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Repository of Cases about Information Systems and Technology Professional Acts: Supporting Practice, Research and Teaching

Master Thesis

Integrated Master's in Engineering and Management of Information Systems

Work developed under the orientation of

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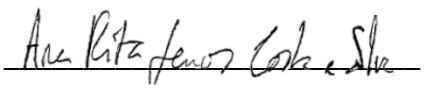
Assinatura: 

“All things are difficult before they become easy.” – Saadi

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Abstract

Repositories have been affirmed in the last decades as a solution for the use, preservation and dissemination of the increasing scientific knowledge.

The presented master thesis proposes the planning, development and consequent implementation of a repository of cases based on three fundamental perspectives: practice, research and teaching.

With this repository, the practitioners will be able to find in the cases the description of situations that have already occurred which will serve them whether an aid in decision making before an act of profession, or as an improvement of their working practices and techniques.

Researchers may accumulate cases in order to establish greater confidence in the efficacy of a method or technique or even in relation to a theory and its constructs.

Teachers will be able to use cases to promote Information Systems and Technology teaching so that their students can learn to acquire scientific knowledge, develop new competences, and improve their skills.

The presented research followed a Design Science Research methodology, in which the concepts of software engineering and project management were inherent to the conception and construction of this informatic platform, while the focus group technique was useful in the evaluation of the same application.

All in all, the proposed repository has as objective the provision of cases whose content allows the benefit of those who use it, presenting itself as an innovative and contributory solution for the scientific area in question.

Keywords: Repository of Cases; Information Systems and Technology; Scientific Knowledge.

Resumo

Os repositórios têm-se afirmado nas últimas décadas como uma solução para o uso, preservação e disseminação do crescente conhecimento científico.

A dissertação de mestrado que se apresenta propõe o planeamento, desenvolvimento e consequente implementação de um repositório de casos assente em três perspetivas fundamentais: prática, investigação e ensino.

Com este repositório, os profissionais poderão encontrar nos casos a descrição de situações já ocorridas que lhes servirão quer de auxílio na tomada de decisão perante um ato de profissão, quer numa melhoria das suas práticas e técnicas de trabalho.

Os investigadores poderão acumular casos com o intuito de estabelecer maior confiança quanto à eficácia de um método ou técnica, ou mesmo, em relação a uma teoria e seus construtos.

Os professores poderão proceder a utilização de casos para a promoção do ensino em Tecnologias e Sistemas de Informação, de modo a que os seus alunos possam aprender a adquirir conhecimento científico, desenvolver novas competências e ainda, aprimorar as suas habilidades.

O presente trabalho de investigação seguiu a metodologia *Design Science Research*, no qual os conceitos de engenharia de software e gestão de projetos foram inerentes à concepção e construção desta plataforma informática, enquanto a técnica de grupo de focos foi útil na avaliação da mesma aplicação.

Em suma, o repositório proposto tem como objectivo a disponibilização de casos cujo conteúdo permita o benefício daqueles que o venham a utilizar, apresentando-se como uma solução inovadora e contributiva para a área científica em questão.

Palavras-Chave: Repositório de Casos; Tecnologias e Sistemas de Informação; Conhecimento Científico.

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The figures displayed in this master thesis were either created, adapted or retrieved. The figures retrieved from public documents, were properly referenced, instead of being replicated by the author of the presented master thesis.

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List of Acronyms

In this master thesis are used the following acronyms.

CFG	*Confirmatory Focus Group*
DRY	Don't Repeat Yourself
DSR	Design Science Research
DT	Development Team
EFG	Exploratory Focus Group
ERD	Entity-Relationship Diagram
IS	Information Systems
IST	Information Systems and Technology
IT	Information Technology
MVC	Model-view-controller
OGC	Office of Government Commerce
PB	Product Backlog
PHP	Hypertext Preprocessor
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PO	Product Owner
RUP	Rational Unified Process
SM	Scrum Master
UML	Unified Modelling Language
WBS	Work Breakdown Structure
Yii	Yes, It Is!

Chapter 1. Introduction

This introductory chapter describes the problem of this research work as well as the goals and expected results on its development. Moreover, it presents an overview and consequent justification of the work plan and, last but not least, the structure of this report.

1.1. Research Problem

Over the years, the technological evolution and consequent development in several scientific areas, led to a considerable increase in the volume and variety of the existing information. Thus, arises the need of implementing specific and adequate repositories to a particular area of interest, not only because they are central locations that allow the collection, storage and manage that information, but also because it serves as support to users, facilitating their understanding and acquisition of knowledge.

The implementation of such repositories, in several scientific areas, had contributed over time for a myriad of practices and theories leading to successful cases. Nevertheless, the unsuccessful ones are not obsolete cases to be forgotten since that creation can be beneficial for other purposes than those it was built. For instance, professionals can learn through past situations without committing the same mistakes or even come up with a solution, answering why those cases were not well succeeded.

Consequently, these particular cases are preponderant once they assist the experts, conducting to an improvement in the performance of certain actions by looking at those supportive references. Moreover, the content of each repository is respective to the concerned field of study.

Although information can be collected, stored and managed on these central locations which enables different types of users accessing resources in a better well thought-out search, the development as well as the usage of these tools are anything less than an ordinary procedure.

This project entails the planning, development and implementation of a repository of cases in the area of Information Systems and Technology (IST), based on three different perspectives, in which all of them are involved in professional acts.

The first perspective is for the IST practitioners, who can seek past situations that can facilitate on the process of decision making in some professional work, which they are involved; secondly, will be IST researchers who will not only empower the repository by adding new cases, as they will also collect cases in order to establish confidence in effectiveness and efficiency of any method or technique, as well as trust relative to some theory and, finally, the IST teachers, where they can promote learning to students in this area of interest by the use of such cases. Lastly, the stored cases in the repository should be arranged so that some layers of cases (mini cases), can be associated with relevant theories as well as its constructs.

It is presumed a lack of repositories in this particular area, once the complexity of elaborating these platforms is not a trivial process when compared to other scientific areas that are historically much older and more feasible to apply this concept.

This master dissertation takes further developed in a doctoral thesis. The doctoral thesis held by a Ph.D. student of the Information Systems Department, at University of Minho (Rito, 2015), entailed the adoption and diffusion of Information Technologies (IT) according to initiatives launched in the scope of implanted applications in the organizations. A supporting tool that would be able to assist professionals in the context previously referred, was considered in its work.

Finally, it is possible to infer that the research problem in the context of this master thesis was better understood in the light of the above mentioned doctoral thesis. A repository of cases which describes IST professional acts, supporting the perspectives of practice, research and teaching.

1.2. Goals and Expected Results

The main objective of this dissertation project is the creation of a repository of cases that describe professional acts, to be used by practitioners, researchers, teachers and students.

Despite those perspectives being defined under the same aim, the resulting actions taken after the observation, analysis and evaluation of cases differ not only according to the type of users themselves, but also in different factors or characteristics that can condition the success of adopting such guidelines.

If the implementation of this repository leads to a more feasible and organized way of receiving information then, in reality, it should conduct to an improvement in decision-making, in effectiveness and efficiency of the actions taken, in comprehension and acquisition of knowledge about cases studies, and also in improvement or creation of theories or practices.

Moreover, it is expectable that the use of this repository of cases, supporting professional acts taken by practitioners, researchers, teachers and students, promotes a better communication and connection between these three perspectives in the IST area.

1.3. Work Plan Overview and Justification

Since this research problem involves planning, developing and implementing a repository of cases about IST area, supporting professional acts in practice, research and teaching, this master dissertation will follow the general process of Design Science Research methodology.

This methodology, which will be further explained in this document, is adequate to situations that involve the construction of artifacts (practices, theories, methods, models, approaches, etc.) for a specific purpose. Once the artifact elaborated in this research work is the production of a software (a repository of cases), then it is important to refer that we are facing a Software Engineering situation, also being described later. Additionally, it is considered to be an iterative process to prototyping, producing and refining the software according to the requirements and continuous feedback provided by the Focus Group technique, to yield a quality and successful product. Finally, the Project Management domain is also extremely preponderant for this research work, once it embraces all these terms and concepts that serve as theoretical foundation for what is seen as an outcome, without forgetting people, resources, and time management, or any other variable which significantly influences the course of the project and its phases.

The work plan is intended to be a guideline for the following phases that concerns the development and consequent implementation of this software. Moreover, it defines a set of activities or actions to be taken during a given period, which adds certainty to its approval and the continuous justification during the process of producing such repository. Such work plan will be particularly detailed later on this document.

1.4. Structure of the Report

The present document is structured in ten chapters, which are following enumerated.

Chapter 1 identifies the research problem and the motivation in which it arises, the goals and expected results of its development, the work plan overview and continuous justification of the research work.

Chapter 2 presents the literature review tied with the research problem that is characterized through the three perspectives of practice, research and teaching. A research about the possibility of other repositories of cases, either as an object of study or as an available platform, is conducted and, ultimately, a general discussion is carried through the presented objective on this research work.

Chapter 3 addresses the software engineering concept in terms of the existent software development process models and the approach taken for this research work, Scrum.

Chapter 4 clarifies the project management term explicating the software development project models as the selected one for the research work, PMBOK.

Chapter 5 contextualizes some matters in the IST research, explaining why Design Science Research methodology is considered adequate for this project, and justifying the use of focus group for the purpose of evaluating the resulting artifact.

Chapter 6 addresses the work plan for this master dissertation, with relevant variables that can influence the justification of moving forward in this work, more specifically, it is referred the activities to execute and its duration.

Chapter 7 covers the conception of the repository of cases, in terms of its requirements and the design models that involves it.

Chapter 8 approaches the construction of the repository of cases, referring not only the development tool used throughout this process, but also the demonstration of the final outcome.

Chapter 9 concerns the evaluation of the repository of cases, while using a research technique above indicated, called focus group.

Chapter 10 concludes this document with the final remarks of this dissertation project, an analysis and discussion of the results, and finally, the future work perspectives.

Chapter 2. Literature Review

In this chapter are presented several concepts considered fundamental for the research problem. Serving as a theoretical foundation for the following work, this chapter starts by addressing a general definition of what is a repository, being further detailed in the subsequent perspectives of practice, research and teaching. Consecutively, it is explained what a case is and in which terms it is assumed as the content of this type of repository. Hereinafter, a research is conducted to understand the possibility of other existent other repositories of cases, either as an object of study or as an available platform and, finally, a general discussion about the proposed repository of cases in the context of this master thesis.

2.1. Repository of Cases

Repositories had emerged in a stronger and frequently way in the last decades, mainly because of two reasons: the first one is the exponential increase of the information and the ease of access mainly due to the technological evolution, secondly, the modern ways of use, store and disseminate the information, had created the necessity of replace several traditional systems into digital repositories (Rodrigues & Rodrigues, 2012).

In fact, the term “repository” has been used among many areas with different connotations by society, becoming a buzzword. For this motive, such concept is commonly characterized according to the purpose for which it was built and the content that it possesses. Therefore, in an overview, a repository can be considered as a place where something may be deposited, saved and managed.

Regardless of their type or designation, repositories should satisfy two basic functions: the preservation and reuse of the digital objects (Minguillón, 2010). Repositories, as information systems, besides storing those digital objects, may support users to the creation of knowledge. In addition, this knowledge that arises may as well be shared through the communities in the area that the repository assists.

Likewise, repositories are commonly referred as “spaces of production and transfer of scientific knowledge” (Leite & Costa, 2006, p. 206).

As previously introduced in the first chapter, the research objective stands for the undertaking of a repository of cases. Therefore, a significant and valid question arises: if it is already known that repositories are generally mentioned by its nature and the content of what they possess, then in reality, what the term "cases" means and what they represent?

To answer this question in the context of this dissertation, cases are descriptions of real situations that happened in a certain background of an organization, about IST professional acts, which were executed by some professional in the area. Cases, as digital objects, are reused and preserved in the repository, to fulfil users of creating and be also able to disseminate scientific knowledge, thus contributing for the IST area.

The accumulation of cases into this repository is intended to contribute to reinforce or mitigate the trust in theories and its constructs, relevant to one or more professional acts. By looking through those cases, initiatives and/or actions can be taken by the practitioners, researchers, teachers or students which leads to two important matters: firstly, the repository will manage the scientific knowledge at one specific point while being functional for all these three perspectives, which avoids information bias, while the second is due to the fact this is a cyclic process flow where knowledge is captured, created, stored and shared by someone, and then by another IST professional and so on, contributing to the IST area and enriching continuously the repository with digital objects such as cases are.

Briefly, the research objective entails the conception, construction and evaluation of a repository of cases which describes IST professional acts by assisting users (practitioners, researchers, teachers or students) when taking initiatives or actions, and consequently, ensure certainty to relative theories and its constructs in this scientific area. These three perspectives of practice, research and teaching, are following described in this chapter.

2.2. Practice Perspective

A fundamental characteristic of the human being is the incessant search for knowledge it is, indeed, the engine for development and progress. Knowledge is assumed as something inexhaustible, evolutive and heterogeneous, an intangible well that organizations use to add value and differentiate themselves from others (Alavi & Leidner, 2016).

An "intelligent" organization, is the one that uses knowledge on its favour to align the core of its existence and activity, but most importantly, to be able to learn from the past and project itself in the future (Bhatt, 2001).

Moreover, the people, that are considered to be one of the most valuable resources in the organization, have the capability of transforming data into information, which generates knowledge. However, the knowledge has more impact when shared, than propriety of few (Choo, 2000).

According to Robbins and Judge (2013), knowledge management is a "process of the organization and distribution of the collective knowledge of the organization, so that the right information reaches the right person at the right time" (p. 242). Briefly, knowledge management is the practice of adding value to the information and distributing it quickly so that communities can benefit from it.

In the past years, the organizations have been treating knowledge in a more meaningful way, considering it as a significant organizational resource. However, when it comes to manage it, organizations need first to understand what is the structure and nature of the organizational knowledge, and what makes it distinct from other forms of knowledge, since it evolves from different origins and is engaged in different ways (Alavi & Leidner, 2016).

Organizations still believe that most of the knowledge they need exists inside the organization, which means that, from this perspective, the concept of open access is not clearly evident, since quite frequently the organizational knowledge is kept only for internal purposes. Instead, the creation, storage, retrieval and transfer of knowledge does not enhance directly the organizational performance, but effective knowledge application does. In fact, organizational performance often depends on the ability to turn knowledge into effective action rather less on the knowledge itself (Choo, 2000).

Spender (1996) argues that "to know is to be able to take part in the process that makes the knowledge meaningfully" (p. 59). Likewise, knowledge "consumers" also have the opportunity to do their work, which means they are able to access, use and manage the extant knowledge, but at the same time to contribute with their knowing's for a certain knowledge base in the organization.

Moreover, a knowledge management application is effective if it creates a system capable of sustaining the knowledge base and support users on its daily work through manage, create, gather, transfer and apply the knowledge, regarding the business needs of the organization. Obviously, there is not a universal solution for how the knowledge can be implemented, managed and effectively applied to an organization or type of organizations or even the most suitable technology to develop such system (Litvaj & Stancekova, 2015).

It is possible to infer that a handy solution is the one that searches for implications where the interactions between people, technologies and techniques has profound consequences in the knowledge and its management within organizations (Bhatt, 2001). Bhatt (2001) also refers that "an organization is not an exclusive artifact of technological system, nor does it represent a social system. It is a system of personal experience, social relations, and technologies that enable coordination between practice communities" (p. 74).

Another concern in knowledge is the fast dynamicity of the information environment we lived in, which forces professionals within organizations to invest the time and energy to update their skills and knowledge, and to network with other experts in their own profession.

So, what organizations learn as they gain experience? Where is this knowledge embedded within organizations? What are the consequences of where knowledge is embedded for organizational performance? This are a few questions that organizations must be concerned with, while implementing a solution for manage knowledge (Argote & Ingram, 2000).

By answering the question of how organizations can create, use and preserve knowledge, that is managing it, repositories are one of the existing solutions that may represent the information that derives at work (Davenport & Prusak, 1998).

In fact, an organization itself would not "remember" things by its own, therefore the necessity of retain the "organizational memory" connotes as a metaphor, which describes information and

represents all the knowledge that is created, acquired, resided and shared by people (Kogut & Zander, 1992; Nonaka & Lewin, 1994).

According to Walsh and Ungson (1991), organizational memory is "the faculty of retaining and recalling things past (...) the acquisition, retention, retrieval of knowledge and experience from work retained into repositories, influencing subsequent individual behaviour" (p. 3).

Therefore, repositories, as the "memory" of the organizations, represent the knowledge that comes from the interactions between the different resources within organizations (people, technologies and techniques). This knowledge management application, when successful, allows a better organizational performance, and consequently, a competitiveness advantage.

Regarding the literature in this discipline, many authors argue that knowledge comes predominantly from people's mind and by the work they perform inside organizations (Argote & Ingram, 2000; Bhatt, 2001; Davenport & Prusak, 1998; Kogut & Zander, 1992; Polanyi, 2015). However, knowledge may also emerge from roles and organizational structures, organization's standard operating procedures and practices, its culture, and the physical structure of the workplace (Walsh & Ungson, 1991).

People within organization firstly, constantly and continuously pursue sharing, learning and knowing to enhance work performance, secondly, propagate what they know throughout the organization, and lastly, marshal it into a repository (Argote & Miron-Spektor, 2011).

Thus, considering the research work, it is possible to envision that practitioners, people within the organizations, can seek for past situations that are stored into the repository, thus acquiring knowledge about a specific professional act, and subsequently taking actions or initiatives to their current work. A repository of cases that describes professional acts in IST area is a solution that will assist practitioners in their working practices. A knowledge management application where processes of acquisition, creation or transfer, organizational memory, sharing, retrieval, and finally leverage may be possible. Thus, is intended for this perspective, a knowledge management based on cases, where these cases allow knowledge for actions or practices taken by practitioners.

This can enhance certainty in decision-making, once practitioners can have informational objects, such as cases, that somehow can guide them at their practices. Through its actions or initiatives, practitioners can as well rely on the experience of others. As a cyclic process, the

produced knowledge from what they did can be preserved into the repositories, allowing other people or even newcomers within organization to benefit with such contribution, when looking through similar professional acts.

Besides these cases represent past situations, failure stories or unsuccessful occurrences are also important so that practitioners prevent the same mistakes from happening again, when leading their own practices.

The repository and all its cases are closely related with the knowledge management discipline, once it allows the process of collecting and identifying useful information (knowledge acquisition), transferring organizational knowledge (knowledge creation or transfer), storing new knowledge into the repository (organizational memory), disseminating it through the whole organization (knowledge sharing), enabling practitioners to easily retrieve it (knowledge retrieval) and exploiting and usefully applying knowledge (knowledge leverage) (Nonaka & Lewin, 1994).

Still, in all organizations, managing knowledge is not such a trivial process, due to two particular problems. Some organizations find difficult to locate knowledge centred at one point to be, after, reused, and therefore practitioners may be unware that the knowledge they need is already available. Moreover, repositories can be used for different purpose than the one it should do, for example, dealing with internal management processes instead of having the essential information to guide practitioners so that they can be able to increase their work performance (Dalkir & Liebowitz, 2011).

Finally, practitioners should be able to find out what they need in order to access, understand, and apply experience and expertise of the organizations. In this way, they can focus on doing their actual work and not loose precious time trying to find all the bits and pieces of knowledge and know-how that have already been captured, coded, vetted, and made available to them (Argote & Ingram, 2000). Repositories are then one of the most commonly solutions for organizations and consequently beneficial in many positive aspects, when seen from the practice perspective.

2.3. Research Perspective

Universities carry with them two fundamental principles: the research and teaching. These two principles are as well the core functions in all institutional entities. Thus, in higher education institutions, the information is used to perform the research and teaching, but also on for its strategic planning and management (Amante & Segurado, 2009). Although, these two principles are intimately connected, in this subchapter it will only be addressed to the research perspective.

According to Rodrigues and Rodrigues (2012), "scientific knowledge is based mostly on an effective diffusion of research results by scholarly communication" (p. 100).

It comprehends the set of all activities that involve production, dissemination and use of the information, since the beginning of the scientific creation process where the ideas are generated, until the moment of the approval of the results as part of the scientific knowledge body.

It is in the higher education institutions, which are large, complex, and adaptive social systems, where the scientific knowledge represents one of its principal academic products, being at the genesis of their raison d'être (Cassella, 2010).

Therefore, institutional repositories are information systems which serve to store, preserve, and diffuse the intellectual production of a certain institution, normally a university community. In other words, it is "a set of services that a university offers to the members or its community for the management and dissemination of digital materials created by the institution and its community members" (Lynch, 2003, p. 2).

The development of institutional repositories is intimately tied and interconnected with two key issues – the technological evolution and exponential increase of the information as well as the open access movement (Jantz & Wilson, 2008).

The first one allows universities to implement new digital and informational systems, such as institutional repositories are, that somehow has been revolutionise not only the traditional approaches of the scientific knowledge and the research and teaching activities, but also challenging scholarly communication.

On the other hand, the concept of open access, as the name suggests, means that scholarly communication should be kept accessible, through internet or any digital system, where it serves as a theoretical foundation for the dissemination of scientific knowledge, and also free from severe constraints imposed by scientific content publishers (Creaser et al., 2010; Cullen & Chawner, 2011). Jantz and Wilson (2008) refer that the open access principle is "an elegant argument that stresses the responsibility of researchers to share their scientific knowledge as widely as possible, particularly in the growing digital environment" (p. 188).

So, and in accordance with Rumsey (2006), an "institutional repository is an open access (i.e. freely accessible by anyone with internet access), searchable, digital archive of materials emanating from an institution, usually scholarly but not limited to journal articles, which are usually (but not always) available in their entirety" (p. 181).

When this digital solution, such as repositories are, is inserted in such informational environment, it allows the enhancement of visibility in higher education institutions and all those who work there, it serves as a tangible indicator of quality and scientific, economic, and social relevance of activities of teaching and research. It enhances the impact and the visibility of the results of such activities, it defines the trends and research lines undertaken, it contributes to an improvement in the intern communication, it preserves the intellectual memory avoiding its dispersion, and finally, it contributes progressively to the traditional academic communication system reform (Aparício & Henriques, 2012).

Thus, repositories represent a new "strategy" for the universities, which allows them to influence in a serious and systematic way the accelerated changes that have been occurring in the production of knowing and scholarly communication.

So far, one of the concepts already addressed was institutional repositories, becoming perceivable how repositories or any space for deposit and storage of digital information can provide benefits when implemented within universities. However, the focus of this perspective is intended to answer the question of how the proposed repository in this research work can assist researchers, through its cases. This means, that the repository of cases is built for other purposes than the ones institutional repositories normally possess when they are used by universities for its own benefit.

Researchers, the ones that have as a major responsibility the process of creating scientific knowledge, are empowered to populate the repository with cases, under a certain cases' guide.

This guide, should contain the policies and rights for validate cases to be contained within the repository. Therefore, the research work allows researchers to have an informational system in where the scientific knowledge that was produced by them, can be as well disseminated.

The same knowledge process is repeated sequentially, in which other researchers can as well see and use one or more cases for their own research work, and posit new scientific knowledge into the repository, preserving and diffusing it. Thus, is intended for this perspective that the cases within the repository, can assist researchers to create scientific knowledge, by studying them.

Despite the existence of other research methods, case studies are commonly used by researchers. This research method produces a research report that will be stored in the repository. The occurrence of a phenomenon about an IST professional act, is described through these cases, which are revealed into the repository.

Gerring (2004) states that "case studies always employ more than one case" (p. 342), therefore researchers, while having in mind certain professional act, should search for those cases and accumulate them for an upfront study during their research. Moreover, this author defines case studies as "an intensive study of a single unit for the purpose of understanding a larger class of (similar) units" (Gerring, 2004, p. 342).

By clarifying the terms in the above definition and compare it with the proposed research work, we have the term population (all the cases within the repository), which is comprised of a sample as well as unstudied cases. A sample, (the cases selected by researchers to be studied), which is comprised of several units (mini-cases) and each unit is observed at discrete points in time, comprising cases. A case is comprised of several relevant dimensions or variables (circumstantial factors), each of which is built upon an observation or observations (describing IST professional acts).

After study through those cases, researchers can ensure not only the certainty about one or more theories and its constructs, but also in the effectiveness of some techniques or method by their actions or initiatives, and consequently acquire scientific knowledge. Researchers, then, can produce cases while using an empirical method research through the study and observation of accumulative cases. Moreover, cases are characterized by its circumstantial factors (professionals, organization, country, year, types of technologies, dimension, activity sector, among others) and should be organized in the repository in order to some extracts from the cases (mini-cases) can be

associated to relevant theorizations. Empirical research, as the name suggests, is research using an empirical evidence – the cases. It is a way of researchers gain knowledge by means of direct and indirect observation or experiment. In this particular work, the experiment is not always a feasible approach, therefore the observation of those cases will contribute directly to researchers driving means to an end – create scientific knowledge (Walsham, 1995).

Finally, researchers, as integrated part of universities or other research institutions, are able to take advantage of these repository to produce and support scientific knowledge, contributing to their own recognition given its research work, as well as the visibility of the entity in which they are members.

2.4. Teaching Perspective

Besides improving the processes of knowledge creation by researchers, another key issue within universities is the knowledge transfer by the teachers, and consequently, the learning by students.

As previously stated, the increase of volume and variety of the information, as well as it eases of access, potentially reinforced by new communication and information technologies, has been changing the nature of knowledge, and even the processes themselves when it concerns teaching and learning.

Over time, the role of teachers "tends to evolve from the principal and practically unique resource of learning in the classroom, to the one of guiding and facilitating the practices and processes of knowledge construction, in a teaching based on different types of educational resources and in new learning environments" (Aparício & Henriques, 2012, p. 378).

Teaching through cases or case teaching is one of the opportunities that some higher education students have, when examining real-life problems in all their complexity and uncertainty. Students attempt to solve those problems settled with their learning areas, with the ability to analyse, synthesize, evaluate, and apply the knowledge they have learned, when they are engaged in the process of a particular context or authentic situations (Guess, 2014).

Thus, students learn to bring all their knowledge, skills, and experience, not just only from IST field of study, but also from all areas of knowledge, to these problems posed in cases. Moreover, students study and learn through these cases, where they may acquire knowledge that, in their future work, can be ensured by this theoretical foundation when applied into their practical career as well (Leonard & Cook, 2010).

According to Anderson, W. Schiano and B. Schiano (2014), "case teaching is an underused, but very effective way of teaching in a number of contexts (...) the students learn not only from the teacher but from each other by bringing their collective experience to bear on the problem" (p. 2).

To develop judgement or critical thinking about something, you need not only to read theory but also apply it, so students should answer the question of what should they do if they were at that specific situation.

This method has been the hallmark of Harvard University for many years, being adopted as the most effective teaching and learning method. They have determined that cases are best used to teach people about realistic decision-making situations (Barnes, Christensen, & Hansen, 1994). In fact, teaching through cases has a long tradition in law schools, hence the term "case".

Generally, the cases simulate actual proceedings and illustrate prior realistic occurrences. Instead of students pass directly into practice, they first need to acquire the knowledge, the theoretical foundation. For example, in areas such as law, business and medicine, where theory comes at first place in comparison with practice, is quite frequent the use of such educational approach.

A case tells a story: what happened, who was involved, what they contended with, and, sometimes, how it came out. Cases recount, as objectively and meticulously as possible, real occurrences or problems so that students experience the complexities, ambiguities, and uncertainties confronted by original participants in the case. As they inhabit a case, students must tease out key components from the real messiness of contradictory and complicated information (Barnes et al., 1994; Lynn & Laurence, 1999).

On the other hand, teachers as mentors and facilitators who aid the learning process, hope, above all, for students to practice the kind of thinking a particular discipline calls for. When using such method as teaching through cases, teachers find a more interesting time preparing and doing

the classes, rather than feeling that they are repeatedly performing the "same" lectures. Moreover, teachers believe that students learn more when they are in the centre of the educational process.

Teachers may choose a specific case if the one shows that is relevant to the topic, is it substantial and complex enough to reflect a real situation, and it is stimulating enough to invoke discussion and subsequent learning by the students while studying it (Hackney, McMaster, & Harris, 2007). These authors also refer that this method "is clearly not the easiest method of teaching, but it can be immensely rewarding and valuable when used properly and when good teaching cases are available" (Hackney et al., 2007, p. 230).

While comparing teaching through cases with the traditional approach, it is assumed that both are alike, and the objectives are largely the same. No matter what pedagogy is used to trigger education, most higher education institutions want their students to learn significant disciplinary content, to refine their critical thinking and communication skills, and to gain in self-confidence and social awareness. The differences between case and traditional teaching derive from the underlying assumptions about how to achieve these goals most effectively (Barnes et al., 1994; Guess, 2014; Merseth, 1991).

Considering the research problem, the repository may assist teachers and students in the educational process, while both using cases. It can be said that these two roles go hand in hand. Although this perspective is more concerned with the teaching part, the educational process concerns not only the teachers and the teaching, but also to the people whom is to learn, the students.

Teachers can use these cases, which describe IST professional acts and are intrinsically associated with certain theories and its constructs, by taking initiatives or actions to enrich their way of teaching. Hence, being more effective and efficient when it comes to motivate students at their current discipline. On the other side, those cases and the respective relations they possess with this scientific area can better understood by students, either learning through these cases, or the knowledge that teachers are trying to provide.

As facilitators, teachers enable students to learn what they need, by helping them to acquire knowledge and creating curiosity, critical reflection, and recognition of their responsibilities as professionals they will become one day.

Moreover, they can assume the role of researchers and creating their own cases as a contribution for the repository and, consequently, to the community of the area it concerns.

Students, may acquire knowledge, competences, and skills, by looking through the cases that were provided by the teachers, or even going further by searching for cases to confirm their perception about one or more theories and its constructs associated with some professional act that instigates them.

Cases assume a major goal in higher education of empowering students to think critically and act responsibly in their various roles at work, at home, at their communities, that students must be able to apply a collection of concepts and facts they learned to new situations, and finally, to integrate knowledge from classes and life experiences for their training.

Furthermore, cases describe real occurrences, past stories no matter if they were successful or not, students should still be able to sharpen their qualities, enhance their ability to use new concepts and information to substantiate their arguments, improve their soft skills, develop hypothetical solutions and examine the consequences of the decisions they make. All the theory they gathered in this learning process, should then be applied to practice, for instance, at their professional work.

Good cases are chock-full of information and require students to apply theory to analyse complicated, real world events. The difference is that active learning promotes deeper understanding and improved retention. Running cases helps build interpersonal skills that find significant resonance with life after the university (Anderson et al., 2014; Leonard & Cook, 2010).

Educational objectives focus on qualities of mind (curiosity, judgement, wisdom), qualities of person (character, sensitivity, integrity, responsibility), and the ability to apply general concepts and knowledge to specific situations, where case teaching may well be very effective. It puts the students in an active learning mode, challenges them to accept substantial responsibility for their own education, and gives them first hand appreciation of, and experience with, the application of knowledge to practice (Barnes et al., 1994).

2.5. Search for Repositories of Cases

A research was conducted in the phase of this work with the objective of searching for an already existent proposal of a repository of cases either as an object of study or as an available platform. It intended to understand if the repository of cases is considered to be something new and, consequently, if what is proposed in this master thesis can lead to a contribution in the IST area, reaching the communities and its professionals.

Following this line of thought, the adopted strategy has begun with searching through scientific documents in several scientific databases and search engines. In this approach was possible to identify a few books, articles and journals.

Some examples of research journals, are mentioned below:

- European Journal of Information Systems;
- Information Systems Journal;
- Information Systems Research;
- Journal of the AIS;
- Journal of Information Technology;
- Journal of Management Information Systems;
- Journal of Strategic Information Systems;
- Management Information Systems Quartely.

Relatively to the databases and respective search engines, the ones used were:

- Google Scholar;
- ScienceDirect;
- Scopus;
- WebOfScience;
- IEEE Digital Library;
- Springer;
- RepositoriUM;
- B-on.

Although there are other resources for the act of research considering the scientific area, only the ones mentioned above were undertaken for this specific research. During this process, several terms and keywords where used to trigger any potential reference to a repository of cases, being following referred:

- “Repository of Cases”;
- “Repositories”;
- “Repository of Cases in IST”;
- “Cases usage, storage and preservation”;
- “Cases for IST professionals”;
- “Repositories in IST”;
- “Open Access repositories”;
- “Digital Repositories”;
- “Scientific Knowledge Repositories”.

All the scientific documents were gathered based on their title and abstract, which allowed boundaries and restriction to the research goal. Some of those documents, which were considered more relevant, were read at their entirety, once it had stimulating a further interest and proximity with the research focus. However, all the scientific documents did not literally address a repository of cases as an object of study.

In terms of possible available platforms, the results were a little bit different. It was found a platform that contains case studies on IT implementation projects. The case studies were written by experts in collaboration with the project managers, possessing the first-hand information without any commercial interest. The cases are based on the eXperience Method, successfully applied to the documentation of project experiences, and even providing the name for the application of "eXperience Cases" (Schubert, 2002). It allows software applications for research and teaching, studies on the technology use, cases on business software implementation and use and, finally, publications such as books, papers or articles where most of the authors are professors, lecturers and Ph.D. students. Although this Web tool has its resemblances, the entire purpose in which is built and the users it supports is not quite the same as the proposed repository of cases in the context of the presented dissertation.

It is believed by the quality of the research made, while perceiving and deciding about the novelty of the artifacts or any existing contributions, specifically, in the IST area. All the selected documents and founded platforms have shown to be mismatched with the focus of this research work, having some similarities but nothing more that ensures that this repository of cases is already an existent artifact or a contribution in this domain.

Finally, it is possible to infer through the analysis of the captured information, the adopted strategy, and performed techniques, that the proposed repository in this research work might be considered something new that will contribute for such scientific area, through the support that gives to IST professionals at their daily working routines, while using its own cases.

2.6. Discussion

The proposed repository of cases for this research work, concerns the three perspectives of practice, research, and teaching, as elucidated above in this chapter. The planning, development and implementation of such repository, centred and focused on cases, should be able to support its users and the roles they represent – practitioners, researchers, teachers and students.

In accordance to what has been said before, this repository of cases aims two different objectives:

1. Accumulate cases that will contribute to reinforce or reduce the effectiveness of certain theories and its constructs, that serve as relevant theoretical foundation for the actions or initiates occurred and involving one or more professional acts;
2. An instrument based on cases that will support the actions or initiatives taken by practitioners, researchers, teachers and students, by searching through a specific IST professional act.

Desirably, the undertake of this repository and its effective use in the above perspectives, implies that it may be open and accessible to whom it may concerns, and obviously, in accordance with the conditions it possess for its use. However, the inclusion of new cases in the repository can be only empowered by researchers, who makes it under a respective cases' guide with its rules and acceptance policies.

Another long-term benefit that can emerge while using such repository is the possibility of serving as an aggregator of a community for practice, research and teaching. That means the practitioners within organizations could be more tied with the academic professionals, such as researchers, teachers and students, through a driving force that this repository allows.

The figure below represents the relation between the three perspectives and it demonstrates that the purpose of using the cases, which are preserved within the repository, may differ according to the user and the role that assumes (Figure 1).

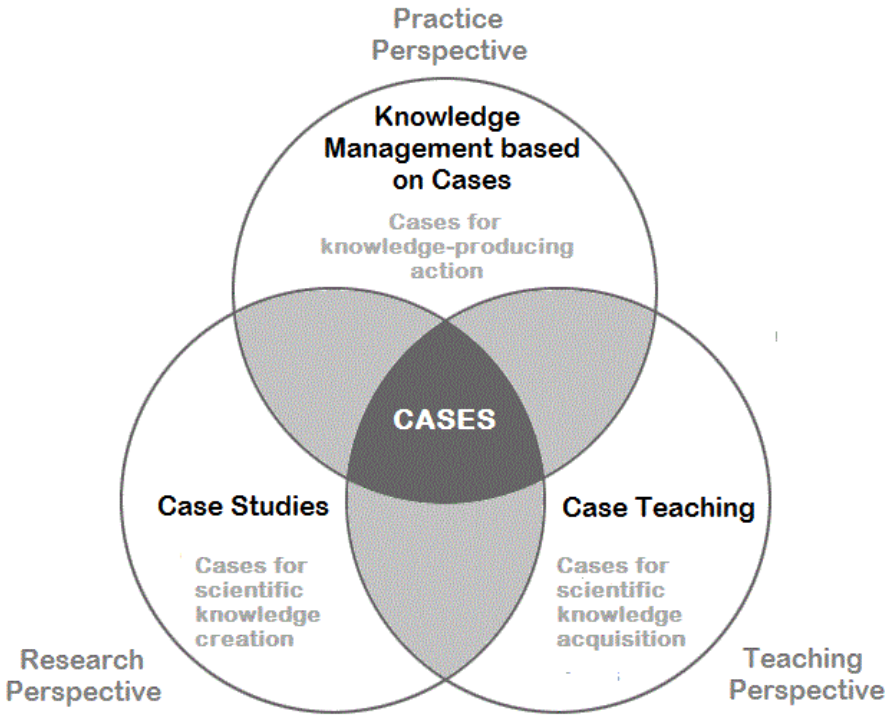


Figure 1 - Relation between Cases and Perspectives

It is possible to observe that cases are the focus of the repository and, in fact, is what motivate any type of user while accessing to this digital and informational platform. An ideal scenario for this repository of cases, would be the chance of a single case be able to address all these perspectives and aid the context in which they exert their profession.

In short, the repository of cases in its perspectives, may be used by:

1. Practitioners, IST professionals who can seek for past situations that can help them make decisions about an act of profession in which they are involved. If the

knowledge is well managed within the organization, they are able to apply good practices at their work, that is based on cases as well as their know-how;

2. Researchers, who can accumulate cases for the purpose of establishing confidence in the efficacy of some method or technique, or even, in confidence regarding some theory and its constructs. They attempt to study cases in order to create scientific knowledge and assume the responsibility of contribute and add more cases into repository;
3. Teachers, who can use a case method to foster the IST education. They are able to teach students through cases so that they can learn and also acquire scientific knowledge, gain other competences and sharpen their skills.

How can the actions that IST professionals have, regarding this repository, be proceed by efficacy and contribute to the related theories and its constructs? How effective are these actions? What are the key factors if they succeed? How can these cases contribute to the professional work? How can these three perspectives be grouped and communicate between themselves while using the same repository of cases?

These questions are preponderant for the conception, construction, and subsequent evaluation of the repository. If this research work will be successfully undertaken, then the production of a repository of cases, withstanding all these IST professionals that use this cases as a reference to move forward at their work, contributes directly to the progress in this area.

Chapter 3. Software Engineering

This chapter focuses on the concept of software engineering. Besides the research problem has been explained in the prior chapters, it is now important to adopt an engineer approach once this repository of cases is also a software that will be planned, developed and implemented. Therefore, an elucidation will be made regarding the software development process models. More specifically, it is described the agile Scrum since it was used in this master thesis.

3.1. Software Development Process Models

According to Sommerville (2010), "software engineering, is an engineering discipline that is concerned with all aspects of software production" (p. 24). An application of engineering to the design, development, implementation, testing and maintenance of software.

The objective in software engineering is the cost-effective development of high-quality software. A software process is seen as a set of activities structured and documented for the development of such applications, that can be able to satisfy the needs of the clients (Pressman, 2009).

Nonetheless, the production of a software does not mean an integral development, once it is more frequent that it emerges from the expansion or modification of an already existent software. That is mainly because these processes are not always something trivial that can be applied in a transversal way to support organizations and people inside them.

As a result, there is not an ideal software process. This means that quite often, a software process must be adapted to the reality of each project that comes up. However, when it comes to creating or improving a software, it must be justified until the software development process is finished, while taking into consideration the characteristics of a specific project.

As evolution dictates, these processes suffered changes over the time while researchers were attempting, not only to explain the capability of people inside the organizations, but also the characteristics and the impact of adopting or developing a given software (Kan, 2002).

Although there are several approaches which are used in the software development process, it is important to understand that each process model represents the software process from a particular perspective. So, independently of the software development process selected, four fundamental activities are generally included:

- Software requirements specification – this activity is concerned in defining of the functionality of the software as well as the constraints on its operation;
- Software design and development – it is intended that the software is produced, meeting the specifications prior defined;
- Software validation – the software is subject to comparison between what it actually does with the requirements that were specified;
- Software evolution – the software must be capable of changing to attend customers' needs or alterations.

Briefly, process models are representations of abstract software processes. Software process models define the activities during development, and how those activities should be done, working as a guide for software development projects.

There are several process models, those that were created from scratch, the ones that emerge from failures of other models, and those that combine several models into one. Some of the existent software development process models are explained, as examples, in the following paragraphs.

At first, the Waterfall Model is the oldest and most used process model. It was introduced by Winston Royce in 1970, and its name derives from the type of process it represents. That is mainly because the software development flows systematically and sequentially through the activities, in which the outputs of each task are used in the following task, as it can be observed in Figure 2.

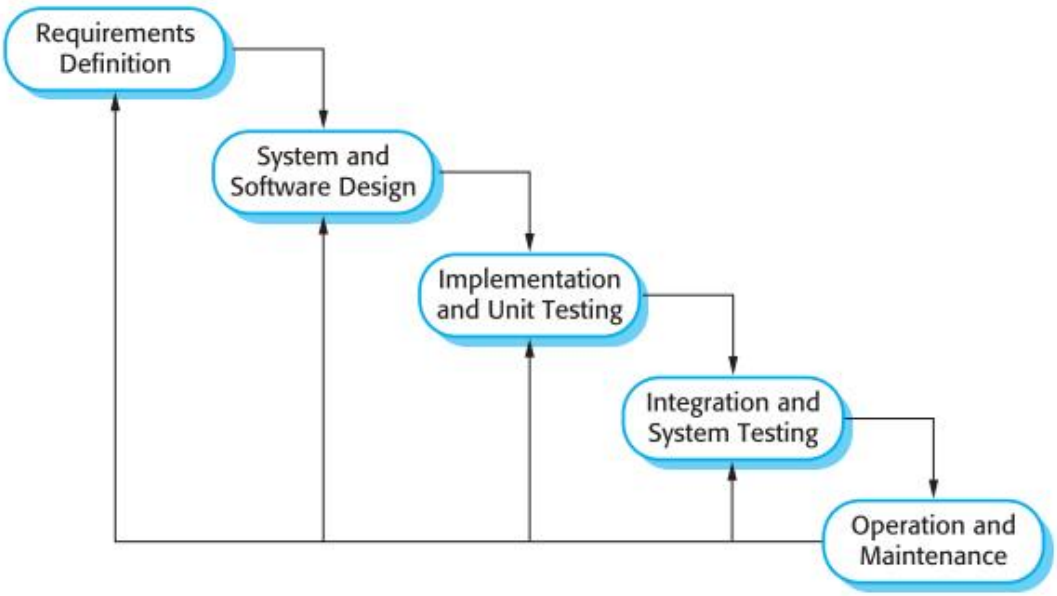


Figure 2 - Waterfall Model [retrieved from (Sommerville, 2010, p. 30)].

In the beginning of the project, requirements are defined accordingly with the problem to be solved, in terms of its functionalities, design and performance, where this output is used in the following activity. Regarding the requirements prior defined, a design is formulated to be applied in the software. After the design of the software, the implementation is ready to start, where the product is finally developed. Besides implementing the software, it must be used for verification tests where issues that are detected can be changed. Finally, the maintenance phase ensures that the system is working as planned (Scacchi, 2001; Sommerville, 2010).

The Waterfall Model was a pioneer in software development, inspiring several process models in benefit through few changes from this original model. One of this process models is the Incremental Model (Figure 3). This model entails an iterative development process be divided into smaller parts and used in repetitive cycles, as it can be seen in the following figure.

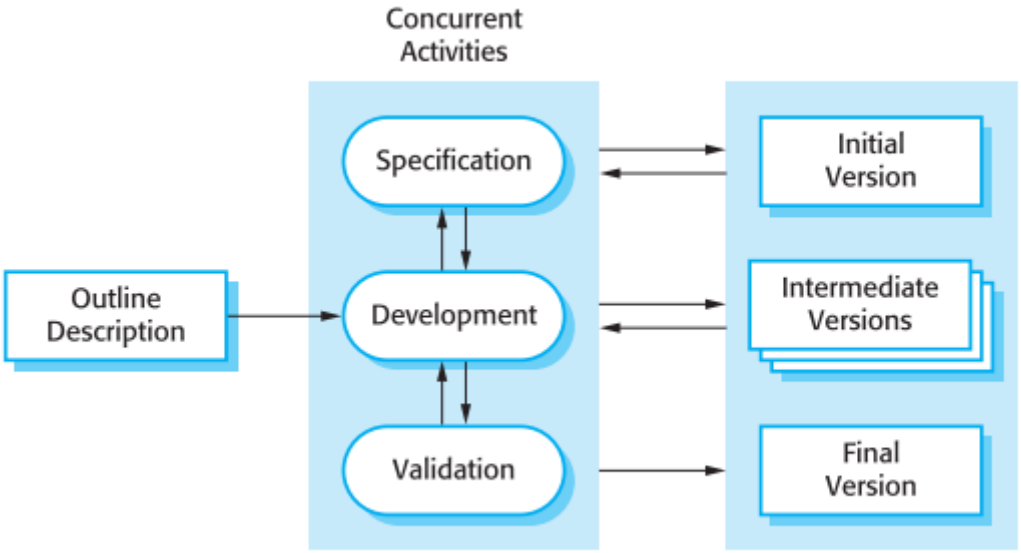


Figure 3 - Incremental Model [retrieved from (Sommerville, 2010, p. 33)].

This process model begins with a subset of requirements, from iteration to iteration, where new functionalities are being added until the solution is concluded. This model addresses different issues in the original Waterfall Model. For example, the fact of being divided into several increments, makes it not only possible to create software rapidly, but the possibility of the client intervenes, shortening the risk and uncertainty of the project. At last, is perceivable that any problem during the phases of the process model may be identified and treated in any iteration (Scacchi, 2001; Sommerville, 2010).

Another process model is the Spiral Model, proposed by Boehm in 1988. As the name suggests, this model is represented as a spiral, where each loop represents a phase in the software development process. Once more, this model has emerged from several experiences and modifications to the original Waterfall Model. The subsequent figure illustrates this particular model that combines change avoidance with change tolerance. The Spiral Model can be seen as a more sophisticated view of the Incremental Model (Figure 4).

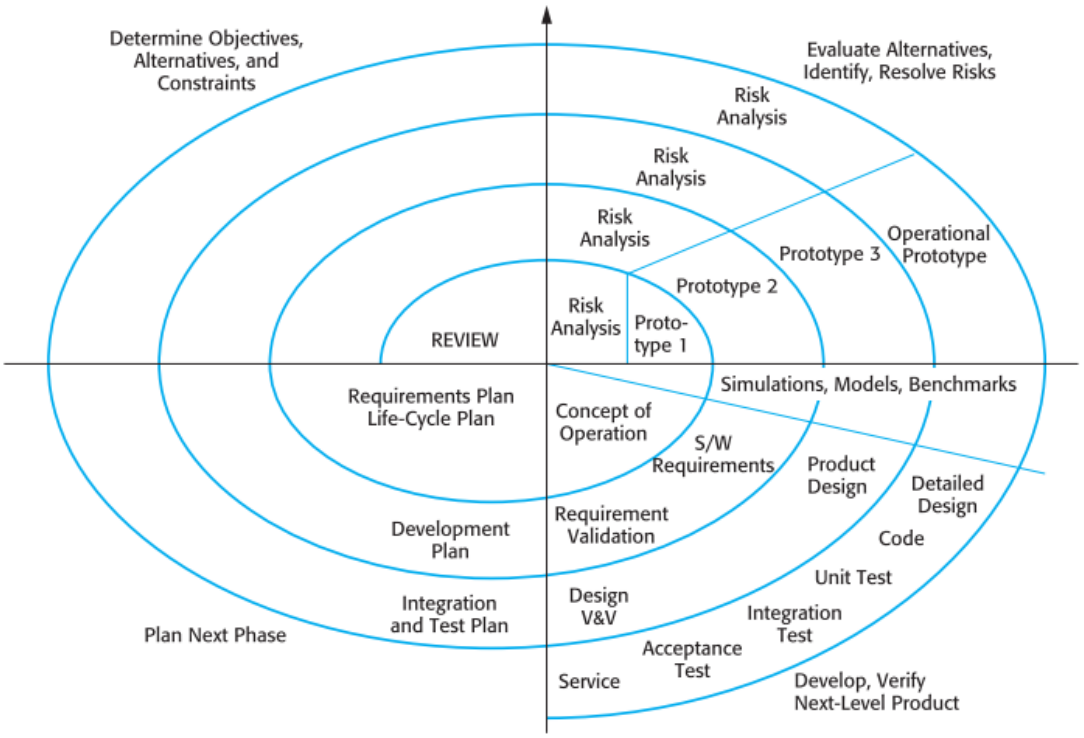


Figure 4 - Spiral Model [retrieved from (Sommerville, 2010, p. 49)].

As it can be seen, the innermost loop is concerned with the system feasibility, the next loop with requirements definition and the succeeding loop with system design. Changes in this model are a result of project risks and includes risk management activities to reduce them, so one of the major focus in this process model is risk analysis.

