A FRAMEWORK FOR THE INTEGRATION OF LEAN TOOLKIT IN ITIL FOR MORE FLEXIBILITY

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ABSTRACT

Due to fast evolution on the services provided by telecommunication companies, the Information Technology (IT) environment has been gaining an increasingly importance inside organizations which are under increasing pressure to improve their efficiency in delivering more and better services to citizens. As a result, IT governance tools are becoming increasingly important in the operation of business, namely ITIL (Information Technology Infrastructure Library) framework which has positioned itself as a generic solution to tackle a broad range of IT service Management (ITSM) issues and try to guide IT managers in their endeavors.
However, researches about ITIL framework has been mostly restricted on the best practices of ITIL to the implementation of incident, problem and change management processes, but few of them focus on its improvement using lean methodology. Also the initiatives taken to improve ITIL processes using Lean have some limitations as they do not address all Lean's principles and goals. The aim of this work is to study an innovative approach of Lean methodology applied to ITIL by representing an ontological framework of ITIL using Lean Toolkits and by developing a model with deeper explanation of the various concepts of Lean that could be used for qualitative use of ITIL service lifecycle, We will try in this paper to show how Lean, from the world of manufacturing, applies to ITIL can improve the performance and the safety of the information system.

Keywords: *ITIL ; Lean IT; IT Services; Framework; Ontology, Improvement; Costumer; Value; Waste; Quality*

1. INTRODUCTION

In an environment characterized by the forced digitalization of society and companies, by the emergence of younger generations of employees more inclined to exchange and increasingly urgent demands of business management not wanting to miss the TGV of the digital, the role of the Department of information system must be increasingly robust and flexible to meet the new demands of market.

Indeed, Increasing competition in service businesses (eg: Information Technology, Healthcare, Education, Logistics, Distribution, Hospitality Financial and other services) is compelling corporates to adopt business improvement philosophies and methodologies for addressing customer demands for better quality service and organizational demands for improving the profit margins through cost reduction. [1]

Actually the Information systems have become more complex, especially with the introduction of software packages based on fully technical platforms, this complexity and duplication of business information can lead to additional costs in terms of development and maintenance. [2] As results, organizations try to keep their Information Technology simplified to achieve a more efficient enterprise with better business outcomes [3]. Simplifying processes and having more consistent IT services results in lower operating costs and reduced operating risks associated with more reliable IT infrastructures [4].

On the IT world, one of the most important reference models to services management is the Information Technology Infrastructure Library (ITIL), it was developed in the 1980s and 1990s by CCTA (Central Computer and Telecommunications Agency), which outlines an extensive set of management procedures that are intended to support

businesses in achieving both high financial quality and value in IT operations.

For these reasons many companies have implemented ITIL and use all the rules of good practice proposed as a way to manage and control their Information Technology (IT) Departments more effectively. In some cases companies are aware of ITIL's benefits and want to implement it in order to guarantee better quality of service, lower costs or better alignment between business and IT [5]. In some other cases companies are influenced by this ITIL fever and want to implement it just because it seems that everyone else is doing it.

However, using ITIL alone may present significant implementation challenges, including time consumption, and it does not address the leadership issues of organizational change also this organizational change required to attain a service-oriented culture [5]. Furthermore, the launch of an ITIL initiative can seem awkward and complex and is always resisted. Departments, teams and individuals tend to defend the status quo and also ITIL isn't a project with a completion date, it's a set of processes that must be continually improved. [6], Employees find that ITIL's responsibilities are very large, it is challenging to "wear two hats and do two roles" while initially conforming to the ITIL processes in their everyday work. [7] Also, one of the biggest challenges in implementation of a system ITSM model based on the ITIL framework is the organizational structure. ITIL reorganizes work, not staff [8].

ITIL books define the processes that should exist, how they should interact with each other and which metrics can be used; they define also the steps that are relevant for the Continual Service Improvement process. However, these steps are no more than a very high level strategy for process improvement. There are no references to tools and procedures that can be used. [9] In the current panorama, only experienced consulting firms can effectively assist organizations in ITIL deployment and process improvement [11]

The desire for ITIL's adoption has arisen and spreaded [12]. But the truth is that adopting this set of best practices is not easy and without proper planning and execution it is most likely that the implementation will be a failure [13].

In this context, the combination between the services of ITIL and lean principles could help to reduce these challenges and is suggested as a means to reduce costs by eliminating waste and improving quality.

