs are usually up to HR and/or DM, using online drives and/or HRMS systems.
RISK		4.33	
Planning		5	Sprint Planning
How to approach and conduct risk management activities.		Mostly during planning before execution but also during sprint planning due to the nature of the framework.	
		Also performed during additional "events" defined by participant organizations.	
T&T: meetings and analysis.		Same	
Risk Identification		5	Sprint Planning

KNOWLEDGE AREA / PROCESS	PMBOK-3	SCRUM-17	
Determining which risks might affect the project.		Mostly during planning before execution but also during sprint planning due to the nature of the framework.	
		Also performed during additional "events" defined by participant organizations.	
T&T: documentation reviews, information gathering techniques (e.g. brainstorming, delphi, interviews, root cause identification, SWOT), checklist analysis, assumptions analysis, diagramming techniques.		Same. The use of one or another T&T varies according to the application area.	
Qualitative Analysis		3	Sprint Planning
Prioritizing risks.		Mostly during planning before execution but also during sprint planning due to the nature of the framework.	
		Also performed during additional "events" defined by participant organizations.	
T&T: probability and impact assessment, probability and impact matrix, data quality assessment, categorization, urgency assessment.		Same. The use of one or another T&T varies according to the application area and complexity. Most software projects relies on expert judgment.	
Quantitative Analysis	Numerically analyizing effects	3	N/A
Quantify possible outcomes.			
Identify realistic and achievable cost, schedule, or scope targets.			
Determine best decisions to manage uncertainty.		Mostly during sprint planning but also during review and daily scrum.	
T&T: data gathering and representation techniques (e.g. interviews, probability distributions, expert judgment), analysis and modeling techniques (e.g. sensitivity analysis, monetary value analysis, decision tree analysis, modeling and simulation).		The use of one or another T&T varies according to application area and complexity.	
Response Planning	Options and actions	5	Events
Developing options and determining actions to enhance opportunities and reduce threats.		Mostly during planning before execution but also during all events due to the nature of the framework.	
T&T: strategies for negative risks or threats, strategies for positive risks or opportunities, contingent response strategy.		Same. Most organizations use contingent repose strategies for projects and have at least an approach —if not an strategy, to respond to risks.	
Monitoring and Control		5	Events
Tracking identified risks, monitoring residual risks.		During all events but mostly during daily scrum and sprint review.	
Executing response plans and evalueate their effectiveness.		Usually during daily scrum and sprint review.	
T&T: risk reassessment, risk audits, variance and trend analysis, technical performance measurement, reserve analysis, status meetings.		Same	

PROCUREMENT		3.17	
Plan Purchases and Acquisitions		4	Sprint Planning
Identifies which project needs can best be met by purchasing or acquiring products, services, or results outside the project organization.		Mostly during planning before execution but also during sprint planning due to the nature of the framework.	
T&T: make-or-buy analysis, expert judgment, contract types.		Same. Organizations relies mostly on expert judgment, contracts of different types are always present.	
Plan Contracting		3	N/A
Prepares the documents needed.		Undefined. Assumable as "part of the sprint".	
T&T: standard forms, expert judgment.		Same	
Request Seller Responses		3	N/A
Obtain bids and proposals from prospective sellers.		Undefined. Assumable as "part of the sprint".	
T&T: bidder conferences, advertising, qualified sellers list.		Same	
Select Sellers		3	N/A
Apply evaluation criteria.		Undefined. Assumable as "part of the sprint".	
T&T: weighting system, independent estimates, screening system, contract negotiation, seller rating systems, expert judgment, proposal evaluation techniques.		Same	
Contract Administration		3	N/A

KNOWLEDGE AREA / PROCESS	PMBOK-3	SCRUM-17	
Ensures that the seller's performance meets contractual requirements and the buyer performs according to the terms of the contract.		Undefined. Assumable as "part of the sprint".	
T&T: records management system, performance reviews, inspections and audits, payment system.		Same	
Contract Closure		3	N/A
Involves verification that all work and deliverables were acceptable.		Undefined. Assumable as "part of the sprint".	
T&T: procurement audits, records management systems.		Same	

Appendix C

Experimentation (Communications, Deliverables and Satisfaction)