Moreover, this process model is splitted into four sections. The objective setting determines not only the objectives of the project, but also the constraints and alternatives which are dependent from the project risks. Then, the sector of risk assessment and reduction allows the analysis of each identified project risk and evaluation of the alternatives, previously planned, in order to reduce the risk impact and probability. The third section represents the development and evaluation of the product, where prototyping is one of the most common approach. At last, the planning section is concerned with the project review and decides whether to continue with a further loop of the spiral or not. If the answer is yes, then plans are drawn for the next phase (Scacchi, 2001; Sommerville, 2010).

Although the software development process models are planned for completely specifying the requirements and then designing, building and testing the system, these processes are not geared to rapid software development. As the requirements change, or problems are discovered,

the following phases in the process need to be redone, which is more time consuming, and the final software is delivered long after than what was agreed.

In fact, the response to more demanding trends and needs by the customers gives to organizations the emergence of taking new opportunities in the markets and compete with products and services. Software, as part of all business operations when developed or improved more quickly, will add value and a significant advantage to the organization compete in the market, among others.

Thus, rapid software development processes are designed to produce useful software quickly. A characteristic of these processes is that the development of a software is not produced as a systematically and sequentially single unit like other models already referred, instead a series of increments is taken where each one includes a new system functionality (Pressman, 2009).

Another process model is the Rational Unified Process (RUP), which provides a disciplined approach to assigning tasks and responsibilities within a software development organization. Its goal is to ensure the production of a high-quality software that meets the needs of its end-users, within a predictable schedule and budget. Moreover, this process is an example of a modern process model, that is associated to the used of the Unified Modelling Language (UML).

RUP suggests two dimensions. The first represents time, showing the dynamic aspect of the process as it is enacted, being expressed in terms of cycles, phases, iterations, and milestones. The second dimension addresses the static aspect of the process, described in terms of its activities, artifacts, workers and workflows. This leads to four phases during the software process: inception, elaboration, construction and transition, which are combined with nine disciplines (Kroll & Kruchten, 2003), as shown in the Figure 5.

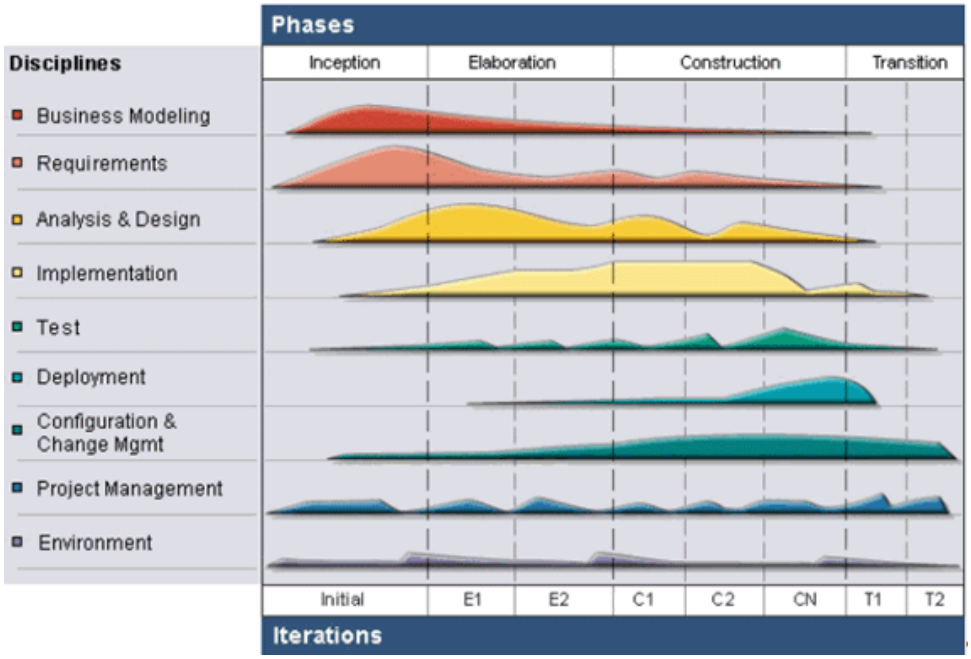


Figure 5 - RUP Overview [adapted from (Kroll & Kruchten, 2003)].

The disciplines are divided into two groups, according to their nature. The disciplines of Business Modelling, Requirements, Analysis and Design, Implementation, Test and Deployment are designed as engineering disciplines, whereas the others are considered as supporting disciplines. Each phase in this process model has one key objective and a milestone at its end, which denotes if the objective was accomplished or not.

Based on iterative or incremental development approaches, agile process models are more focused on people and the feedback they provide, whereas traditional approaches possess a different mechanism control during its software development process. To better understand this type of development, it is presented some fundamental characteristics of agile software development, following mentioned (Popli, 2013):

- Individuals and iterations instead of processes and tools;
- Functional software rather than comprehensive documentation;
- Client collaboration with the team instead of contractual negotiations;
- Response to change rather than following a plan.

Each iteration consists in a total development cycle that encompasses the planning, requirement analysis, design, implementation or coding, testing, deployment, maintenance. The demonstration to the client is extremely important for the team members, once it will ensure

unceasing feedback for producing a software and the justification to move forward in the iterative process, until the product is finished.

There are several process models of agile software development. Essentially, this process models divide their activities in small iterations, developed in a given short time with the minimum planning, but sufficient enough (Popli, 2013). Among the most known are:

- Extreme Programming (XP);
- Crystal;
- Dynamic System Development Method (DSDM);
- Adaptive Software Development;
- Feature-driven Development;
- Pragmatic Programming;
- Lean Development;
- Scrum.

Regarding the research problem, the planning, development and implementation of a repository of cases, it is possible to infer that we are standing before a software engineering situation, where the phases of the model can be revisited to further improvements if necessary, even if it has already been finished. It will be an iterative process model where the aim is to prototype, produce and refine the software according to the requirements and continuous feedback provided, to yield a quality and successful product.

The Scrum is the adopted model for the present project of software development, being enlightened in the next section. This agile process model helps to understand how tasks fit with the purpose of the project, it allows greater transparency in the work management that is being carried out, it enables a greater management in delivery times that are defined for the stipulated short time, and it promotes a better organization in the communication.

3.2. Scrum

Schwaber and Sutherland (2013), defined Scrum as a "framework within which people can address complex, adaptive problems, while productively and creatively delivering products of the highest possible value (...). Scrum is not a process or a technique for building products; rather it is a framework within which you can employ various processes and techniques" (p. 3).

This framework, founded on the experience of software developers, assumes that knowledge comes from the experience and decision making on the basis of what is truthful and known. Thus, to develop rapid software, Scrum employs an iterative, incremental approach to optimize predictability and control risk (Schwaber & Sutherland, 2013). Moreover, the implementation of every empirical process control consists in three pillars:

1. Transparency. All the significant aspects of the process should be perceptible to any person responsible for the outcome. These aspects may be defined by a common standard in order to observers be able to share a common understanding of what is being seen;
2. Inspection. Useful for Scrum users to inspect artifacts and the progress towards a final objective, detecting undesirable variances. It should not be so frequent that will decay the current course of the work;
3. Adaption. Adjustments should be done to the deviant processes. Changes must be made as soon as possible to minimize further deviation. Scrum establishes four phases for inspection and adaption: sprint planning, daily scrum, sprint review and sprint retrospective.

The Scrum, based on an agile methodology, is a framework for developing complex products. It consists in Scrum's roles, events, artifacts and the rules that bind them together (Schwaber & Beedle, 2001). These components are going to be explained after the Scrum life cycle, that is presented in the Figure 6. It illustrates how part of those components are included and connected to each other.

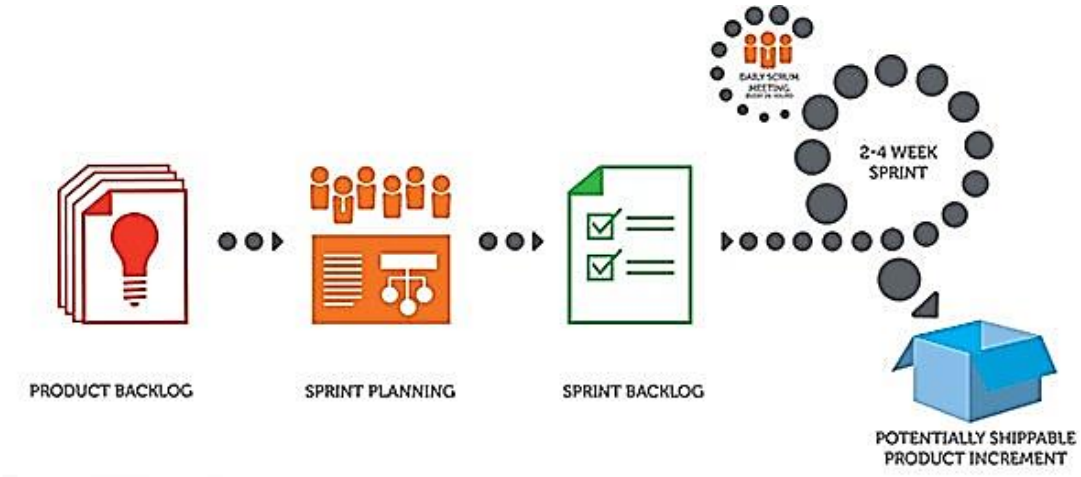


Figure 6 - Scrum Life Cycle [retrieved from ("Scrum Alliance," 2016)].

Scrum involves three fundamental roles: Product Owner, Development Team and the Scrum Master. The Scrum Team includes all the previous roles, and where its purpose of producing a final product that is gradually concretized in an iterative and incremental way.

The Product Owner (PO) is responsible for maximizing product's value and for the work for the Development Team. The PO is a person that is responsible for managing the Product Backlog (PB), which includes:

- Expressing PB items clearly;
- Ordering the items in the PB to best achieve the goals and missions;
- Optimizing the value of the work that the Development Team executes;
- Ensuring that PB is visible, transparent and clear to all, showing what Scrum Team is going to work on the next step;
- Guaranteeing that the Development Team understands items in the PB for the needed level.

Although this is the PO work, does not mean that the Development Team cannot do it as well, when the same is defined by that person. This particular role remains accountable, which means that only one person can assume this position. The decisions made by him or her should be respected by the others, specially the Development Team, in order to the project follows its course based on the requirements that were initially defined and becomes successful (Schwaber & Sutherland, 2013).

The Development Team (DT) involves professionals who are responsible for delivering a potentially releasable product, at the end of each iteration or Sprint. These members are the only ones able to create increments in the process. The organization allows a well-structured and empowered DT, for managing their own work. It possesses the following characteristics:

- Self-organizing;
- Cross-functional;
- Independently of the nature of the work to be executed by an individual, the only title that Scrum recognizes for the DT member is the Developer one;
- Regardless of the particular domains that are addressed during their work, Scrum does not assume any sub-teams;
- Individually, DT members may have specialized skills and areas of focus, but the DT team should be seen as a whole.

The dimension of the DT should be small enough to be able to maintain its agility, and big enough to perform the totally of the work to be done. The recommended numbers for the DT are more than 3 and less than 9, to sustain the interaction and productivity among the team.

The Scrum Master (SM) is responsible for guaranteeing that Scrum comprehension and disclosure is achievable if the Scrum Team adheres to the Scrum theory, practices, and rules. The SM helps the communication and interaction between the external people and the Scrum Team.

SM aids the PO in:

- Finding techniques to come up with an effective PB management;
- Communicate clearly the vision, objectives and items of the PB;
- Understanding product planning regarding an empirical environment;
- Guaranteeing the PO knows how to arrange the PB to maximize value;
- Understanding and practice agility;
- Facilitating Scrum events when needed or requested.

SM serves DT in:

- Training the DT in self-organization and cross-functionality;
- Supporting the DT to create high-value products;
- Removing impediments that can influence the DT's progress;

- Facilitating Scrum events when needed or requested;
- Coaching the DT in organizational environments in which Scrum in not yet entirely adopted and understood.

SM helps the organization in:

- Leading and training the organization in its Scrum adoption;
- Planning Scrum implementations within the organization;
- Supporting employees and stakeholders so they can understand and enact Scrum and empirical product development;
- Instigating change that increases the productivity of the Scrum Team;
- Working with other SMs to rise the effectiveness of the application of Scrum in the organization.

After the three roles being enlightened, now it is time to explain the next component of this processual framework. The Scrum events are used to create regularity and minimize the need for meetings that are not defined in Scrum. All events are time-boxed events; this means that every event has a maximum duration. Thus, is guaranteed that the right amount of time is stipulated avoiding any wastes on the planning process.

Sprint is the heart of Scrum. It is a time-box of one month or even less, during which an increment is created. The durations are consistent throughout a development effort and a new Sprint begins right after the conclusion of the previous Sprint.

The Sprints include and consist of the Sprint Planning, Daily Scrums, the development work, the Sprint Review, and the Sprint Retrospective. During the Sprint:

- No changes are made that would compromise the Sprint goal;
- Quality goals do not decrease;
- The composition of the DT should remain unchanged;
- As more is learned, scope may be clarified or even re-defined between the PO and DT.

The PO can cancel the Sprint before it terminates, albeit this decision is normally influenced by the DT and/or SM.

In the Sprint Planning, as the name suggests, the plan of the work to be done for the Sprint is created by the entire Scrum Team. This meeting is limited to 8 hours for a one-month Sprint. Sprint Planning answers the following questions:

- What can be delivered in the increment resulting from the upcoming Sprint?
- How will the work needed to deliver the increment be achieved?

The Daily Scrum duration is about 15 minutes where the DT synchronizes activities and creates a plan for the next 24 hours. It occurs at the same local and time in which each element of the DT explains:

- What was done since the last Daily Scrum?
- What will be done until the next Daily Scrum?
- Which obstacles are in the following course of the DT?

The Daily Scrum helps the DT to enhances the possibility to attain the Sprint goal by evaluating its progress. It communicates to the PO and the SM how they need to organize themselves to achieve the goals and create the stipulated increment in what is left for the rest Sprint. The SM curbs the Daily Scrum so that stakeholders are the only responsible for transforming the PB items into increments.

The Sprint Review is performed at the end of the Sprint to inspect the increment and could adapt the PB, if necessary. It is an informal reunion where the presentation of the increment aims at obtaining feedback and promotes further collaboration. It has a duration of 4 hours in one month for Sprints, including the following elements:

- PO identifies what was done or not;
- PO discusses how is the current PB and it projects the deadline of the project with base on the actual progresses;
- DT argues what turned out to be good, the problems that it faced, and how they were solved, during Sprint;
- DT demonstrates the work done and answers several questions about the increment;
- All the group collaborates what to do next, in a way that the Sprint Review reunion provides a valuable contribution to the following Sprint Planning reunion.

The revised PB is defined according to the probable PB items for the next Sprint, and if possible, to meet new opportunities.

The last Scrum event is the Sprint Retrospective. For the Scrum Team, is deemed as a chance to inspect itself and create an improvement plan to be followed during the next Sprint. It occurs between the Sprint Review and the succeeding Sprint Planning. It has a duration of 3 hours in one month in which the objectives are:

- Verifying how the last Sprint has gone, in terms of people, relationships, process and tools;
- Identifying and ordering the items that had gone better or had potential enhancements;
- Creating a plan for implement improvements in the working mode of the Scrum Team.

At last, the artifacts defined in this processual framework, are clearly understood to maximize the transparency of the information. Considered as a necessary condition to ensure that the Scrum teams are successful in the accomplishment of an increment.

The Product Backlog is a sorted list of anything that can be considered necessary for the product. A unique requirements source to represent such alterations done into the product. The PO is responsible for the PB, including its content, availability and ordination. The items of this artifact possess a description, an order and an estimative, while being ordered for its value, risk, priority and necessity. The PB is dynamic once it evolves in proportion with the product and it no longer exists when the product is finished.

The Sprint Backlog corresponds to the selected set of items, belonging to the PB, about a certain Sprint, another plan to the increment's delivery, and the attainment of the Sprint goal. The DT foresees what functionality will be in the next increment as well as the work for attain certain objective. This artifact is a detailed plan so that progress changes can be understood in the Daily Scrum.

Increments, as a sum of all the items from the PB, are completed during the Sprint and all the other precedents. In the final of a Sprint, a new increment must be done, which means that must be in conditions of being used and attain the definition elaborated by the Scrum Team.

By using the Scrum process in this the research work, some relevant questions may be answered. The fact of Scrum has been generally considered as a team process and commonly used for that motive, how this project can use Scrum while have just a single person for SM and DT?

Although Scrum is a team process, Scrum is also an iterative process model able to be used personally, which adapts and applies Scrum practices to one-person project, as such is this research work. The existence of other models capable of structuring the work for just one person is possible, however Scrum highlights itself to do what we can with what we have, a constant self-reflection, work towards clearly defined, short-term goals, and last but not least, plan and work in sprints.

Regarding the Daily Scrum for this research work, instead of being performed team self-reflection moments, an exercise is undertaken by a single individual, regarding the work that has been done and it is about to be done in the project.

On the other side, the PO is composed by the Supervisors of this master thesis, a panel of experts able to give feedback and to define the product in term of its requirements and functionalities, above all, what is important to plan for each moment during the project.

Therefore, Scrum in the context of this research work, will promote personal productivity, through observation, adaptation, progressive elaboration, prioritizing and sizing work, and time-boxing.

As previously stated for the project software development, the Scrum is the selected process model for the creation of a repository of cases. The SM and DT roles are centred in only one person, and the development of the product is planned for a short time and according with the PO requirements, therefore the necessity of using such agile processual framework is fundamental.

Chapter 4. Project Management

In this chapter, the aim is to describe what is a project and how it can be managed to yield a product or a service. As the software to be produced in this research work is a repository of cases, this chapter also describes the several approaches for software development projects and its management, more specifically, the model is going to be used in the research project, PMBOK. At the end of this chapter, is important to understand the relation involved in the both areas of project management and software engineering, extremely concerned with the nature and the elaboration of the proposed artifact.

4.1. Software Development Project Models

To understand project management, its fundamental to acknowledge first what is a project. It does not exist an ultimate consensus about this concept, once it is frequently used in many situations and with different meanings. In practice, a project cannot be defined in a simple word.

According to Project Management Institute (2013), a "project is a temporary undertaking to create a product, service or an exclusive result" (p. 2). In other words, a project is considered to be a sequence of unique activities, complex and connected with each other, with an objective or purpose that must be achievable in a time interval, within a budget and accordingly with a certain specification.

Notice that the time dimension is not being applied in relation to the results, instead this variable is tied up with the project. The project ends mainly because of three motives: the goals are achieved, the objectives are not possible to attain, and the project has no longer utility for continue or even be justifiable.

In the mid-1950s, appeared the first attempts to define project management. Considering the existent tools and technology at that time, for example the Gantt diagrams, the applications of such concept were performed first in military projects. In the following years, this area suffered a

significant evolution with the arising of several tools, such as, the critical path, the PERT diagram, the Work Breakdown Structure (WBS), among others.

Olsen (1971), defines project management as "the application of a set of tools and techniques to guide the use of several resources in the accomplishment of a complex and unique task, within time restrictions, cost and quality. Each task requires a particular combination of tools and techniques that were structured for the work environment and the task life cycle" (p. 2).

Around mid-1980s it was already a frequent and spread activity, however the lack of standardization was considered a step needed for the area of project management could be able of moving forward (Charvat, 2003).

A big step was taken in the mid-1990s, when the Project Management Institute (PMI), launched the Project Management Body of Knowledge (PMBOK) guide. This guide became the pillar of project management in the following years. The fast-technological evolution, had contributed to the importance of the given projects and respective key factors, which was raising significantly. By that time, standards proposals and methodologies emerged, contributing for a unique definition in this area.

LaBrosse (2008), refers that project management is the "discipline of the organization and its resources management for the conclusion of the project, within scope, quality, time and defined costs" (p. 122).

The PMBOK defines the traditional approach for the project management. This guideline serves as a standard identifying forty-seven processes, gathered into ten knowledge areas and five process groups (Project Management Institute, 2013), as shown in Figure 7.

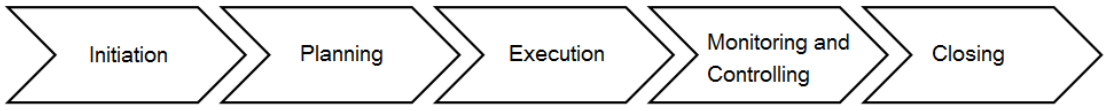


Figure 7 - Process Groups [adapted from (PMI, 2013)].

A life cycle of a project gathers a set of phases that follow each other since the beginning of the project to its end. These phases are organized according to the project needs, generally having their duration well-defined. Process groups are presented in each life cycle and related with the phases of initiating, planning, executing, monitoring and controlling, and finally, closing.

In the initial phase, the objectives of the project are defined carefully so that nothing fails at the first sight. The identification and analysis of requirements, costs, stakeholders, deadlines and a development of a project charter that encompasses all these prior variables are also performed in this step.

In the planning phase, the prior objectives are detailed and a work plan is created, bringing all the project elements such as costs, roles, risks, deadlines, deliverables for the activities be carried out.

The execution phase, is where the processes, initially defined in the work plan, occur in order to create the deliverables for the client.

After the product or the service is completed, it is important to ensure that the same meets the client's needs and requirements. Comparisons are made between what was expected and what was created, as well as, the variables of the project with what has been elaborated in the work plan. Therefore, the monitoring and controlling phase is more concerned with the prior two phases in the life cycle of planning and executing processes.

The closing phase, as the name implies, is the final phase. The project ending is formalized and the deliverables are released to the client. A review is made with the aim of comprehending what has been good or bad in the project, considering it as a point of improvement in future projects.

Independently of the names given for each life cycle approach, the activities included in each phase should be done for the project and its management, as above mentioned (Miguel, 2006).

An example of a project management approach is the PRINCE2 (Projects in Controlled Environments), created by the Office of Government Commerce (OGC), at the United Kingdom. It is a process-based method for effective project management. Despite it is recognized worldwide, it has a wide usage in the government and in the private sector (Office of Government Commerce, 2009).

It supports a range of seven themes that should be kept over the project: Business Case, Organization, Quality, Plans, Risk, Change and Progress. Even more, it includes seven fundamental principles, also illustrated in the Figure 8:

1. Continued business justification, which means that the approved and documented reason of starting the project should maintain itself valid until the project is finished, otherwise it is not worth it to move forward;
2. Learn from experience, where past experiences are documented and taken into account. They are useful during the project life cycle where new experiences are created in each phase, until the project is finished;
3. Defined roles and responsibilities for the project success. A person can have more than one role if its qualified for the role in cause;
4. Manage by stages, the projects are planned in the management phases, where the control points are created over the life cycle. It allows monitorization and control from stage to stage;
5. Manage by exception, defining tolerances for time, cost, quality, in order to outline the limits for the working team. If these tolerances are crossed, measures should be taken to reduce its impact on the project;
6. Focus on products, the PRINCE2 is a product-oriented approach, which means that all life cycle project processes are defined according to the last delivery of the final product;
7. Tailor to suit the project environment, it should be applied to the environment of the project, its size, complexity and risks rather than applied by default. It cannot be use as a management template once it will lose all its strengths.

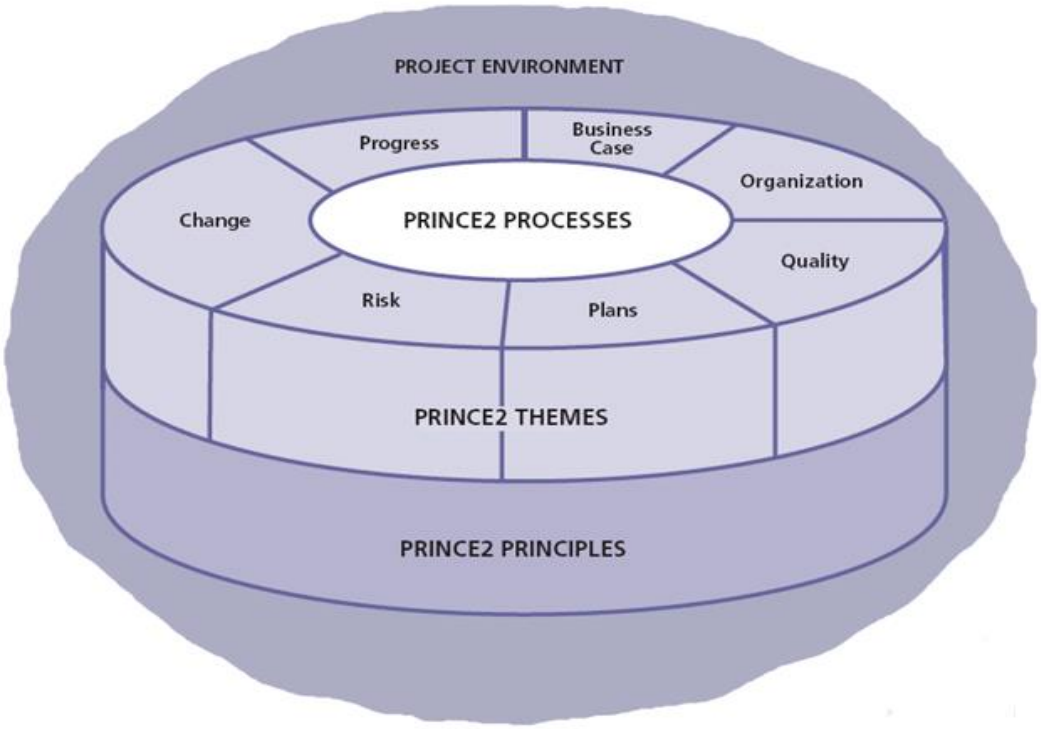


Figure 8 - PRINCE2 Structure [retrieved from (OGC, 2009, p. 6)].

At last, the PRINCE2 is comprised with seven base processes, being follow referred and illustrated in the Figure 9. The principal processes are:

1. Starting up a Project (SU). The main objective of this process is avoiding the creation of projects which does not possess a clear and viable objective. Some of the activities include researching past experiences, setting the management team and plan the next process;
2. Initiating a Project (IP). The planning of the project is made, where it defines each area from quality to risks. After conditions are settled, the project is authorized to begin;
3. Directing a Project (DP). This process predicts the course that the project should follow, and tries to prevent any risks that can emerge in the project to be undertaken;
4. Controlling a Stage (CS). A continuous activity that details the project day-by-day, monitoring its development cycle and taking corrective measures, if needed;
5. Managing Product Delivery (MP). The main objective is ensuring that products are created and delivered to the client. It is the point of connection with the process of developing a product;

6. Managing Stage Boundaries (SB). Is responsible for guaranteeing that all the done work in the prior stages was successful enough to begin the procedure of the next phase;
7. Closing a Project (CP). It certifies that the product continues to support the purpose in which it was built, even after being finished and, consequently delivered.

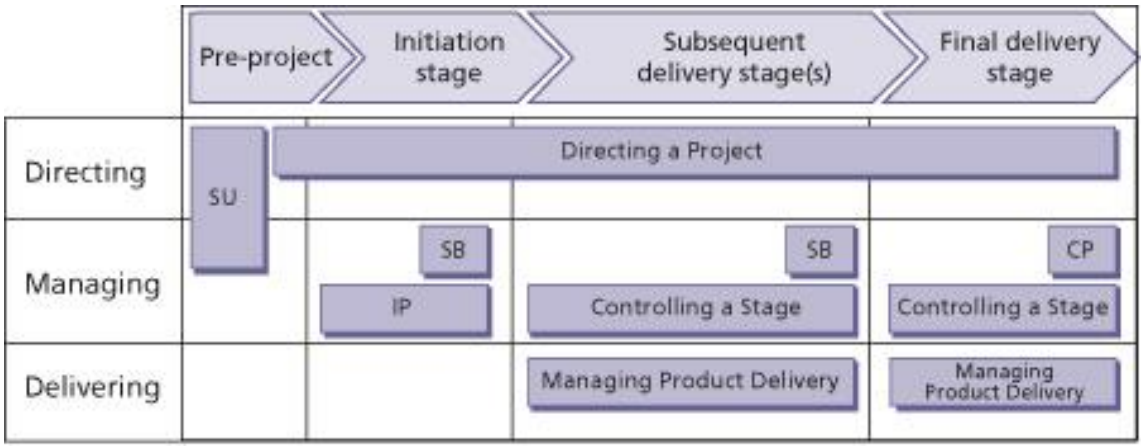


Figure 9 - PRINCE2 Processes [retrieved from (OGC, 2009, p. 113)].

Building a software product requires the planning and the execution of a project, and dealing with the key issues of such an effort. Most project management models or guides are not software specific. However, this research work entails a software development process model and a software development project model in which they must be combined to attain the desirable repository of cases.

Considering the what have been presented previously, the PMBOK was the selected project management guide for the proposed repository of cases in this master thesis. This approach will be explained in the next section, keeping in mind the nature of the product to be developed.

4.2. PMBOK

The acquisition of excellence in project management is not possible without processes that could be used in each project. A project management methodology includes a set of processes, which in turn also implies methods and tools to attain the project goals (Kerzner, 2013).

In other words, it is assumed as a set of guidelines and principles that can be adapted and applied to a specific project or situation. “The entire project is unique as it is to develop something different from what already exists. Although there are aspects that are repeated from one project to the other, a project as a whole, to be considered as such, it needs to differentiate itself from other existing ones” (Paiva, Varajão, Domínguez, & Ribeiro, 2011, p. 201).

As previously stated, the PMBOK was proposed by the PMI, one of the most world-wide known organization in the project management area.

This approach contemplates the best practices of project management, through the application and process integration (Project Management Institute, 2013). The Figure 10 below illustrates the process groups, referred in the prior section.

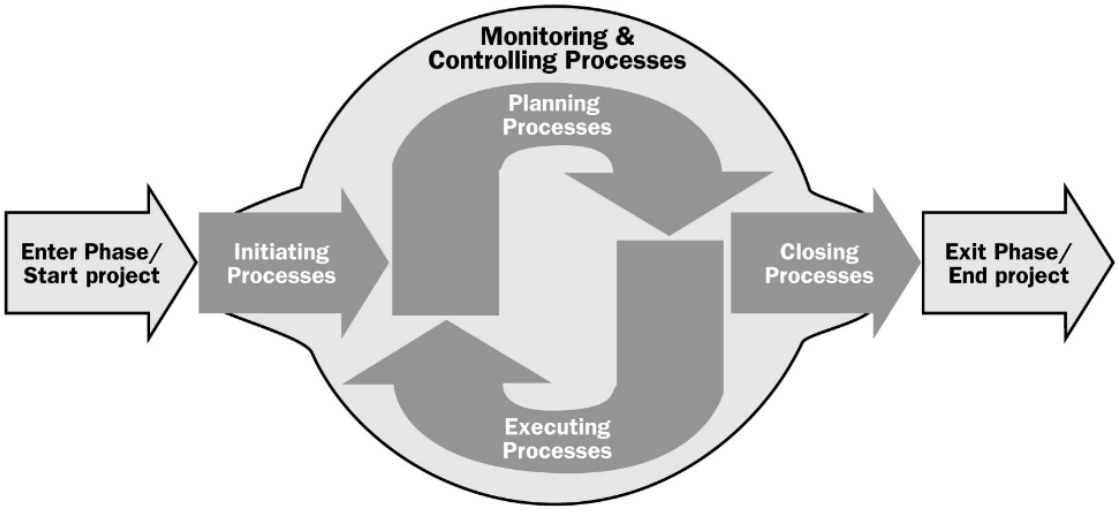


Figure 10 - PMBOK Process Groups [retrieved from (PMI, 2013, p. 31)].

Also, PMBOK emphasizes that exist several ways to manage a project and that process groups are considered guidelines for the application of knowledge and skills in project management. The processes are applied iteratively being even repeated through the life cycle of the product. Thus, this iterative and integrative method in project management, forces process group of monitorization and control to interacts with all the other process groups during the project, as it can be seen in Figure 11.

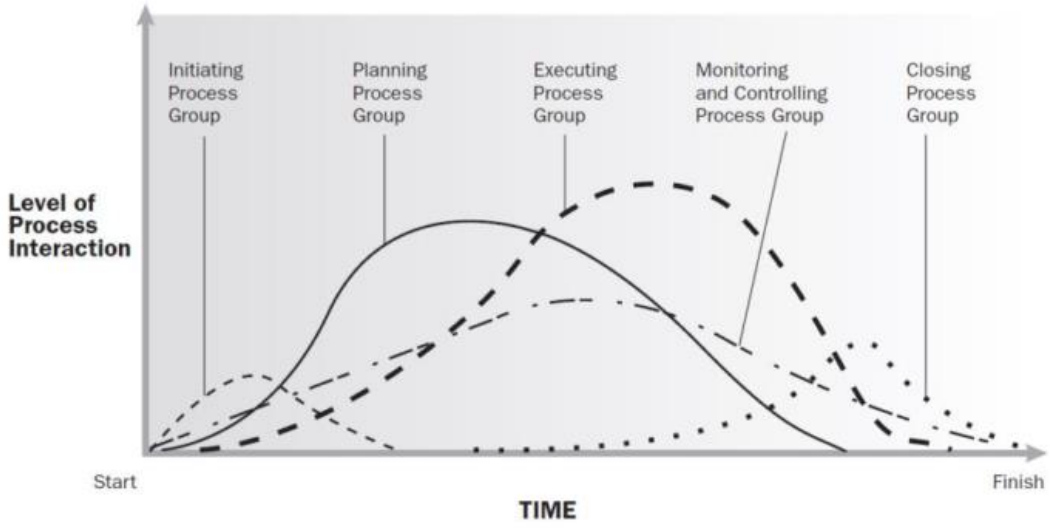


Figure 11 - Process Groups Interact in a Phase or Project [retrieved from (PMI, 2013, p. 32)].

Additionally, the PMBOK constitutes ten knowledge areas, in which each represents an individual set of processes, as it follows listed. A knowledge area has its own input, output, tools and techniques to come up with a result.

1. Integration – includes the processes and activities needed to identify, define, combine, unify, and coordinate the various processes and project management activities within the project management process groups;
2. Scope – requires the processes needed to ensure that the project includes all the work required to complete the project successfully;
3. Time – requires the processes to manage the timely completion of the project;
4. Cost – involves the processes in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the agreed budget;
5. Quality – implies the processes and activities of the acting organization that define quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken;
6. Human Resource – describes the processes that organize, manage, and lead the project team;
7. Communications – requires the processes to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and the ultimate disposition of project information;

8. Risk – conducts the processes for risk management planning, identification, analysis, response planning, and controlling risk on a project;
9. Procurement – processes need to purchase or acquire products, services, or results needed from outside the project team;
10. Stakeholder – processes require to identify all people or organizations impacted by the project, analysing stakeholder expectations and impact on the project, and developing appropriate management strategies for effectively engaging stakeholders in project decisions and execution.

To illustrate and comprehend the mapping between the knowledge areas and the process groups, also deeming all the project management processes, consult Table 1.

The act of developing software has two perspectives, which need to be aligned to work together in search of a final quality product: the project management perspective and the perspective of the application development process.

Considering the perspectives enlightened above, the PMBOK is the chosen approach for this master thesis in the perspective of project management, whereas the agile processual framework, Scrum, was the introduced and selected approach in the previous chapter, that ties with the perspective of the software development process.

Thus, by using the PMBOK together with the Scrum, it makes possible the combination of good project management practices with the dynamic of an agile software development. By balancing both methodologies, the achievement of a software product, as is a repository of cases, can be planned, developed and implemented in a more conducted way.

Table 1 - Knowledge Areas and Process Groups Mapping Matrix [adapted from (PMI, 2013)].

	Process Groups				
Knowledge Areas	Initiation	Planning	Executing	Monitor and Controlling	Closing
1. Integration	*1.1 Develop Project Charter*	*1.2 Develop Project Management Plan*	*1.3 Direct and Manage Project Work*	1.4 *Monitor and Control Project Work* 1.5 *Perform Integrated Change Control*	*1.6 Close Project or Phase*
2. Scope		*2.1 Plan Scope Management* *2.2 Collect Requirements* *2.3 Define Scope* *2.4 Create WBS*		*2.5 Validate Scope* *2.6 Control Scope*	
3. Time		*3.1 Plan Schedule Management* *3.2 Define Activities* *3.3 Sequence Activities* *3.4 Estimate Activity Resources* *3.5 Estimate Activity Durations* *3.6 Develop Schedule*		*3.7 Control Schedule*	
4. Cost		*4.1 Plan Cost Management* *4.2 Estimate Costs* *4.3 Determine Budget*		*4.4 Control Costs*	
5. Quality		*5.1 Plan Quality Management*	*5.2 Perform Quality Assurance*	*5.3 Quality Control*	
6. Human Resource		*6.1 Plan Human Resource Management*	*6.2 Acquire Project Team* *6.3 Develop Project Team* *6.4 Manage Project Team*		
7. Communications		*7.1 Plan Communications Management*	*7.2 Manage Communications*	*7.3 Control Communications*	
8. Risk		8.1 *Plan Risk Management* 8.2 *Identify Risks* 8.3 *Perform Qualitative Risk Analysis* 8.4 *Perform Quantitative Risk Analysis* *8.5 Plan Risk Responses*		*8.6 Monitor and Control Risks*	
9. Procurement		*9.1 Plan Procurement Management*	*9.2 Conduct Procurements*	*9.3 Control Procurements*	*9.4 Close Procurements*
10. Stakeholders	*10.1 Identify Stakeholders*	*10.2 Plan Stakeholder Management*	*10.3 Manage Stakeholder Engagement*	*10.4 Control Stakeholder Engagement*	

Chapter 5. Research Methodology

This chapter begins by addressing the research in the IST area. It aims to answer the question of what researchers have at their disposal and what surrounds them, while doing research. Moreover, it exposes why the Design Science Research methodology is considered to be the most adequate and applicable for the research problem. Finally, a research technique called focus group is explained and, subsequently framed with the outcome of the adopted research methodology, an artifact.

5.1. Research in Information Systems and Technology

Information technology (IT) are implemented within an organization with the purpose of improving not only effectiveness, but also efficiency of certain organization. The combination of the capabilities and functionalities of IT plus the characteristics of the genesis of that organization, its work systems, its people, and its development and implementation methodologies, together determine the extent to which that purpose is achieved.

It is incumbent upon researchers in the information systems (IS) area to acquire knowledge that aids in the productive application of IT to human organizations as well as their management, and to develop and communicate this knowledge regarding both the management of IT and the use of IT for managerial and organizational purposes (Hevner, March, Park, & Ram, 2004).

Also, it is truly important to conceptually understand the framework of this scientific area, so that existing communities can develop and, consequently, evaluate their work as researchers in the IS field of study. Therefore, an alignment between the environment, which defines the problem space being composed with people, organizations and technology, and the knowledge base which provides foundations and methodologies for supporting the IS research. To illustrate how researchers balance the business needs and the applicable knowledge for assess and refine their research work, without forgetting that all these variables are subject to change due to its own existent dynamicity, it is presented a conceptual framework of the IS research (Figure 12).

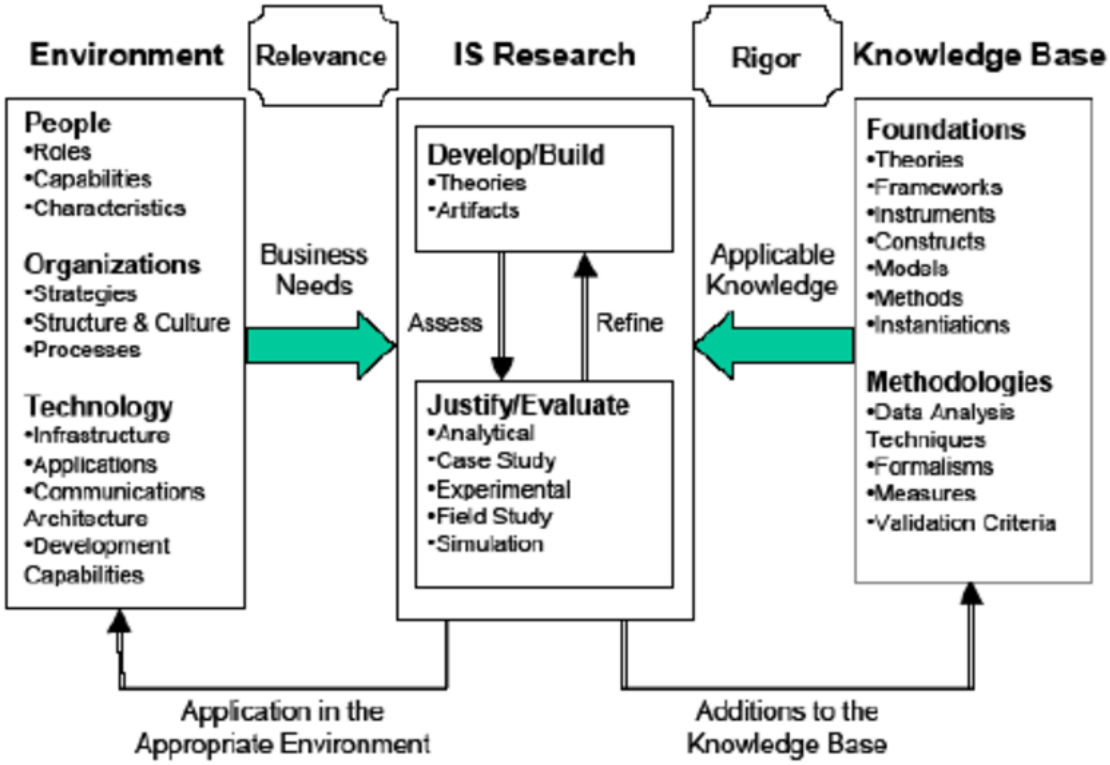


Figure 12 - IS Design Science Research Framework [retrieved from* (Hevner et al., 2004, p. 80)*].

Accordingly, IS research can be complemented with two but quite distinct paradigms: the first one is concerned with the paradigm of behavioural science which "has its roots in natural science research methods and it seeks to develop and justify theories that explain or predict organizational and human phenomena surrounding the analysis, design, implementation, management, and use of information systems", whereas the second paradigm named design science "has its roots in engineering and the sciences of the artificial and it seeks to create innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, management, and use of information systems can be effectively and efficiently accomplished" (Hevner et al., 2004, p. 76).

Thus, behavioural science research is addressed through the development and justification of certain theories that explain or predict the phenomena related with the business need, while design science research is addressed through the building and evaluation of artifacts designed to meet the identified business need.

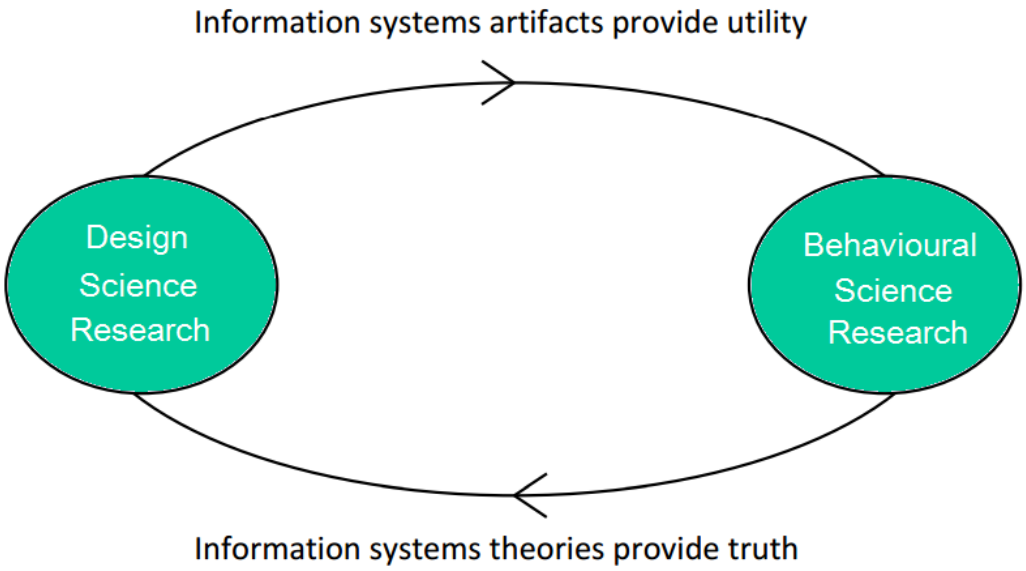


Figure 13 - Two-phased Research Cycle [based on* (Hevner et al., 2004)*].

As can be observed in Figure 13, this research cycle represents the relation between these two complementary phases in the IS research, when given a determined business need. Hence, it is assumed that the goal of the design science research, intrinsically related with the theories, is above all to provide truth to the research itself. On the contrary, it is assumed that the goal of the behavioural science research, intrinsically related with the artifacts is, above all, to provide utility to the research itself (Hevner et al., 2004).

Therefore, IS researchers can acquire two types of scientific knowledge while working: the knowledge based mostly in theories, named as knowledge-for-understanding and, the knowledge based mostly in artifacts, named as knowledge-for-a-purpose (Carvalho, 2012). Furthermore, Carvalho (2012) refers that at any rate, the outcome of the research is new scientific knowledge, so as the same applies to design research. That is mainly because the relevant result of design research is not the design of artifacts them self, it is rather the knowledge about them.

Artifacts, "human-creations designed during design research projects" (Carvalho, 2012, p. 3) and new scientific knowledge, formed about artifacts that can lead to contributions for the research area, have a fine line that is not always demarcated and easy to establish because these two concepts are intrinsically related with each other.

When answering to the question of how artifacts and its respective scientific knowledge can be validated, researchers define several elements which are included into the validity criteria. The four considered elements are following mentioned (Carvalho, 2012).

1. Artifact success. This validation element refers that new artifacts should be successful. However, this success must be established in terms of measures such as:
    a. Usefulness – the degree in which the artifact contributes to the attainment of a certain result, in a level broader than the artifact itself; and it takes into account that the artifacts, by themselves, might be insufficient to achieve the expected results, once they should be used or applied by humans or even operated with already existent artifacts;
    b. Efficacy – the degree in which the artifact accomplish the expected results, accordingly with the purpose it was created for; and perform its role in a level higher of independence from other artifacts or from their human operators;
    c. Efficiency – a combination of measures between the efficacy measures and the resources involved in the operation or use of the artifacts.
2. Generalization. This element, as the name suggests, is related with an important characteristic of scientific knowledge. Its applicability is not restricted to a specific set of situations. For instance, the knowledge that results about some artifact, which was built for a purpose, does not mean it cannot be applied to other situation. It tries to demonstrate, regarding several instantiations or classes of situations, the feasibility of artifacts and/or to enable the assessment of their success;
3. Novelty. As stated above, research produces new knowledge, so in design research there is new knowledge if there is a new artifact, corresponding to a new class of artifacts, or if it shows significant improvements when compared with the existent artifacts of some class. Researchers are intended to demonstrate the novelty of the outcome, by expressing that acquisition of knowledge of what did not existed before, what they did not knew or even what is better now;
4. Explanation capability. The reasons of coming up with successfully designed objects should be explained. There is no point in design an artifact, even being successful in achieving the purpose, if the researchers are not sufficiently capable of explaining

> it in terms of usefulness, efficacy and efficiency. It implies, for researchers, an understanding of the phenomena that enable the realization and performance of an artifact and/or the phenomena that encompass its use or operation. Finally, researchers acquire knowledge that tries to justify and explain the success of a certain artifact when compared with alternative ones too.

At a last instance, the contributions in IS research while in an appropriate environment, considering the business needs, as well as adding content for the knowledge base, considering the applicable knowledge, will be valuable for further research and practice.

Although, the conceptual framework is intended to contextualize the components and their relation within research, it is important to go further and try to answer to another question: if we already know what researchers have at their disposal, how they should act while doing research? This question will be answered in the next section, without forgetting the focus of research problem.

5.2. Design Science Research

In recent years, several researchers had succeed in bringing the design research into the IS research community, by slowly diffusing the value of design science as an IS research paradigm, and actually integrating design as a major component of research (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2008). Therefore, and despite several research methodologies in this scientific area, the Design Science Research (DSR) has turned out to be an adequate methodology, considering the research problem.

In fact, a methodology is "a system of principles, practices, and procedures applied to a specific branch of knowledge" (Peffers et al., 2008, p. 49).

Thus, the DSR methodology involves the creation of new knowledge throughout design and consequent construction of artifacts (things or processes) and analysis of the use and/or performance of such artifacts along with reflection and abstraction, in order to improve and understand the behaviour of aspects of IS (Vaishnavi & Kuechler, 2004). In other words, DSR is the purposeful seeking of an embedded solution to an understood research problem, by including any designed object (Iivari, 2007).

Artifacts are potentially constructs (by which to think about them), models (by which to represent and explore them), methods (by which to analyse or optimize them), instantiations (that demonstrates how to affect them), in overall any designed object that is only complete and effective, when it satisfies the requirements and constraints of the problem it was meant to solve (Hevner et al., 2004; Peffers et al., 2008).

To understand how researchers do high quality DSR in IS, it is important to review the Figure 12 which represents the IS research framework, and overlays a focus on three inherent DSR cycles such as: the relevance cycle, the rigor cycle and, finally, the design cycle, as shown in the Figure 14.