The application of Lean to IT Service Management is becoming more popular among researchers and academicians, many researches has focused on the value of applying Lean to ITIL, [8] and [9], specially the application of Lean thinking as a process of continuous improvement for great achievement of ITSM, there is evidence of frameworks, based on the Lean methodology, which can be used to guide ITIL processes optimization [10]. But the initiatives taken to improve ITIL processes using Lean have some limitations as they do not address all the Lean principles and goals. [9].

From a very simplified and high level perspective, Lean can be seen as a process and methodology that allow process improvement and optimization. One of the ITIL's v3 goals is to continuously improve IT processes, making them more effective and efficient. The catch here is that ITIL documentation does not provide a clear and specific roadmap to do it. There are only some clues and generic advices in the ITIL v3 books.

In this paper we answer the question of how Can the association of Lean and ITIL be modeled in a way that can be comprehensive, stable and formal in order to speed up a qualitative implementation of ITIL in organizations of all nature. Many books on lean and ITIL framework, that are valuable to promote the amelioration of ITIL using Lean concept, do not attempt to be comprehensive and many lean practitioners are using only a subset of the concepts and practices that are available. A comprehensive and structured knowledge base would help speed up and increase the quality of implementations.

Academic research regarding ITIL amelioration is limited, with most ITIL publications being produced by training and consultancy firms with potentially biased agendas. These papers are usually marketed for IT managers with a focus on increased productivity, compliance and governance, training and certification and Cost reduction solutions. They are marketing the attractiveness and immediate benefits of ITIL and have been mostly restricted on the best practices of ITIL to the implementation of incident, problem and change management processes, but few of them focus on its improvement using lean methodology.

This paper is part of a wider effort to join both of these approaches by defining a generic framework, which addresses all the Lean principles, and that provides guidance to ITIL's processes optimization. It would be also an opportunity to model the lean and ITIL in a way that can be comprehensive, complete, reusable and formal in order to speed up a qualitative implementation of the services of ITIL V3 in organizations of all nature and to show how Lean is used as the methodology to enable the processes improvement of ITIL.

2. ADVANTAGE AND CHALLENGES OF USING THE ITIL TOOL IN ITSM

2.1 The ITIL organization framework

ITIL is a framework of best practices collected from public and private sector organizations worldwide intended to accomplish the delivery of high quality IT services, essentially for ITSM, it is a globally recognized best practice methodology for IT service management that is used all over the world by leading organizations. ITIL® ensures that their IT services are aligned to the needs of their business, (ITIL Official web site, 2019). It was created within the UK Public Trade Office; it offers a structured and process-oriented development framework focused on the customer. The customer is indeed the founding point and the heart of the approach, using ITIL allows companies to increase user and customer satisfaction with IT services and to improve service availability. Being a quality improvement framework, ITIL is similar to other quality frameworks in the aspect that it "reorganizes work, not staff". [16]

ITIL is the most widely adopted tool for ITSM. This practice can be adapted for use in all commercial and organizational environments. ITIL's Value Proposition Focuses on IT service provider (internal or external provider) including the objectives and priorities of a customer, and the role that IT departments in achieving these goals. [17]

ITIL is considered among the best framework of the continuous improvement of the quality of the IT service delivered, considering the commercial aspect and the expectations of the customer at the heart of its activities, the advantages that a company can draw from the implementation of ITIL are numerous:

• Increased user and customer satisfaction;

• Improved service efficiency, Well-defined processes with clearly documented accountability for each activity, leading to increased business profits and revenue;
• Financial savings from improved resource management and usage;
• Improved time to market for new products and services;
• Improved decision-making and reduced risk.

2.2 Ontology of ITIL Service Lifecycle Approach represented in Protégé ontology editor

The Service Lifecycle concept was introduced to the ITIL framework some years ago, it allowed a revolution of the ITIL framework: ITIL Best Practice turned from a rather isolated process-driven view (ITIL V2) into a more holistic, service lifecycle-oriented approach (ITIL V3), IT services, delivering value to clients, pass through a lifecycle from service structuring, design, transition, operations (where the service is delivered to the client) and finally continual [18]. Each book covers a phase from the service Life cycle and encompasses various processes which are always described in detail in book in which they find there key application. [19]

In order to have a formal and explicit specification of a shared conceptualization of ITIL service lifecycle we have chosen to model ITIL lifecycle as an ontology realized by Protégé, which is the most used ontology editor, and is correctly maintained on various platforms.