VARIABLES	P-1 Monthly		Value			P-2 Monthly		Value				
COMMUNICATIONS	MIN	MAX	QTY	FREQ	QLTY	MIN	MAX	QTY	FREQ	QLTY	DIFF	Description
Preset events			12.00	12.00	4.37			20.00	20.00	3.60	0.77	
Non preset events	4.00	40.00	22.00			4.00	40.00	22.00				
Preset channels			3.00	4.00	2.26			3.00	20.00	4.02	1.76	P1: slack, e-mail, video-call P2: voice, whatsapp, phone
Non preset channels			3.00	20.00	5.00			3.00	0.00	5.00		P1: whatsapp, phone, video-call P2: voice, whatsapp, phone
Preset reporting events			4.00	4.00	3.00			0.00	0.00	3.00		Reporting to management, C-Level or sponsor.
										3.91		
DELIVERABLES	MIN	MAX	QTY	FREQ	QLTY	MIN	MAX	QTY	FREQ	QLTY		Description
Preset review events			1.00	1.00	5.00			4.00	4.00	5.00		
Non preset review events	0.00	2.00	1.00		5.00			0.00		0.00		
Overall Quality	4.00	5.00	4.50		4.37	4.00	5.00	4.50		3.44	0.93	
Scope management					5.00					5.00		Including how changes were managed.
SATISFACTION	MIN	MAX	QTY	FREQ	QLTY	MIN	MAX	QTY	FREQ	QLTY		Description
Preset measurement events			1.00	1.00	5.00			1.00	1.00	3.00		Formalization and documentation.
Active presence in planning					4.48					3.00		Participation in project and/or phase planning.
External influences					1.00					3.00		From management roles, C-Level and/or sponsor.
Visibility					5.00					5.00		Satisfaction of the C-Level and/or Sponsor.

VARIABLES	P-1 Monthly		Value			P-2 Monthly		Value				
COMMUNICATIONS	MIN	MAX	QTY	FREQ	QLTY	MIN	MAX	QTY	FREQ	QLTY	DIFF	Description
Preset events			12.00	12.00	4.37			20.00	20.00	3.60	0.77	
Non preset events	4.00	40.00	22.00			4.00	40.00	22.00				
Preset channels			3.00	4.00	2.26			3.00	20.00	4.02	1.76	P1: slack, e-mail, video-call P2: voice, whatsapp, phone
Non preset channels			3.00	20.00	5.00			3.00	0.00	5.00		P1: whatsapp, phone, video-call P2: voice, whatsapp, phone
Preset reporting events			4.00	4.00	3.00			0.00	0.00	3.00		Reporting to management, C-Level or sponsor.
										3.91		
DELIVERABLES	MIN	MAX	QTY	FREQ	QLTY	MIN	MAX	QTY	FREQ	QLTY		Description
Preset review events			1.00	1.00	5.00			4.00	4.00	5.00		
Non preset review events	0.00	2.00	1.00		5.00			0.00		0.00		
Overall Quality	4.00	5.00	4.50		4.37	4.00	5.00	4.50		3.44	0.93	
Scope management					5.00					5.00		Including how changes were managed.
SATISFACTION	MIN	MAX	QTY	FREQ	QLTY	MIN	MAX	QTY	FREQ	QLTY		Description
Preset measurement events			1.00	1.00	5.00			1.00	1.00	3.00		Formalization and documentation.
Active presence in planning					4.48					3.00		Participation in project and/or phase planning.
External influences					1.00					3.00		From management roles, C-Level and/or sponsor.
Visibility					5.00					5.00		Satisfaction of the C-Level and/or Sponsor.

Appendix D

Experts Panel & Organizations

ORGANIZATION	ORG. TYPE	NAME	ROLE	TITLE
Ministerio de Agricultura	Government	William Jácome	Manager de Procesos	PMP
Ministerio de Agricultura	Government	Roberto Mayorga	Jefe de Tecnología	SCRUM Master
Kruger Corp	Software Factory	Ernesto Kruger	CEO	Six Sigma - Black Belt
N/A	Individual	Jorge Villavicencio	Civil Engineer	PMP
Location World	Geolocation	Santiago Suárez	Leader de Desarrollo	Ing. en Sistemas

ORGANIZATION	ORG. TYPE	PARTICIPATION
Anexus Latam S.A.	IT Outsourcing	Sponsor for Project 1 Rigid
Jorge Villavicencio	Individual	Sponsor for Project 2 Agile