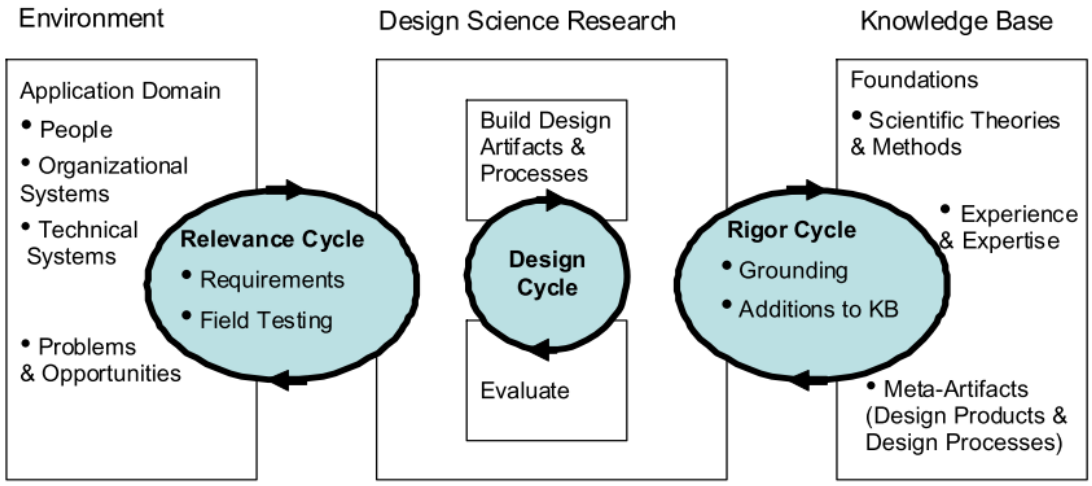


Figure 14 - Design Science Research Cycles [retrieved from (Hevner, 2007, p. 88)].

The relevance cycle links the surrounding environment of the research project with the design science activities involved, whereas the rigor cycle bridges those activities with the knowledge based scientific foundations, experience and expertise that assist the research project. The central Design Cycle iterates between the core activities of building and evaluating the design artifacts and processes of the research (Hevner, 2007).

The internal design cycle is the core of any DSR project, in which research activities iterates more rapidly between the construction of an artifact, its evaluation, and subsequent feedback to refine the design further. The final purpose of this cycle is generating design alternatives and evaluating those suggestions against requirements until a satisfactory design is achieved. This means that the other two cycles, either the requirements of the relevance cycle, or the theories

and methods in the rigor cycle, should as well sustain these activities in order to outcome with a final output – the artifact (Hevner, 2007).

Although the design cycle is where the hard work of DSR is done, it is important to understand the dependencies of the design cycle on the other two cycles while appreciating its relative independence during the actual execution of the research.

Despite the DSR process model for this methodology, developed by Vaishnavi and Kuechler (2004), can be a relevant literature on the topic, it is deemed the adoption of Peffers, et al. (2008) as a ground for the research problem laid.

To elucidate this decision, the Figure 15 shows the six activities of the process model aforementioned, being following explained (Peffers et al., 2008).

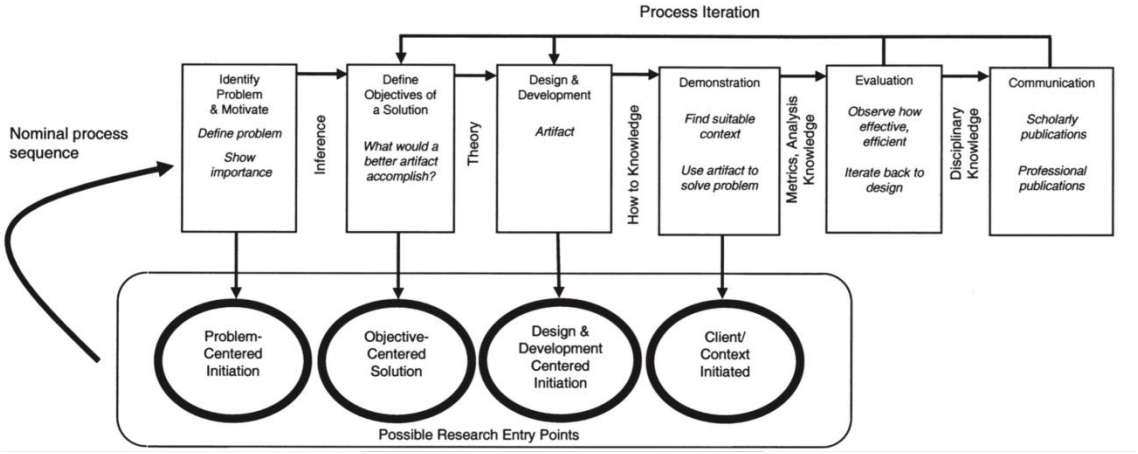


Figure 15 - DSR Methodology Process Model [retrieved from (Peffers et al., 2008, p. 54)].

Respectively, the phases of the DSR methodology process model are following mentioned:

1. Problem Identification and Motivation defines the research problem and justifies the value of a solution. The problem definition is used to develop an artifact that can effectively provide a solution that can capture the solution's complexity. Justifying the value of a solution, not only motivates the researcher to pursue the solution, but also the reasoning associated with the researcher in understanding of the problem. In addition, the resources required for this activity include knowledge of the state of the problem and the importance of its solution;
2. Define the Objectives for a Solution accordingly with the problem definition and knowledge of what is possible and feasible. The objectives should be inferred

rationally from the problem specification, in which they can be categorized as quantitative (better solution) or qualitative (new solution). Moreover, the resources required for this activity include knowledge of the state of problems and current solutions, if any, and their efficacy;

3. Design and Development, as the name suggests, is to create the artifact. As previously said, artifacts can be constructs, models, methods, or instantiations, that can conduct to a research contribution, embedded in design. This activity is followed by determining the artifact's functionality and architecture and, consequently, the construction of the actual artifact. Once again, resources required for moving from objectives to design and development include knowledge of theory that can be brought to bear in a solution;
4. Demonstration, in other words, is to prove the use of the artifact which will solve one or more instances of the problem. Normally, involves experimentation, simulation, case study or other appropriate action. Therefore, resources required for this step include effective knowledge of how to use the artifact to solve the problem;
5. Evaluation passes through observing and measuring how well the artifact supports a solution to the problem. A comparison is made with the objectives of a solution and actual observed results from the use of the artifact in the demonstration activity. It can take many forms depending on the nature of the problem venue (which dictates whether an iteration is feasible or not) and the artifact built for the solution. An analysis is made between what is produced and what was expected. For instance, some variables can be taken into account, such as functionality, performance, time-response, availability, resources, cost, user-friendly (feedback provided by clients, surveys, focus groups, experiments, simulations), and many more. Conceptually, this activity can lead to any empirical evidence or logical proof. It is required knowledge of relevant metrics and analysis techniques. Finally, researchers can decide whether to iterate back to activity 3 (Design and Development) to try to improve the effectiveness of the artifact or to continue the communication activity and leave further improvement to subsequent projects;
6. Communication is important not only to communicate the problem, but also to the artifact itself in its utility and novelty, the rigor of its design, and its effectiveness to

researchers and other relevant audiences. Moreover, it can assist researchers in the academic environment when facing research publications. This last activity requires knowledge of the disciplinary culture.

So far, it has been presented the concerned methodology for this master thesis. Thus, after a better comprehension of such research process, perhaps is conceivable to framework it with the research problem.

To place the research problem on its working context, it is important to remind what encompasses. To begin with, the research problem demands the conception, construction and evaluation of a repository of cases that will describe professional acts, and which it can be accessed by practitioners, researchers and by teachers or students.

Whereas it was looked as a problem hitherto, the term itself in this research may as well be identified as a state of view or an arising necessity/opportunity for developing a solution that can facilitate and assist the experts in IST.

Taken into consideration the process model above, the first and second activities addresses the phase of artifact's conception. At first, the research problem along with its motivation and objectives was initially described in the introduction chapter. Then, to shrink the knowledge gap and be familiarly with the problem, the result obtained upon completion of the literature review provides theoretical foundation for the use of the repository of cases by the practitioners, researchers, teachers and students. For this particular work, the concept of project management is implicit once it we will identify the needs/requirements and other well thought out variables for developing such repository.

Subsequently, the third and fourth activities represents the phase of artifact's construction, where it is centred most of the research work. The design and development of the artifact, and consequent demonstration of the repository of cases, normally are taken as an iterative process, which means that the concepts and terms of software engineering, as discussed in a previous chapter, are intrinsically connected.

At last, the fifth and sixth activities represent the phase of artifact's evaluation. The stage concerns the validation of the artifact, where the design cycle ends, determining the impact of success and quality of the artifact that was built for solving the research problem. For this artifact,

it was used a focus group, further explained in this chapter, to obtain feedback about the repository of cases efficiency, efficacy and utility in supporting the three perspective roles.

Above all, the importance of choosing an adequate research methodology is relevant not only to take the necessary steps in this research, but also for narrowing the line between what is expected and what is produced. Thus, DSR stands for the possibility of something new or a contribution that can improve and understand the behaviour of aspects of IS, where the research entails the design of an artifact and analysis of its use and/or performance.

5.3. Focus Groups

Essentially, DSR in IS is used for situations that involve the development and evaluation of artifacts that are designed for some purpose, responding at some human needs, either already existing or foreseen. Rather than a procedural methodological approach, this is a process which involves frequent iteration between the major two phases: development and consequent evaluation of the artifact.

In other words, a researcher not only designs the artifact, but must provide evidence that this artifact solves an actual problem. So, the artifact evaluation is crucial for the research methodology, in which the artifact is subject to validation criteria elements, namely artifact's success in usefulness, efficacy and efficiency, generality, novelty and explanation capability (Carvalho, 2012; Vaishnavi & Kuechler, 2004).

The evaluation phase attempts to identify the strengths and weaknesses of the design, as well as, provide feedback for further development and refinement of the artifact. There are numerous methods or techniques available to validate an artifact. One such method are focus groups (Tremblay, Hevner, & Berndt, 2010).

According to Morgan (1988), a focus group is "a research technique that collects data through group interaction on a topic determined by the researcher" (p. 6). It is the person's interest that provides the focus of the group, whereas data is obtained through the interaction of the group. Thus, the primary challenge is the structuring of the focus group so participants can collectively use an IT artifact in order to provide feedback.

Note that the use of focus group is a recent technique used in the IS field, when compared with its application in the social sciences. It has been long used in social research to study ideas in a group setting (Gibson & Arnott, 2007). Nevertheless, there are four key reasons why focus groups are an appropriate method for DSR projects (Tremblay et al., 2010):

1. Flexibility. Focus groups allow an open format and are considered flexible enough to deal with a wide range of design topics and domains;
2. Direct Interaction with Respondents. The researcher is not only putted into direct contact with domain experts, but also with potential users of the designed artifact. It helps the research by clarifying any questions regarding the design of the artifact as well as probing respondents in some key design issues;
3. Large Amount of Rich Data. The interaction while using these technique produces a large amount of information in the form of quantitative and qualitative feedback. In addition, this rich data set allows deeper understandings in respondents' reactions and use of the artifact, as well as other concerns that may be present in a business environment and would significantly impact the design;
4. Building on Other Respondent's Comments. Once the settled group normally interacts with the artifact, ideas or opinions can emerge from respondents, which are not commonly covered in individual interviews.

Traditional focus groups, when used in this IS area, need to be adapted to meet to specific goals of the DSR methodology.

In one hand, is the refinement of the artifact design, so exploratory focus groups (EFG) study the artifact to propose improvements in the design. The design cycle uses EFG for the construction and refinement of the artifact, until the same is released for the field test in the application environment. On the other hand, the field test employs confirmatory focus group (CFG) to the evaluation of the artifact in the research field. The relevance and rigor research of the artifact requires multiple CFG to be run with opportunities for quantitative and qualitative data collection and analyses across the multiple CFG (Tremblay et al., 2010).

Both focus groups are used to seek participant feedback about an artifact's success in terms of its utility, efficiency and efficacy. Normally, they are conducted with similar characteristics and

designed questioning routes for the participants. The EFG achieve rapid incremental improvements in the artifact design, whereas the CFG demonstrate the utility of that design.

In Figure 16, it is possible to observe two different relations. The first is concerned with the use of focus groups in DSR, while the second is focused in EFG and CFG in terms of its position in this research methodological process.

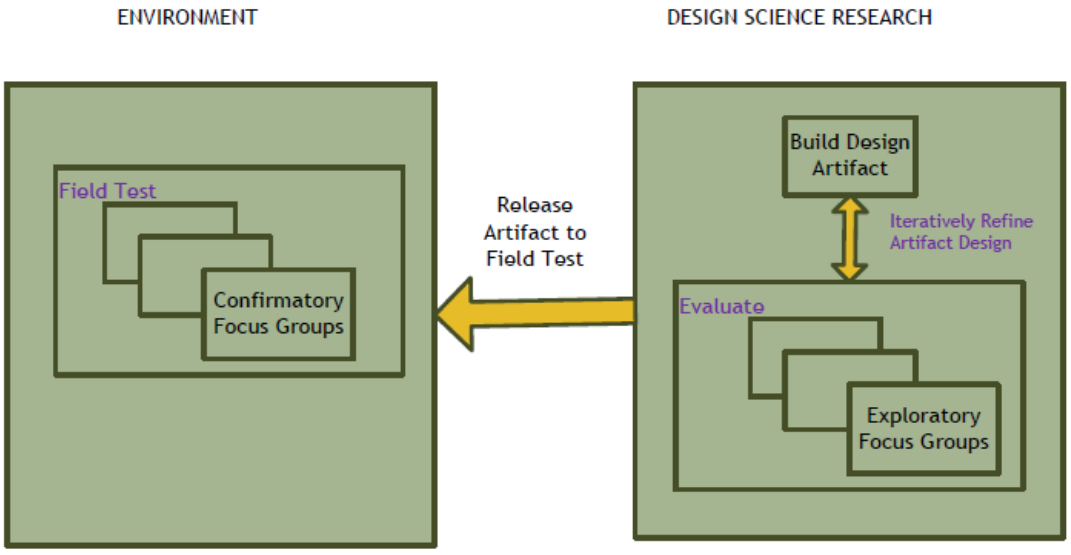


Figure 16 - Focus Groups in DSR [retrieved from (Tremblay et al., 2010, p. 603)].

With regards to the prior framework between the research methodology and the use of focus groups in the concerned area, now it may be explained the basic steps applicable to a research-oriented use of focus groups. Each step takes into consideration the two primary goals of DSR, as previously stated, the refinement (EFG) and evaluation (CFG) of a certain artifact, and outlines some changes to the traditional focus group technique.

To elucidate the use of focus groups in DSR projects, Figure 17 presents the different steps that are taken during the course of this approach (Tremblay et al., 2010).

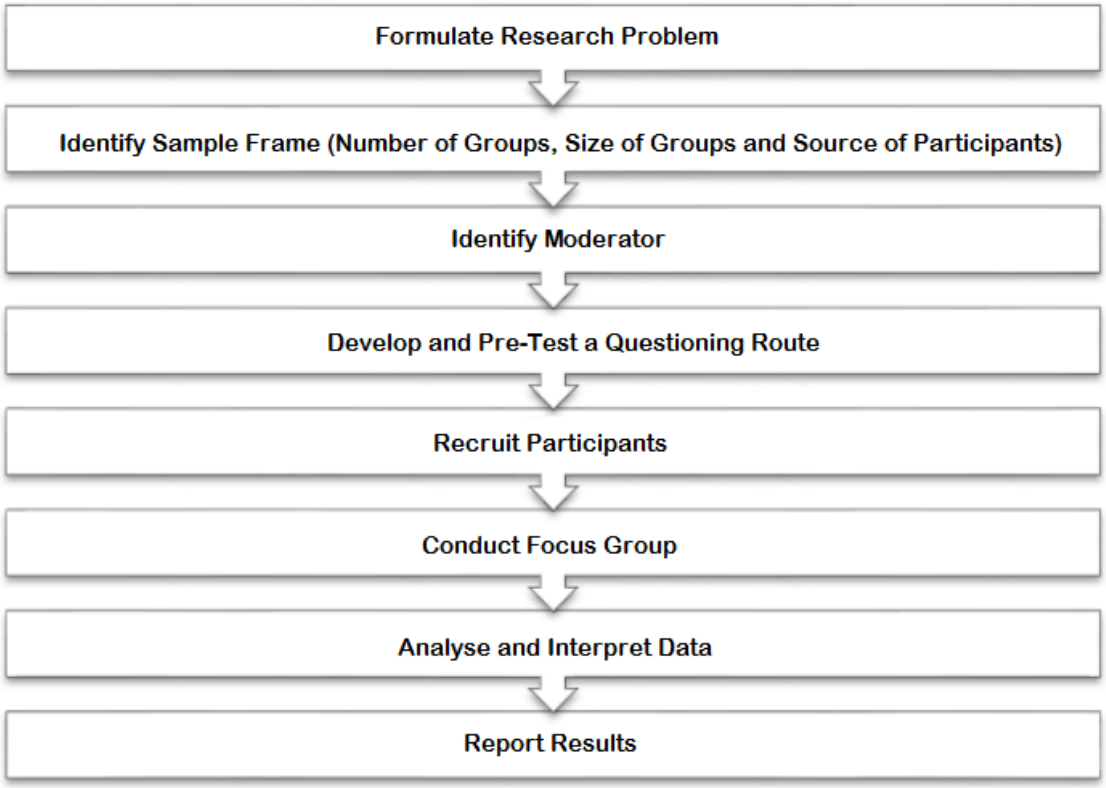


Figure 17 - Focus Group Steps [based on (Tremblay et al., 2010, p. 602)].

Respectively, the steps in the focus group are enumerated below:

1. Formulate Research Problem. When a focus group is conducted, the first activity researchers should do is defining which problem, more specifically which artifact is subjected to analysis in the sequence of the focus group study. The subsequent task should be to identify the objective and the purpose of the focus group, so also research goals must be clearly identified;
2. Identify Sample Frame. Three decisions are done by researchers:
    a. Number of Groups. It decides how many focus groups to run. Focus groups should continue until "nothing new" is learned. However, this is quite difficult to determine, once there is always "room for improvement of an artifact" and subjectivity in interpreting the design of an artifact is truly complete. The same applies to evidence the utility of an artifact. It is important to balance between people and resources since focus groups can be expensive both in time and money. The advisable is at least one pilot focus group, two EFG and two CFG;

b. Size of Groups. The ideal number of participants depends on the objective of the focus group study. Therefore, smaller groups require each participant to be more active while larger groups may lead to social loafing. Once again, it is recommended that the focus groups do not exceed six participants since it may be tricky to apply a higher number in such projects. That is mainly due to the subject matter is more complex than the topics of traditional focus groups;

c. Source of Participants. This decision is not a random process, rather the selection of the participants is based on its characteristics, that must be somehow related to the artifact in discussion. If participants are chosen based on skills and knowledge it may provide more in-depth trade-offs in values and success measures. The diversity of participants can potentially produce more creative ideas or perhaps create more conflict depending on the topic. Sometimes, bringing together groups which are too diverse in relationship to the topic of interest could result in data of insufficient depth.

3. Identify the Moderator. This phase is a critical factor for the conducted focus group be successful. The moderator should be chosen in terms of its skills and personality. For example, its ability to listen, its respectful tone, its communication skills, its open mindedness, its friendly character and sense of humour, its ability to involve and motivate participants to contribute and actively take part in the focus group. However, the context of this type of research restricts the moderator to focus on communication and interpersonal skills only. A second observer, who takes notes during the focus group and also acts as a time coordinator, is advisable. It not only helps and simplify the moderator's work, but also facilitates the final result analysis;
4. Develop and Pre-Test a Questioning Route. The questioning route represents the agenda of the focus group. This component should at least be pre-tested once before applying it in the actual focus group, for instance in the course of a pilot study. Furthermore, it should allow flexible ways of communication and, also provide a clear framework and structure for the moderator. Questions should be open ended, the moderator should be only asking questions and without indicate possible answers that can influence participants and consequently, distort results. Note that,

conducting focus groups with the objective to confirm a developed artifact, a rolling interview guide in EFG must not be used as this would as well distort the results;

5. Recruit Participants. Another critical success factor for focus groups. This key element is usually rather complex in DSR projects, once participants should be familiar with the topic of interest. Yet, the heterogeneity of the group could lead to new insights as things are not taken for granted and are discussed more deeply. For this type of projects, it is proposed 4 to 6 participants who are familiar with the application environment of the artifact and could have different backgrounds;
6. Conduct Focus Group. The focus group must be conducted accordingly with the questioning route. During the focus group, experience regarding the settled and developed questioning route can be gained and transferred into subsequent focus groups for improvements. Is recommended to use audio and/or video recording for further documentation and evaluation purposes. Moreover, the moderator should also provide to the participants a briefly explanation of the objectives of the focus groups, protocols or rules of its existence and the timeline of this process;
7. Analyse and Interpret Data. After conducting the focus groups, the results produced need to be analysed and interpreted. Although there are many approaches to analyze the collected data, the chosen scheme should produce the same or similar results regarding the group focus study. Normally, researchers opt for a mixture of approaches in this step;
8. Report Results. Besides conducting the group focus, analyse and interpret the consequent results, those results should be reported and evaluated. Therefore, a CFG is advisable, after the EFG are finished and the results gained during its course be grouped and ready to be confirmed and evaluated. Even though, there are many ways of reporting focus groups results, researchers should choose regarding the quality and nature of the artifact and the research objectives.

Hitherto, the focus groups have been contextualized in the IST area. Now, after a deep understanding of such reasearch technique, is plausible to framework it with the outcome of DSR methodology.

The artifact produced, defined as an outcome of the research methodology, is a repository of cases that would describe professional acts and subsequently support practitioners, researchers and teachers or students.

Emphasizing what was stated earlier, it is not enough to conceive and construct the artifact, yet it is important to evaluate it. The validity criteria, prior enumerated in this chapter, refer the elements of how an artifact should be evaluated.

For evaluate the efficacy and efficiency of the repository, if it does what it should do and if it does it well, it is required for it to be validated with tests. Since this artifact is a software engineering production, software testing is decisive for this project.

For the utility, it is way more complex. Desirably, having the repository to be used and then perceive what happens, would be more appropriate to the research. As that might not be achievable for a numerous people and within the stipulated time, the solution was joining a panel of experts including the Supervisors of this master thesis, and make a demonstration of the artifact to the selected participants, and finally, ask their opinion about it.

At last, this can be done while using focus groups. A research technique that collects and analyses feedback from its interaction's participants with the artifact, until the same is finished. By doing so, researchers will be better equipped to create useful design artefacts, which address challenging problems, and solve organizational problems (Gibson & Arnott, 2007).

Chapter 6. Work Plan

This chapter, as its name suggests, deals with the work plan for the present master thesis. It describes the activities as well as its duration, which are structured into a scheduling.

6.1. Activities Description

This research work involves the planning, development and implementation of a repository of cases that can be used by practitioners, researchers, teachers and students. It aims to attain the possibility of a contribution for something new in the IST area, a new artifact, that can assist the IST professionals on what they exert in their daily work.

During this dissertation, several activities are presented into the work plan, which were defined into three milestones: Work Plan, Dissertation Project and Dissertation Report. Obviously, each one has different objectives where one or more activities are inherent to the respective milestone. Some fundamental and essential tasks are described below, considering the relation with each milestone:

- Task 1: Work Plan (October 2016) – the work plan, produced in October 2016, describes the motivation for this master thesis, containing its framework, objectives and expected results, methodological approach and, finally, the schedule of the project. This milestone lasts for one month;
- Task 2: Literature Review (October 2016 to February 2017) – the literature review is one of the most crucial activities that is intended for the Dissertation Project document. In this activity, a theoretical foundation was done, regarding the focus in the context of this dissertation. Several concepts and terms were mentioned and explained, in order to justify the proposed outcome for the research problem. With that knowledge base was then possible to infer which methodology and techniques can be used for the problem solution, which lead to the planning, development and

implementation of something that may be new, as such a repository of cases. It had a duration of four months;

- Task 3: Conception, Construction and Evaluation of the Artifact (February to August 2017) – these three complex activities were essential and fundamental to come up with a repository of cases, which is the principal outcome of this master thesis. The theoretical foundation was applied into the conception of the artifact (planning of the repository of cases) regarding its requirements and functionalities, the construction of the artifact (development of the repository of cases) following the considered methodology and using the Yii development framework, and finally, the evaluation of the artifact (testing and implementation of the repository of cases) by using the focus group technique to demonstrate the usability, efficiency and efficacy of the new artifact. This was the most practical component of the project with a duration of six months;
- Task 4: Elaboration of the Dissertation (September to October 2017) – this task concerns the elaboration of the last document, the Dissertation Report. All the activities held during this dissertation were continuously described. This task represents the necessary documentation to support the result of the focus of this research, the repository of cases, which lasts for two months.

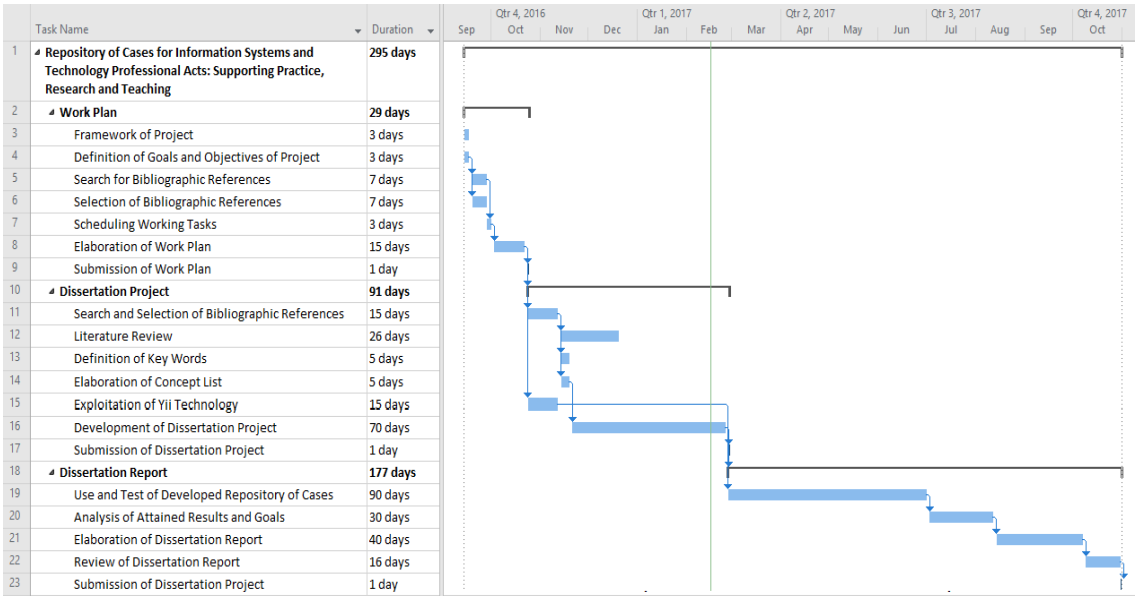
The chapters proposed for the final document (Task 4) were the Artifact Conception,(which will address the entirety of the software conception, for instance, the UML representation and the Entity-Relationship Diagram (ERD) or other relevant design models), the Artifact Construction where it explains which, what, and how technologies are used to produce such software and its initial prototype) and, finally, the Artifact Evaluation (where the analysis of the focus group technique is described, and the results as the artifact itself are evaluated).

6.2. Scheduling

A scheduling was made, taking into consideration all the tasks that were defined for this dissertation project as well as the official delivery dates of the various moments of evaluation. Therefore, it is presented below the deadlines of such milestones:

- Submission of the Work Plan (task 1) – 24th October 2016;
- Delivery of the Dissertation Project (task 2 and 3) – 27th February 2017;
- Delivery of the Dissertation Report (task 3 and 4)– 31th October 2017.

The Gantt diagram was done considering all the tasks for this dissertation project and duration of each one of these assignments, being illustrated in the following figure. As it is possible to observe, the main tasks that characterize each milestone and that were previously described in the prior section, are also implicitly included in this representation of the project scheduling (Figure 18).



	Task Name	Duration
1	**Repository of Cases for Information Systems and Technology Professional Acts: Supporting Practice, Research and Teaching**	**295 days**
2	**Work Plan**	**29 days**
3	Framework of Project	3 days
4	Definition of Goals and Objectives of Project	3 days
5	Search for Bibliographic References	7 days
6	Selection of Bibliographic References	7 days
7	Scheduling Working Tasks	3 days
8	Elaboration of Work Plan	15 days
9	Submission of Work Plan	1 day
10	**Dissertation Project**	**91 days**
11	Search and Selection of Bibliographic References	15 days
12	Literature Review	26 days
13	Definition of Key Words	5 days
14	Elaboration of Concept List	5 days
15	Exploitation of Yii Technology	15 days
16	Development of Dissertation Project	70 days
17	Submission of Dissertation Project	1 day
18	**Dissertation Report**	**177 days**
19	Use and Test of Developed Repository of Cases	90 days
20	Analysis of Attained Results and Goals	30 days
21	Elaboration of Dissertation Report	40 days
22	Review of Dissertation Report	16 days
23	Submission of Dissertation Project	1 day

Figure 18 - Gantt Diagram

Finally, the Project Charter (see Appendix A), served as a guideline for the research work. It defines some variables such as executive summary, justification, purpose, requirements, deliverables, stakeholders, timeline, constraints and assumptions, evaluation and success criteria, and success factors.

Chapter 7. Artifact Conception

Related with the two initial phases of the methodological approach, the conception of the artifact will be explained throughout this chapter. So far, the purpose and utility of the repository of cases as well as the use of cases by the practitioners, researchers, teachers and students was theoretically sustained. Thus, keeping an eye at a more practical perspective, this section not only describes the requirements for this particular software, but also the resulting design models elaborated during the planning of the repository of cases.

7.1. Software Conception

For the software conception, several sessions were accomplished to understand not only the research problem, but also to comprehend which necessities must be attained for such IT product. Fully understanding what a project will deliver is critical to its success.

As previously referred, the customers in this specific project are the Supervisors of this master thesis (in Scrum, defined as PO), thus the reason why some sessions were merely dedicated to the requirements specification.

Moreover, all the sessions were audio recorded, being listened every time a doubt or an eminent question had arisen in the process of making the requirements specification list (in Scrum, defined as the PB). In fact, performing sessions are one of the most common techniques for gathering requirements, by simply sit down with the clients and ask what they need. As the solution for the research problem is something new, some ideas made part of a brainstorm, being subsequently settled, so that all participants could be in accordance with what the solution might look like, what it should accomplish and who it may support.

The most important key issue in the conception of this artifact was the comprehension of how the repository of cases should be built and what functionalities it should possess to support its user's needs. Figure 19 presents one of the results from the performed sessions, illustrating a representation of how the repository of cases should be arranged.

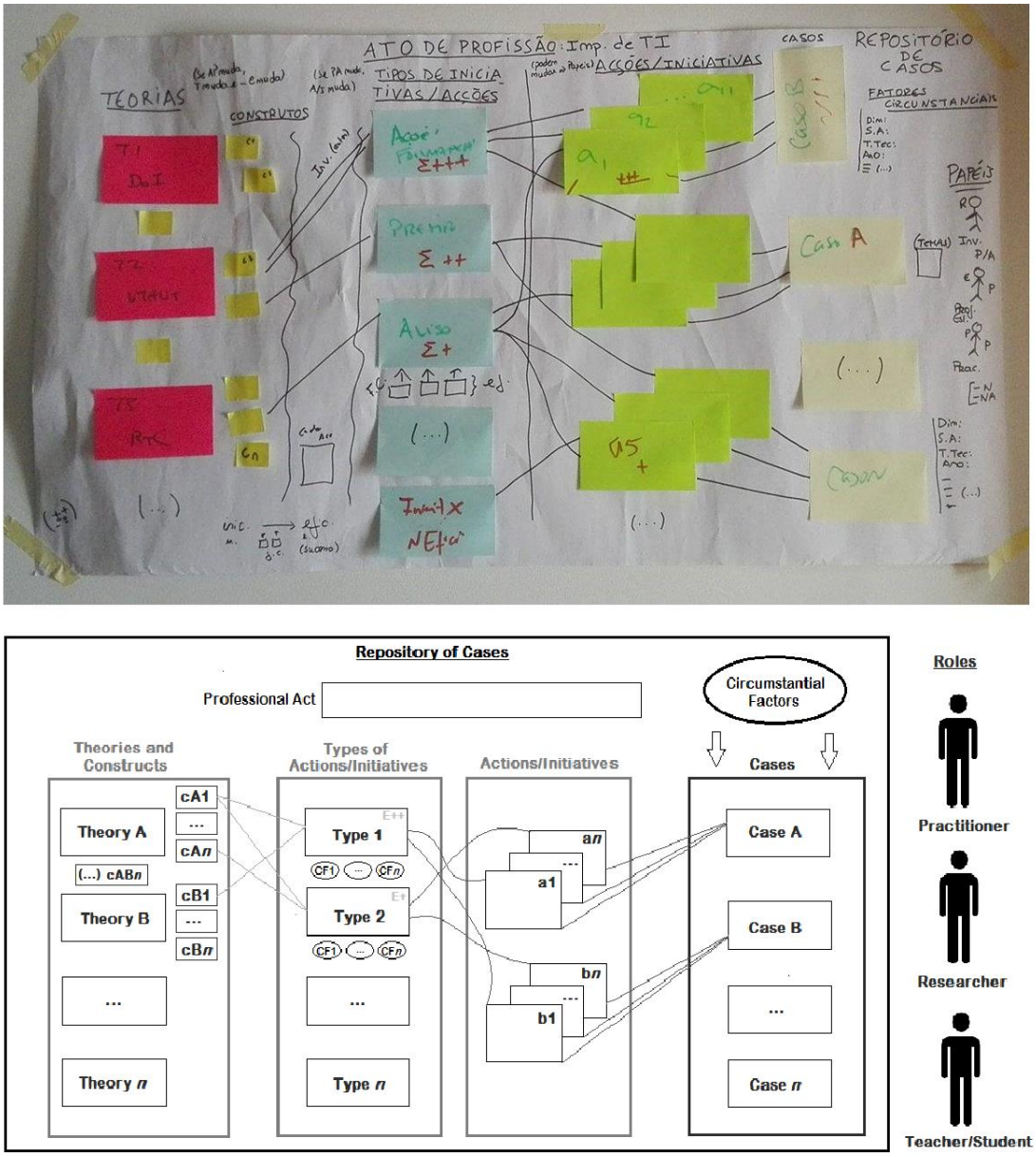


Figure 19 - Repository of Cases Representation

Three main roles or users are covered in this repository of cases: practitioners, researchers, teachers and students. These users can search for a professional act in the repository of cases. According to the requested professional act, several cases are shown in accordance with the search made by the users. Each case has its own circumstantial factors, such as: professionals, organization, country, year, types of technologies, dimension, activity sector or other features that may characterize the case. Other components in this repository of cases are the actions or initiatives associated to a specific case. These actions or initiatives are grouped in types of initiatives or actions (assigned with a respective effectiveness level and influenced by the circumstantial factors), independently of the case they are associated with. Each type of actions or initiatives can

contribute for a better confidence in one or more theories and its constructs. Also, one construct can be related with more than one theory.

It is intended that the search is done through professional acts, however other layers or components of the repository of cases are also possible of being searched for. For instance, users can also search for cases, circumstantial factors, actions or initiatives, types of actions or initiatives, theories or constructs.

Although it is not represented in the figure above, an administrator user is intended for the repository of cases to edit the cases' guide, so that researchers can be able to add new cases into the repository according to the rules and policies of the repository, and also, to manage the remaining users.

The requirements elicitation was performed as the process of collecting the customers' needs to solve the research problem and achieve the objective in this master thesis. Some of the requirements that were defined at this initial stage for the planning, development and implementation of a repository of cases, are following mentioned:

- Create, read, update and delete users;
- Create, read, update and delete cases;
- Create, read, update and delete theories and constructs;
- Search for professional acts, cases or its circumstantial factors;
- Search for actions or initiatives or types of actions or initiatives;
- Search for theories and its constructs;
- Advanced search for cases;
- Application of filters or keywords in search.

To clarify the strategy adopted for the requirements gathering, the sessions that were performed are outlined in the following table, according to the date of its occurrence, topics covered during the session, the participants and the outcomes they produced. Notice that these sessions were undertaken not only in accordance with the requirements gathering, but also about what is being developed after a deeper understanding of what the repository of cases should possess, serve and support.

Table 2 - Work Sessions

Sessions			
Occurrence Date	Topics Covered	Participants	Outcomes
25/10/2016	• Focus of the research work; • Repository of cases concepts and terms.	Prof. João Álvaro Carvalho Prof. João Varajão Rita Costa e Silva	Better understanding of the research problem and the solution proposed.
01/11/2016	• Users in the repository of cases; • Searches in the repository of cases; • Actions or initiatives in the repository of cases; • Theories and constructs in the repository of cases.	Prof. João Álvaro Carvalho Prof. João Varajão Rita Costa e Silva	Requirements gathering
06/12/2016	• Database schema; • Use cases in UML; • Mockups; • Prototype Specification; • New requirements for the repository of cases.	Prof. João Álvaro Carvalho Prof. João Varajão Rita Costa e Silva	Initiation of the design model and the prototype
03/01/2017	• Review of the requirements list; • Repository of cases representation.	Prof. João Álvaro Carvalho Prof. João Varajão Rita Costa e Silva Eng. Pedro Rito	Final requirements list and repository of cases representation

A better perception of the research problem allowed to take first steps towards what is called the conception of the repository of cases, without forgetting that this comprehension itself was also important throughout the subsequent activities.

At last, it was possible to understand which necessities may be achieved so the repository of cases will be able to support its users and attain the purpose it will be built for. This section, artifact's conception, also referred as planning phase, not always have its due importance in the projects overall, but can significantly influence the following steps on it.

Therefore, in this research work the requirements elicitation were a preponderant activity for the conception of the proposed informatic application while identifying the requirements and consequent functionalities for the repository of cases.

7.2. Design Model

A design model of the repository of cases was done with partial representations, which sustain the conception and, consequently, the construction of the projected repository of cases. Regarding the repository of cases to be developed, the creation of an SQL (Structured Query Language) database and its schema using MySQL Workbench, as well as the design of use case diagrams with UML, were considered relevant for the informatic application to be developed.

An Entity-Relationship Diagram (ERD) shows, logically and physically, a database schema structured according to its entities and relationships (Figure 20). Moreover, the elaboration of this database was well-designed while having in mind a high scalability, not only for the application to be able to grow, but also without any further necessary changes in its structure.

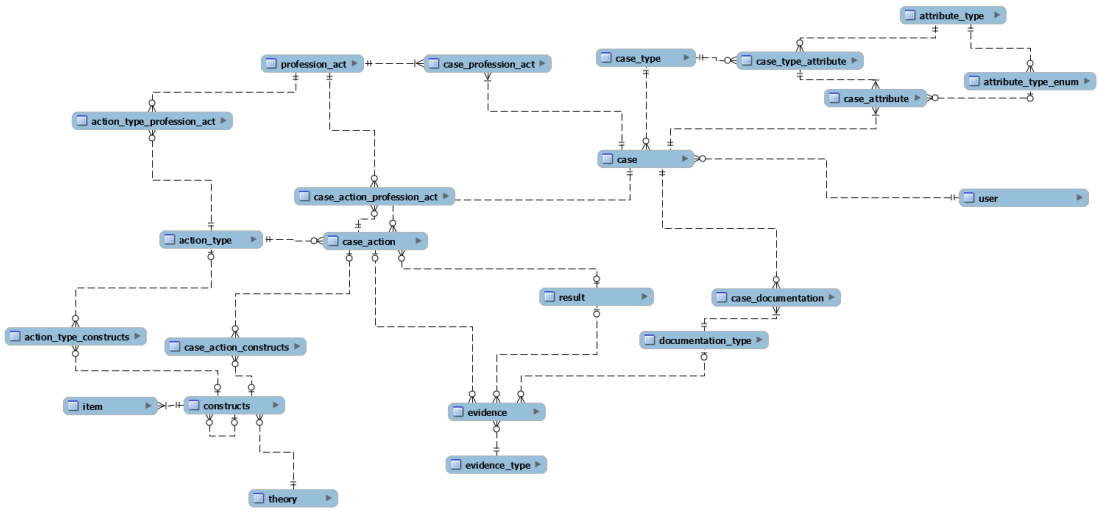


Figure 20 - Database Schema (entities and relationships)

As the complexity and dimension of the database for the project work is extensive, it is displayed a diagram with a partially extended database schema, with relevance to some entities and its attributes (see Figure 21).

Each presented entity in the database is created according to the importance it has for the repository of cases as well the information it will support. Thus, the Table 3 provides a more detailed explanation about the name of the entities and its respective description.

Table 3 - Database Entities and its Descriptions

Entities	Descriptions
CASE	Entity that describes occurrences executed by some IST professional, related with a profession act.
CASE_TYPE	Entity that relates the cases with their type.
CASE_TYPE_ATTRIBUTE	Entity that specifies the attributes for a case type.
CASE_ATTRIBUTE	Entity that possesses the attributes for each case.
ATTRIBUTE_TYPE	Entity that relates the attributes of cases with their type.
ATTRIBUTE_TYPE_ENUM	Entity that enumerates the types of attributes associated with the cases.
CASE_DOCUMENTATION	Entity that contains the documentation associated with a case.
DOCUMENTATION_TYPE	Entity that specifies the types of documentation for a case.
USER	Entity that constitutes the information about the users of the repository of cases.
CASE_PROFESSION_ACT	Entity that relates a profession act in an existing case.
CASE_ACTION_PROFESSION_ACT	Entity that represents the actions associated with a profession act and, consequently, with a specific case.
PROFESSION_ACT	Entity that contains the profession acts.
ACTION_TYPE_PROFESSION_ACT	Entity that specifies the types of actions associated with a profession act.
CASE_ACTION	Entity that specifies the actions related with a specific case.
ACTION_TYPE	Entity that constitutes the types of actions, associated with the case and the profession act.
THEORY	Entity that represents the information about the theories.
CONSTRUCTS	Entity that relates the constructs to a respective theory.
CASE_ACTION_CONSTRUCTS	Entity that represents the constructs related with a case action.
ACTION_TYPE_CONSTRUCTS	Entity that specifies the constructs related with the action type.
ITEM	Entity that represents the items associated to a construct.
EVIDENCE	Entity that specifies the evidences for a specific action of a case.
EVIDENCE_TYPE	Entity that contains the type of existent evidences.
RESULT	Entity that represents the type of result of an action of a case.

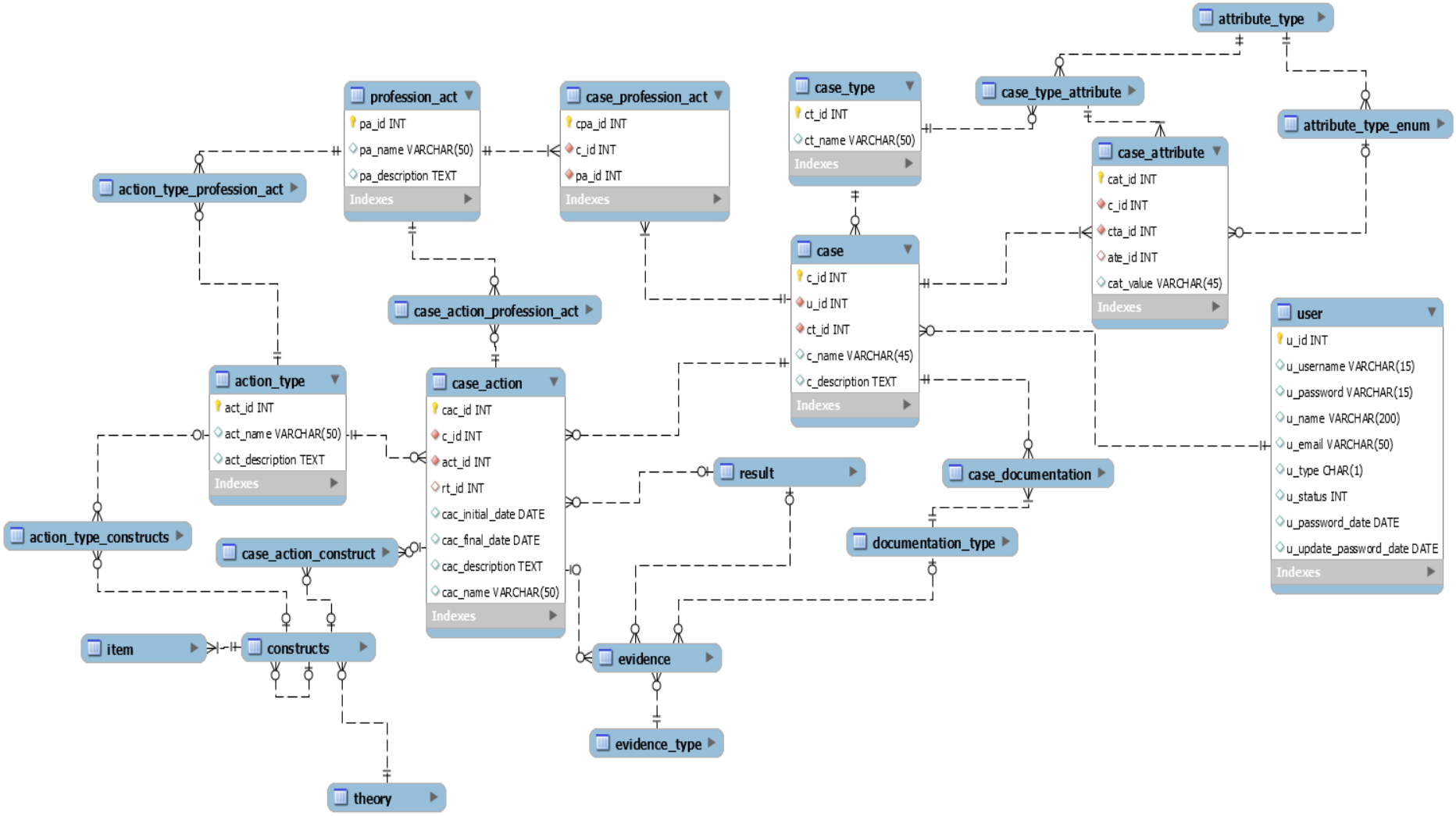


Figure 21 - Database Schema (partially extended)

To confirm the structure of the database, several records were created to understand if each entity, its attributes and relationships were in accordance with the intended schema. An example of an insertion is shown below with the *USER* entity and the attributes it requires for a single record at a time (Figure 22).

user - Table

Table Name: user Schema: db_repository

Filter Rows: Edit: Export/Import: Wrap Cell Content: Apply changes:

iduser	u_username	u_password	u_name	u_email	u_type	u_status	u_password_date	u_update_password_date
1	admin	admin	rita silva	r@istrep.com	admin	active	12.09.2015	12.01.2016
2	prac	prac	carlota ajuda	c@istrep.com	practicioner	pendent	13.09.2015	13.01.2016
3	res	res	ana mendes	a@istrep.com	researcher	pendent	14.09.2015	14.01.2016
4	stu	stu	carla moreira	c@istrep.com	student	active	16.09.2015	16.01.2016
5	tea	tea	diogo costa	d@istrep.com	teacher	pendent	15.09.2015	15.01.2016

Figure 22 - Insertion Example (USER entity)

Another design model presented in this section is the functional specification of the repository of cases while using UML. Thus, it was created use case diagrams. As mentioned before, the users of this repository of cases, or better said, the actors of this system are represented below, according to what they are allowed to perform in the application (Figure 23).

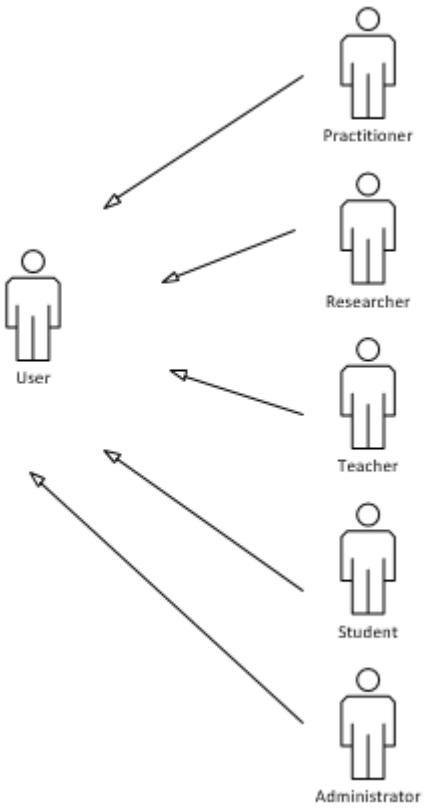


Figure 23 - Actors

All the users of the repository of cases, independently of being practitioners, researchers, teachers or even students, need to be approved by the administrator. Only after, they become confirmed users and they can use the repository according to their own privileges and restrictions.

The following diagrams are mentioned below with an own terminology, so it would be easier to identify each use case and the user it belongs to. For example, the letters "UC" are denominated use case, whereas the letters P (Practitioner), R (Researcher), T (Teacher), S (Student) and A (Administrator). At last, the numbers are according with the enumeration of the use cases in each type of user.