Practically speaking, ontology is a hierarchy of concepts, attributes, constraints and relations that defines a common vocabulary in a specific domain, stressing uniform knowledge representation and knowledge sharing between heterogeneous systems. [20] It is in this context that regrouping all the concepts in one place clarifies the hierarchy of notions and the functions of each service. These are aspects that are meant to cover all areas of ITSM (IT Service Management). This ontology will represent the first part of our work before moving to the main objective of this article which is summarized in the presentation of an ontology grouping Lean and ITIL.

Figure 1: The ITIL Service Life Cycle Ontology In PROTEGE

We notice that each of these phases shown in the figure 1 are in interaction and has outputs and feedback that comes from other phases. Service Strategy has out put into Service Design, it has feedback that comes into that, as well as Service Transition, Service Operation, and notice Continual Service Improvement, from a lifecycle stand point, touches every one of those phases as well as the services including the processes we use to support the lifecycle as well. (figure2) [21]

3. OVERVIEW OF LEAN APPLIED TO THE INFORMATION TECHNOLOGY

3.1 Lean concept from manufacturing to information system

Coming from Toyota's total quality method, like many others (Six Sigma,…), the Lean method is not revolutionary, but its principles are currently being updated wherever rationalization is needed, especially in computer science that we called Lean information technology(Lean IT) .

Lean IT is the application of lean manufacturing and lean services principles to the development and management of information technology products and services. It designs the information system that could provide right information to the right people, at the right time and first times, it aims also, the elimination of waste that adds no value to a product or service by using particular principles and methods. [22]

The Lean concept was first applied in the industry, the transfer of its methods from the industrial world to the information systems, as shown in the figure bellow, requires to reconsider the Information Systems Department as a company: providing products and services to its customers with management and administrative constraints (budget, human resources,..), it is then appropriate to:

- Specify the value: Clearly identify the products and services provided and define the expected service levels with users to assess the customer's need and remove services without added values;
- Identify the value streams: Identify the various processes and map them with a functional cartography (value stream mapping) of the client's business, in order to assess the respective issues;
- Make value flow: Make the remaining value creating steps flow.
- Define the chain of values creation on these processes to identify the possible optimizations and anticipate the impacts and the risk induced by any change on the organization;
- Let the customer pull value: Design and provide what the customer wants only when the customer wants it;
- Pursue perfection: Strive for perfection by continually removing successive layers of waste as they are uncovered. [23]
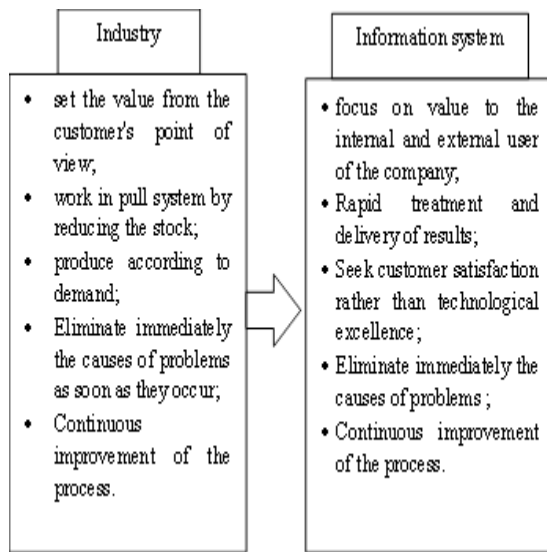
Figure 3: Lean Practices From Industry to IS

With the new generation of Lean IT, the IS has a tool to adjust supply on demand, improve IT efficiency, control quality, and reduce costs.

The Department of information system applying for Lean must ask the cardinal question of lean: 'what does the customer expect from my product? The Lean IT perspective is that IT is an investment chosen by the company to deliver more value to its customers and to deliver the information processing capability required by the business at a cost that represents [24], for information systems, the notion of value should not be confused with functionality, this value is delivered to the internal users of the company and to external users (employees and customers). It is therefore two very different populations and the value is not measured in the same way for both.

In order to follow Lean principles on IT management it is important to know how to apply the concepts to identify waste, improve effectiveness, and increase value to the business. The best way to make significant changes is to define strategic objectives for eliminating waste and redeploying capabilities and budgets to services that provide value.

3.2 Identification of the mudas of IS using Lean toolkit

Lean IT is complementary to other project management techniques like Scrum that allows teams to focus on delivering product and improved

communication it has been designed for collocated software development and it focuses on project management institutions where it is difficult to plan ahead [25], unlike the Lean that was initially applied to the production systems and actually it can be transported to the information system; it allows companies to achieve permanent improvement and facilitates the work of teams, eliminate non-values added activities and reduce complexity of systems.

In general, when we consider developing a system by Lean Management Information system, we normally refer to all the tools of lean used in production system such as VSM, PCA, SMED and specially the Japanese 5S: Structurize, Systemize, Standardize, Self- Discipline, and Sanitize. These lean tools can help companies to minimize the sources of waste (Muda) in the information system defined in table 1. [26]

Table 1: Sources of waste in the   information system (MUDA)

Mudas	Examples
Defaults	• Repetitive activity; • Unstable processes; •Low level of customer relationship management; • No compliance with cost /quality / time commitments.
Waiting time	• Poor communication between the IT and the production Departments that causes • A delay between service and system development processes
Overproduction	• Deliveries of unused features; • Bad definition of customer needs which generates a production earlier; • Faster or in greater than the quantity expressed by the customer (Level of service too high (24h / 24h- 7days / 7days for an application used on working days).
The unusual use of knowledge	• Low capitalization of knowledge • Non-reuse of components (codes ...) • Lack of tools and skills management process.
Activities without added value	• Activities that do not add value to customers, such as presenting technical dashboards to managers.
Unnecessary movement	• Emergency response to recurring problems • Frequent change of environments (technical bases, framework, tools ...) • Multi staffing: too many topics managed in parallel, no prioritization • Multiple interventions on incidents without resolution

These sources of waste can be improved by using Lean practices, namely Failure Modes, Effects and Criticality Analysis (FMECA) to avoid failures due to unstable processes. Optimization packages to put into production (decoupling applications) can also help to minimize the waiting time in applications, implementation of processes and tools for skills management, implementation of capitalization tools and processes, the creation of sharing times between teams including the costumer and the implementation of collaborative tools (wiki, collaborative workspace, search engines ...) can help capitalize knowledge and

process review by identifying and eliminating non-value-added tasks (VSM, MIFA) combined with the best practices of ITIL. [2]

4. ONTOLOGICAL FRAMEWORK RESULTING FROM THE COMBINED USE OF LEAN TOOLKIT WITH THE FRAMEWORK ITIL

4.1 Key links between ITIL and Lean concept

Used separately, ITIL and Lean standards are undeniable help for today's organizations; let's see where the connection can be made between them:

Even if companies know the voice of the customer through satisfaction questionnaires sent to customers every year, the question that arises is how do we make sure that we are moving in the right direction? The answer to this question is one of the important aspects of Lean IT: it is about translating the needs of customers into comparable criteria by computer production. ITIL V3 is also starting to focus on these aspects and can use Lean to get good results;

- ITIL works on robustness to accomplish the delivery of high quality IT services, while Lean works on efficiency, both approaches are complementary.

- Defining the value that a product or service brings to a customer is the starting point of the Lean approach. The Lean approach further specifies that the value provided by a service or a product can only be defined by the end customer. It is also one of the principles affirmed in ITIL;

- ITIL, used in the agile method, promotes adaptive planning, evolutionary development and delivery, a time-boxed iterative approach, and encourages rapid and flexible response to change, just like the Lean approach used in manufacturing, But, conversely, the principle of Lean "think product, not project" is very disturbing for a team of developers who have not been trained and accustomed to this;

- Pull production is one of the principles of Lean: No action should be launched until someone downstream asks for it, In the ITIL world, it is a simple principle that often goes unnoticed when presenting the characteristics

of a process: the trigger of the process is the one that will benefit from the outcome of the process;

Consequently, using lean tools combined with ITIL then becomes a true benefits for any company that want to perfectly master the entire value chain of processes.

4.2 Ontological framework of the service life cycle of ITIL associated with Lean

As we mentioned in the previous paragraph, ITIL, used in the agile method as a conceptual framework that promotes foreseen tight interactions throughout the development cycle. A series of books in the reference [26], recommended practices on a broad range of IT management topics.

However, ITIL has some limits and is still reactive in nature, as a response to one or more incidents. It does not define the time consumption and does not provide insight into gaining efficiencies, nor does it address the leadership issues of organizational change. Furthermore, the implementation of an ITIL initiative can be difficult since it is a top down approach. It is in this context that the application of Lean management in a company can be associated with the best practices provided by ITIL. It will helps to control its software delivery times, to ultimately result in a streaming delivery, it can also help an IT support department to significantly reduce the time to correct incidents, by identifying and eliminating major waste in the chain of resolution and also by setting up trainings between team members to raise in competence all the collaborators.