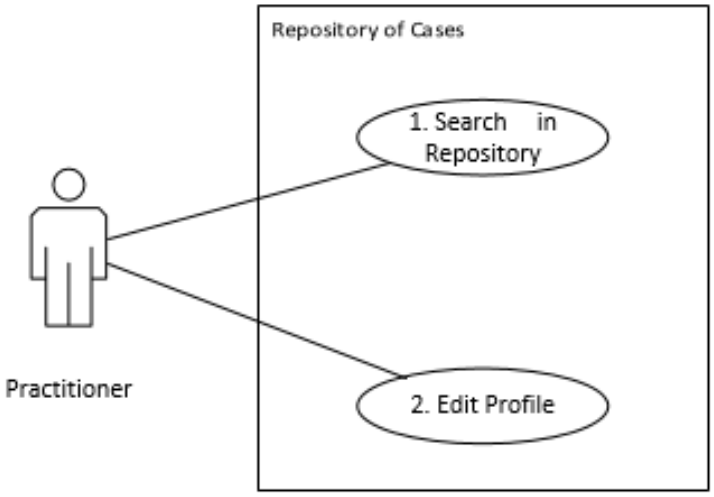


Figure 24 - Practitioner Use Case diagram

Practitioners are intended to use the repository of cases to seek for past situations either to improve their working practices and techniques, or in the process of decision-making, regarding some professional act in which they are involved (Figure 24).

- *{UC-P1}* – this use case allows the user to do any type of search in the repository of cases, either by cases and its circumstantial factors, professional acts, actions and initiatives and its types or even through theories and constructs;
- *{UC-P2}* – this use case allows the user to edit its own profile, whenever he/she desires.

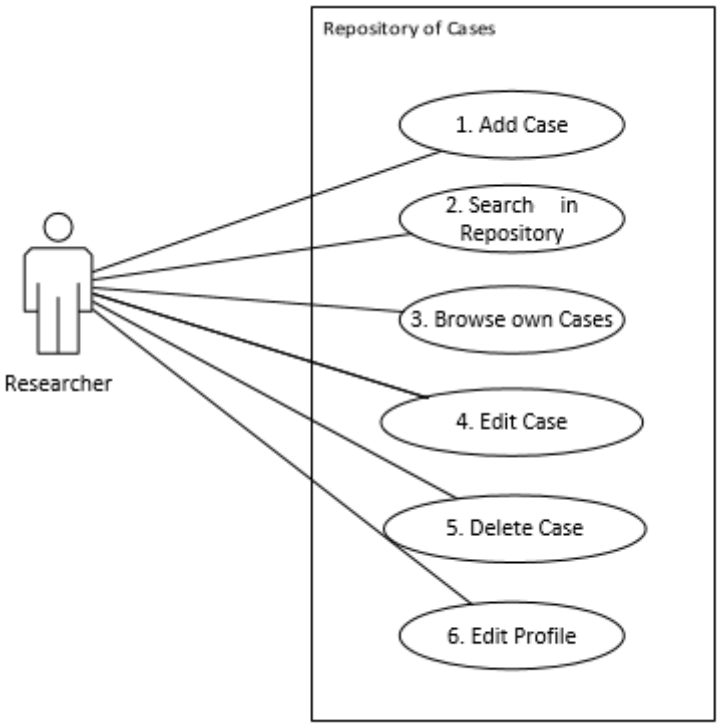


Figure 25 - Researcher Use Case diagram

Researchers are intended to use this repository of cases in order to accumulate cases, for establishing a greater confidence in relation to a theory and its constructs as well as better efficacy and efficiency of a method or technique (Figure 25).

- *{UC-R1}* – a use case that allows the user to add a new case into the repository. In comparison with the rest of the users, the researcher is the only one that has this privilege;
- *{UC-R2}* – this use case represents the searches the user can do in the repository of cases. Once again, the type of searches can be done by several components of the repository of cases;
- *{UC-R3}* – once this user is the only one who can add cases into the repository, he/she is also the unique person to browse the cases he/she created;
- *{UC-R4}* – this use case allows the edition of a selected case, created by the researcher;
- *{UC-R5}* – this use case enables the researcher to delete a chosen case;
- *{UC-R6}* – this use case permits the user to edit its own profile.

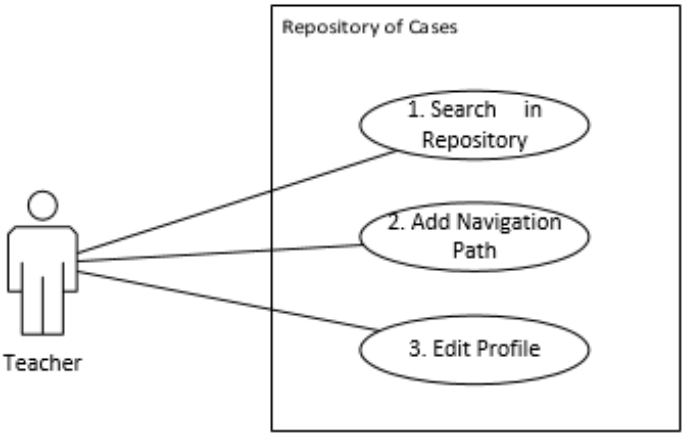


Figure 26 - Teacher Use Case diagram

Teachers are able to use the repository of cases in order to promote IST education and to teach its students through a case method (Figure 26).

- *{UC-T1}* – this use case represents the searches that this user can perform in the repository of cases, as considered the same privilege as the previous users;
- *{UC-T2}* – a use case that allows teachers to add a navigation path in the repository of cases according to what students need to explore;
- *{UC-T3}* – the use case describes the profile edition performed by its own user.

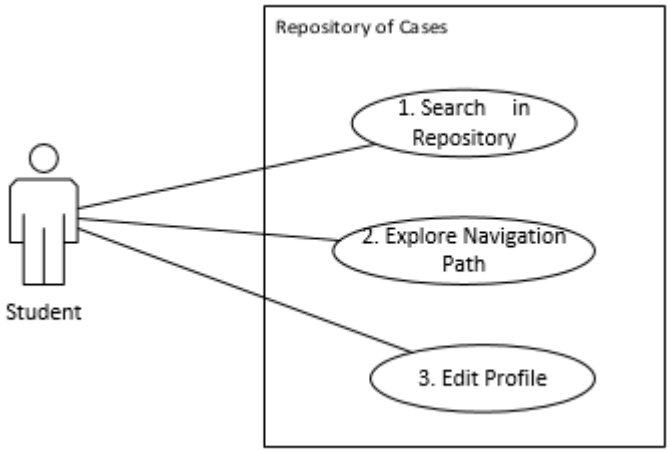


Figure 27 - Student Use Case diagram

Students are able to use the repository of cases such as to acquire scientific knowledge, gain new competences or improve their own skills (Figure 27).

- *{UC-S1}* – the same privilege, as the remaining users. Students can search for cases and its circumstantial factors, professional acts, actions or initiatives, types of actions or initiatives and, finally, theories and its constructs;
- *{UC-S2}* – this use case allows students to explore the navigation path, which was previously added by a teacher;
- *{UC-S3}* – this user possesses the same benefit as the rest of the users. He/she can edit its own profile, whenever it is needed.

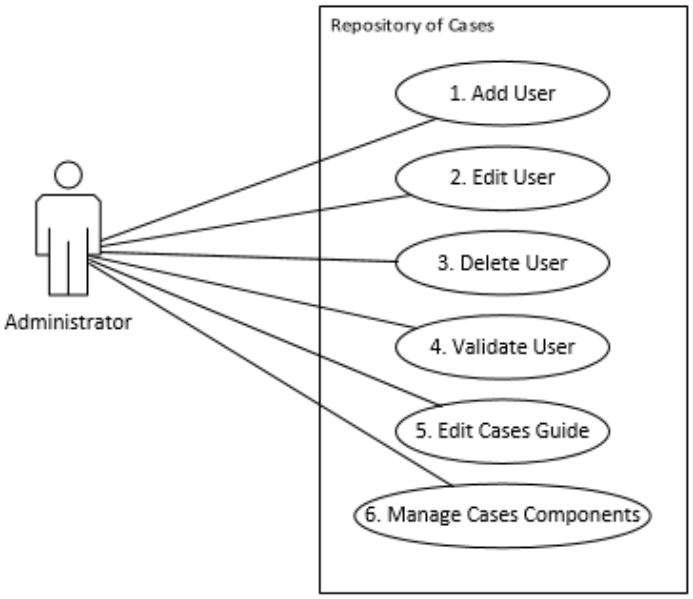


Figure 28 - Administrator Use Case diagram

The administrator, who is a confirmed user by default, manages cases and users of such repository. Moreover, this user is in charge of defining the rules and policies of the cases' guide, through which researchers are intended to add new cases into the repository (Figure 28).

- *{UC-A1}* – this use case represents the addition of a new user into the repository of cases;
- *{UC-A2}* – a use case that describes the edition of a user, if needed;
- *{UC-A3}* – this use case enables the deletion of any user already registered in the repository of cases;
- *{UC-A4}* – the administrator accepts or denies a user registration. When accepted, the user in question becomes a confirmed user;

- *{UC-A5}* – the use case allows the user to define and edit the cases' guide according to the repository policies and rights, for the addition of new cases into this platform;
- *{UC-A6}* – the administrator can manage the attributes what will characterize a case, for instance, action types, case types, profession acts, theories and constructs or any other attribute needed to be controlled in the repository of cases. It can also accept or decline a case into the repository by taking into account the guide what he/she defines.

All partial representations described above were subject to changes according to specific demands throughout the work of the conception, development and consequent implementation of this repository of cases. However, these implications did not have a significant impact during the course of the project in hands.

Chapter 8. Artifact Construction

Pertaining to the third and fourth phases of the methodological approach, comes up this chapter about the artifact construction. As the name might suggest, this is the longest and one of the most crucial stages of this dissertation project. It is explained the technology used during the development of the repository of cases and a final version of the informatic application prototype.

8.1. Software Construction

The Yii framework is the adopted tool for the development of the repository of cases for this master thesis, because of its component-based architecture and sophisticated catching support, especially suitable for developing large-scale applications (Safronov & Winesett, 2014).

The name Yii is an acronym of “Yes, It Is!” which also means in Chinese “simple and evolutionary”. The Yii is a high-performance, component-based PHP (HyperText Preprocessor) framework for rapid developing modern Web applications. Yii incorporates the latest Web development trends and the best practices and features found in other frameworks and projects, which means that this framework is not, independently, following the same standards of other frameworks, which does not obligate a deep understanding about the use of this flexible and extensible framework (Xue, Makarov, Brandt, & Klimov, 2014).

On the side of the development, to whom wants to create Yii applications, the fundamental requirements are PHP language and object-oriented programming, once this framework is a pure object-oriented programming and PHP based framework. It promotes the maximum customization or replacement of Web programming code, which may significantly accelerate the development of such informatic application. The Yii development platform also imposes a structure to the application under development.

Yii is backed up by a strong core development team, as well as a large community of professionals, who are constantly contributing to Yii’s development, therefore all contributors can

augment or improve resources which can be implemented into the core of this framework and, consequently, available to everyone who intend to use Yii.

This open source framework has two relevant key-issues in its use. Firstly, Yii follows the development philosophy of DRY (Don't Repeat Yourself) which is a commonly used concept in most all of the agile development methodologies. Secondly, all the Yii applications are arranged according to the MVC (Model-View-Controller) architecture.

The MVC architecture separates the execution part, from the user's interface iterations, which means that is possible to change pieces of the application, without affecting the rest of the informatic application. The Model (M) represents the information and execution rules, the View (V) corresponds to the interface elements of the user and, finally the Controller (C) establishes and manages the connections between the Model and the View (Krasner & Pope, 1988). As previously referred this applications architecture, illustrated in the next figure, enables changes in these three components, without prejudice of the others (Figure 29).

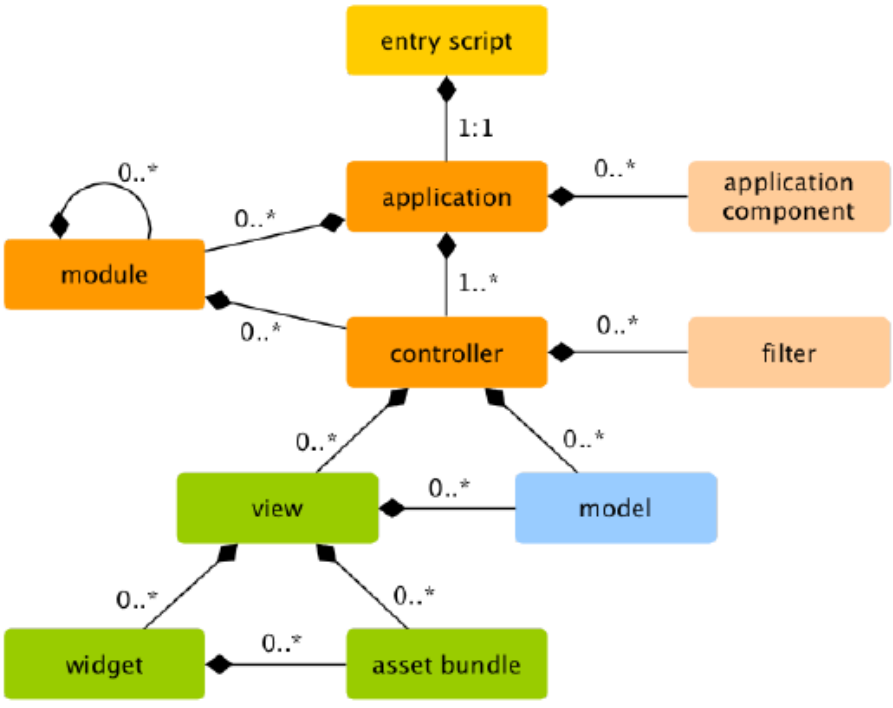


Figure 29 - Application Static Structure [retrieved from (Xue et al., 2014, p.48)].

As it can be seen, the applications are structured according to the MVC architecture, which enables the separation of several inherent concepts. In addition to these three major components

(Model, View and Controller) inherent to this technology structure, the remaining ones are as well following explained:

- Model, represents the inferior layer of the application. It is generally shared between sub applications, containing the information, validation rules and information manipulation code;
- View, consists in the visual representation that is shown to the users of the application. Information manipulation code should be avoided in this particular component;
- Controller, establishes the bridge between the components of the application. It ties the model and view components and is also responsible for the management of the user's requests;
- Module, is a software unit that exists within the applications. It has the components models, views, controllers, among others and functioning as mini-applications;
- Entry Script, is an integral part of any Web application (commonly named as "index.php"), where the user executes the first call of the same. Besides, the single-entry script starts running the application, it should as well be stored under Web accessible directories, to be reached by end users;
- Application, is an object that rules the overall structure and lifecycle of Yii application systems. All the Web applications contain an application that, besides acting as a location service, is also initiated in the entry script;
- Application Component, works by providing services for processing requests. Each application component possesses a unique ID, allowing to distinguish among other application components within the same application;
- Filter, is executed before and/or after the controller actions, with the intention of verifying activities. After this validation, a filter should take an adequate action according to its own purpose. It can also be assigned to a certain model or application, therefore being allocated to controllers which are presented on these components;
- Widget, is defined as reusable building blocks, predominantly used in views. Generally, these components permit to create complex and configurable user interface elements in an object-oriented manner;

- Asset Bundle, is a collection of assets located in a directory. An asset is a file that may be referenced in a Web page, having Web accessible directories and being directly served by Web servers.

Besides the Yii application structure, this framework contains other important features that due to its relevance may be as well referred. One of these characteristics is the workflow that each Yii application have when it handles a request:

1. A user makes a request to the entry script;
2. The entry script loads the application configuration and creates an application instance to handle the request;
3. The application resolves the requested route with the help of the request application component;
4. The application creates a controller instance to handle the request;
5. The controller creates an action instance and performs the filters for the action;
6. If any filter fails, the action is cancelled;
7. If all filters pass, the action is executed;
8. The action loads a data model, possibly from a database;
9. The action renders a view, providing it with the data model;
10. The rendered result is returned to the response application component;
11. The response component sends the rendered result to the user's browser.

To illustrate this process, as well as the steps that were previously enumerated, the Figure 30 shows a workflow diagram of how the application handles a request.

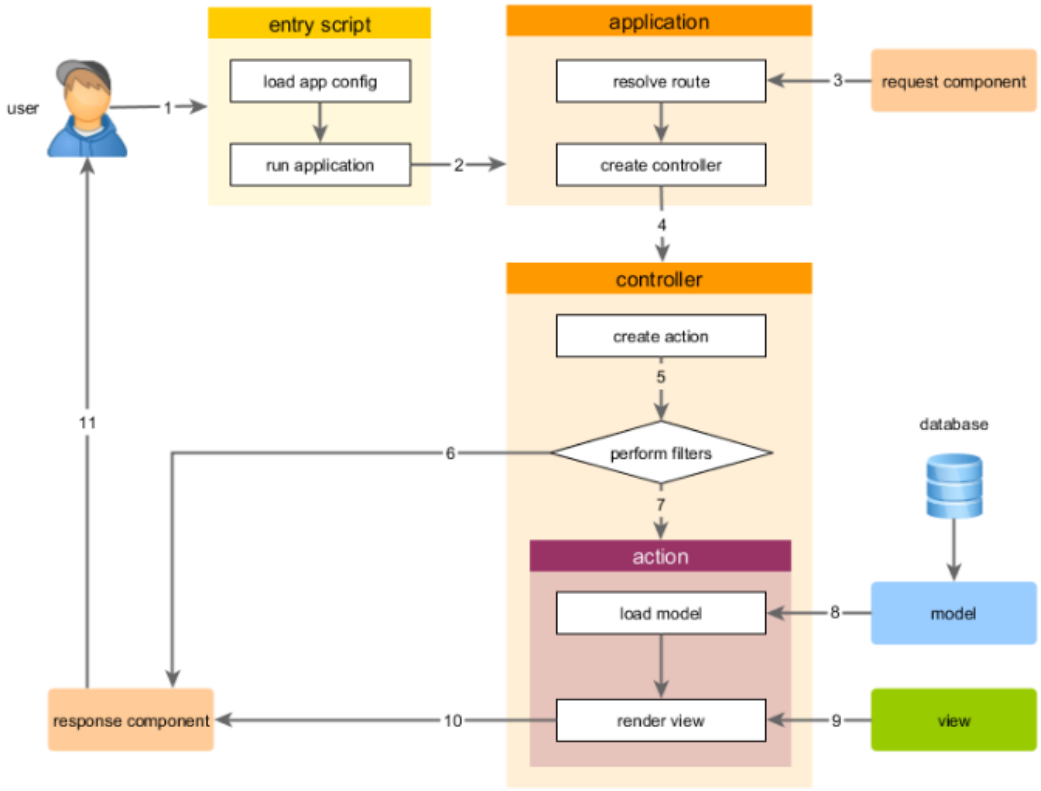


Figure 30 - Handling Requests Workflow [retrieved from (Xue et al., 2014, p.144)].

Although other frameworks and technologies for Web development do exist, and could as well be used for the work in hands, Yii was the adopted framework for this dissertation project. Despite Yii is the adopted development tool in this dissertation project, it was also truly important to perceive other available possibilities (Laravel, Symfony, CodeIgniter, CakePHP, Zend, etc.), even for a future Web development project, while choosing the most adequate working tool.

Three adjectives characterize Yii framework: easy, efficient and extensible. Easy, because its installation and configuration can be all done by the composer and possessing less time-consuming extensions for automatic code generator for the application skeleton, efficient once it carries only the currently and necessary resources and safest due to protects the system from SQL injections, and finally, extensible because it allows to write a simple and elegant code that can be reusable throughout the MVC pattern.

Concerning the software construction, several concepts and terms were used, for example, Web languages (client) were the HTML (HyperText Markup Language), JavaScript (JS) and CSS (Cascading Style Sheets), the PHP (HyperText Preprocessor) as server language, SQL (Structured Query Language) as a database access language, Yii framework as the web application

development accelerator, and finally, Bootstrap as a frontend component library that allows you to make the application responsive. Moreover, for the representation and specification of the application, the UML (Unified Modeling Language), previously introduced, was used in the software conception phase for building up the use case diagrams.

Hitherto, the Yii framework has been briefly explained as the needed and used Web development tool in this dissertation project. Therefore, now it is time for making a proof of concept throughout the next section, by introducing the repository of cases prototype as the output of this software construction phase.

8.2. Prototype

The planning, development and implementation of a repository of cases capable of supporting the IST professionals in the perspectives of practice, research and teaching is not only considered the main purpose and finality of this master thesis, but also a final product or an informatic application that might be something new and unique able to contribute for this scientific area. While what has been found in prior made research has its own similarities, helping to the comprehension of the work in hands, it did not fully propose the same when compared to the current investigation problem.

The informatic application was called R-CASUM, in which the name emerged by a combination of the words “repository”, “cases” and without forsaking the acronym of the institution “University of Minho” (UM).

As result of the design, is represented the application architecture that allows the users to access the application through any device, for instance a tablet, smartphone, desktop, among others. Once this application was developed for Web access, this requires the application to be accessed through the browser, so that through the Internet can be able to make a request to the Web server (Figure 31).

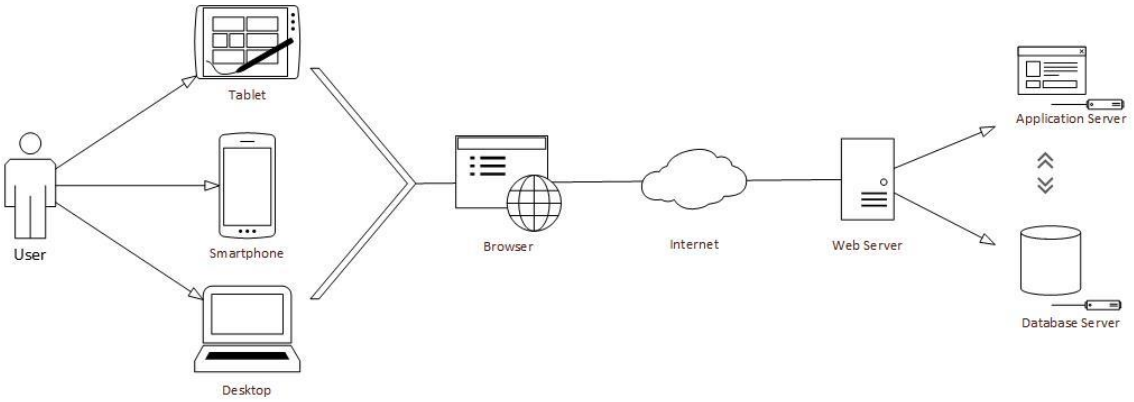


Figure 31 - Application Architecture

In order to demonstrate the application, a practical simulation was recreated step-by-step with screenshots of the functional prototype, developed during this dissertation project. Moreover, a testing user is created to interact with the platform and exploring the various functionalities of this repository of cases. Obviously, it also raises the need of resort to other users, for example, the administrator with exclusive permissions and a researcher that has the possibility to manage the cases within the repository.

Given this demonstration as started, the R-CASUM homepage is displayed. As it can be seen, several components presented in this principal page allows the user to perform different actions. For instance, the user can login its own account if it is already registered in the application, if not, he/she can sign up into the repository of cases. Moreover, it is possible to consult either the "about page" which contains more information regarding the finality of this Website, or even the "contact page", for further clarifications that users might have (Figure 32).

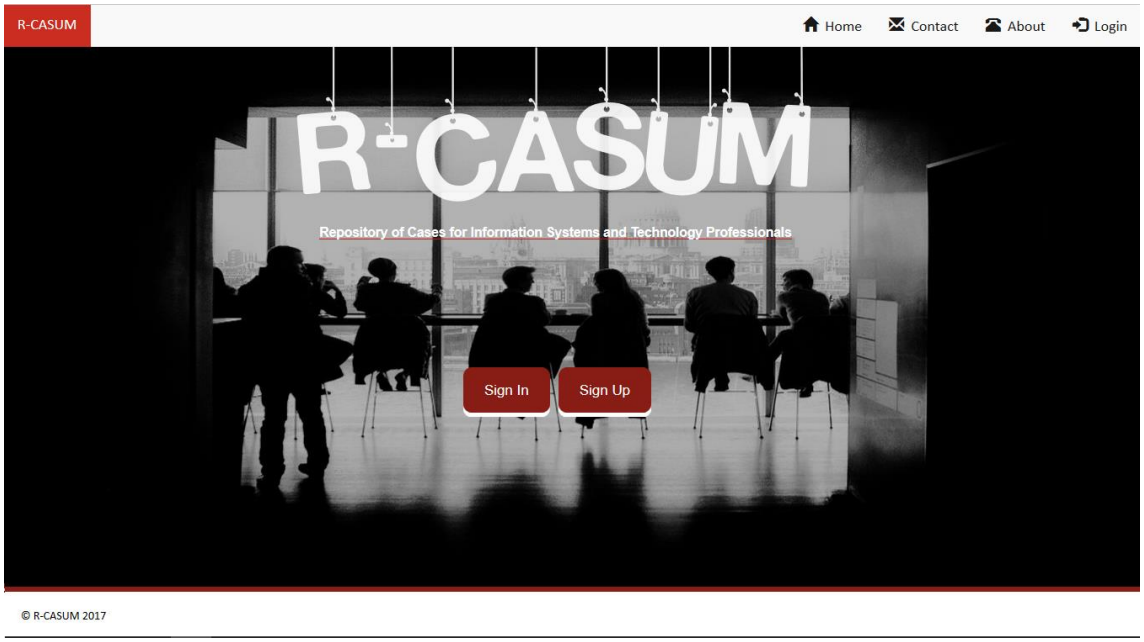


Figure 32 - R-CASUM Homepage

As previously said, the test user is created in this step. To demonstrate this process, a screenshot is displayed of the signup page, where is possible to register a user which is not yet registered into the system. Besides the email, username and password, which are commonly standard registration attributes, it is also request to the user to insert his/her name and the type of user – practitioner, researcher, teacher and student (Figure 33).

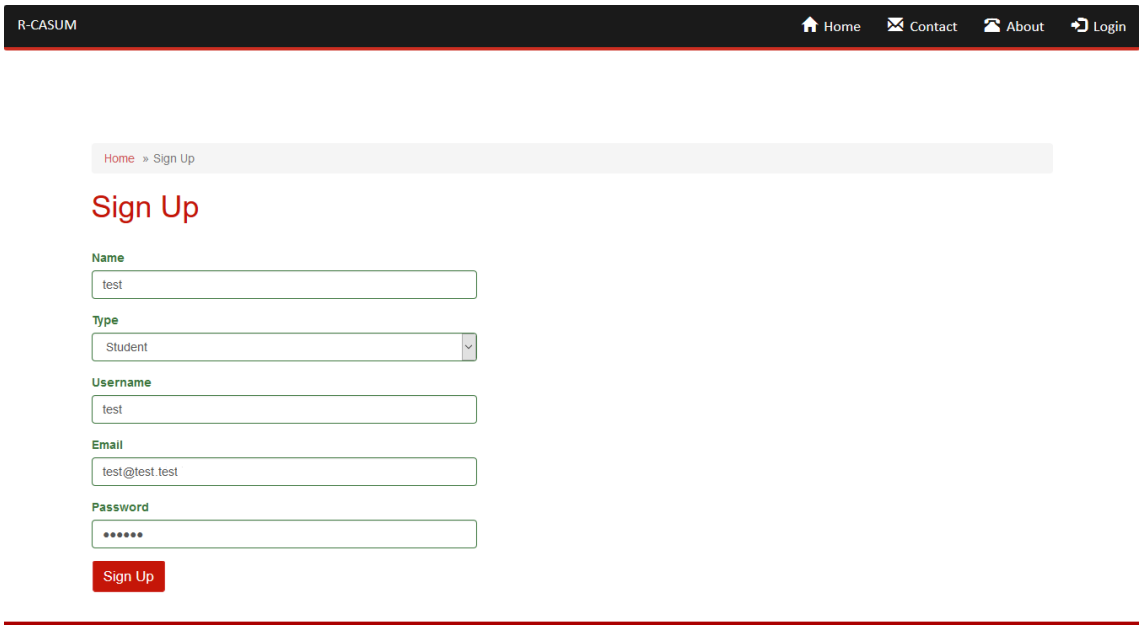


Figure 33 - User Sign Up

Assuming that the user's registration fulfils all the requirements needed for each parameter, the application redirects the new user to the login page, where the same can be apt to authenticate into the repository of cases by using his/her credentials (Figure 34).

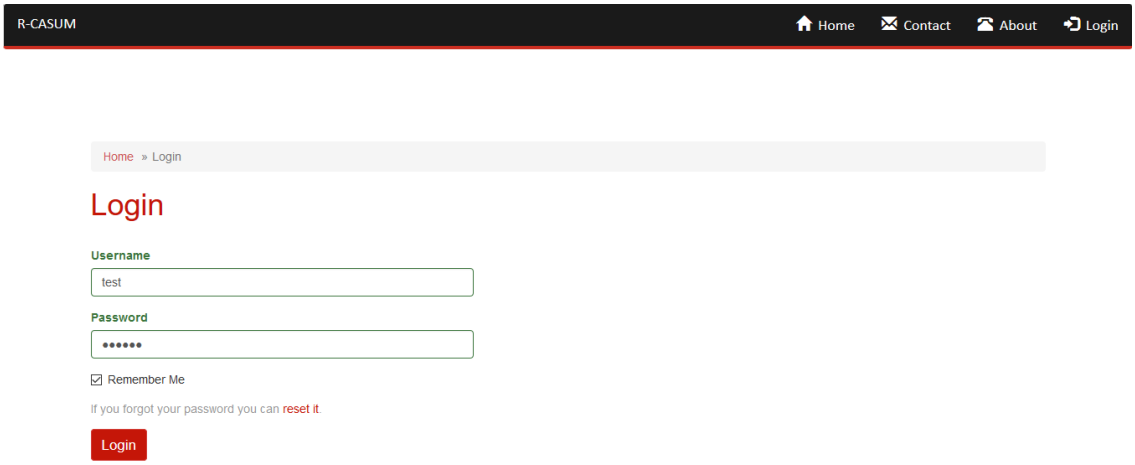


Figure 34 - User Login

Now that the user is logged, he/she can access his/her working area. Notice that, all users belong to a type, for instance, the practitioner, teacher and student type have the same working area and permissions. On the other hand, the researcher type and administrator type possess specific working areas, that is to say, the researcher have the cases management and the administrator has the administrative permissions of the application. These two users and its working areas will be seen after in this demonstration.

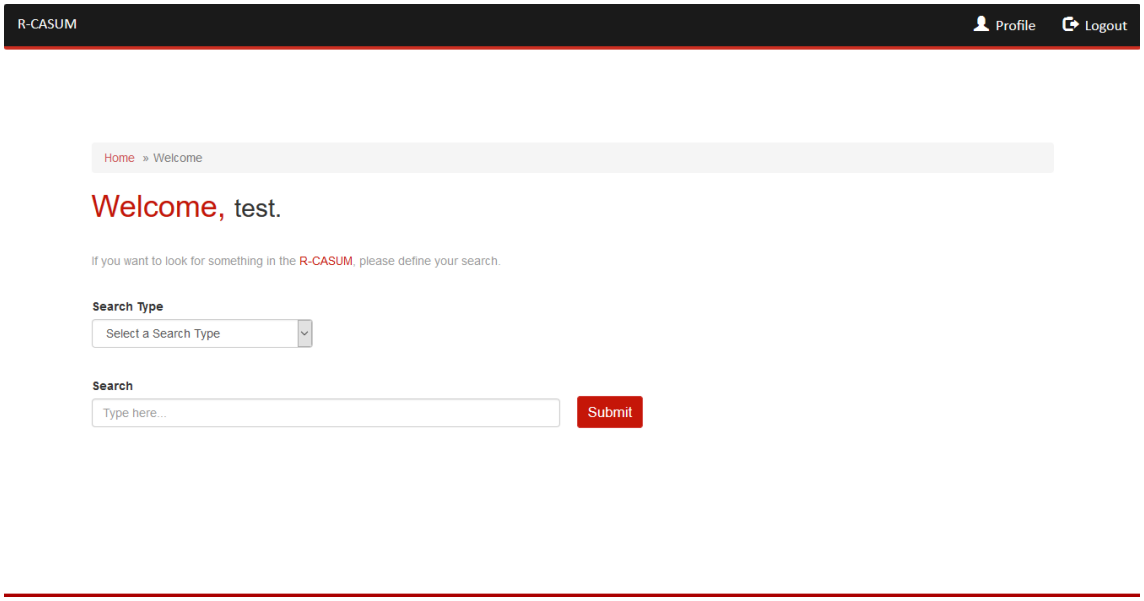


Figure 35 - User Working Area

In Figure 35, is it possible to see a search area that is common to all users in the application after they are logged in the repository of cases. This search area has two different parameters: the search type in which the user can decide to search for everything within the repository or restrict the search in case types, action types or profession acts, and the search that is an optional field if the user needs to make a more selective search while typing what he/she wants.

Now if the user decides to search in the repository of cases, using the search type "All" and the optional search empty, all the search results will appear in the application, containing case types, action types and profession acts. This exhaustive list is illustrated on the Figure 36, which represents all the search results in the current repository of cases, so far.

Type	Name	Details
Action Type	Define usage policy for the application	
Action Type	Provide support documentation	
Action Type	Stand out the use of the application in community	
Action Type	Demonstration of the application	
Action Type	Alert users of the application of the policy compliance	
Action Type	Provide and disseminate new features of the application	
Action Type	Provide support services	
Action Type	Make sessions for boosting the application	
Action Type	Establish an incentive or award for the application usage	
Action Type	Alert for application unavailability or maintenance	
Action Type	Promote the use of the application	
Action Type	Listen clients suggestions or recommendations	
Action Type	Provide policy documentation	
Action Type	Make a pilot test	
Action Type	Define the administrators and managers for the application	
Action Type	Make improvements in the development of the application	
Action Type	Announce and foster training actions of the application to users	
Case Type	ATI Implementation	
Case Type	LMS Implementation	
Profession Act	Construction and maintenance of informatic solutions	
Profession Act	Analysis and effort estimation of communication, services and computing infrastructure requirements	
Profession Act	Management of resources and stakeholders in information systems projects	
Profession Act	Implementation of governance plans for information systems	
Profession Act	Specification of informatic solutions requirements	
Profession Act	Test planning and validation of informatic solutions	
Profession Act	Configuration, integration and delivery of computing infrastructures, communications and services	
Profession Act	Monitoring, control and reporting on the evolution of information systems	
Profession Act	Characterization of domains and informational or informatic requirements elicitation	
Profession Act	Design of informatic solutions	
Profession Act	Implementation and execution of tests of informatic solutions	
Profession Act	Design of project management plans for information systems	
Profession Act	Conception of information systems strategies	
Profession Act	Design of information systems	
Profession Act	Configuration, integration and delivery of informatic solutions	
Profession Act	Design of computing infrastructures, communications and services	
Profession Act	Risk management in information systems projects	
Profession Act	Analysis and effort estimation of informatic solution requirements	
Profession Act	Analysis and design of tests of informatic solutions	
Profession Act	Management and maintenance of computer infrastructures, communications and services	
Profession Act	Closure of information systems projects	
Profession Act	Specification of information systems requirements	

Figure 36 - Search Results

For instance, if the user decides to choose the profession act named "Design of information systems" by clicking on the plus button it will provide the resulting cases in which that profession act is being used, as illustrated in Figure 37.

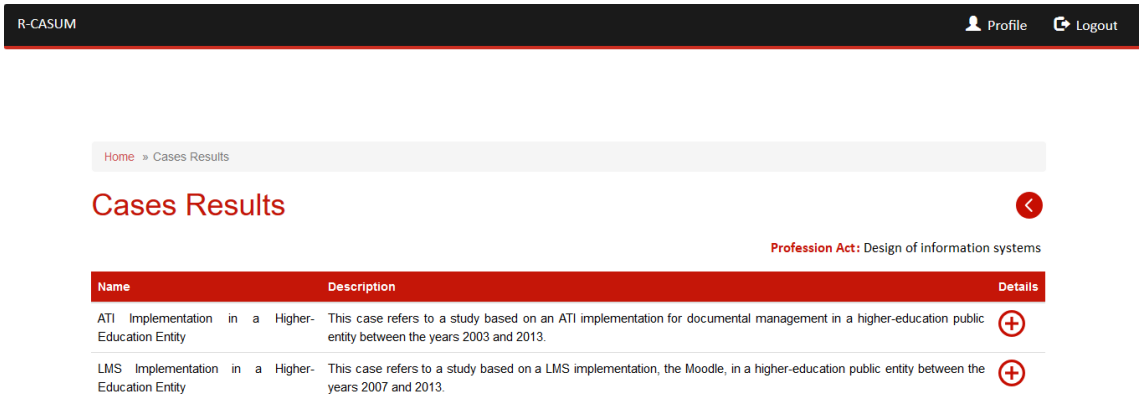


Figure 37 - Cases Results

Once again, if the user wants to see the information about one specific case he/she just needs to click on the plus button, thus showing all the details about one chosen case. The next four screenshots display the information about the case, its actions, its profession acts (the chosen one highlighted in black) and its documents. These will be later further explained.

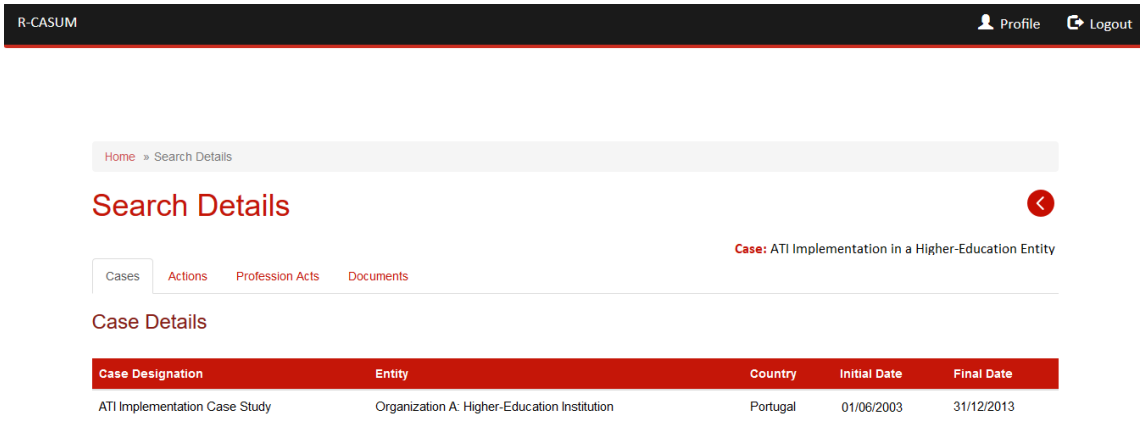


Figure 38 - Case Details

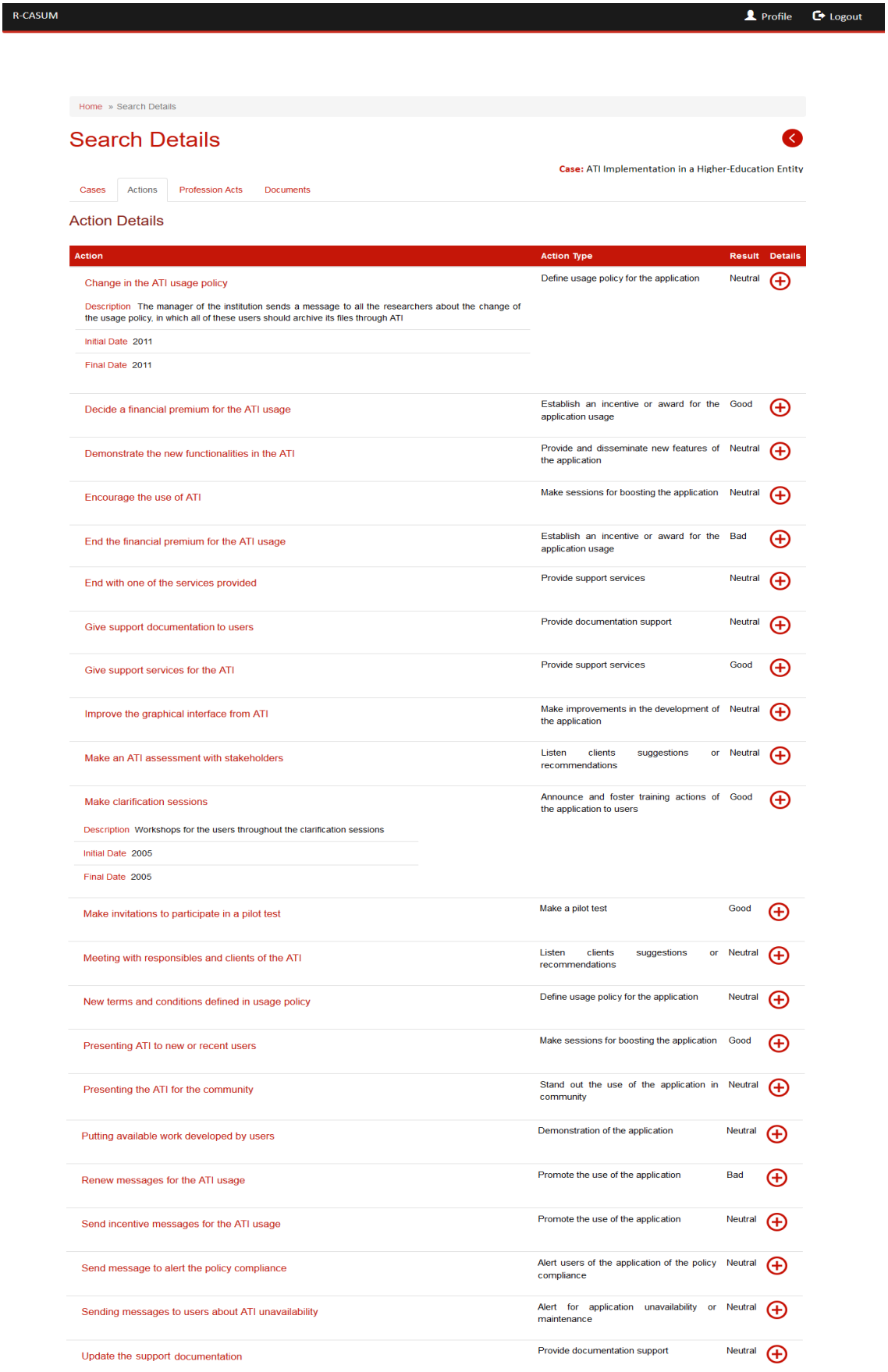


Figure 39 - Action Details

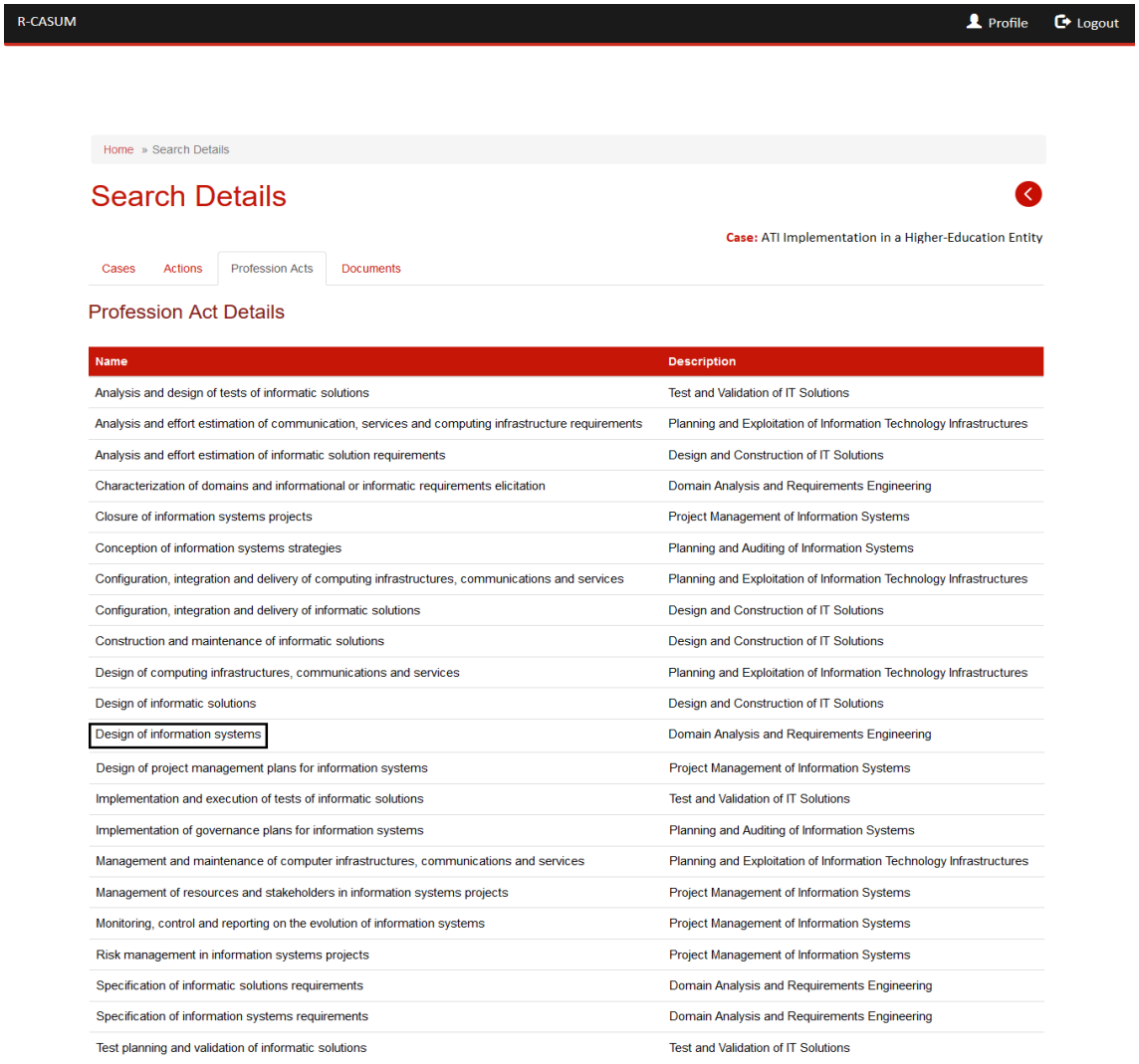


Figure 40 - Profession Act Details

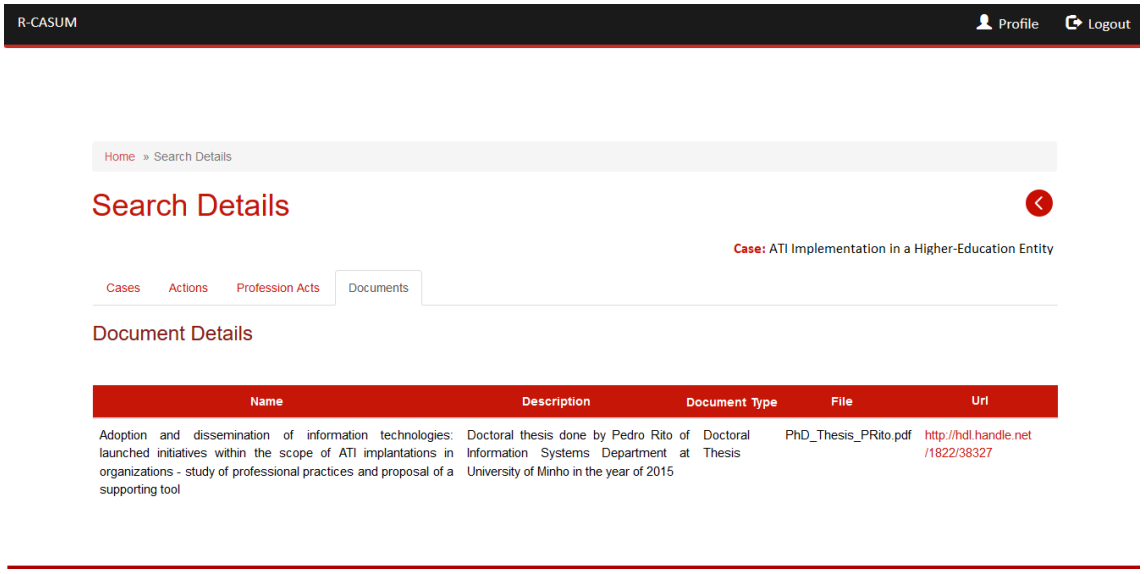


Figure 41 - Document Details

As previously referred, these four screenshots represent the information about one specific case, being functionally built into four different tabs, and so as, for formatting reasons the four different figures were displayed. In this demonstration, the selected case to look at, is called “ATI Implementation in a Higher-Education Entity”.

With respect to the first screenshot (see Figure 38), it is possible to observe the case details, that obviously differ according to the selected case, priorly chosen by the user. Moreover, the information filled for each case can as well be influenced by the type of case that is defined for.

Regarding the second screenshot (see Figure 39), it is perceivable the existence of numerous actions that belong to this case. In fact, the action details also allow the possibility of knowing when these actions were performed, as well as the impact that these actions had. This particular screenshot will be mentioned later in this document once it contains additional features.