Lean thinking uses a lot of tools to organize work namely:

- Kanban: First invented in the automotive sector, it is also possible to adapt Kanban to software creation. It helps to start where the team is in its maturity of knowledge of processes. It doesn't need to start a cultural revolution right away, as Scrum demands; Companies can keep the same people and the same roles. It can also be a solution for teams who cannot switch to Scrum for corporate cultural reasons but still want to be more agile.

- Collective visualization: One of the keys to Lean is the development of person's skills

through job training or problem solving. Lean information management attaches great importance to the collective visualization of the (performance, problems ...) and on its application to the computer science, where everything tends to happen in the computer and networks.

We soon realized that it would be harder to integrate two approaches if they did not speak exactly the same language, so we needed a uniform representation, a common frame of reference. Our intention was to find an ontology that described each approach and map them together to similar concepts as shown in the figure below.
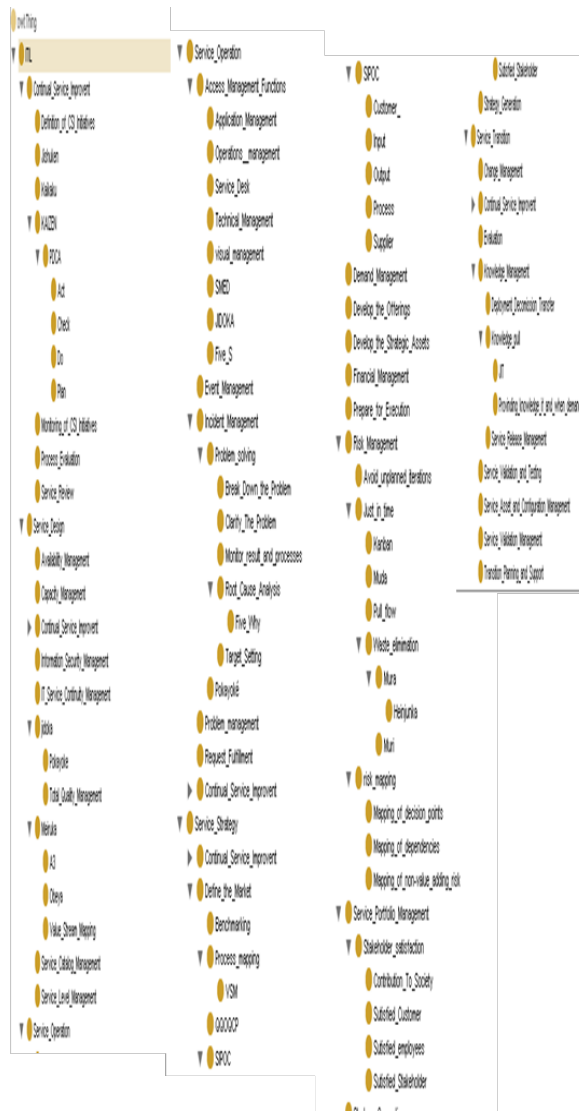

Figure 4: The ITIL Service Life Cycle Using Lean Toolkit Ontology In PROTEGE

We As shown in the figure above The Service Strategy phase of the Service Lifecycle provides guidance on how to design, develop, and implement IT Service Management. Using lean tools in particular VSM and SIPOC in service strategies can be developed to give the business a distinct advantage in the definition of market and how to differentiate itself from its competitors. The organization's management team will understand the costs and risks associated with their Service Portfolios and can efficiently use this information in their operational decision-making.

The Service Design phase focuses on the design for new changed and updated services and develops IT Service Management processes that will support the service strategies already developed. Using jidoka (Stop in Time, traditionally called automation with a human touch), Meiruka (need for the supportive management to understand what the situation is as a basis for problem solving, Jishukan(autonomous study group) and the value stream mapping will help to detect the occurrence of a malfunction, and stop operations immediately and also to learn how to design service plans in an efficient way to prepare IT professionals and business leaders to address customer concerns in the most proficient manner.

As for as using Lean tool kit in the Service Transition phase teaches IT professionals and their business associates to manage changes in a productive manner and will help to provide guidance on how to efficiently and effectively change services into operations without disrupting or interrupting other services or processes..

The Service Operation phase of the Service Lifecycle provides guidance on the practical aspects of day-to-day business operations. The goal of using lean problem solving tools and continuous improvement tools is to keep things running smoothly, reliably, efficiently and cost-effectively. The activities and processes in this phase ensure that services are delivered to customers at the right time and at the agreed upon levels with minimal interruptions and disruptions. The value will be then provided to both the customer and the service provider.

Lean can help secure the company's information systems by risk mapping, taking into account all the elements that make up the IS: users, procedures and tools. Protect the entire information system at the

same level of security would be extremely expensive, hence the need to first use value stream mapping to identify:

- Internal resources to the company: emails, contacts, calendar, strategic and technical data, customer file.

- The resources of the enterprise operated or held by an external service provider or a third party.

- The resources belonging to an outside provider operated for the benefit of the enterprise.

The identification of all these resources will help on identifying the processes that need to be secured, at the operational level we can use the visual management to formalize and make known the general rules of security to all actors of the information system and to ensure the integrity, confidentiality and availability of the IS.

As to continuous development the key element of the Lean concept to understand where improvements can be made. PDCA, KANZEN, KAIKAKU, can help learners identify where these possibilities for progress are.

5. CONCLUSION

The objective of this paper is to create an ontological framework of ITIL using lean principles that was initially applied to the industrial world to support the improvement and productivity of the information system. This ontology enables to describe the concepts in a structured and formal way, It will be a framework to control the software delivery times and to reduce the time to correct incidents, by identifying and eliminating major waste in the chain of resolution, it is more specifically about making technology transparent and the complexity to the benefit of obtaining faster, for the user, the expected value: communicate, learn, produce, consume and entertain.

This research method is theoretical and the introduction of this Framework within the company will allow as to measure the effectiveness of the proposed approach and to determine its limits.

As a perspective, this framework can be useful for the integration of other IT Governance frameworks like COBIT and CMMI practices which are closely aligned and can be used together for the governance

of information systems; it remains a good area of research for future studies..