In third place, can be seen the profession acts details. Following the same line of thought, the presented profession acts are as well recognized for this particular case, previously selected by the user. Notice that, the search in this repository of cases has begun with the selection of a profession act among the search results, and following through one of the cases in which this profession act is encompassed. Thus, in the Figure 40 it is possible to verify the highlighted profession act that has triggered this search process.

The last figure of this sequence represents the document details for the selected case (see Figure 41). Although this page can contain more types of documentations or even more documents of the shown kind, this information should be also able to sustain the case.

Returning to the action details, it is possible to realize that each action presented in this case have additional information that can be consulted. For instance, if the user decides to choose the action called “Make clarification sessions” by clicking on the plus button, it is possible to see further details about results, evidences, theories and constructs, related to that particular action.

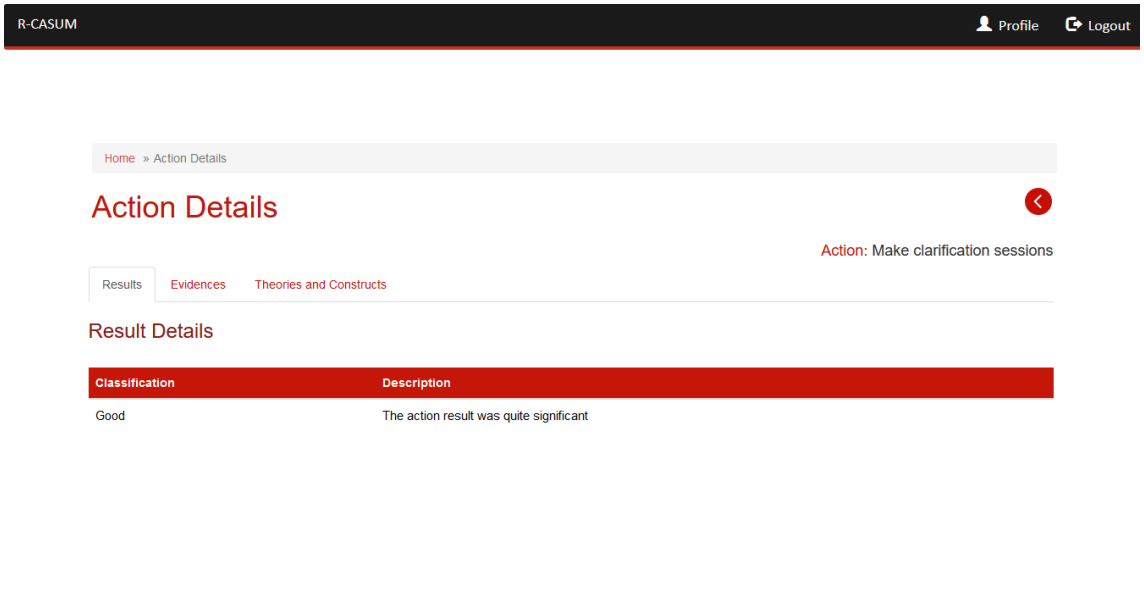


Figure 42 - Result Details

The Figure 42 represents the result of the carried out action. In this situation, this action had a significant impact in the organization. Nonetheless, the result can be quantified in 5 levels, very bad (1), bad (2), neutral (3), good (4) and very good (5), according to the impact or effect which a certain action has. For example, other actions presented in the current case possess a different result (see Figure 39).

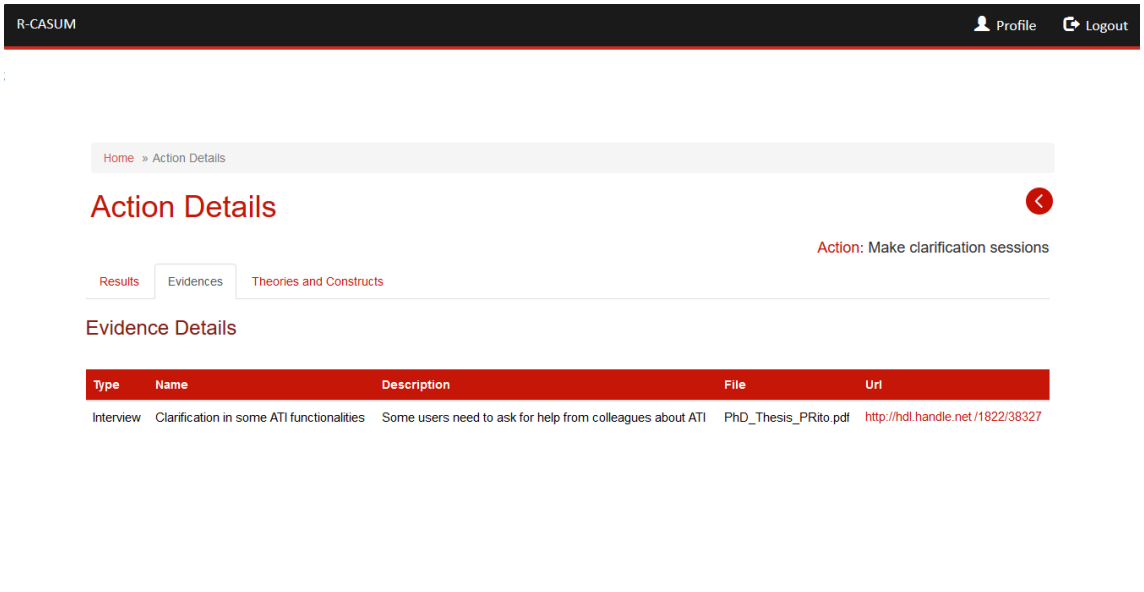


Figure 43 - Evidence Details

In the above figure, it is possible to observe the evidence details of the selected action. The evidences, as the name suggests, serve as testimony or witness of the resulting action and its

effect. Similar to the document details, these evidences can appear in text excerpts (doctoral or master thesis, scientific articles, surveys, focus group, etc.), audio record or video record (Figure 43).

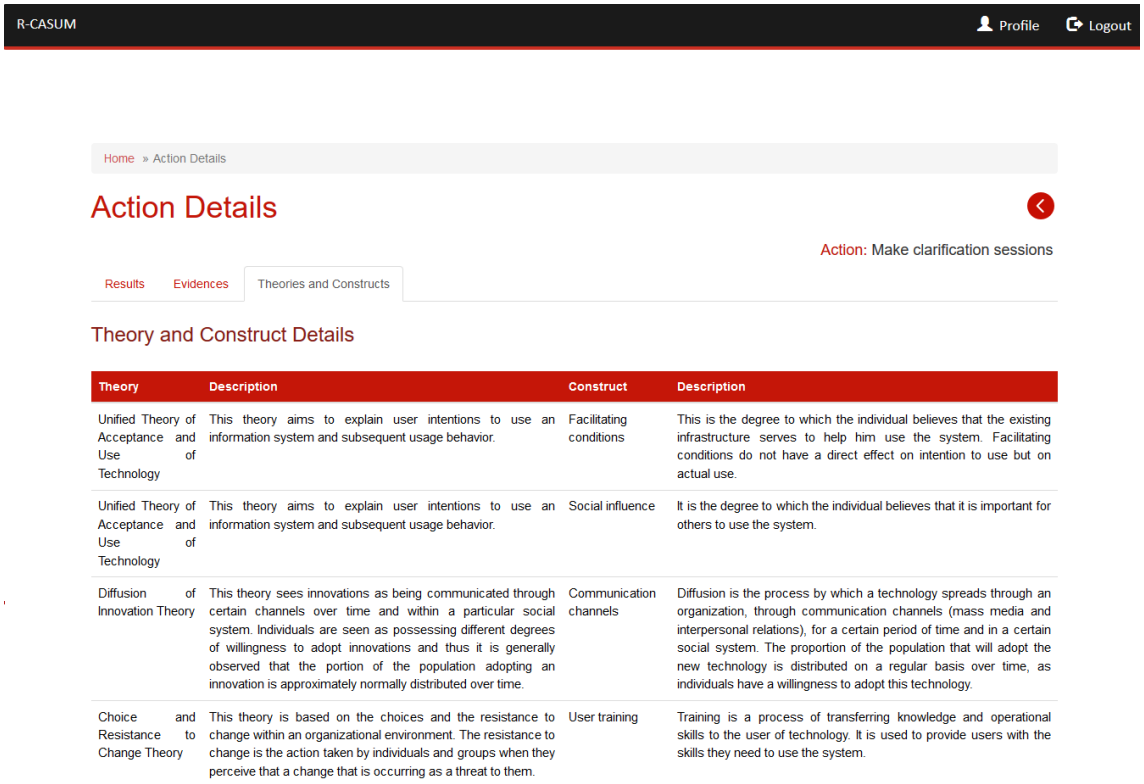


Figure 44 - Theories and Constructs Details

Following the same line of thought, the above figure represents the theories and its constructs which are presented in this action, and consequently, in the previously selected case. Notice that, for one theory it is possible to have more than one construct related with a certain action (Figure 44).

The process of searching into the repository of cases, the main functionality, is fully demonstrated with a test user, that was signed up in the application. Although all types of users can search within the repository as well as manage their own profile, as previously mentioned, the researcher and the administrator have different peculiarities.

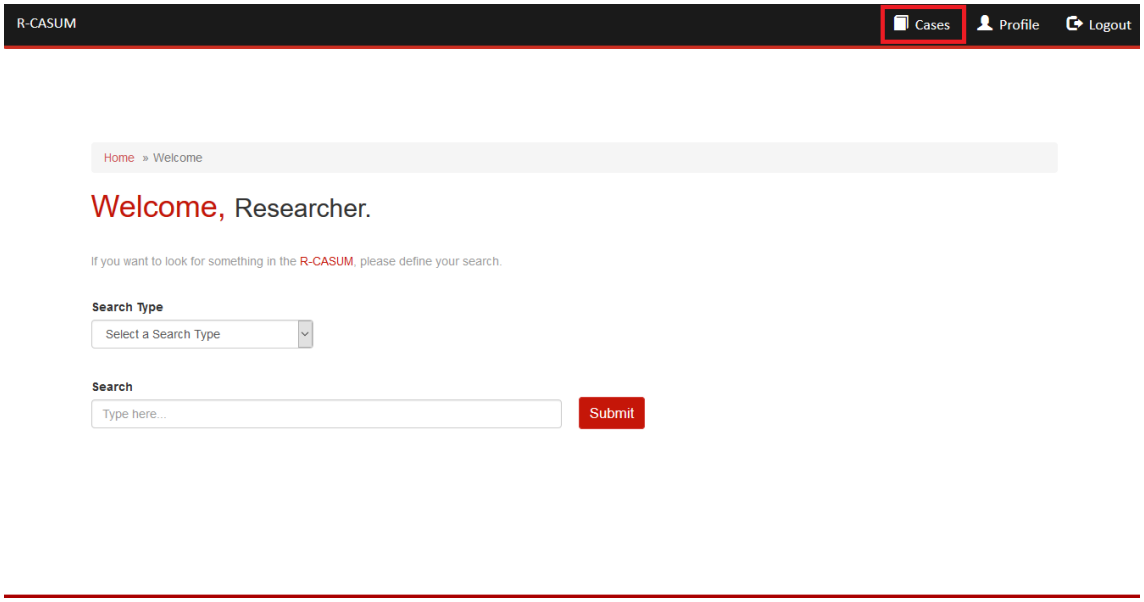


Figure 45 - Researcher Working Area

As for the researcher, this user type has the possibility to manage cases. This means that the researcher is responsible for adding, editing and deleting its own cases, or even consult all the existent ones in the repository. In the above figure, the cases section is highlighted in red once this user type has a different working area that allows the functionalities referred before (Figure 45).

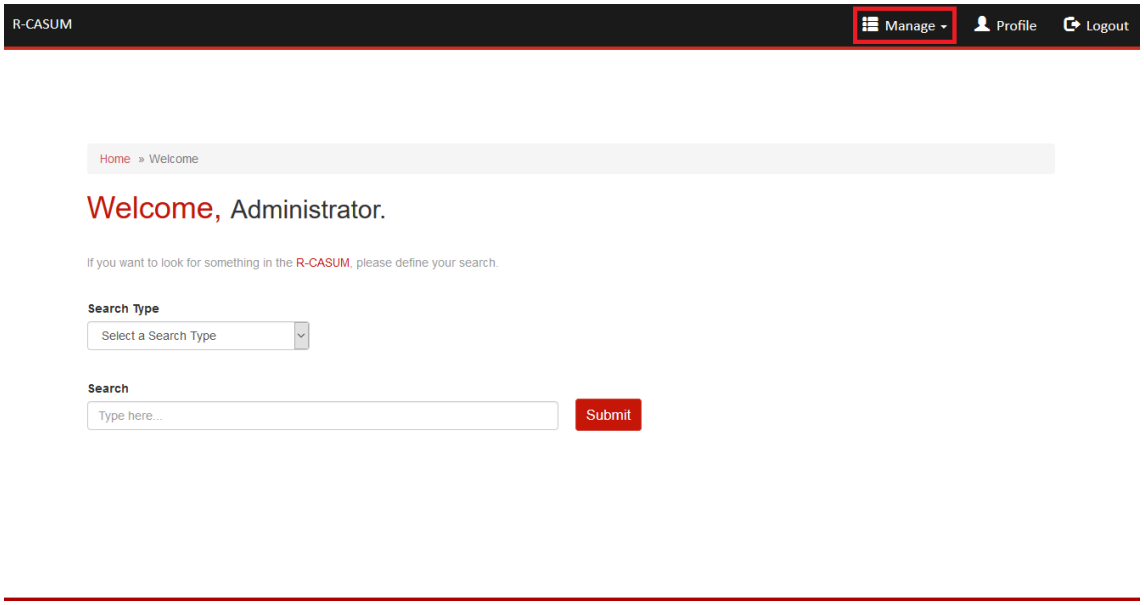


Figure 46 - Administrator Working Area

As for the administrator, this user type has the possibility of managing different concepts in the repository, such as: users, cases types, action types, profession acts, theories and constructs

and all attributes that need to be controlled for the application. Once more, it is possible to see that working area, highlighted in red, is different from the remaining ones, defined to other types of users (Figure 46).

Due to formatting reasons, not all the functionalities were demonstrated herein. However, for more information and illustration either of the processes highlighted in the last two figures, or any other functionality please consult the Appendix B.

Concluding the demonstration of the repository of cases, it is now time to proceed to the evaluation of the repository of cases, as the resulting artifact of this dissertation project while following the methodology adopted. In the next section, an analysis is made, considering not only what has been and has not been achieved in the repository of cases, but also which obstacles or difficulties emerged during the planning, development and implementation of the R-CASUM.

Chapter 9. Artifact Evaluation

Regarding the fifth and sixth phases of the methodological approach, arises the chapter of the artifact evaluation. This final stage encompasses a comparison between the objectives defined for the investigation problem and the actual observed results from the use of the artifact in a real demonstration activity. In other words, an analysis is made between what is produced and what was expected while using as resource a research technique denominated focus group.

9.1. Software Evaluation

This section concerns the evaluation of the proposed artifact for this dissertation project, the repository of cases. Thus, a reflection is made regarding what has been and has not been entirely developed and which obstacles had arisen, influencing the creation of such software.

Remembering the different phases of the adopted methodology, the development phase turned out to be the most lasting phase. Although this phase is considered one of the most crucial ones, producing the repository of cases by itself is not enough. To not leave the process by half, is important to evaluate the artifact, and finally, perceive if what has been developed needs to be refined or is satisfactorily concluded.

Regarding the use cases diagrams and the requirements for the IT application pointed out in the Chapter 6, a table was created representing the functionalities that were and were not accomplished during the construction of the repository of cases.

Some functionalities that were initially thought to be used by the four types of users with except for the administrator, turned out to be common to all of them, namely, the searches in the repository and the edition of each user profile (not presented in the table for the administrator).

Moreover, the management of all components that characterize a case ({UC-A6}), had proven to be defined in a more abstract level than the one expected. Although it is considered to be a single functionality in the table below, it contains different processes that should not have

been grouped together in a single use case as well. This reflection is due to the fact of the user can add, edit, delete or consult case types, action types, profession acts, theories and constructs, or any kind of attributes that need to be controlled in the repository.

Table 4 - R-CASUM Functionalities

	USERS				
USE CASES	Practitioner	Researcher	Teacher	Student	Administrator
{UC-P1}	Searches in Repository ✓				
{UC-P2}	Edit Profile ✓				
{UC-R1}		Add Case ✓			
{UC-R2}		Searches in Repository ✓			
{UC-R3}		Browse own Cases ✓			
{UC-R4}		Edit Case ✓			
{UC-R5}		Delete Case ✓			
{UC-R6}		Edit Profile ✓			
{UC-T1}			Searches in Repository ✓		
{UC-T2}			Add Navigation Path ✗		
{UC-T3}			Edit Profile ✓		
{UC-S1}				Searches in Repository ✓	
{UC-S2}				Explore Navigation Path ✗	
{UC-S3}				Edit Profile ✓	
{UC-A1}					Add User ✓
{UC-A2}					Edit User ✓
{UC-A3}					Delete User ✓
{UC-A4}					Validate User ✓
{UC-A5}					Edit Cases Guide ✗
{UC-A6}					Manage Cases Components: - Case Types; - Action Types; - Profession Acts; - Theories and Constructs; - General Attributes; - Case Type Attributes. ✓

The limitation of time did not allow to fulfil all the desired functionalities for the informatic application, thus arising the necessity to prioritize the most vital functionalities to be implemented.

Unfortunately, the time consumption in the development on some of the functionalities turned out to be longer than the expected duration, thus letting three functionalities remained as future work of this dissertation project, as it can be seen on the above table.

As previously said, some difficulties felt had significantly influence the course of the R-CASUM planning, development and implementation.

The first awareness was in the conceptual model that was built in order to provide a higher flexibility and dynamicity for the data operations in the database. However, the complexity of the database structure had proven to be challenging by the time that some functionalities were being developed and added into the informatic application.

Another struggle in this master thesis was the process of learning to use the Web development tool for the construction of the repository of cases which was also time consuming, a requirement that, with know-how, would allow more time for the remain functionalities.

Lastly, the necessity of having as a content of the repository of cases, not only a higher number of cases, but also real case situations that would allow a better comprehension during the development of the informatic application in terms of its business rules and design concepts.

Regardless the time underestimation and all the obstacles or difficulties occurred during the different steps for the R-CASUM, the truth is that the repository of cases was enough to foster a session to evaluate it while using the focus group research technique. This session will be particularly explained in the next section along with its results.

9.2. Use of Focus Group

It is fruitless to produce an artifact and not evaluate it, which means, that when researchers design artifacts they also need to prove that the artifact itself solves a real problem or evolves in something new hence contributing to a scientific area. To culminate this process, the evaluation of the artifact attempts to identify the strengths and weaknesses of the design by providing a feedback loop for further development and refinement of the same.

Likewise, the resultant artifact in the context of this dissertation project needed to be assessed. Therefore, a research technique called focus group, previously explained in the Chapter 5, was applied for the evaluation of the repository of cases.

A session was undertaken with the purpose of evaluating the R-CASUM. This session had a duration of approximately one hour and a half, with a total of five participants. The Supervisors of this master thesis were also helping and fostering the session for the evaluation of the proposed repository of cases in the context of this dissertation project.

Regarding the roles played throughout this evaluation session, the moderator was the Professor Doctor João Álvaro Carvalho, the secretary the Professor Doctor João Varajão, and, finally me as the demonstrator of the IT application.

From the five participants, four were internal, teachers and researchers from the University of Minho representing the research and teaching perspective, in other words, the academic environment, whereas one external representing the practice perspective, or better said, the professional environment.

The session began with a presentation and a framework of all the process and work performed during this master thesis, following then the demonstration of the R-CASUM and a simple activity about one of the developed functionalities. One of the objectives of this session was for the participants to understand what the repository of cases stands for, as such, its finality and usability, according to the theoretical foundation that sustains it.

In general, the session was very enriching and uplifting, where the participants were able to understand what the repository of cases was and what was intended for, giving several suggestions, recommendations and constructive criticism about what has been shown.

Questions have been raised, not only regarding design approaches in different functionalities of the informatic application, but also in the business concept and processes that the repository of cases relies on.

As an example of the opinions that were focused on application design intuitiveness, it is possible to refer the improvement in having an advanced search which would allow the users to search about what they would need in a much more flexible way. Another observation was the possibility of rearranging all the information about the case in a simpler way, giving the suggestion

of placing the actions according to either the phase or time of occurrence, or by the result possessed when are performed.

Regarding the business concept and processes, some considerations that the participants had are following presented, as such a list of recommendations for the repository of cases.

Firstly, the necessity of having case protocols so that the users could be aware about how to add and use cases for their own benefit, while using this platform. This protocol should be defined as way of ensuring all the elements for search and cases registration, without limiting the necessities of people who are contributing for the R-CASUM.

Although it has been previously wondered, an observation was made regarding that the repository should as well contain cases in which failures in the IST area are presented, contributing to the learning process in this scientific domain (teaching perspective). On the other side, it was said that entities can have interest on advertising successful cases that are inserted on this repository of cases, as a way of showing itself, to have recognition (practitioner perspective).

With the maturity of what cases are and what they have, it was suggested that cases should be treated in a deeper information granularity, making it even more detailed and showing it in a more lightly way within the informatic application. It would be better having a vaster range of case typifications, preferably not static, with a use of keywords or labels to better characterize a case.

Context variables are also influencing positively or negatively each case, therefore the concepts of risk management and success factors for this repository were two topics mentioned by the participants.

The two main challenges regarding the idea of having a repository of cases would be stimulating or encouraging users to not only add their own cases (research perspective), but also search for others the same way. It could be flexible enough to not restrict the researchers by doing it, that means turning their effort valuable for them and others.

Adopting strategies, such as a score by points, more views or premium members in which the user can equally benefit from it, and somehow, promoting the repository of cases in terms of its usability and utility. Another example for enriching the repository of cases would be the search of existent literature in this area, and adapted it, store and preserve it in form of cases.

Once again it is reinforced that this repository of cases is a development motor to other versions of the proposed repository of cases. As for, this is the first version or prototype of the R-CASUM, that hopefully if continued and matured, perhaps could lead to quality software that would help and contribute to the IST community and its professionals.

The participants agreed to make this informatic application available between an experimental time where users could gain sensitiveness, awareness and acceptance of the repository of cases, as a means of commenting it, give suggestions or recommendations.

Finally, it was perceived that the proposed repository in the context of this dissertation, is a satisfactory begin, with some time limitation for developing the remain functionalities, but which definitely is in a good path to continue and turn ideas into reality.

Chapter 10. Conclusion

This last chapter concludes this dissertation by referring its final remarks, an analysis and discussion of the achieved results, and finally, a proposal of future work whereas keeping in mind with this master thesis.

10.1. Project and Final Remarks

This document exposes firstly the theoretical foundation in the context of this master thesis, by explaining the terms and concepts for the planning, development and implementation of a repository of cases which is intended to support IST professionals. It was presented the focus of the research problem into three perspectives: practice, research and teaching, and how those cases (within the repository) could support and lead to more efficient and effective actions or initiatives during the daily routines taken by practitioners, researchers, teachers and students. Consecutively, a research was conducted in order to understand if what was proposed for this research work can be in fact, something new.

The techniques and methodologies to the conception, construction and evaluation of the new artifact were identified and described according to the nature of this dissertation project and its purpose that, if attained, can lead to a contribution in this area as well as help professionals inserted on this scientific domain.

Considering the nature of this research work, the DSR methodology was the chosen methodological approach, followed for the creation of an artifact with its novel features, which enables an integrated and multi-faceted repository of cases, empowering the opportunity of something new and a contribution for the IST area.

Moreover, once the nature of this repository of cases is a product software, the software engineering was one of the concepts explained in this document, where the agile processual framework, Scrum, was used for the software development process. However, to plan a software of this complexity, other resources were taken into consideration, thus project management arises

where the PMBOK was adopted with the method previously referred, to yield a repository of cases. At last, to evaluate the usability, efficiency and effectiveness of such artifact the focus group technique was intended to be used for the refinement of this artifact through the provided feedback, until the product has the required functionalities and quality to fulfil the purpose it was built for.

The theoretical foundation was intended to be applied during the subsequent phases of the conception, construction and evaluation of such artifact, which is indeed considered the most practical component of this research work.

In the conception of the artifact, several sessions were performed for the requirements elicitation and some design models were elaborated, representing the repository of cases. In the construction of the artifact, the most lasting phase, it was explained the Yii as the Web development tool used for the creation of the repository of cases, and consequently, the demonstration of the most important functional flow in the application which was illustrated through figures of the R-CASUM. Lastly, in the evaluation of the artifact, a meeting was undertaken to evaluate the repository of cases in light of the research technique of focus group.

Thus, the repository of cases is considered undoubtedly, a mean as for start this master thesis, and also a final result, as a way of ending it.

10.2. Analysis and Discussion Results

How this repository of cases can be a surplus value for the IST professionals? It can help practitioners, by seeking for past situations which can facilitate them on the process of decision making in some professional work, which they are involved; researchers who can add cases as well as accumulate them in order to establish confidence in effectiveness and efficiency of any method or technique, as well as confidence relatively to some theories and its constructs; and, finally, the teachers in promote learning to students in this area of interest by the use of such cases. Thus, cases are the centre of this repository, which describes real situations that happened in a specific context regarding some IST professional act, executed by a professional in this area. This repository allows the usage, storage and preservation of those cases in such way that users can benefit from such information system, in many contexts and at many ways.

Two contributions can be triggered in this research work. Firstly, this repository can come to reinforce the bridge between the academic environment, such as teachers, researchers and students with the professional environment, practitioners, shorten the still existent gap between these perspectives. Secondly, if the elaboration of this artifact is held successfully and yield a quality software product, then this repository of cases can not only mean a new contribution for the IST area, but also be prone to other scientific areas in order to stay for supporting other existing communities and its professionals.

10.3. Future Work

Naturally, as a first perspective of future work would be definitely the implementation of the remaining functionalities, in the repository of cases.

Additionally, the possibility of having the repository of cases inserted in a real context either in academic environment, or in professional environment, would allow a more accurate evaluation of the application in terms of its utility and acceptance in these means.

At last, the final result of this dissertation project is assumed as a first version or a prototype of the repository of cases, that if considered as work to follow could become something that professionals in our area would definitely deserve to have it, which means, that the more cases the repository has, the better it will be for those who use it.

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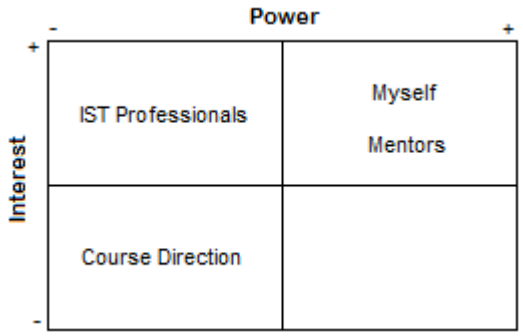
Appendices

Appendix A - Project Charter

This appendix represents the Project Charter, as previously referred in the Work Plan chapter. The Project Charter contains the essence of this research work, providing a further comprehension of what is undertaken.

Project Charter

Variables	Descriptions
Executive Summary	This master thesis entails the development of a repository of cases that can be used by practitioners, researchers, teachers and students. • Practitioners, IST professionals who can seek for past situations that can help them make decisions about an act of profession in which they are involved. • Researchers, who can accumulate cases for the purpose of establishing more confidence in the efficacy of some method or technique, or even, in confidence regarding some theory and its constructs. • Teachers, who can use a case method to foster the IST education. They are able to teach students through cases so that they can learn and also acquire scientific knowledge, gain other competences and sharpen their skills. An informatic application intended to be planned, developed and implemented, where the concepts of software engineering and project management are inherent to this research work. Moreover, the focus group technique is used to evaluate the artifact in terms of its success, usability, efficiency and efficacy. Also, as something new is tried to be pursued, the DSR is the methodological approach for the context of this dissertation.
Justification	An informatic application that is capable to address the IST professionals, practitioners, researchers, teachers and students at their daily working routines, reinforcing the union between these three perspectives and contributing with something new for the IST area.
Purpose	This master thesis aims to develop a repository of cases about IST professional acts, supporting professionals in the perspectives of practice, research and teaching.
Requirements	The new informatic application should enable: • Create, read, update and delete users; • Create, read, update and delete cases; • Create, read, update and delete theories and constructs; • Search for professional acts, cases or its circumstantial factors; • Search for actions or initiatives or types of actions or initiatives; • Search for theories and its constructs; • Advanced search for cases; • Application of filters or keywords in search.

<table>
<tr><td>Deliverables</td><td>The repository of cases, which is the informatic application, and a specification report with clarification and explanation of its conception, construction and evaluation, for its subsequent use by the stakeholders.</td></tr>
<tr><td>Stakeholders</td><td>The matrix shows the relation between stakeholders and the repository of cases in terms of its power and interest.
 
</td></tr>
<tr><td>Scheduling</td><td>
<table>
<tr><th></th><th>Task Name</th><th>Durat</th><th>Start</th><th>Finish</th><th></th><th>Resource Names</th></tr>
<tr><td>1</td><td>Repository of Cases for Information Systems and Technology Professional Acts: Supporting Practice, Research and Teaching</td><td>295 days</td><td>Wed 14/09/16</td><td>Tue 31/10/17</td><td></td><td>Rita Costa e Silva</td></tr>
<tr><td>2</td><td>Work Plan</td><td>29 days</td><td>Wed 14/09/16</td><td>Mon 24/10/16</td><td></td><td>Rita Costa e Silva</td></tr>
<tr><td>3</td><td>Framework of Project</td><td>3 days</td><td>Wed 14/09/16</td><td>Fri 16/09/16</td><td></td><td>Rita Costa e Silva</td></tr>
<tr><td>4</td><td>Definition of Goals and Objectives of Project</td><td>3 days</td><td>Wed 14/09/16</td><td>Fri 16/09/16</td><td></td><td>Rita Costa e Silva</td></tr>
<tr><td>5</td><td>Search for Bibliographic References</td><td>7 days</td><td>Mon 19/09/16</td><td>Tue 27/09/16</td><td>4</td><td>Rita Costa e Silva</td></tr>
<tr><td>6</td><td>Selection of Bibliographic References</td><td>7 days</td><td>Mon 19/09/16</td><td>Tue 27/09/16</td><td>4</td><td>Rita Costa e Silva</td></tr>
<tr><td>7</td><td>Scheduling Working Tasks</td><td>3 days</td><td>Wed 28/09/16</td><td>Fri 30/09/16</td><td>5</td><td>Rita Costa e Silva</td></tr>
<tr><td>8</td><td>Elaboration of Work Plan</td><td>15 days</td><td>Mon 03/10/16</td><td>Fri 21/10/16</td><td>7</td><td>Rita Costa e Silva</td></tr>
<tr><td>9</td><td>Submission of Work Plan</td><td>1 day</td><td>Mon 24/10/16</td><td>Mon 24/10/16</td><td>8</td><td>Rita Costa e Silva</td></tr>
<tr><td>10</td><td>Dissertation Project</td><td>91 days</td><td>Mon 24/10/16</td><td>Mon 27/02/17</td><td>8</td><td>Rita Costa e Silva</td></tr>
<tr><td>11</td><td>Search and Selection of Bibliographic References</td><td>15 days</td><td>Mon 24/10/16</td><td>Fri 11/11/16</td><td>8</td><td>Rita Costa e Silva</td></tr>
<tr><td>12</td><td>Literature Review</td><td>26 days</td><td>Mon 14/11/16</td><td>Mon 19/12/16</td><td>11</td><td>Rita Costa e Silva</td></tr>
<tr><td>13</td><td>Definition of Key Words</td><td>5 days</td><td>Mon 14/11/16</td><td>Fri 18/11/16</td><td>11</td><td>Rita Costa e Silva</td></tr>
<tr><td>14</td><td>Elaboration of Concept List</td><td>5 days</td><td>Mon 14/11/16</td><td>Fri 18/11/16</td><td>11</td><td>Rita Costa e Silva</td></tr>
<tr><td>15</td><td>Exploitation of Yii Technology</td><td>15 days</td><td>Mon 24/10/16</td><td>Fri 11/11/16</td><td>8</td><td>Rita Costa e Silva</td></tr>
<tr><td>16</td><td>Development of Dissertation Project</td><td>70 days</td><td>Mon 21/11/16</td><td>Fri 24/02/17</td><td>14</td><td>Rita Costa e Silva</td></tr>
<tr><td>17</td><td>Submission of Dissertation Project</td><td>1 day</td><td>Mon 27/02/17</td><td>Mon 27/02/17</td><td>16</td><td>Rita Costa e Silva</td></tr>
<tr><td>18</td><td>Dissertation Report</td><td>177 day</td><td>Mon 27/02/17</td><td>Tue 31/10/17</td><td>16</td><td>Rita Costa e Silva</td></tr>
<tr><td>19</td><td>Use and Test of Developed Repository of Cases</td><td>90 days</td><td>Mon 27/02/17</td><td>Fri 30/06/17</td><td>15</td><td>Rita Costa e Silva</td></tr>
<tr><td>20</td><td>Analysis of Attained Results and Goals</td><td>30 days</td><td>Mon 03/07/17</td><td>Fri 11/08/17</td><td>19</td><td>Rita Costa e Silva</td></tr>
<tr><td>21</td><td>Elaboration of Dissertation Report</td><td>40 days</td><td>Mon 14/08/17</td><td>Fri 06/10/17</td><td>20</td><td>Rita Costa e Silva</td></tr>
<tr><td>22</td><td>Review of Dissertation Report</td><td>16 days</td><td>Mon 09/10/17</td><td>Mon 30/10/17</td><td>21</td><td>Rita Costa e Silva</td></tr>
<tr><td>23</td><td>Submission of Dissertation Project</td><td>1 day</td><td>Tue 31/10/17</td><td>Tue 31/10/17</td><td>22</td><td>Rita Costa e Silva</td></tr>
</table>
</td></tr>
<tr><td>Assumptions and Restrictions</td><td>Assumptions:
Use of open source technologies, necessarily Yii framework;
One developer for the informatic application.
Restrictions:
The informatic application must be ready in October;
An available server for the informatic application provided by the orientation team, so that the repository of cases be at disposal of its users.</td></tr>
<tr><td>Success Evaluation Criteria</td><td>Dispose an informatic application, that is able to fulfil the purpose in which is built, functional and free from errors.</td></tr>
<tr><td>Success Factors</td><td>Have the Supervisors available for giving the inputs of the project, which means the requirements and functionalities should be initially defined and consequently accomplished, in order to produce with the expected and desired repository of cases.</td></tr>
</table>

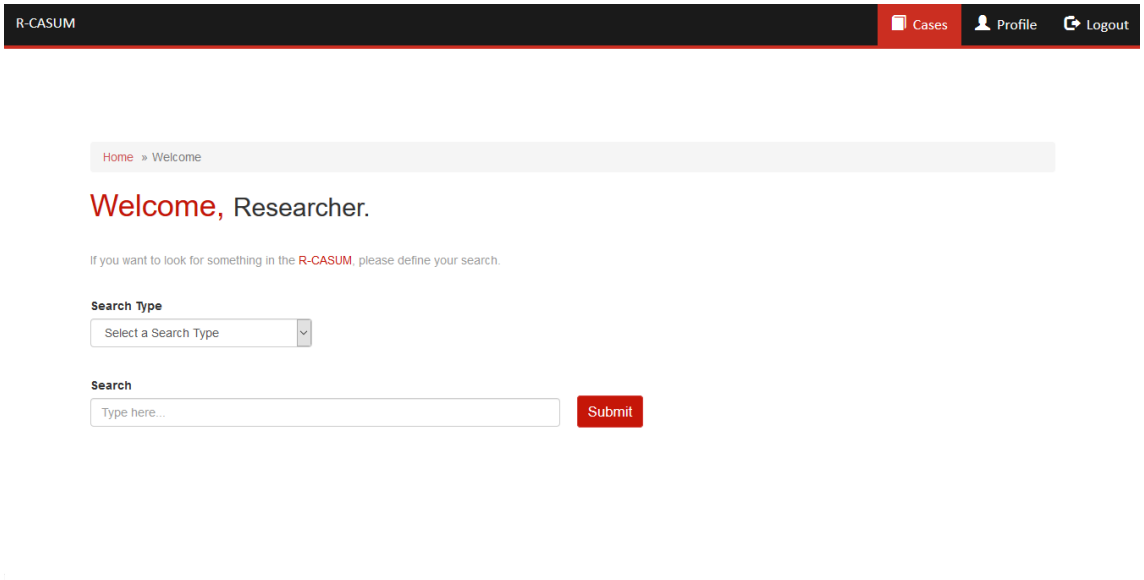
Appendix B - More Functionalities

This appendix represents other functionalities that were not previously demonstrated in the section 8.2. Prototype, but they were as well implemented and functional in the repository of cases. Firstly, are presented the processes referred about the administrator and the researcher, and then, other processes that were not mentioned, but are inherent to any application. In the identification of each functionality is nominated its respective use case(s).

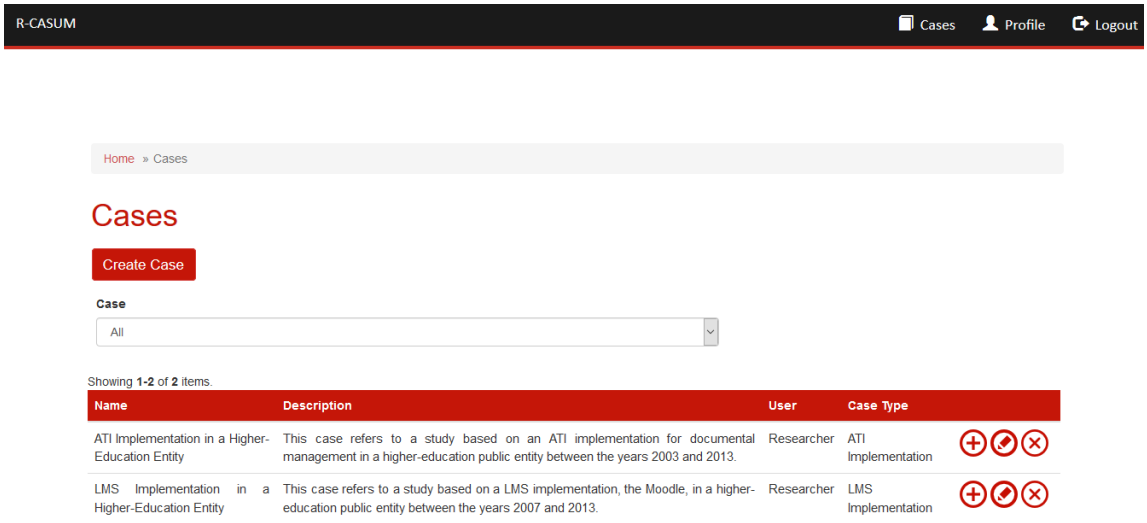
B1 - Add Case (Researcher)

In this process the researcher can create one entire case in the application.