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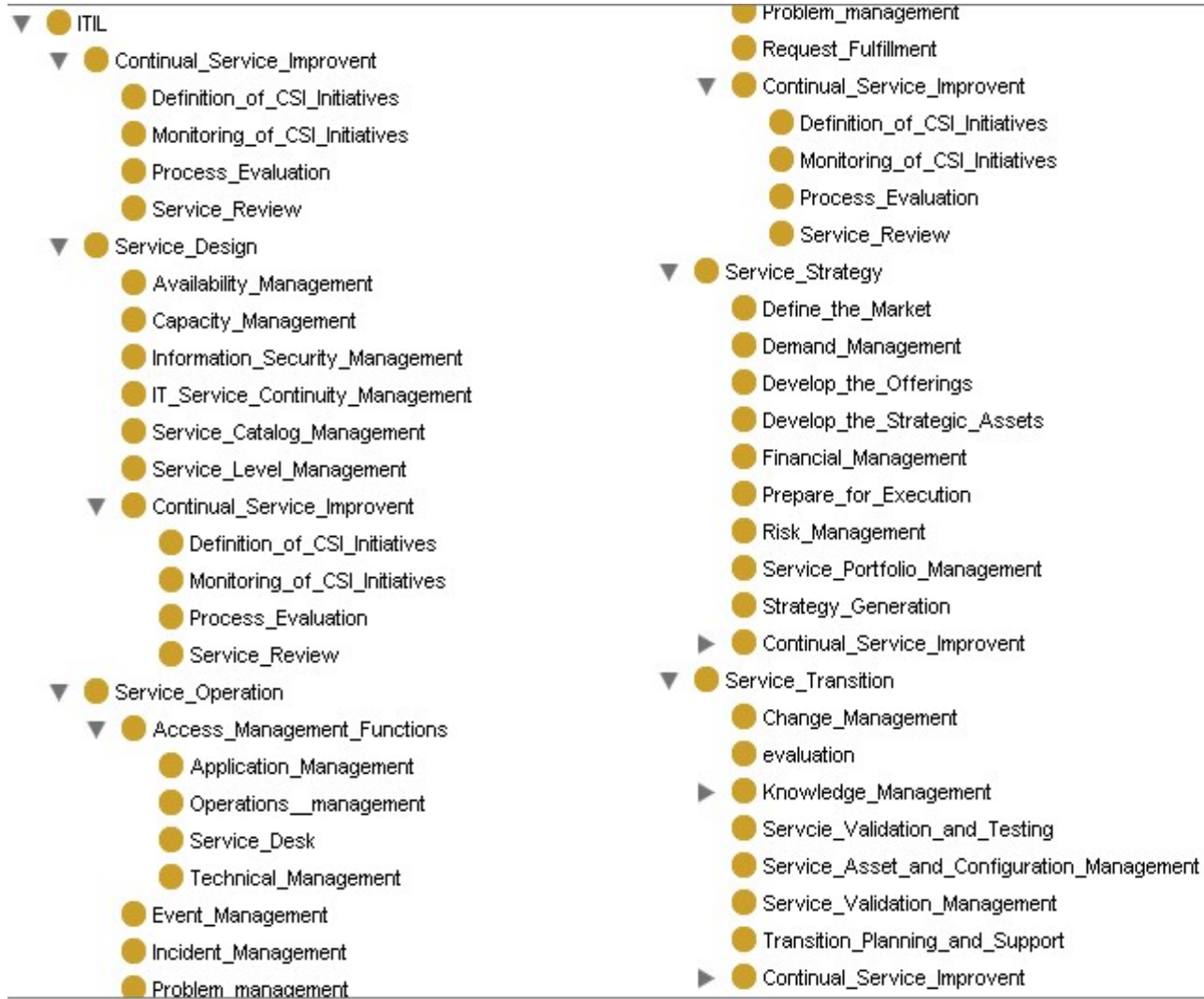
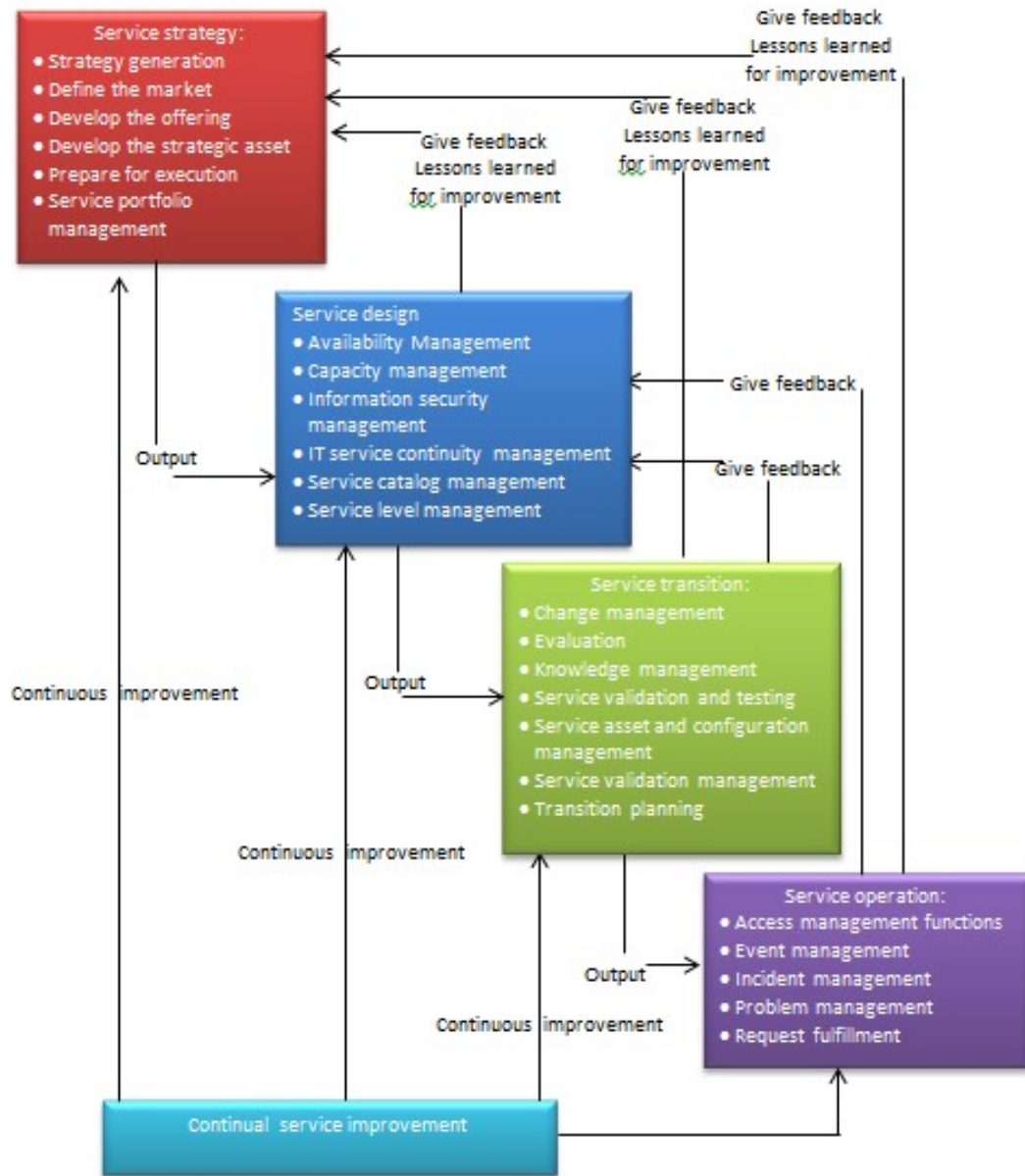*Figure 1: The ITIL Service Life Cycle Ontology In PROTEGE*

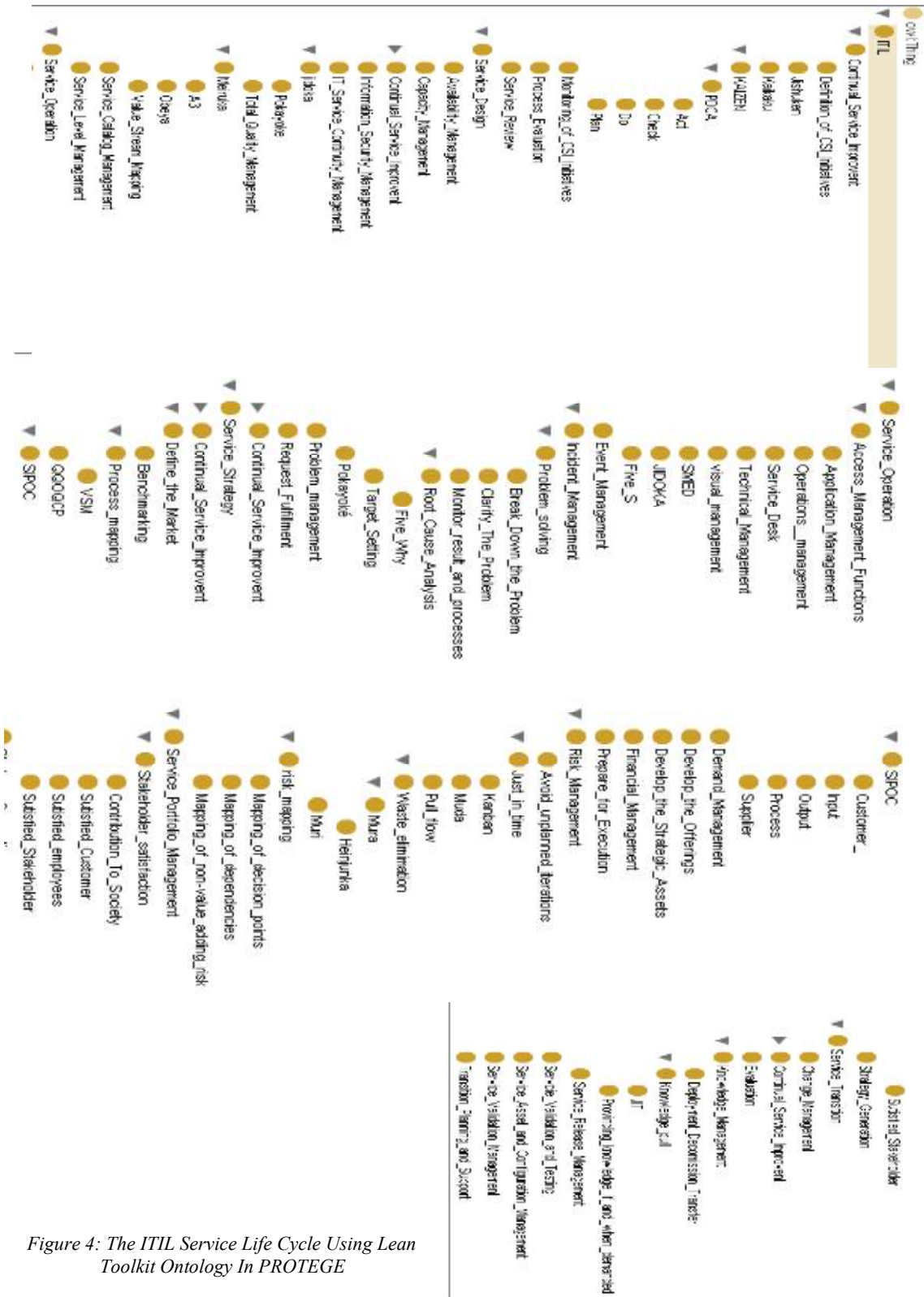*Figure 2: Representation of the ITIL Service Life Cycle Framework With Relations*

Figure 4: The ITIL Service Life Cycle Using Lean Toolkit Ontology In PROTEGE