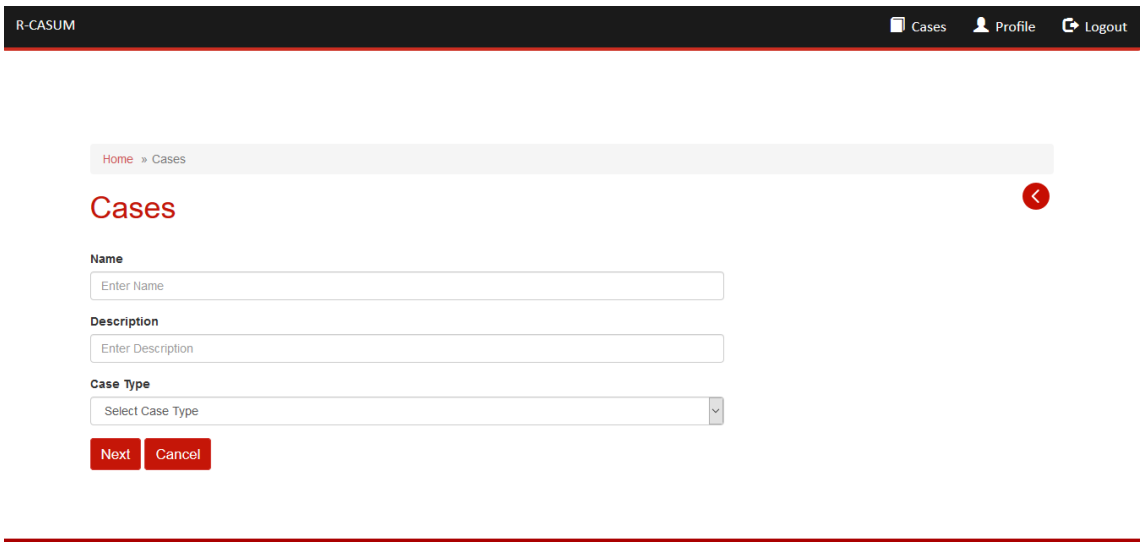
Use Cases: {UC-R1, UC-R3}



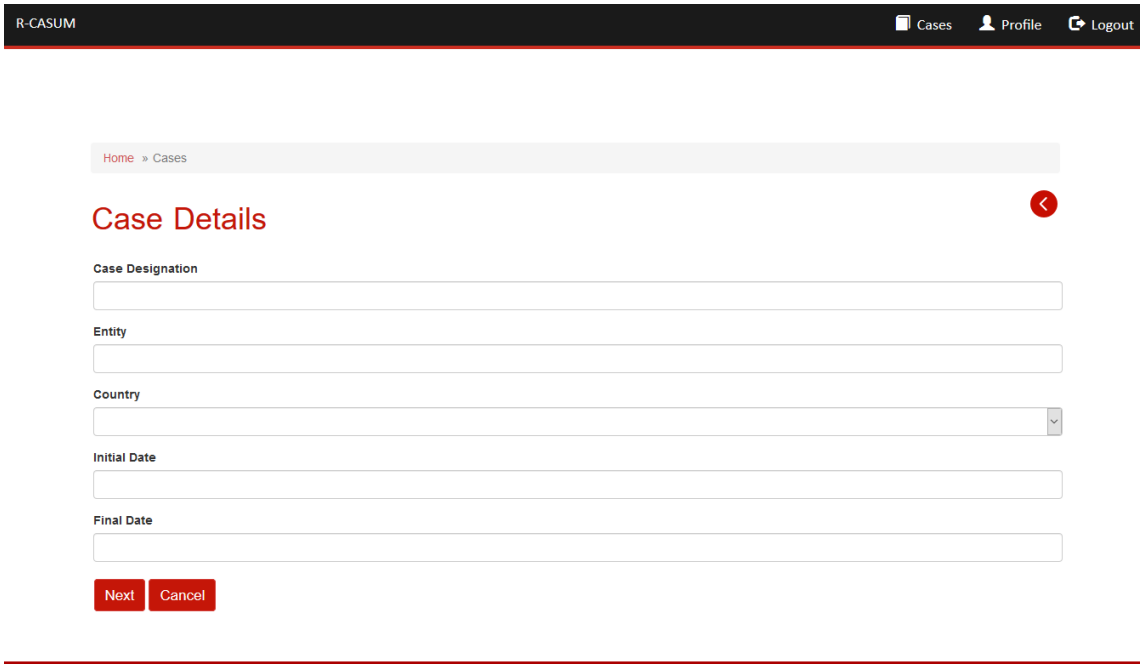
Cases



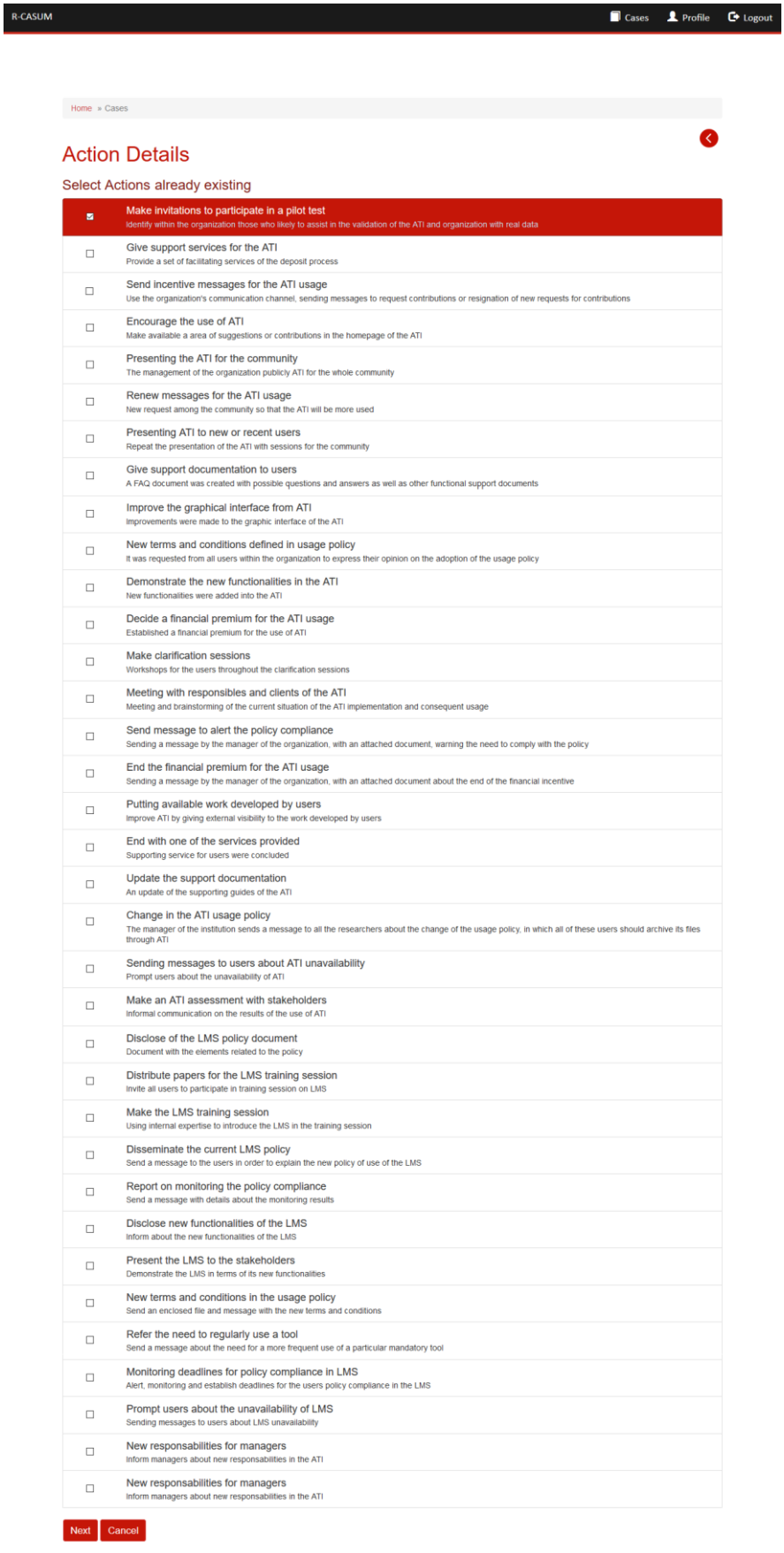
Manage Cases



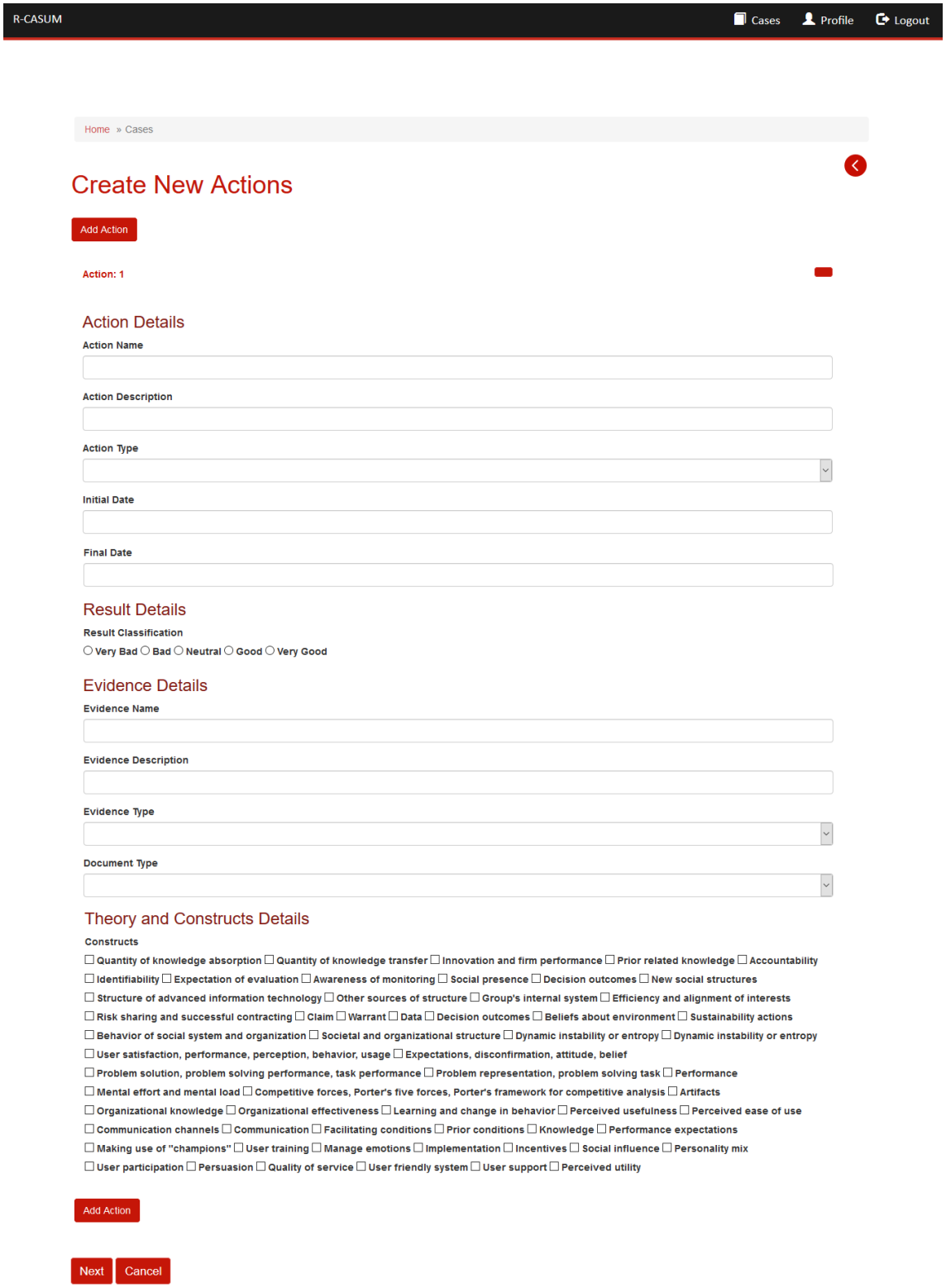
Create Case Step 1: Case Information



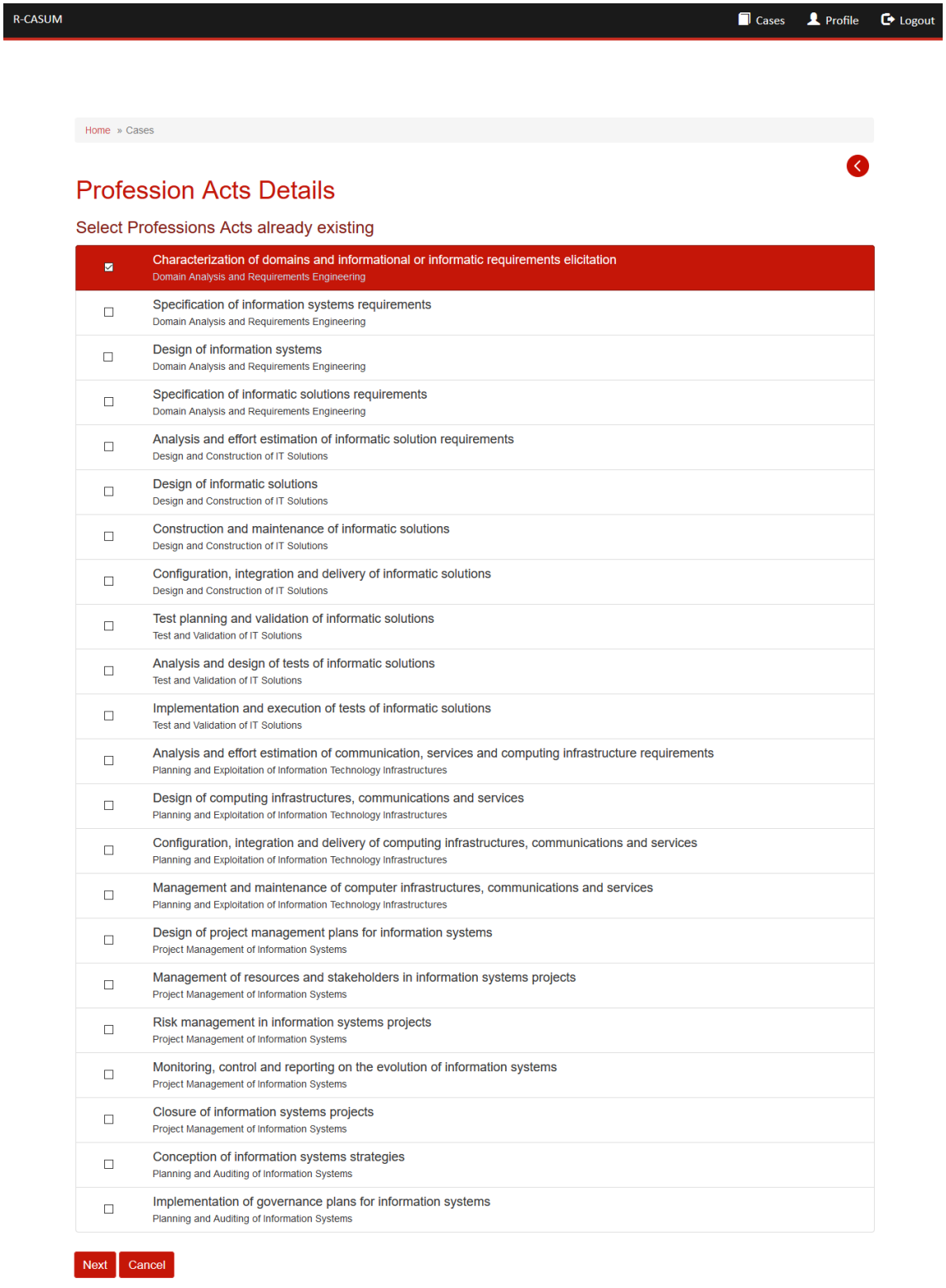
Create Case Step 2: Case Details



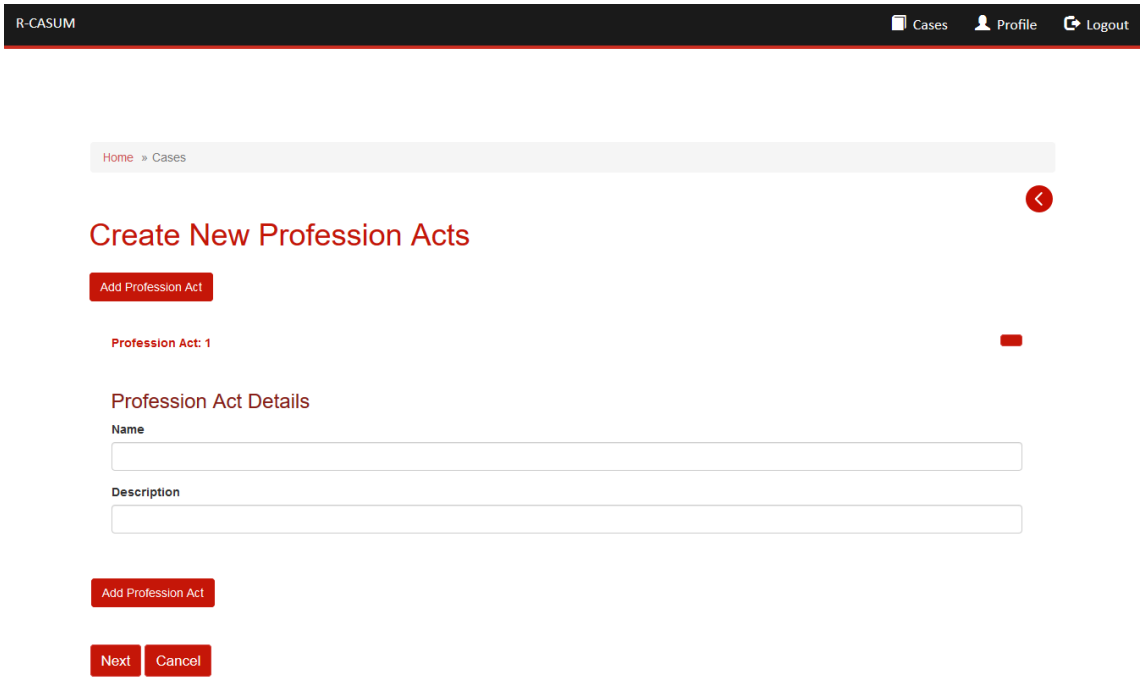
Create Case Step 3: Action Details (associate existing actions)



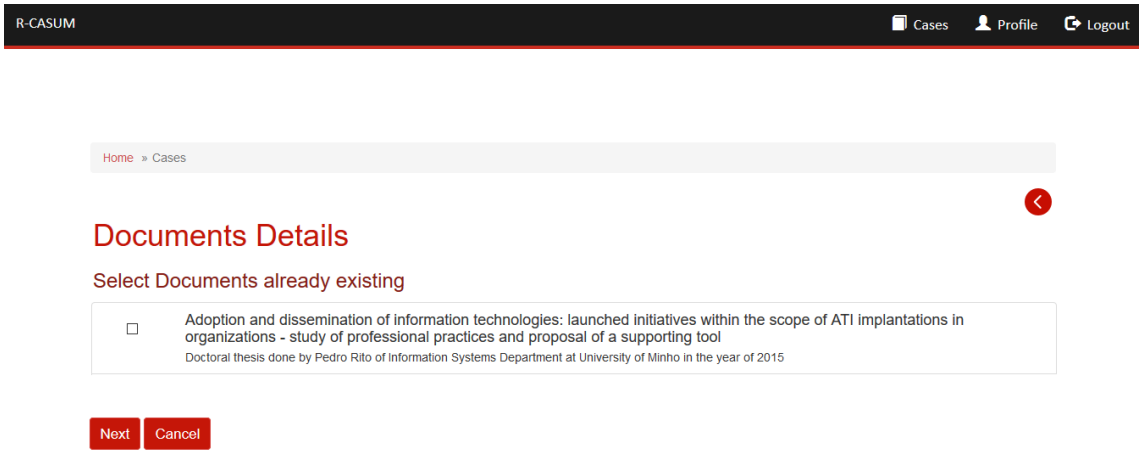
Create Case Step 4: Action Details (create new actions)



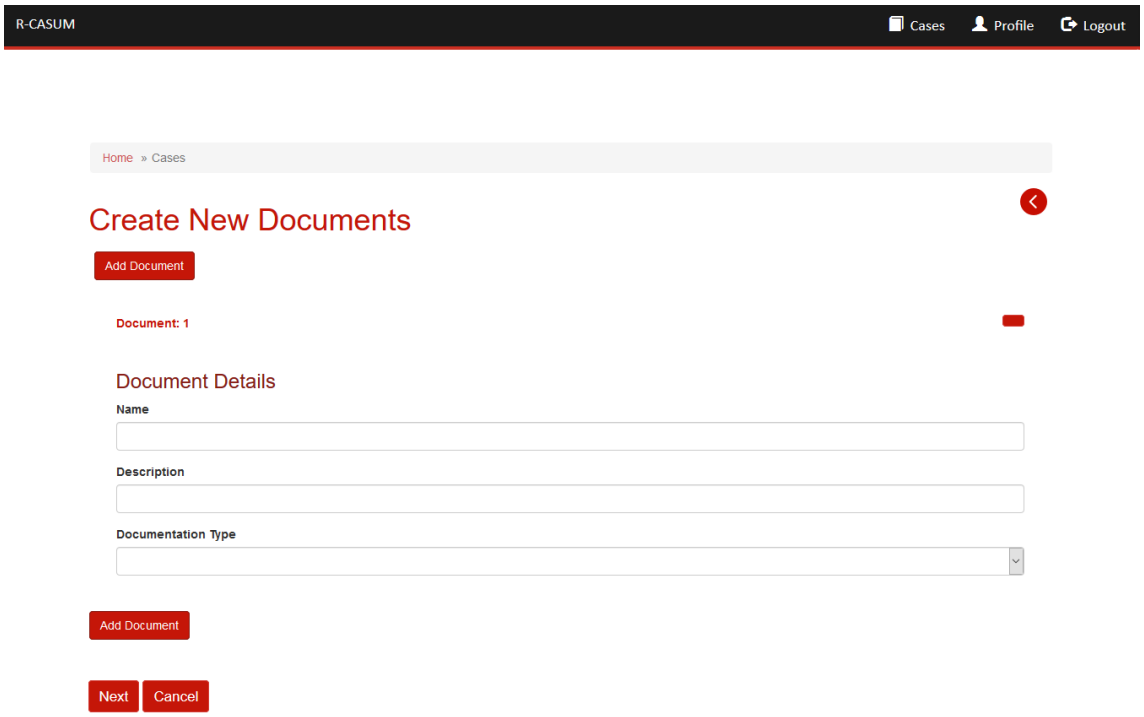
Create Case Step 5: Profession Acts Details (associate existing profession acts)



Create Case Step 6: Profession Acts Details (create new profession acts)



Create Case Step 7: Documents Details (associate existing documents)

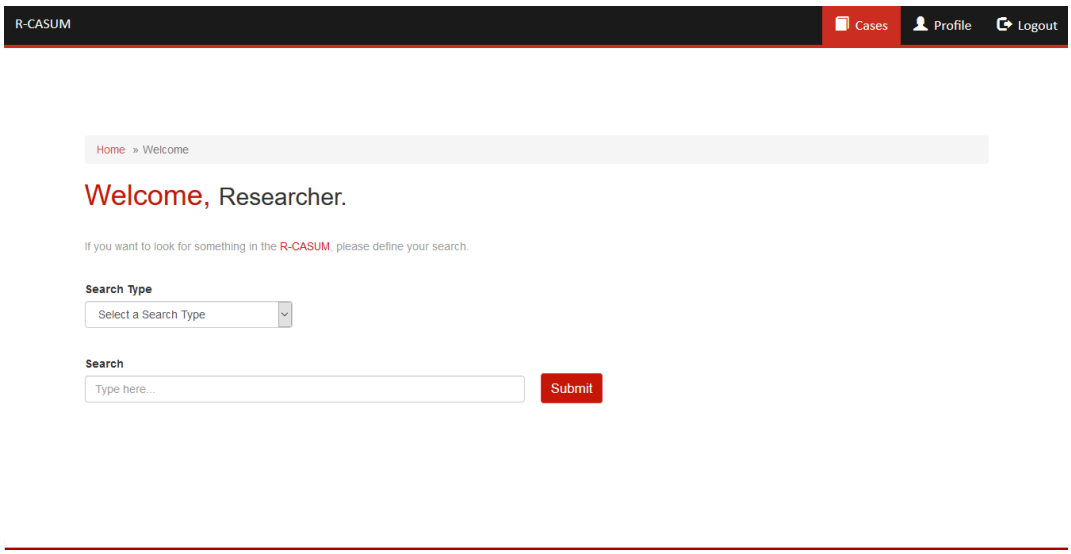


Create Case Step 8: Documents Details (create new documents)

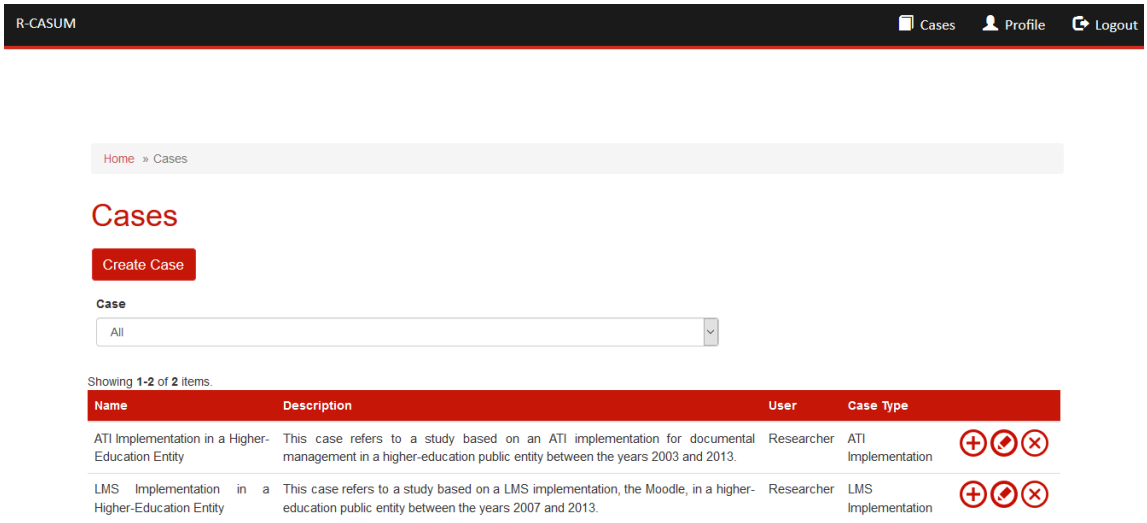
B2 - Edit Case (Researcher)

In this process the researcher can edit one of its own cases in the application.

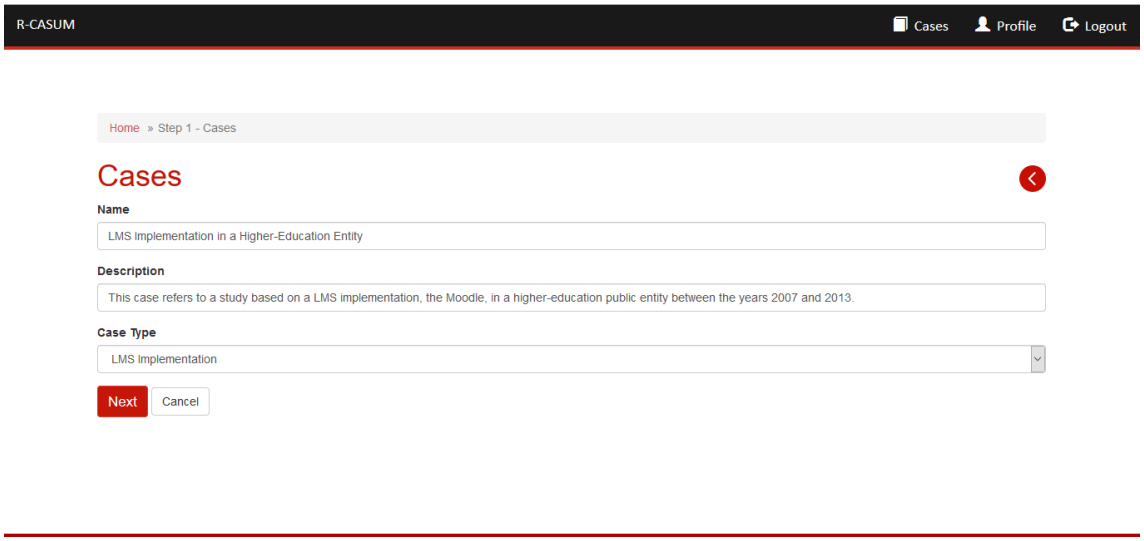
Use Cases: {UC-R4, UC-R3}



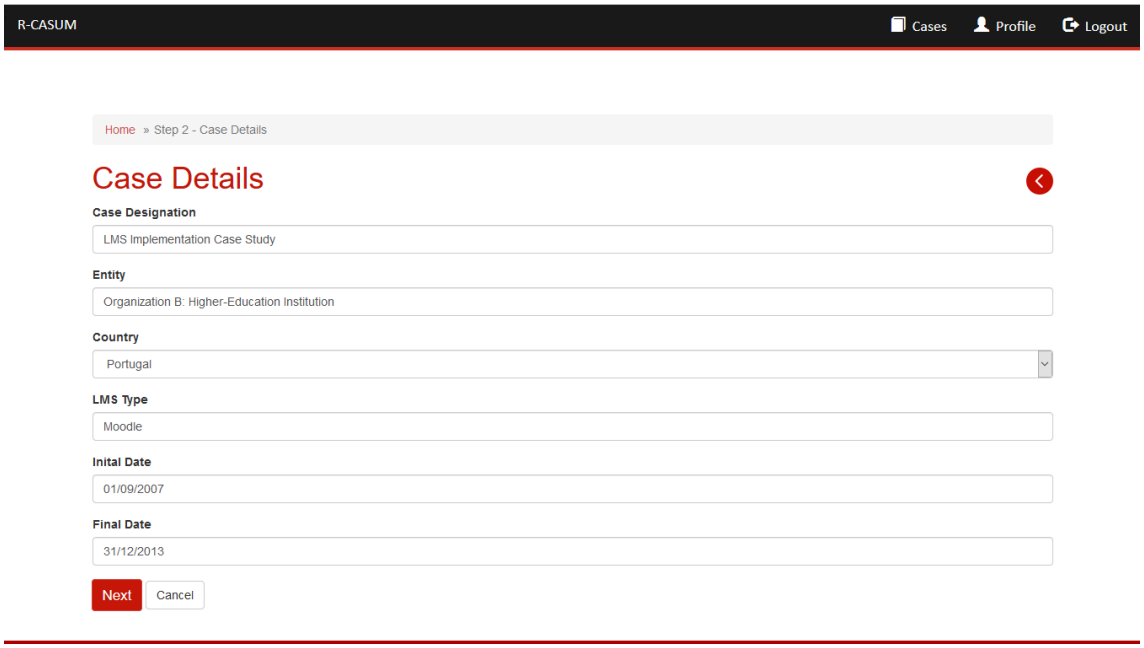
Cases



Manage Cases

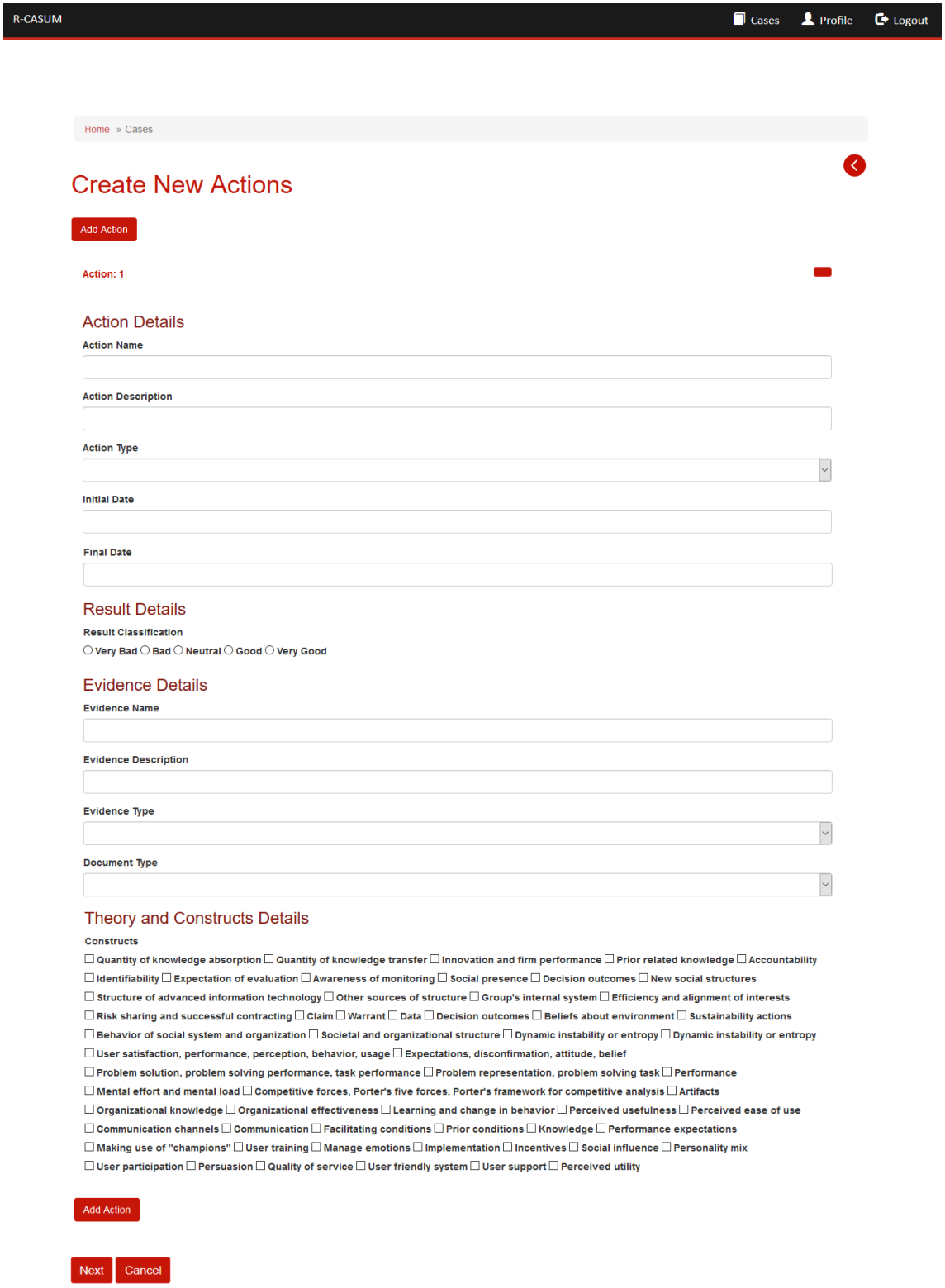


Edit Case Step 1: Case Information

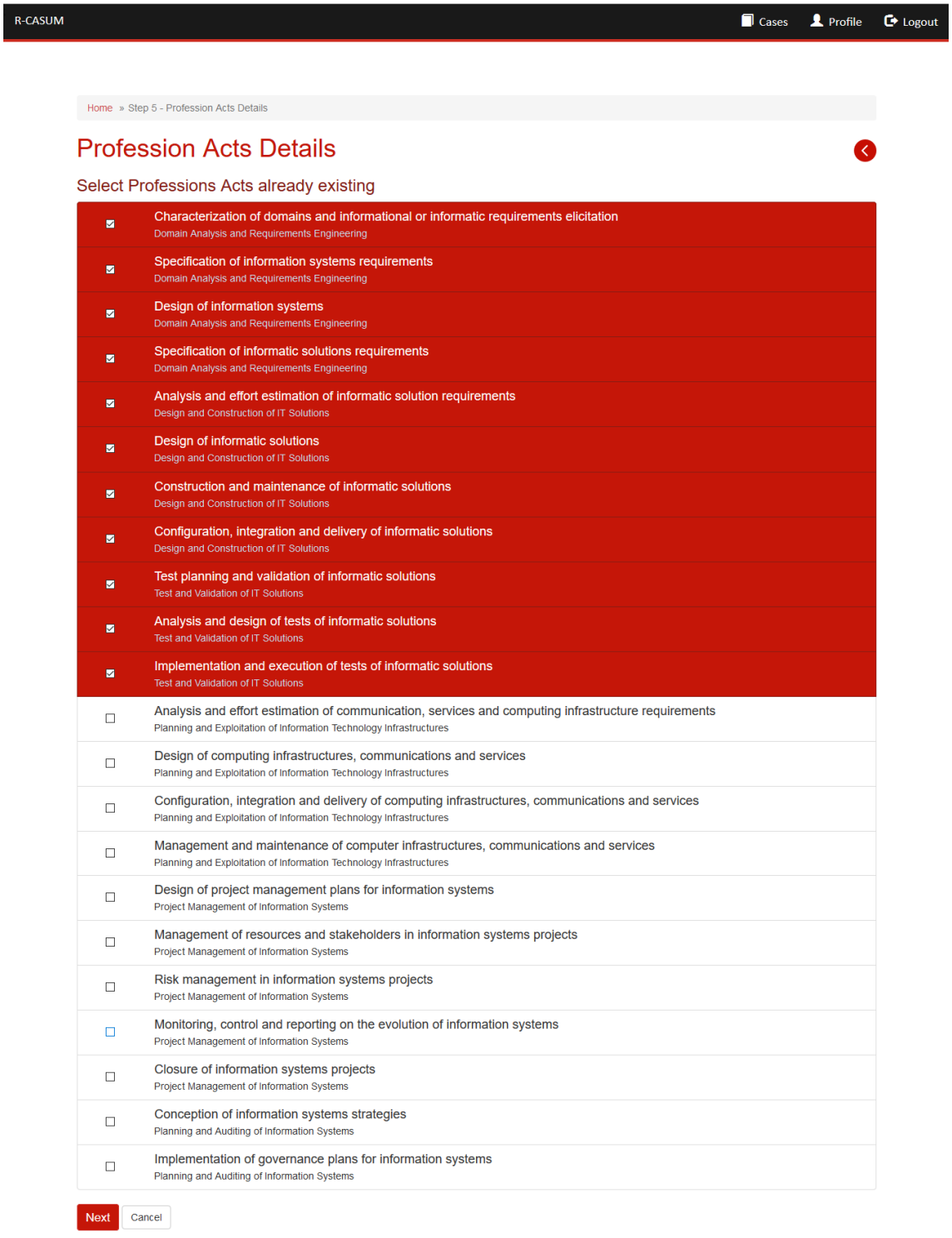


Edit Case Step 2: Case Details

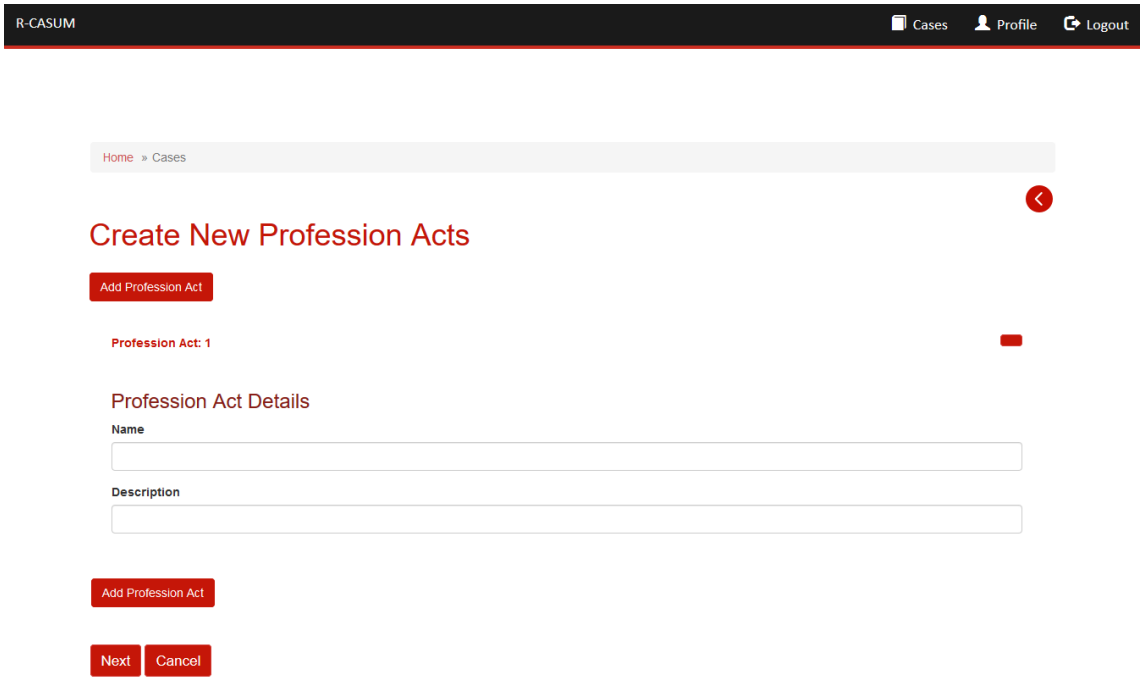
Edit Case Step 3: Action Details (associate existing actions)



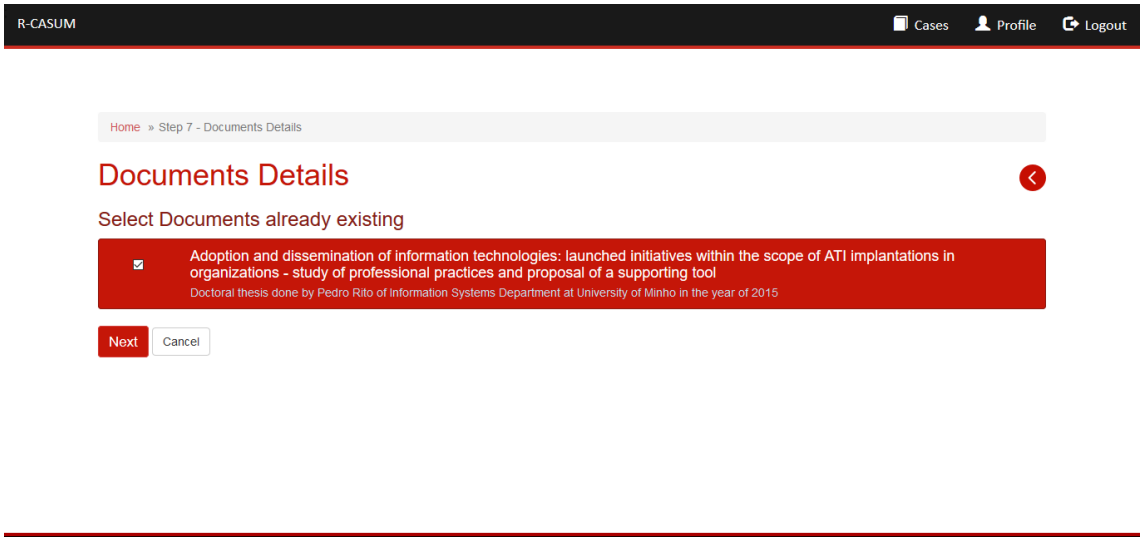
Edit Case Step 4: Action Details (create new actions)



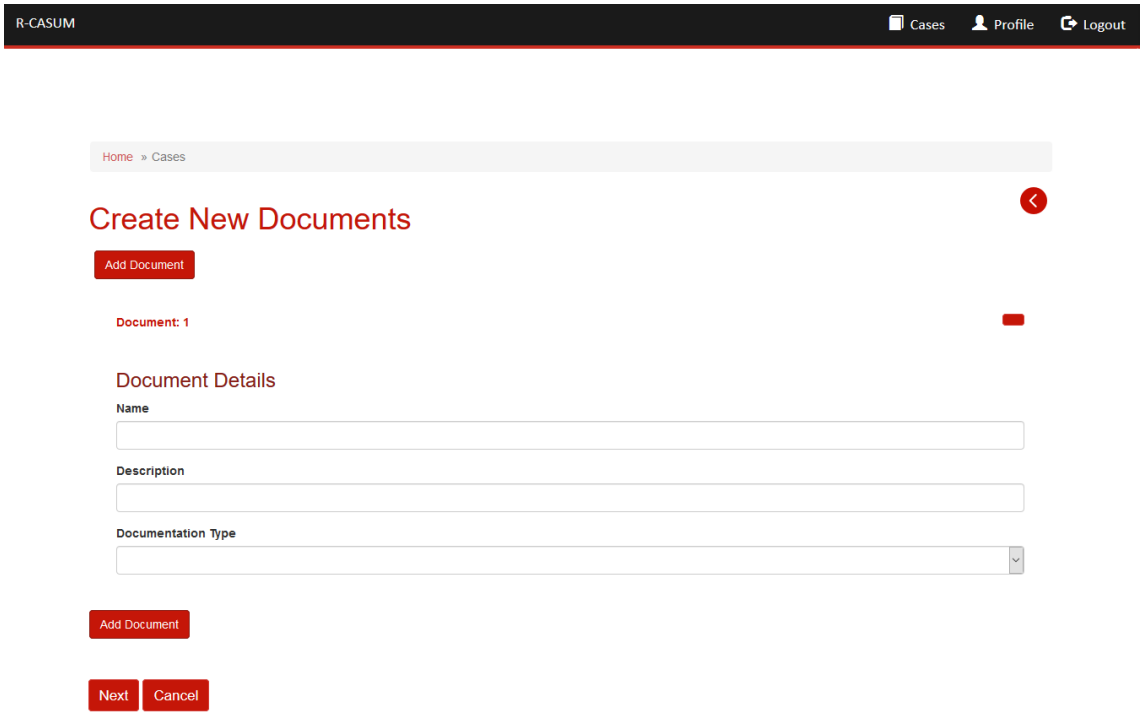
Edit Case Step 5: Profession Acts Details (associate existing profession acts)



Edit Case Step 6: Profession Acts Details (create new profession acts)



Edit Case Step 7: Documents Details (associate existing documents)

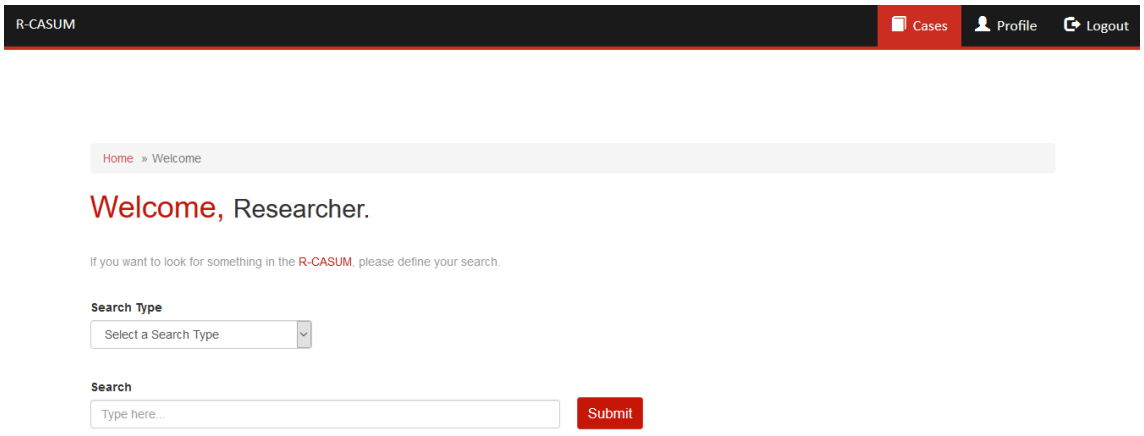


Edit Case Step 8: Documents Details (create new documents)

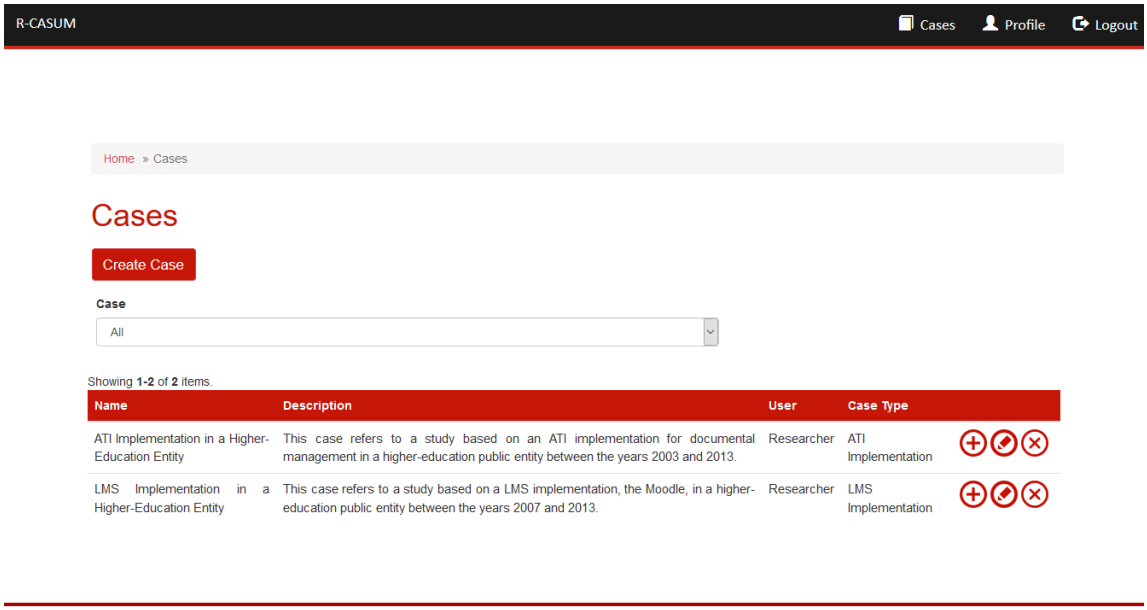
B3 - Delete Case (Researcher)

In this process the researcher can edit one of its own cases in the application.

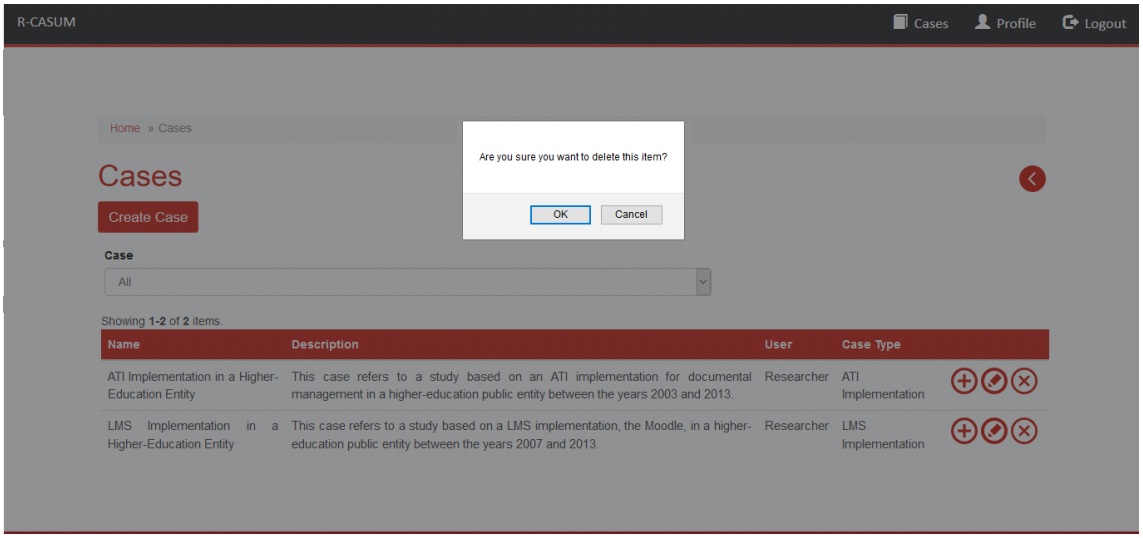
Use Cases: {UC-R5, UC-R3}



Cases



Manage Cases

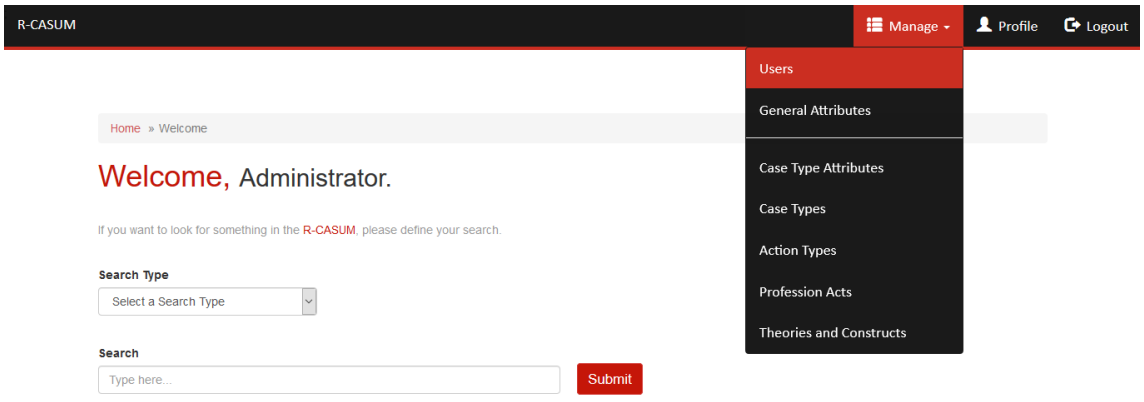


Delete Case

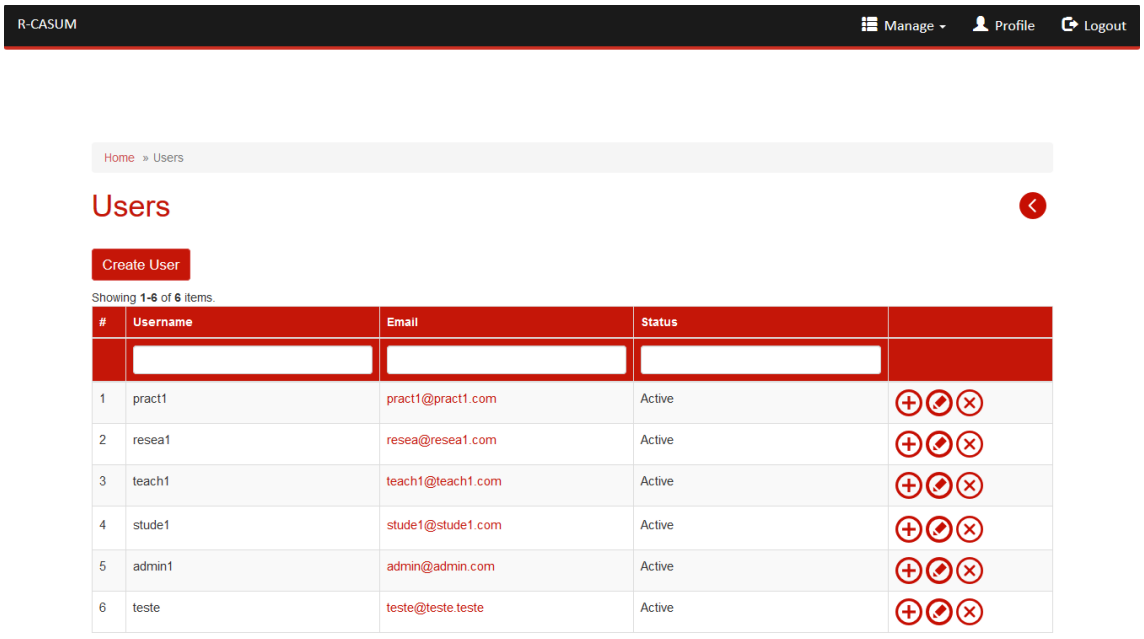
B4 - Manage Users (Administrator)

In this process the administrator can see all users, and consult, add, edit or delete a user.

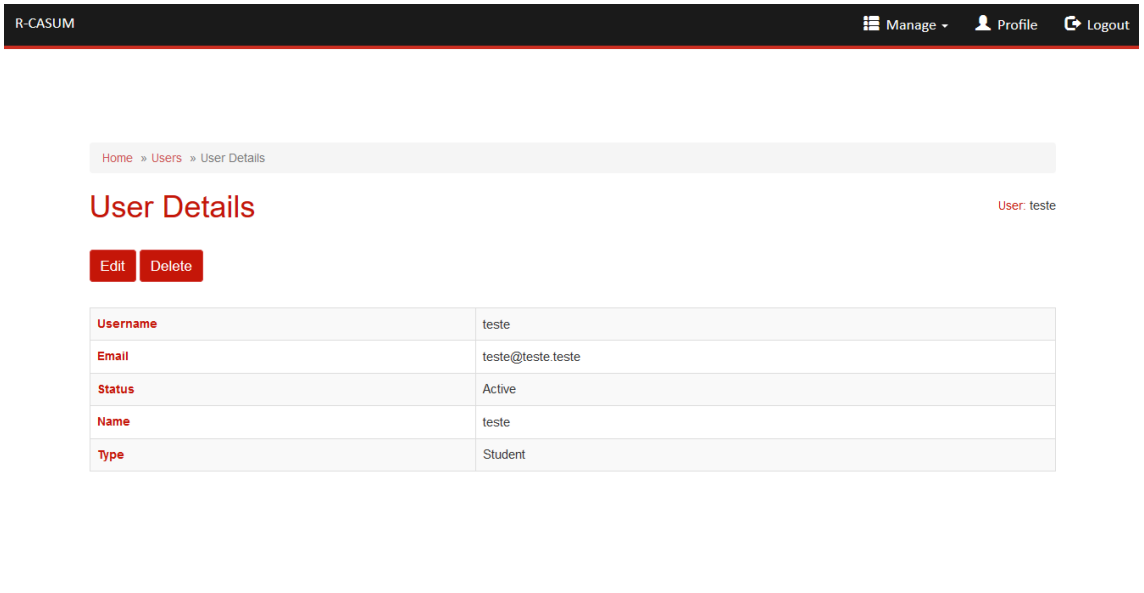
Use Cases: {UC-A1, UC-A2, UC-A3, UC-A4}



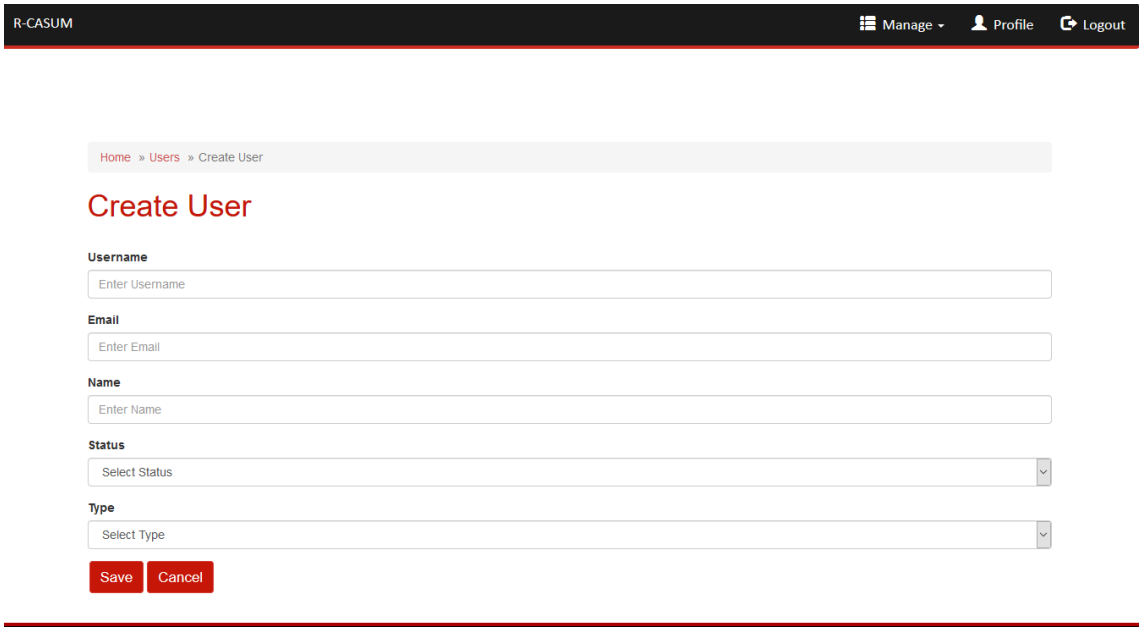
Manage Users



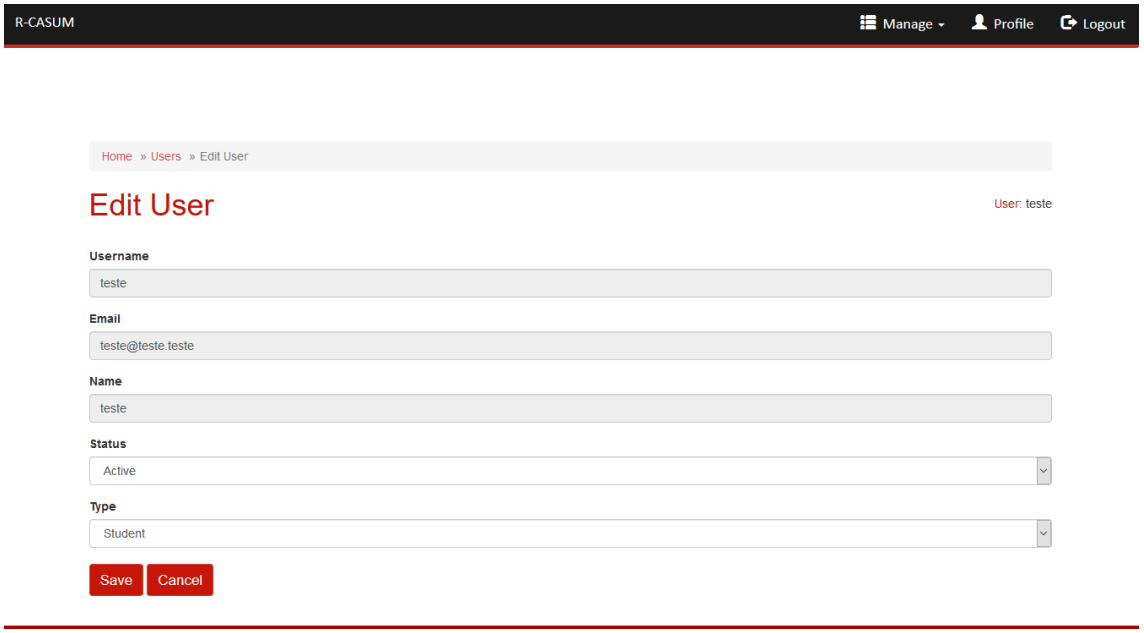
Users List



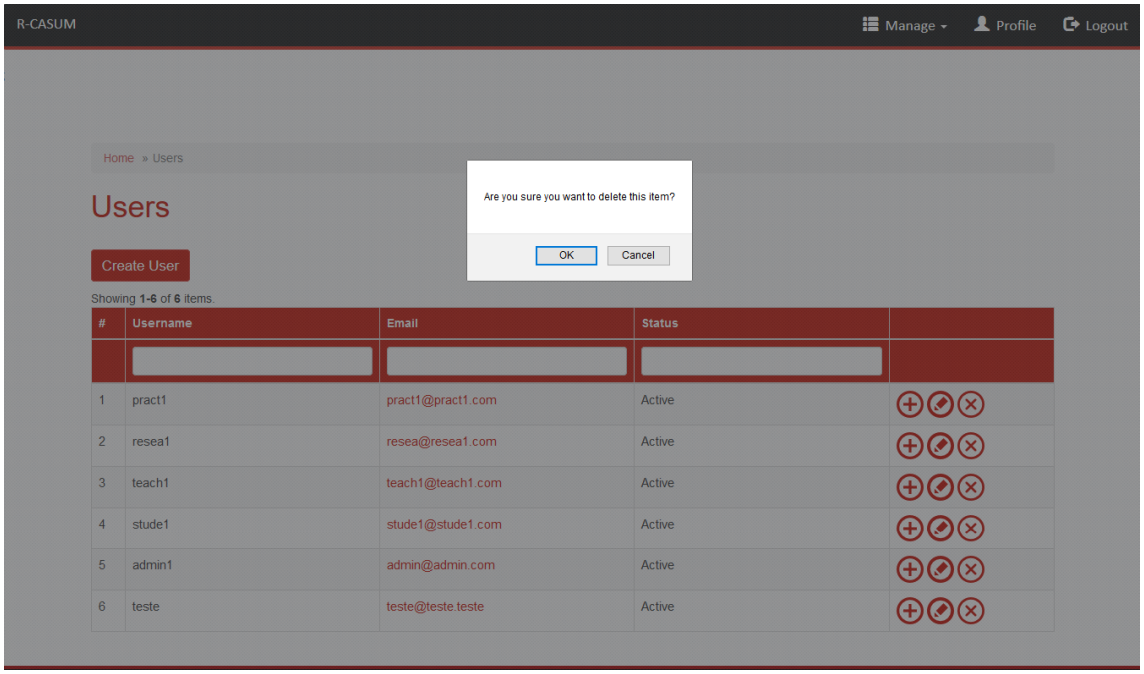
Consult User



Add User



Edit User

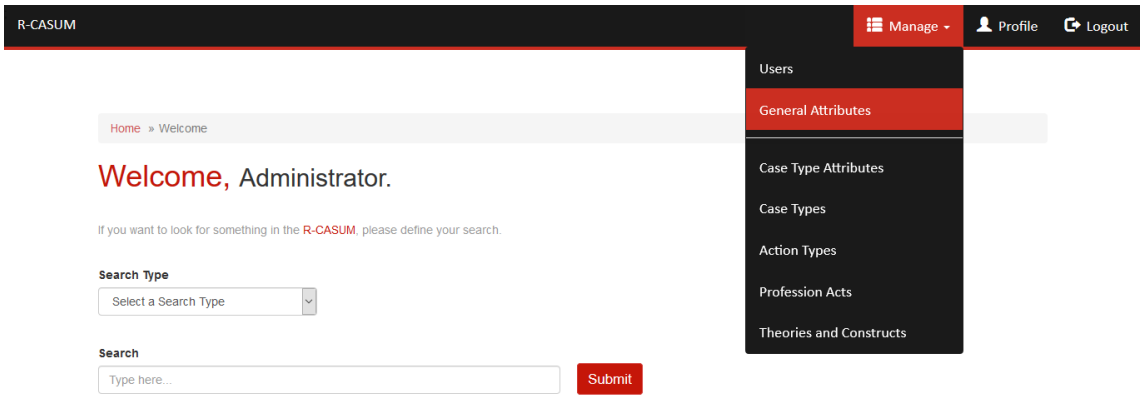


Delete User

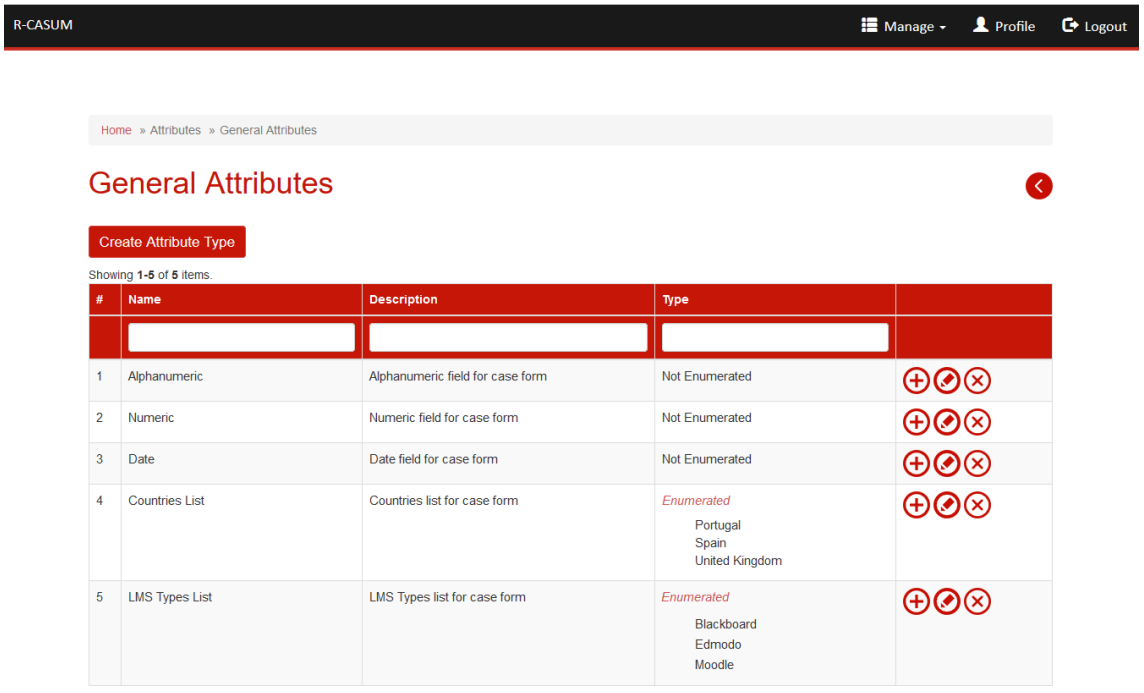
B5 - Manage General Attributes (Administrator)

In this process the administrator can manage the general types of attributes of the application, and consult, add, edit or delete a type of attribute.

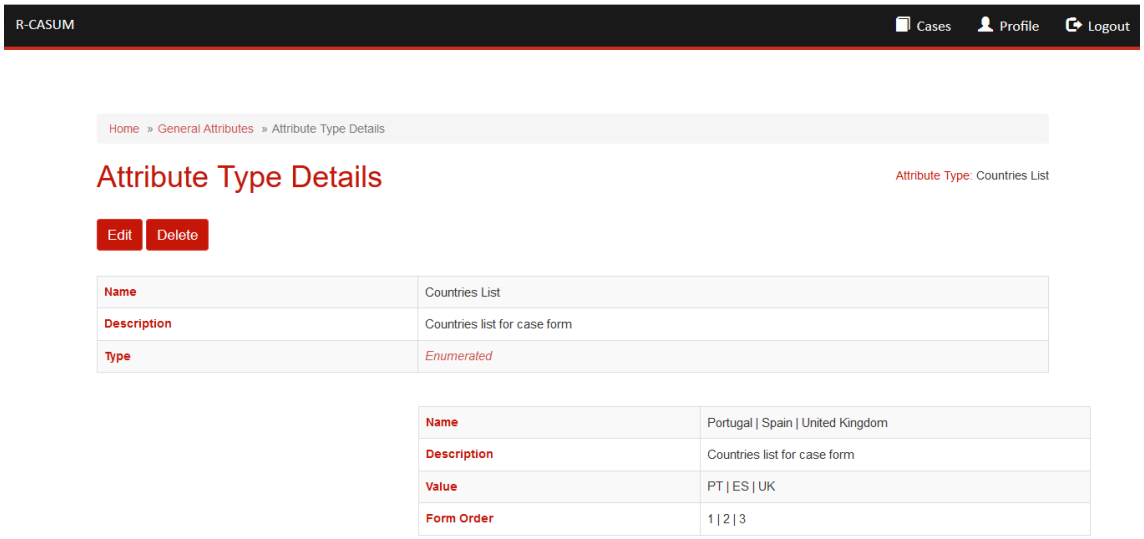
Use Cases: {UC-A6 – General Attributes}



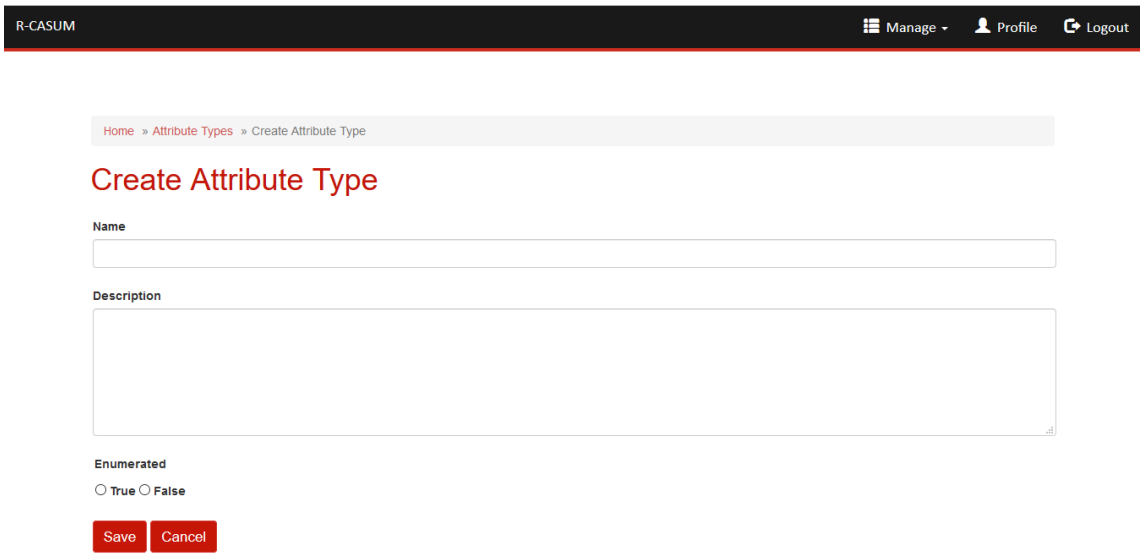
Manage General Attributes



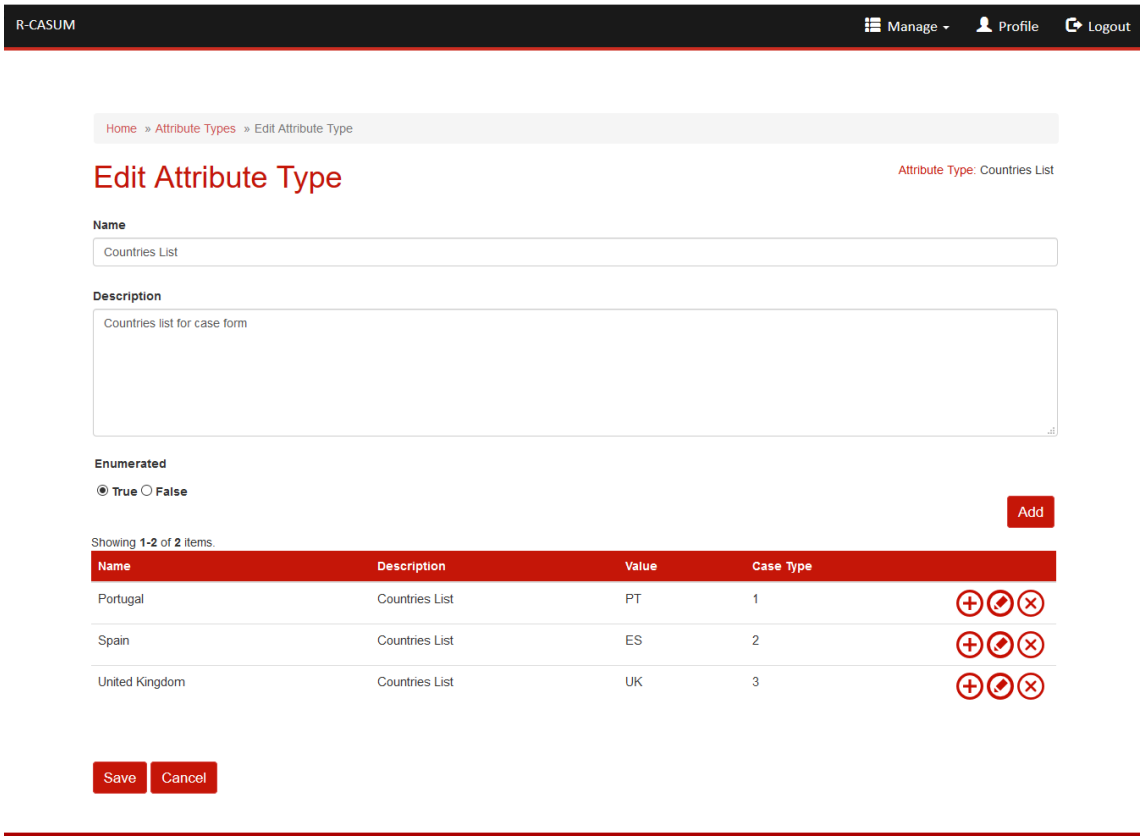
General Attributes List



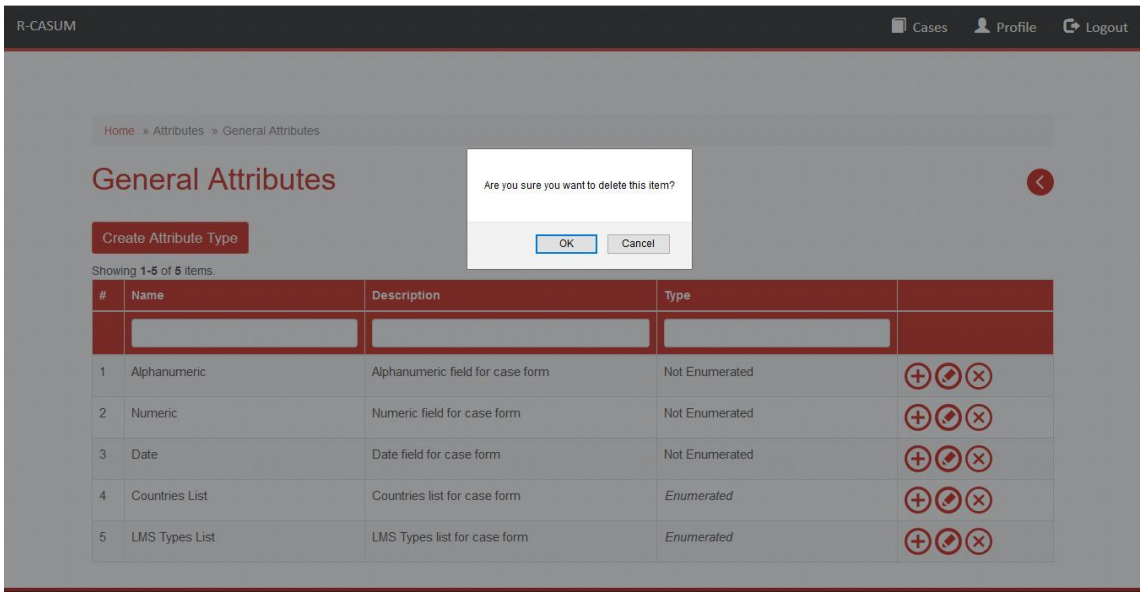
Consult Attribute Type



Add Attribute Type



Edit Attribute Type

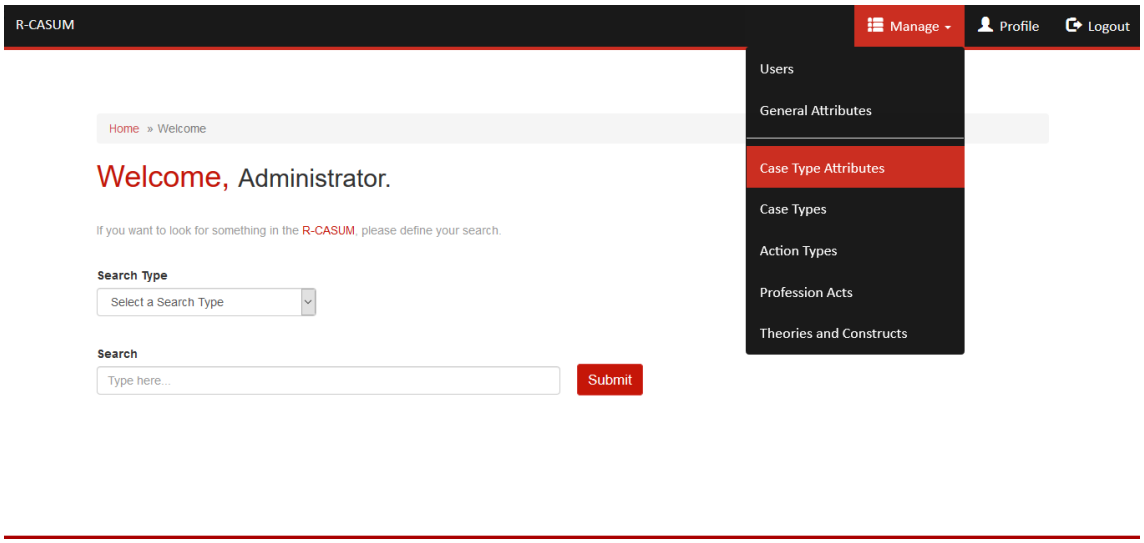


Delete Attribute Type

B6 - Manage Case Type Attributes (Administrator)

In this process the administrator can manage the attributes according to chosen case type as well as consult, add, edit or delete a case type attribute.

Use Cases: {UC-A6 – Case Type Attributes}



Manage Case Type Attributes

R-CASUM Manage Profile Logout

Home » Attributes » Case Type Attributes

Case Type Attributes

Create Case Type Attribute

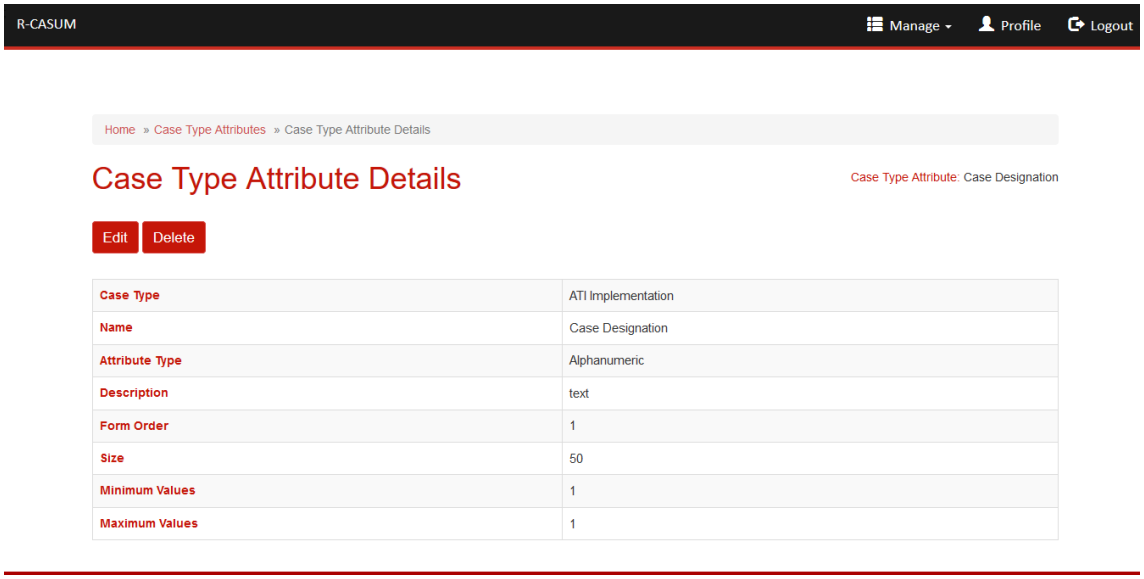
Case Type

All

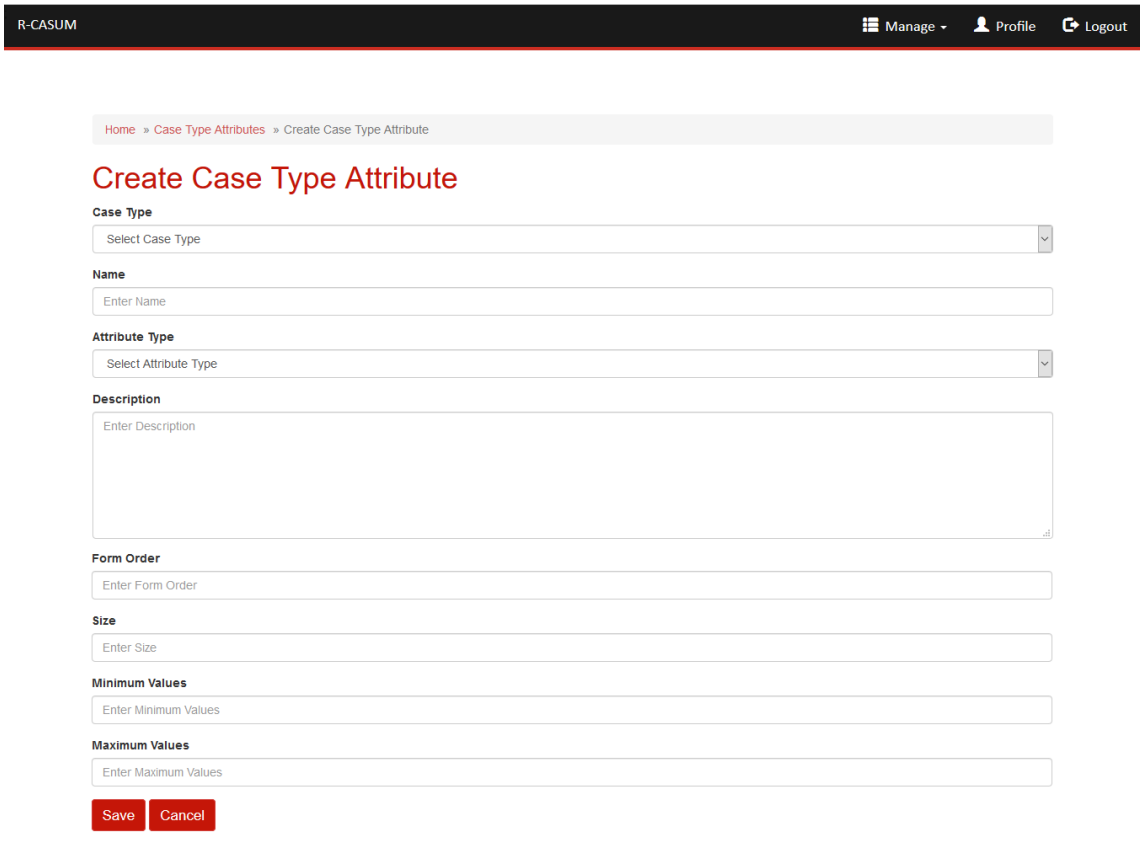
Showing **1-11** of **11** items.

#	Case Type	Name	Attribute Type	Description	Form Order	Size	Minimum Values	Maximum Values	
1	ATI Implementation	Case Designation	Alphanumeric	text	1	50	1	1	
2	ATI Implementation	Entity	Alphanumeric	text	2	50	1	1	
3	ATI Implementation	Country	Countries List	list	3	0	1	1	
4	ATI Implementation	Initial Date	Date	date	4	10	1	1	
5	ATI Implementation	Final Date	Date	date	5	10	1	1	
6	LMS Implementation	Case Designation	Alphanumeric	text	1	50	1	1	
7	LMS Implementation	Entity	Alphanumeric	text	2	50	1	1	
8	LMS Implementation	Country	Countries List	list	3	0	1	1	
9	LMS Implementation	LMS Type	Alphanumeric	text	4	50	1	1	
10	LMS Implementation	Inital Date	Date	date	5	10	1	1	
11	LMS Implementation	Final Date	Date	date	6	10	1	1	

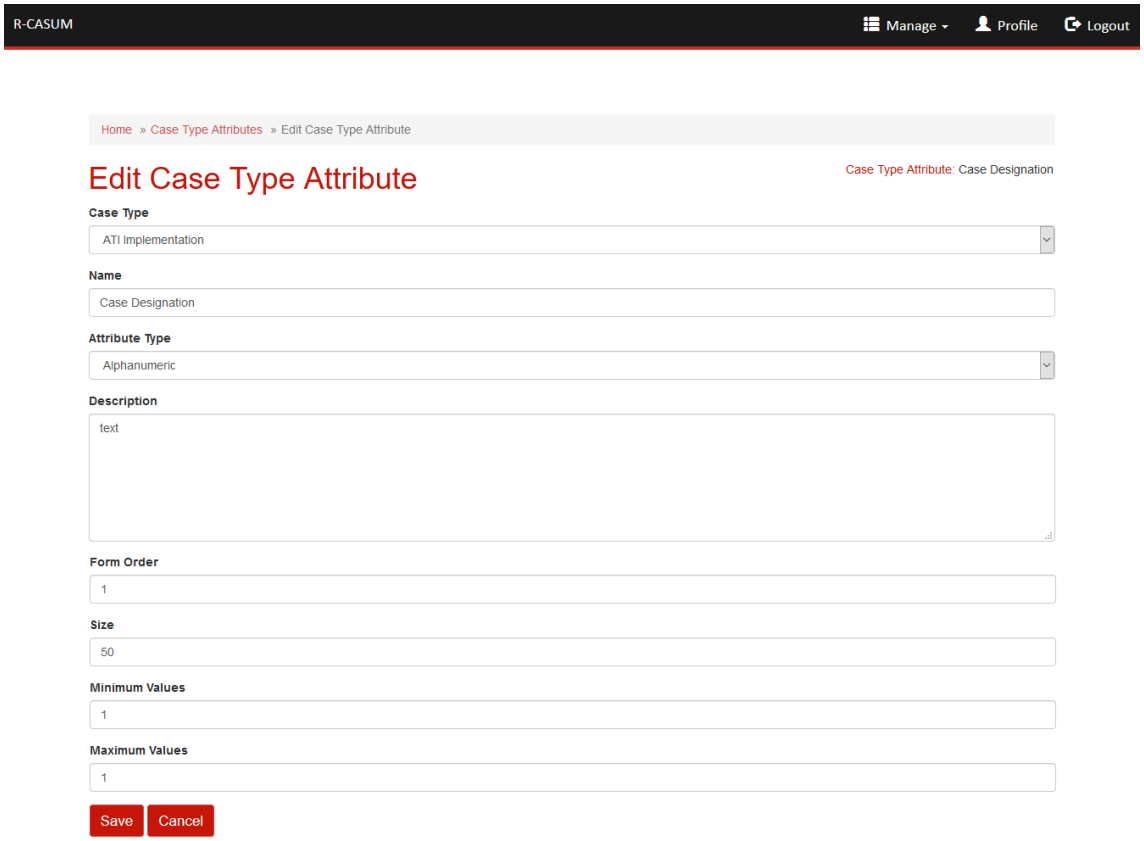
Case Type Attributes List



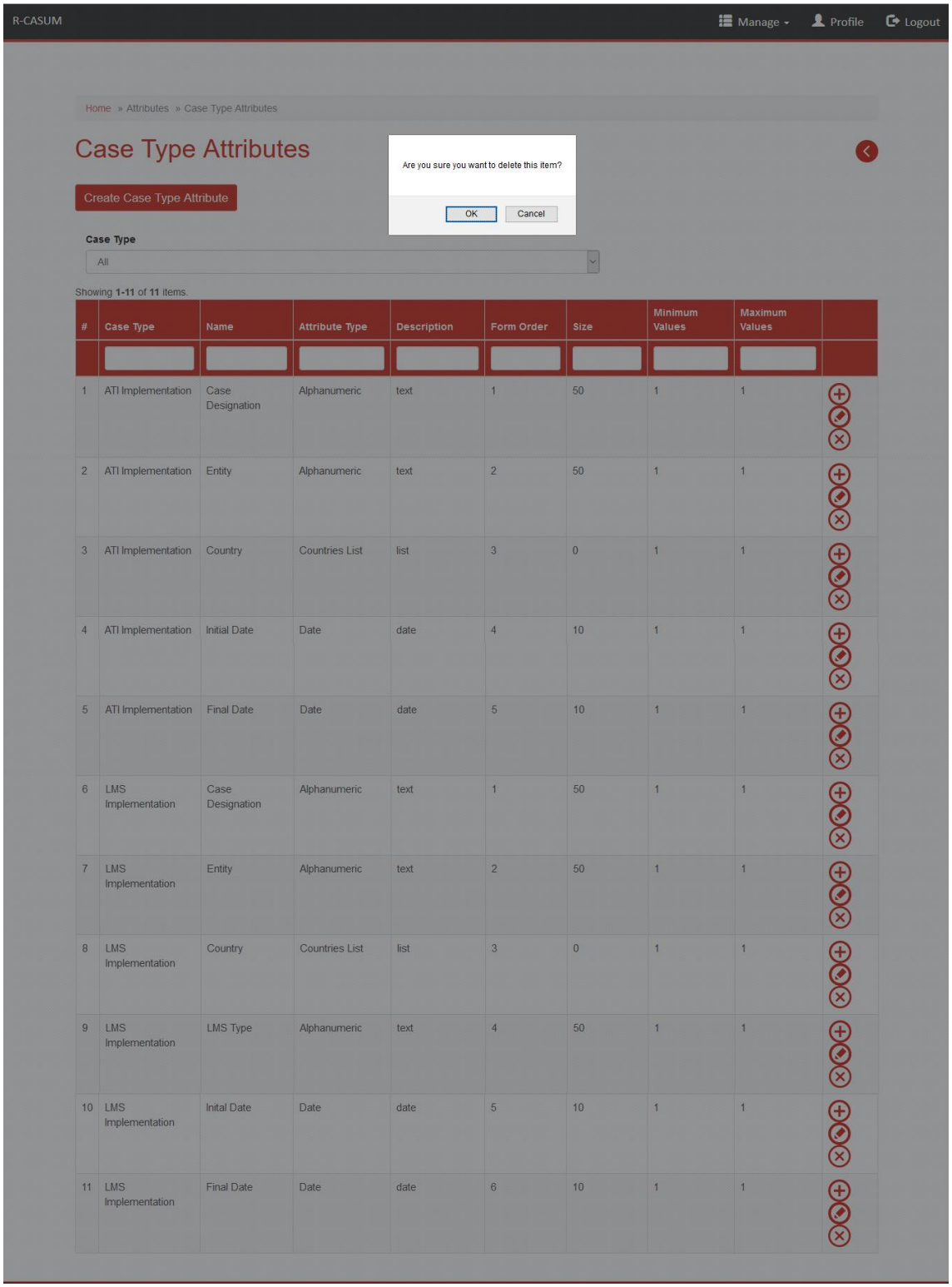
Consult Case Type Attribute



Add Case Type Attribute



Edit Case Type Attribute

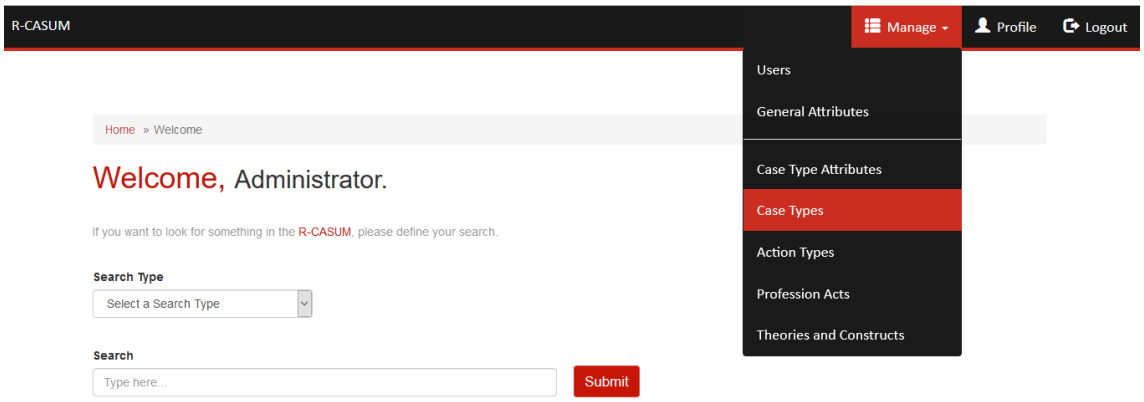


Delete Case Type Attribute

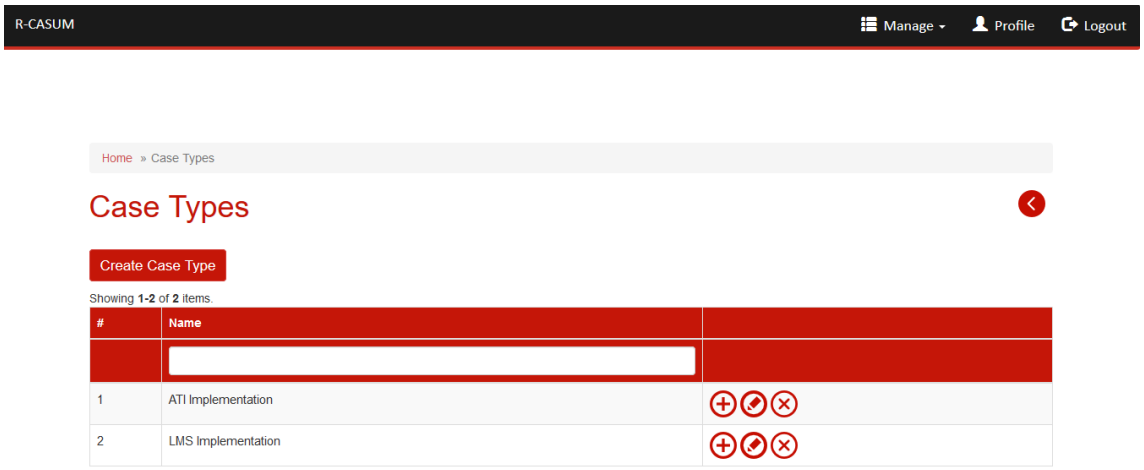
B7 - Manage Case Types (Administrator)

In this process the administrator can see all case types, and consult, add, edit or delete a case type.

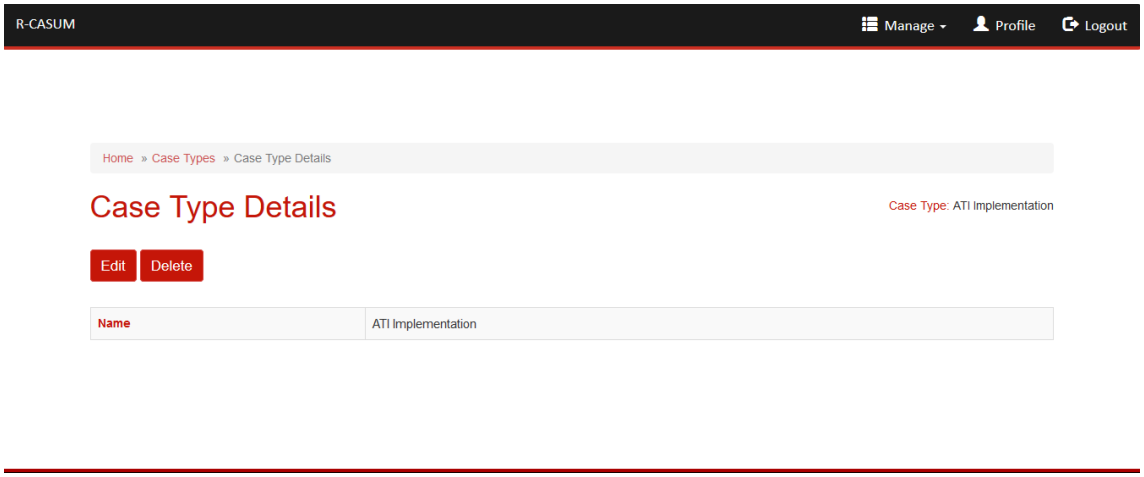
Use Cases: {UC-A6 – Case Types}



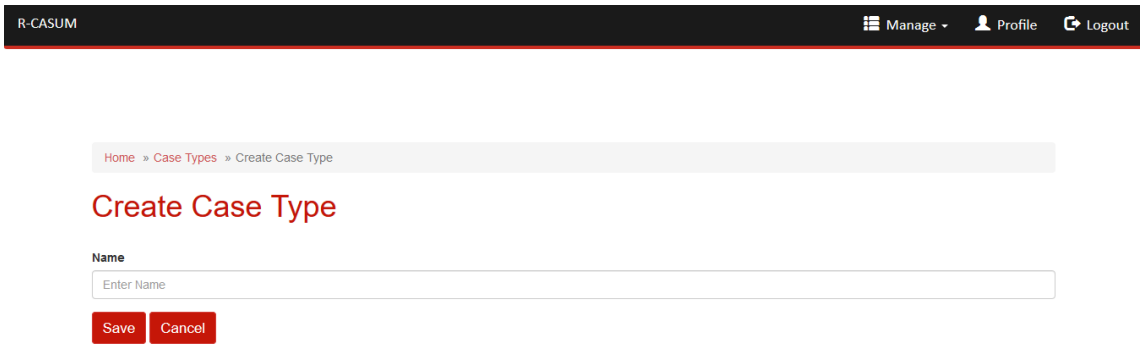
Manage Case Types



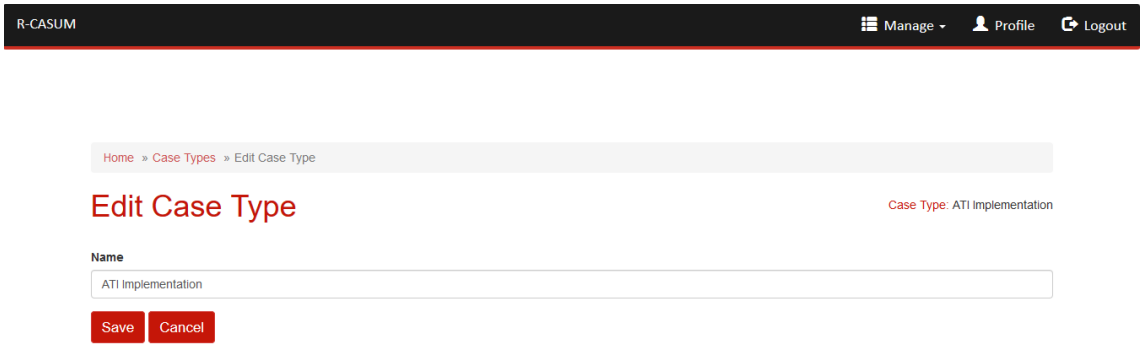
Case Types List



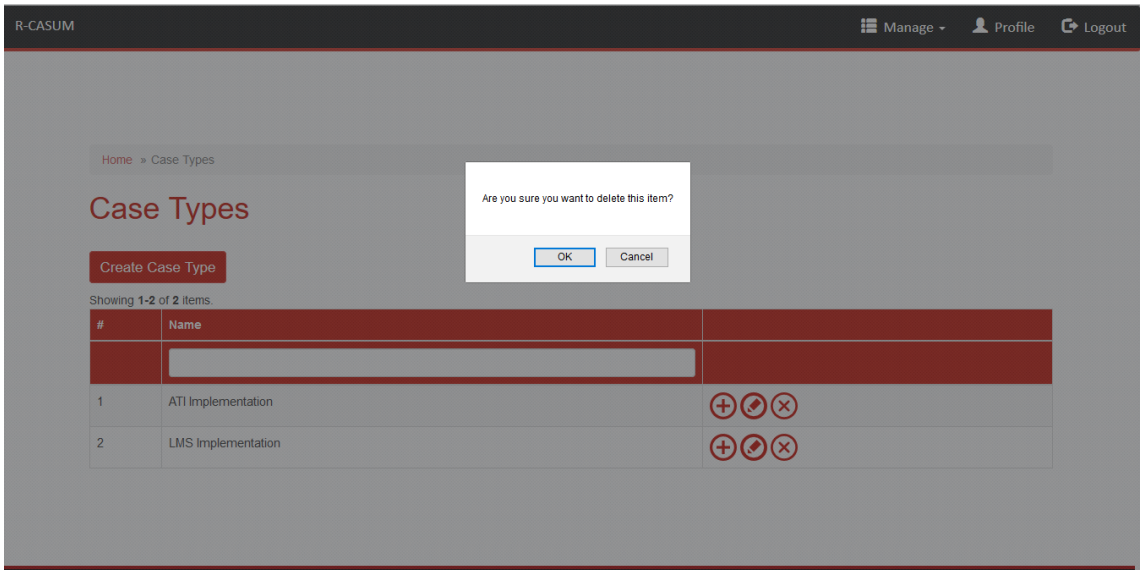
Consult Case Type



Add Case Type



Edit Case Type

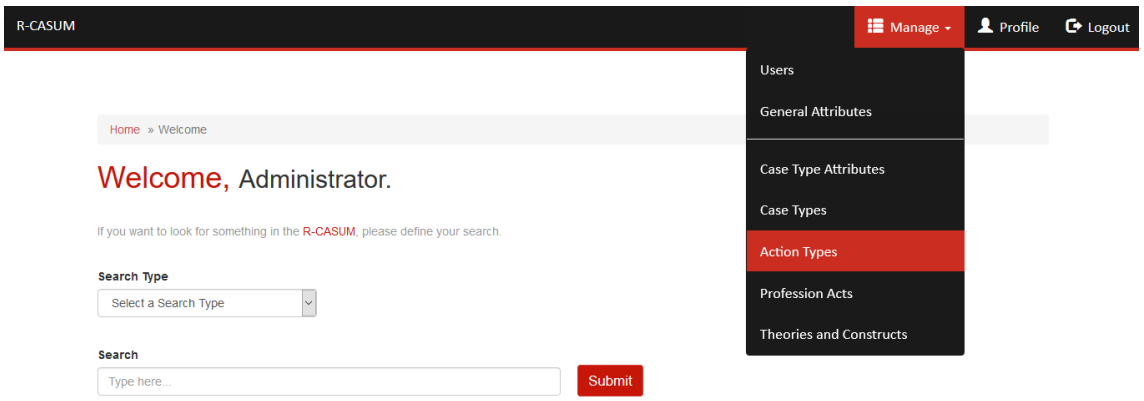


Delete Case Type

B8 - Manage Action Types (Administrator)

In this process the administrator can see all action types, and consult, add, edit or delete an action type.

Use Cases: {UC-A6 – Action Types}



Manage Action Types

R-CASUM Manage Profile Logout

Home » Action Types

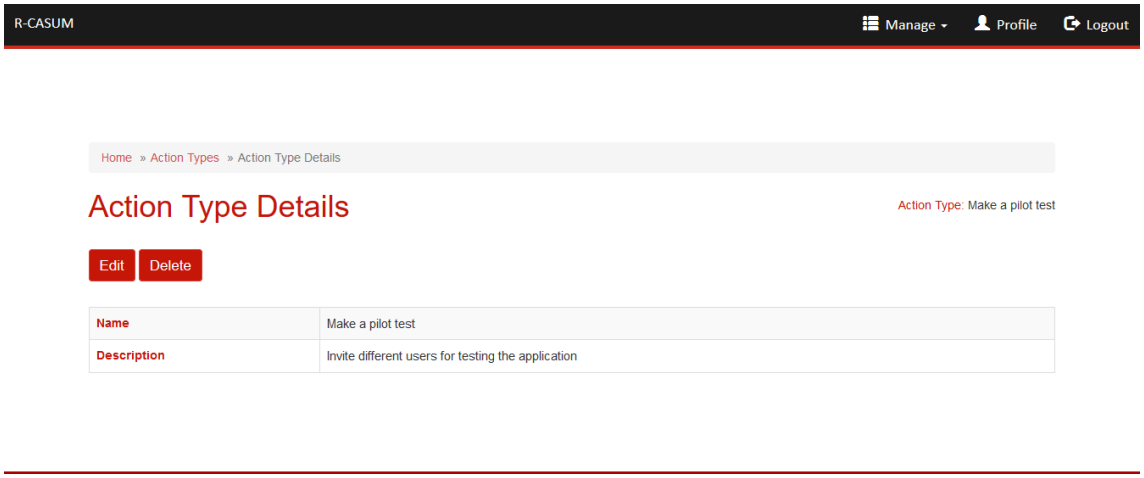
Action Types

Create Action Type

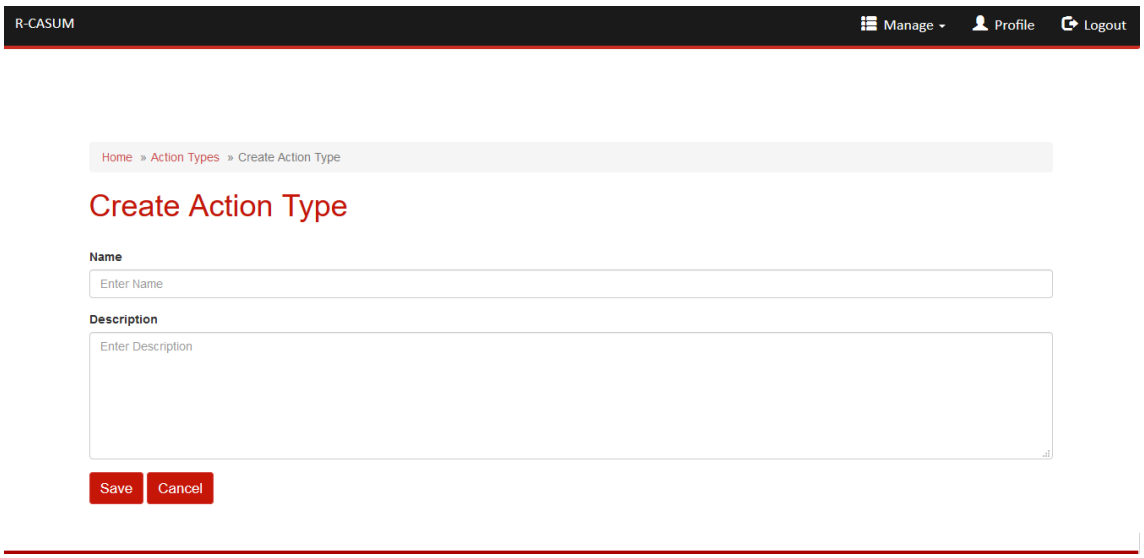
Showing **1-17** of **17** items.

#	Name	Description
1	Make a pilot test	Invite different users for testing the application
2	Provide support services	Maintainenance of the application through supporting services
3	Define usage policy for the application	Allow the possibility of individual definition of the usage policy
4	Promote the use of the application	Disclosure of the application to its future users
5	Demonstration of the application	Present the utility of the application
6	Define the administrators and managers for the application	Identify the users for managing and maintain the application
7	Make sessions for boosting the application	People get to know about the application or clients be aware of what is presented in these sessions
8	Provide support documentation	Give documentation support to users or clients for comprehension of the application
9	Listen clients suggestions or recommendations	Improvement of the application or prototype by listening the clients in calls, meetings or other way of communication
10	Alert users of the application of the policy compliance	Inform users about policy compliance
11	Make improvements in the development of the application	Improve the application according to what is been agreed in meetings with the clients
12	Establish an incentive or award for the application usage	Compensate somebody for the use of the application
13	Stand out the use of the application in community	Ability to the community be also aware of the presented application
14	Provide policy documentation	Policy documentation of the application so that users are aware of what they need to comply
15	Provide and disseminate new features of the application	Users should know what is new in the application
16	Announce and foster training actions of the application to users	Give training to the users of the application
17	Alert for application unavailability or maintenance	Users should know when the application is not or will be unavailable

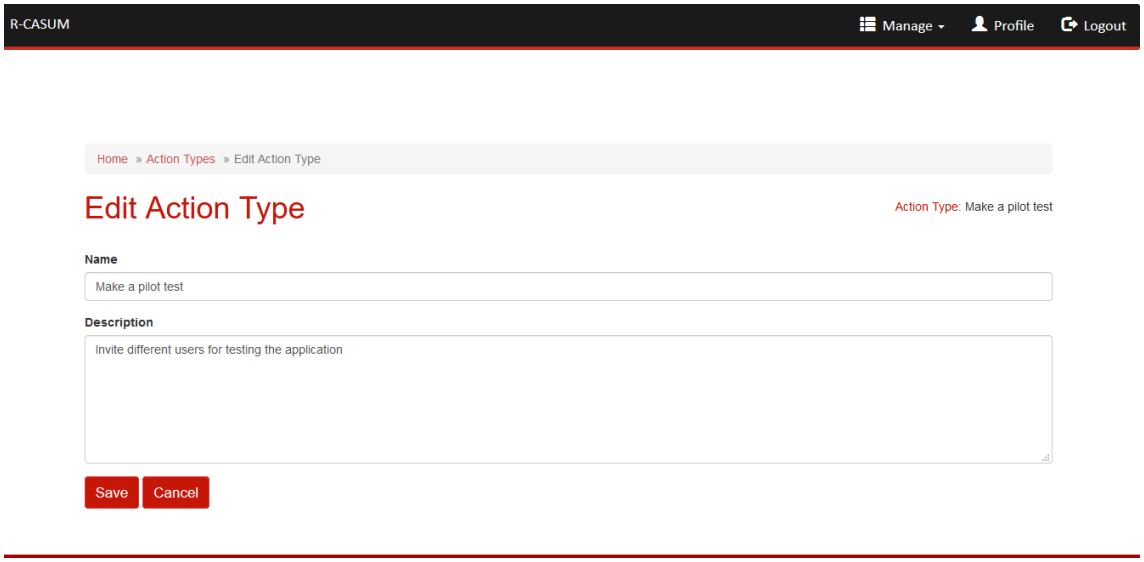
Action Types List



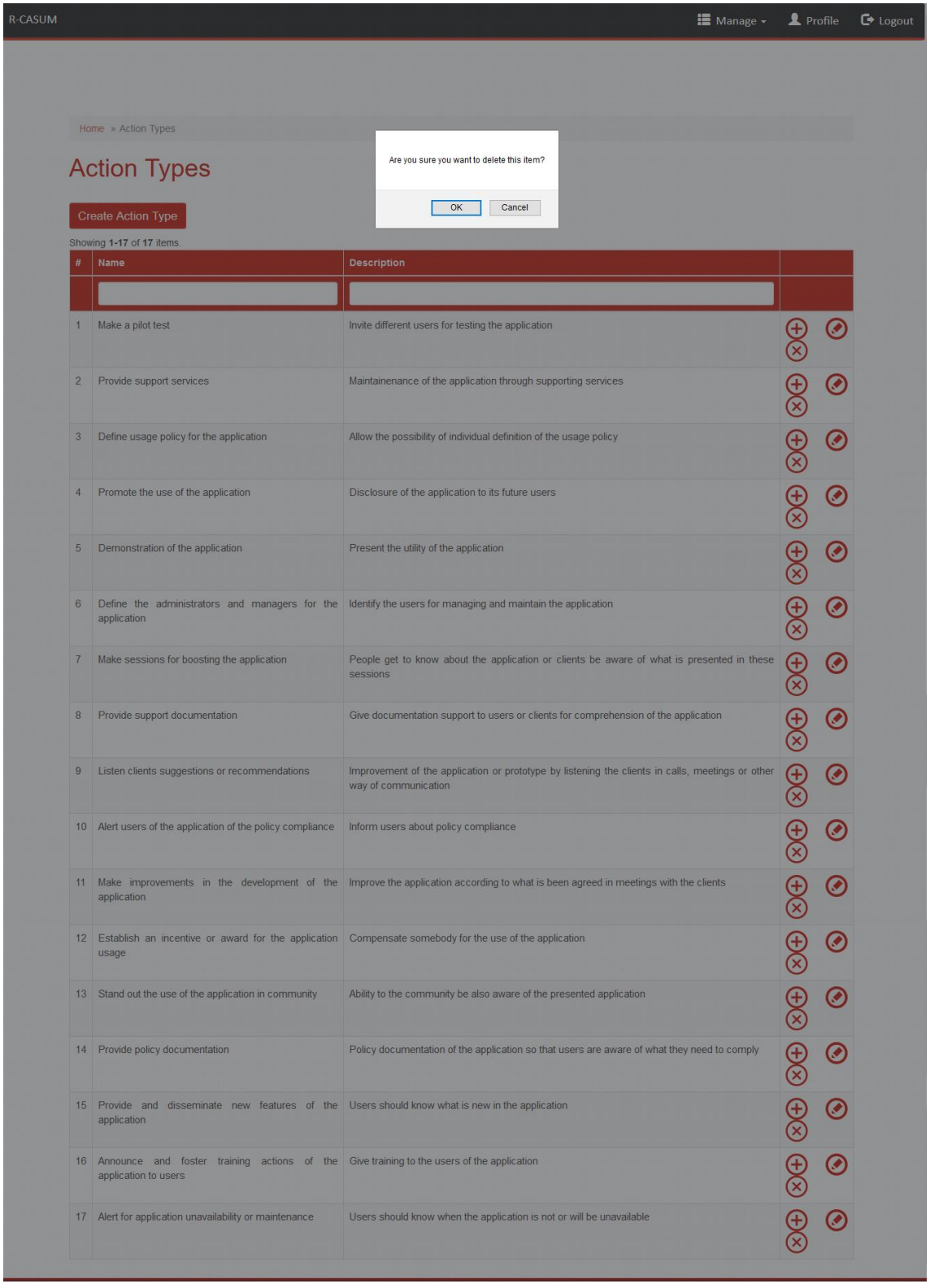
Consult Action Type



Add Action Type



Edit Action Type

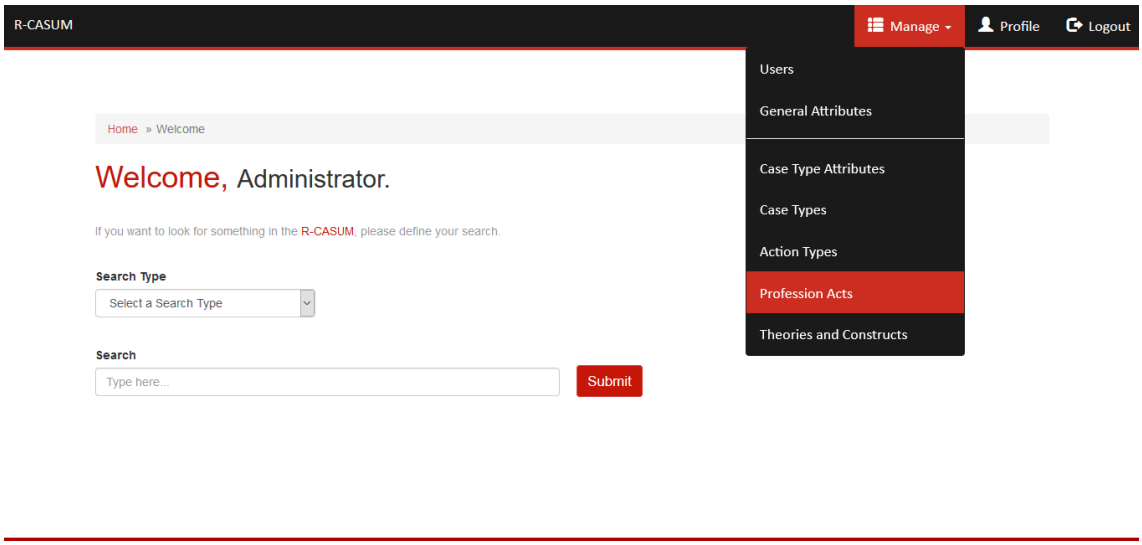


Delete Action Type

B9 - Manage Profession Acts (Administrator)

In this process the administrator can see all profession acts, and consult, add, edit or delete a profession act.

Use Cases: {UC-A6 – Profession Acts}



Manage Profession Acts

R-CASUM Manage Profile Logout

Home » Profession Acts

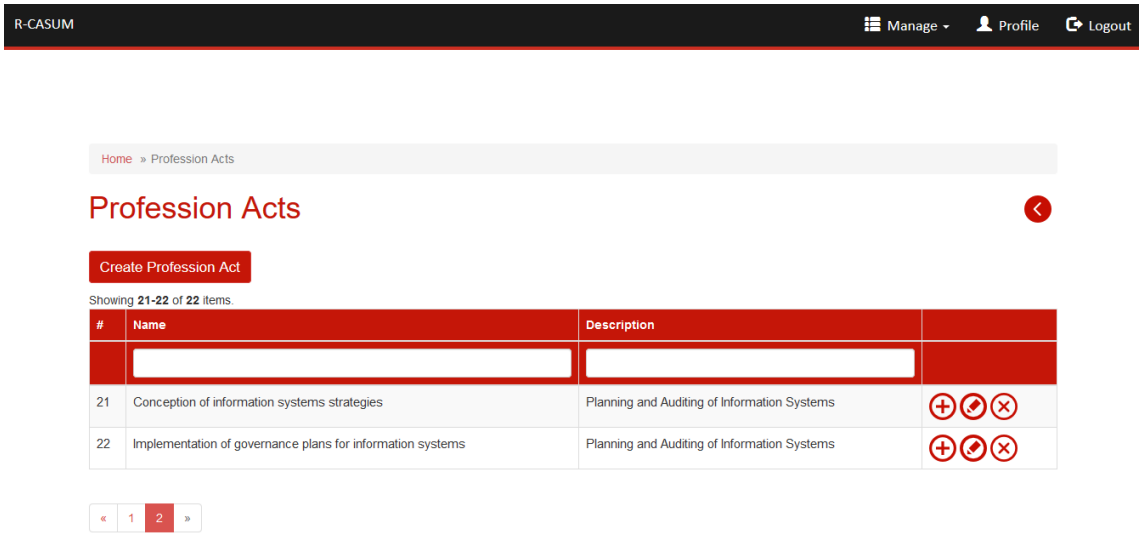
Profession Acts

Create Profession Act

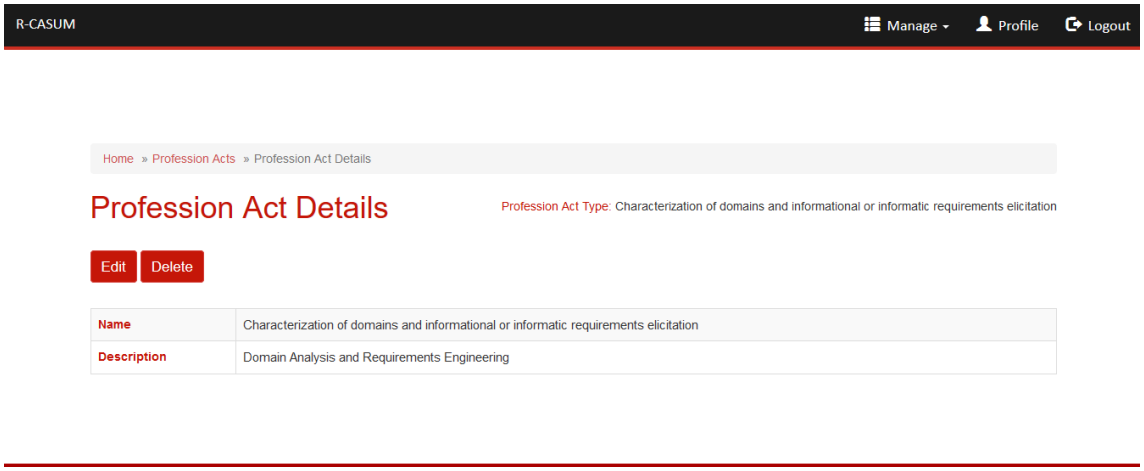
Showing **1-20** of **22** items.

#	Name	Description	
1	Characterization of domains and informational or informatic requirements elicitation	Domain Analysis and Requirements Engineering	
2	Specification of information systems requirements	Domain Analysis and Requirements Engineering	
3	Design of information systems	Domain Analysis and Requirements Engineering	
4	Specification of informatic solutions requirements	Domain Analysis and Requirements Engineering	
5	Analysis and effort estimation of informatic solution requirements	Design and Construction of IT Solutions	
6	Design of informatic solutions	Design and Construction of IT Solutions	
7	Construction and maintenance of informatic solutions	Design and Construction of IT Solutions	
8	Configuration, integration and delivery of informatic solutions	Design and Construction of IT Solutions	
9	Test planning and validation of informatic solutions	Test and Validation of IT Solutions	
10	Analysis and design of tests of informatic solutions	Test and Validation of IT Solutions	
11	Implementation and execution of tests of informatic solutions	Test and Validation of IT Solutions	
12	Analysis and effort estimation of communication, services and computing infrastructure requirements	Planning and Exploitation of Information Technology Infrastructures	
13	Design of computing infrastructures, communications and services	Planning and Exploitation of Information Technology Infrastructures	
14	Configuration, integration and delivery of computing infrastructures, communications and services	Planning and Exploitation of Information Technology Infrastructures	
15	Management and maintenance of computer infrastructures, communications and services	Planning and Exploitation of Information Technology Infrastructures	
16	Design of project management plans for information systems	Project Management of Information Systems	
17	Management of resources and stakeholders in information systems projects	Project Management of Information Systems	
18	Risk management in information systems projects	Project Management of Information Systems	
19	Monitoring, control and reporting on the evolution of information systems	Project Management of Information Systems	
20	Closure of information systems projects	Project Management of Information Systems	

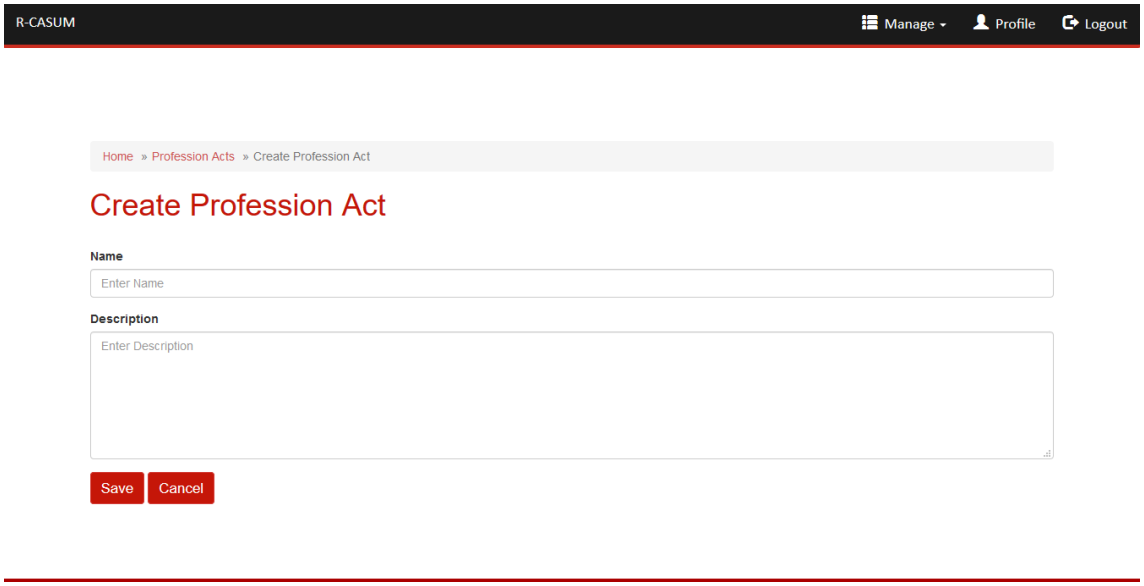
« 1 2 »



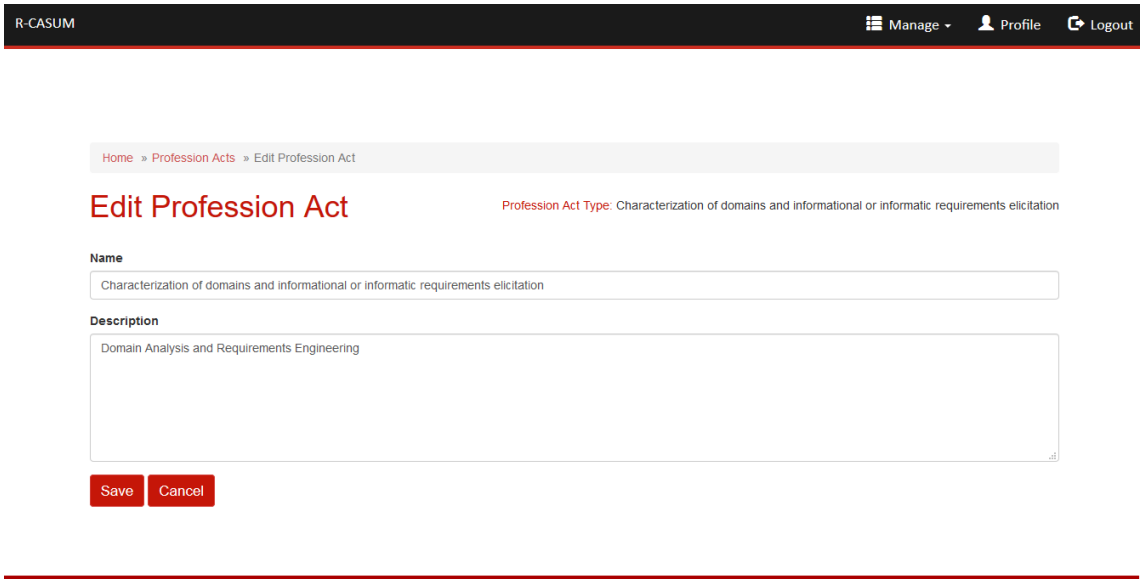
Profession Acts List



Consult Profession Act



Add Profession Act



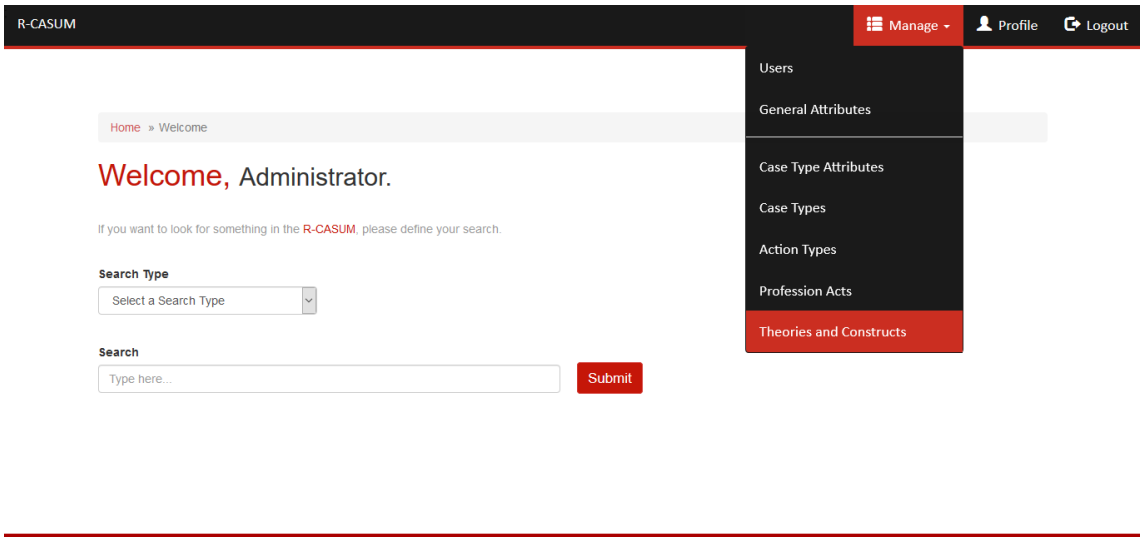
Edit Profession Act

Delete Profession Act

B10 - Manage Theories and Constructs (Administrator)

In this process the administrator can see all theories and its constructs, and consult, add, edit or delete a theory and each related construct.

Use Cases: {UC-A6 – Theories and Constructs}



Manage Theories and Constructs

R-CASUM

Manage Profile Logout

Home » Theories and Constructs

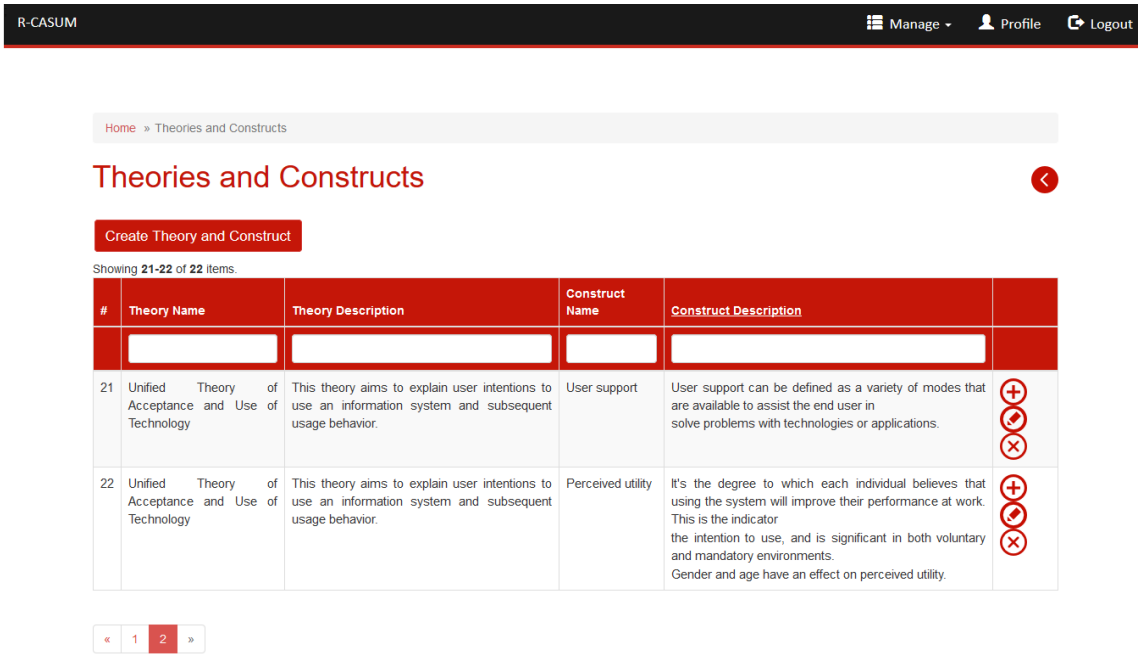
Theories and Constructs

Create Theory and Construct

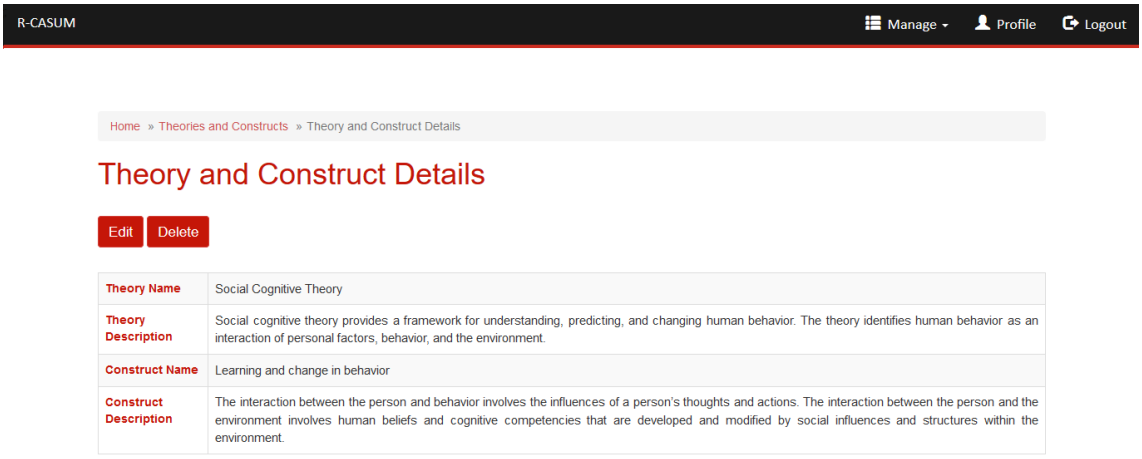
Showing **1-20** of **22** items.

#	Theory Name	Theory Description	Construct Name	Construct Description
1	Social Cognitive Theory	Social cognitive theory provides a framework for understanding, predicting, and changing human behavior. The theory identifies human behavior as an interaction of personal factors, behavior, and the environment.	Learning and change in behavior	The interaction between the person and behavior involves the influences of a person's thoughts and actions. The interaction between the person and the environment involves human beliefs and cognitive competencies that are developed and modified by social influences and structures within the environment.
2	Technology Acceptance Model	This theory posits that perceived usefulness and perceived ease of use determine an individual's intention to use a system with intention to use serving as a mediator of actual system use. Perceived usefulness is also seen as being directly impacted by perceived ease of use.	Perceived usefulness	The degree to which a person believes that using a particular system would enhance his or her job performance.
3	Technology Acceptance Model	This theory posits that perceived usefulness and perceived ease of use determine an individual's intention to use a system with intention to use serving as a mediator of actual system use. Perceived usefulness is also seen as being directly impacted by perceived ease of use.	Perceived ease of use	The degree to which a person believes that using a particular system would be free from effort.
4	Diffusion of Innovation Theory	This theory sees innovations as being communicated through certain channels over time and within a particular social system. Individuals are seen as possessing different degrees of willingness to adopt innovations and thus it is generally observed that the portion of the population adopting an innovation is approximately normally distributed over time.	Communication channels	Diffusion is the process by which a technology spreads through an organization, through communication channels (mass media and interpersonal relations), for a certain period of time and in a certain social system. The proportion of the population that will adopt the new technology is distributed on a regular basis over time, as individuals have a willingness to adopt this technology.
5	Choice and Resistance to Change Theory	This theory is based on the choices and the resistance to change within an organizational environment. The resistance to change is the action taken by individuals and groups when they perceive that a change that is occurring as a threat to them.	Communication	Communication is one of the most important strategies to avoid resistance on the part of the user. It is a tool which helps organizations in a process of technology change, making users feel breaking the resistance among these users, and increasing their confidence will arise.
6	Unified Theory of Acceptance and Use of Technology	This theory aims to explain user intentions to use an information system and subsequent usage behavior.	Facilitating conditions	This is the degree to which the individual believes that the existing infrastructure serves to help him use the system. Facilitating conditions do not have a direct effect on intention to use but on actual use.
7	Choice and Resistance to Change Theory	This theory is based on the choices and the resistance to change within an organizational environment. The resistance to change is the action taken by individuals and groups when they perceive that a change that is occurring as a threat to them.	Prior conditions	Where resistance behavior on the part of users happens after the user experiences threats that result of the interaction between the initial conditions and the new application presented to them.
8	Diffusion of Innovation Theory	This theory sees innovations as being communicated through certain channels over time and within a particular social system. Individuals are seen as possessing different degrees of willingness to adopt innovations and thus it is generally observed that the portion of the population adopting an innovation is approximately normally distributed over time.	Knowledge	The individual has knowledge or is exposed to the existence of an innovation.
9	Unified Theory of Acceptance and Use of Technology	This theory aims to explain user intentions to use an information system and subsequent usage behavior.	Performance expectations	Degree of facility related to system use. Gender, age and experience have an effect on the expectation of performance.
10	Choice and Resistance to Change Theory	This theory is based on the choices and the resistance to change within an organizational environment. The resistance to change is the action taken by individuals and groups when they perceive that a change that is occurring as a threat to them.	Making use of "champions"	The" champions "are more than leaders, they are transforming leaders who will inspire other individuals in the organization so that these are transcended by a higher and collective purpose.
11	Choice and Resistance to Change Theory	This theory is based on the choices and the resistance to change within an organizational environment. The resistance to change is the action taken by individuals and groups when they perceive that a change that is occurring as a threat to them.	User training	Training is a process of transferring knowledge and operational skills to the user of technology. It is used to provide users with the skills they need to use the system.
12	Choice and Resistance to Change Theory	This theory is based on the choices and the resistance to change within an organizational environment. The resistance to change is the action taken by individuals and groups when they perceive that a change that is occurring as a threat to them.	Manage emotions	Emotions can help stimulate the use of the application.
13	Diffusion of Innovation Theory	This theory sees innovations as being communicated through certain channels over time and within a particular social system. Individuals are seen as possessing different degrees of willingness to adopt innovations and thus it is generally observed that the portion of the population adopting an innovation is approximately normally distributed over time.	Implementation	The time when the individual begins to effectively use the technology.
14	Choice and Resistance to Change Theory	This theory is based on the choices and the resistance to change within an organizational environment. The resistance to change is the action taken by individuals and groups when they perceive that a change that is occurring as a threat to them.	Incentives	The incentive can be used to influence system users to use the system in accordance with the objectives of the organization.
15	Unified Theory of Acceptance and Use of Technology	This theory aims to explain user intentions to use an information system and subsequent usage behavior.	Social influence	It is the degree to which the individual believes that it is important for others to use the system.
16	Choice and Resistance to Change Theory	This theory is based on the choices and the resistance to change within an organizational environment. The resistance to change is the action taken by individuals and groups when they perceive that a change that is occurring as a threat to them.	Personality mix	Human resources and recruitment departments should try to encourage a healthy mix between individuals with the application profiles and those of other technical departments.
17	Choice and Resistance to Change Theory	This theory is based on the choices and the resistance to change within an organizational environment. The resistance to change is the action taken by individuals and groups when they perceive that a change that is occurring as a threat to them.	User participation	User participation can be defined as a set of activities performed by the user during the process development and deployment of the application.
18	Unified Theory of Acceptance and Use of Technology	This theory aims to explain user intentions to use an information system and subsequent usage behavior.	Persuasion	It is the degree to which the individual believes that it can persuade others to use the system.
19	Diffusion of Innovation Theory	This theory sees innovations as being communicated through certain channels over time and within a particular social system. Individuals are seen as possessing different degrees of willingness to adopt innovations and thus it is generally observed that the portion of the population	Quality of service	The existence of support to the use of information systems.
20	Choice and Resistance to Change Theory	This theory is based on the choices and the resistance to change within an organizational environment. The resistance to change is the action taken by individuals and groups when they perceive that a change that is occurring as a threat to them.	User friendly system	The design and its features are significant, particularly to deal with resistance from users.

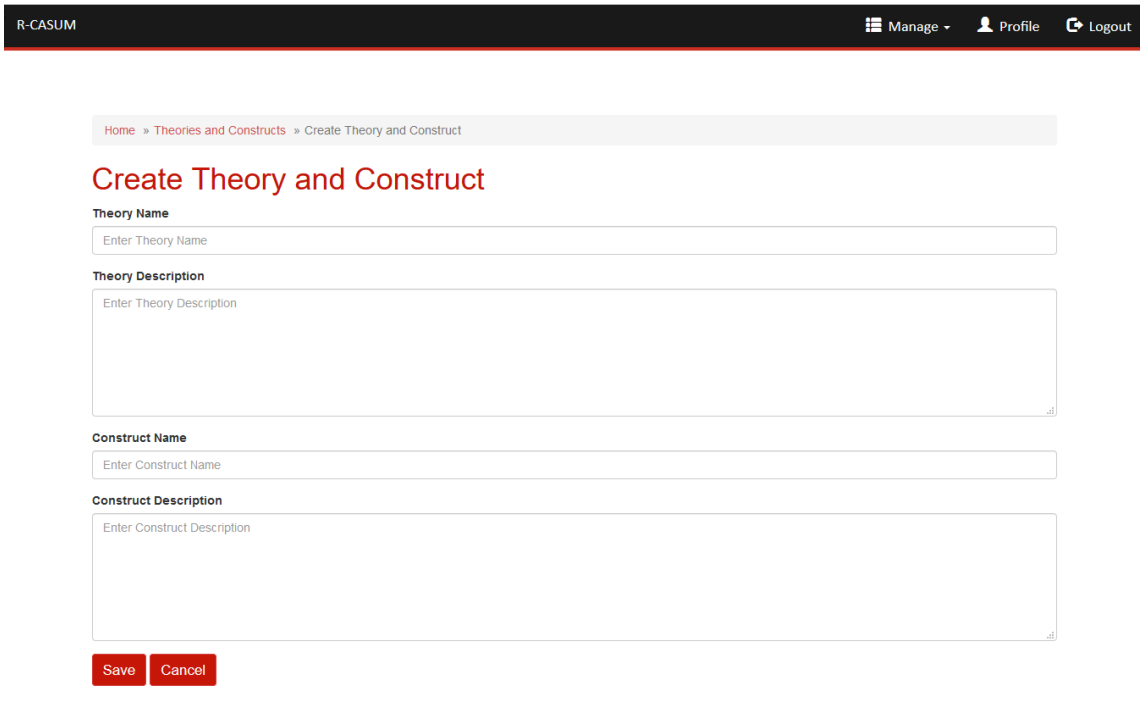
« 1 2 »



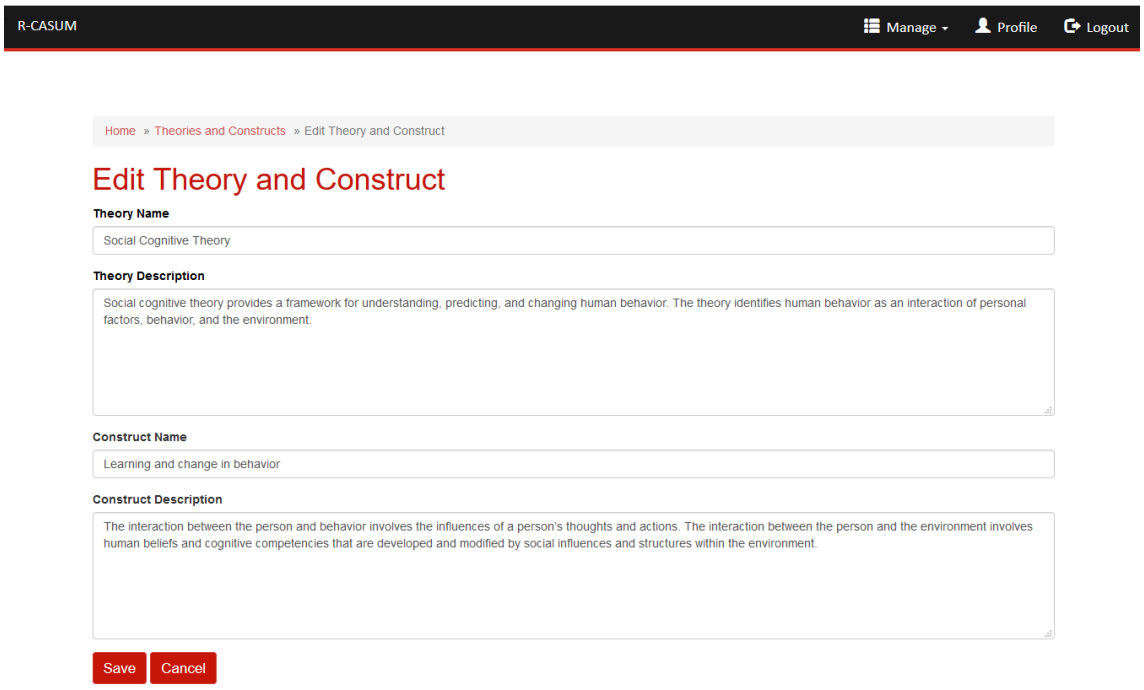
Theories and Constructs List



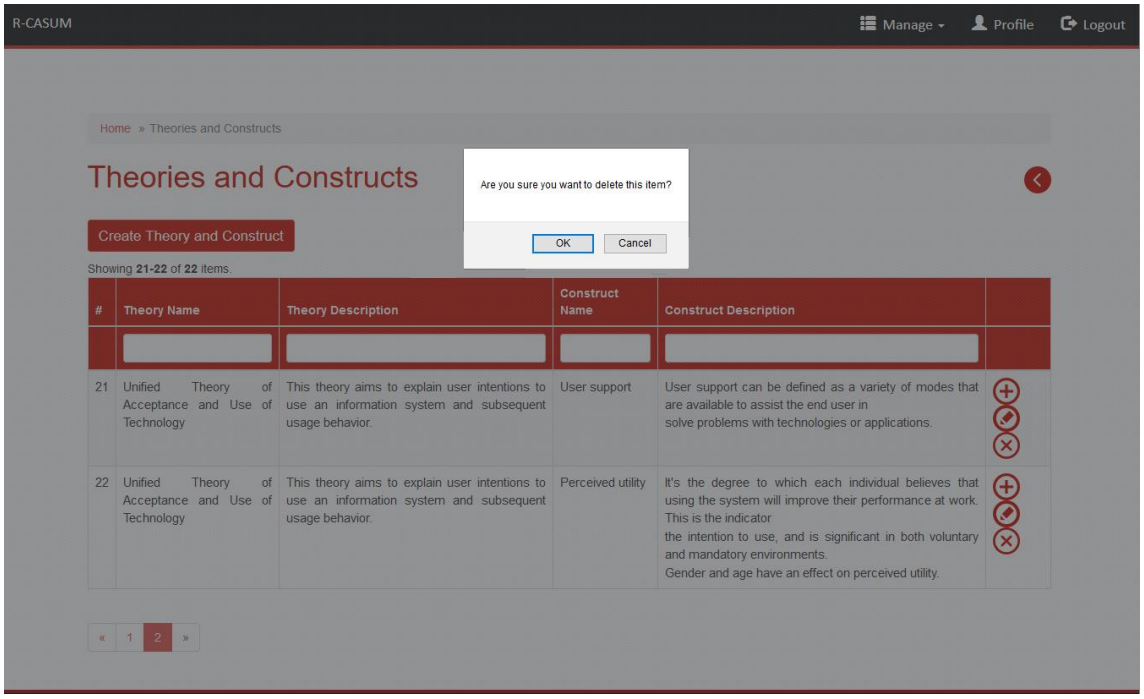
Consult Theory and Construct



Add Theory and Construct



Edit Theory and Construct

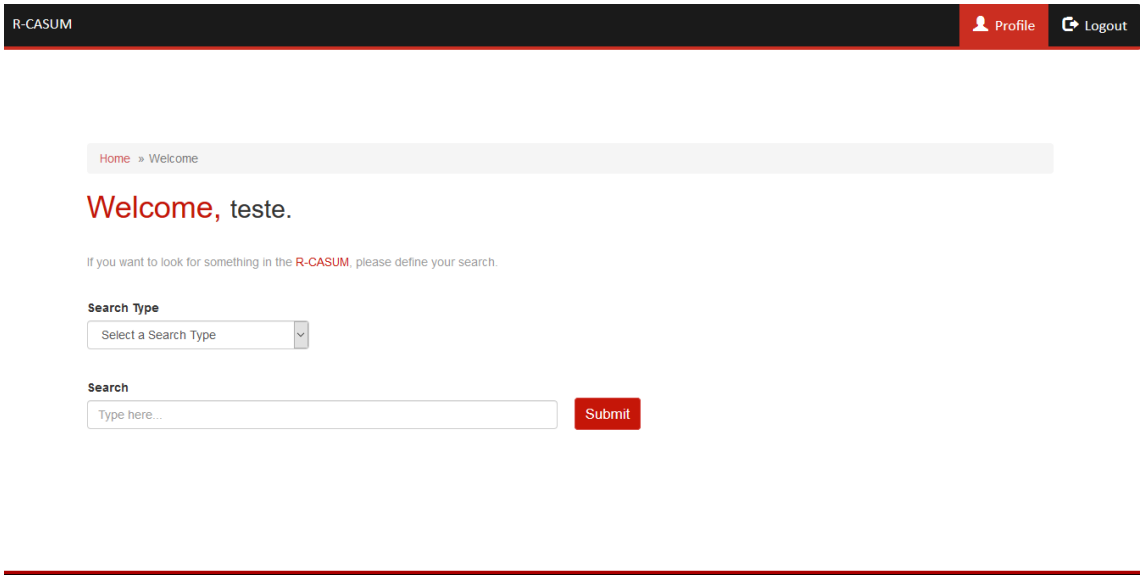


Delete Theory and Construct

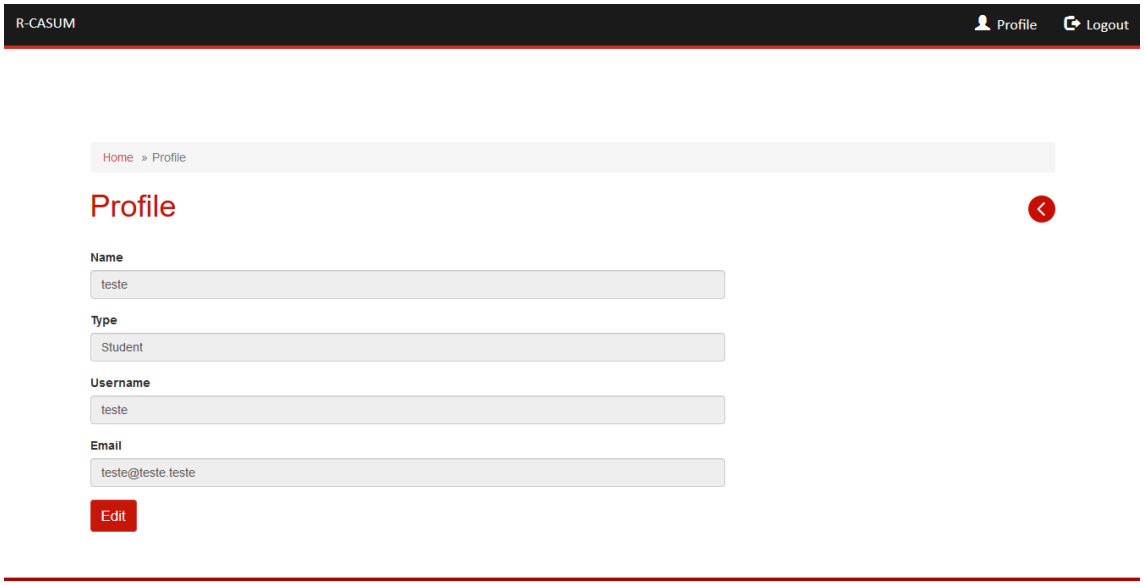
B11 - Profile (All Users)

In this process all users can consult their own profile, as well as edit it if he/she wants it.

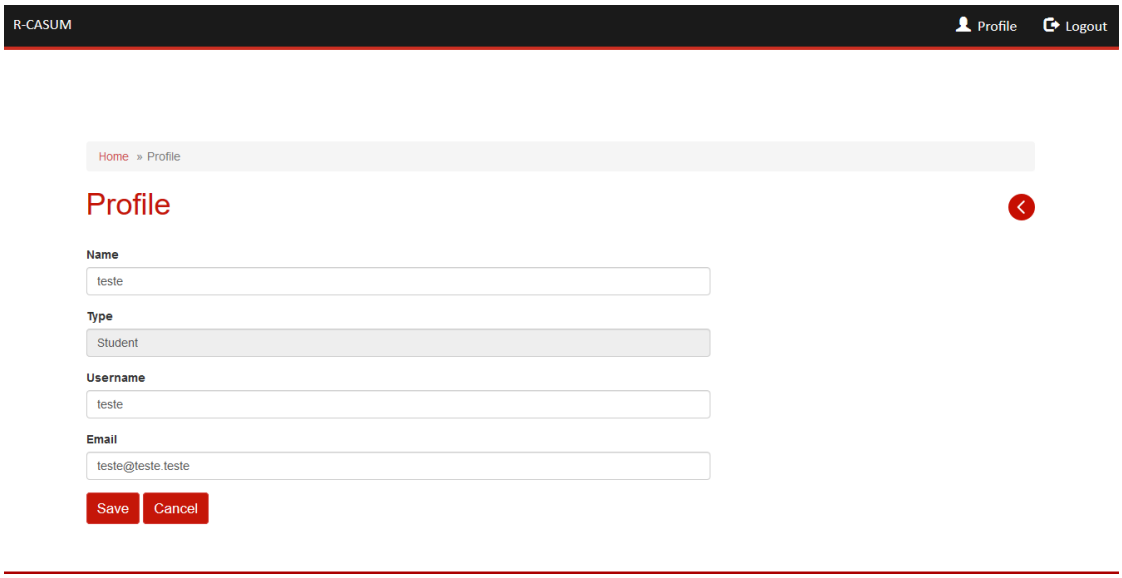
Use Cases: {UC-P2, UC-R6, UC-T3, UC-S3, (UC-A7)}



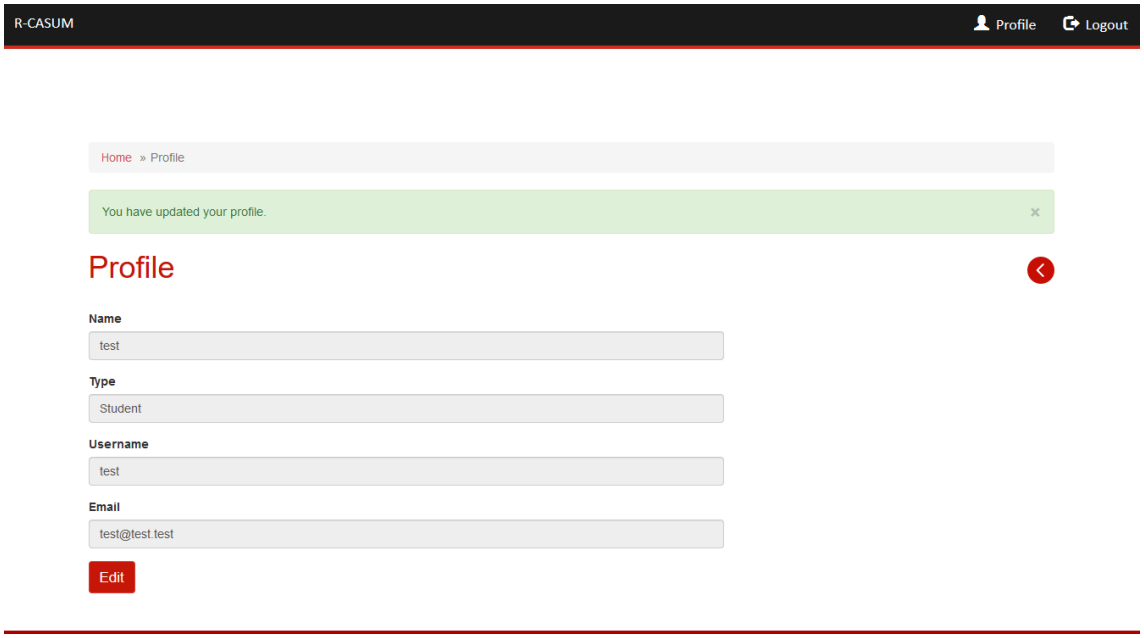
Profile



Consult Profile



Edit Profile



Updated Profile