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GAIA Service Catalogs: A Framework for the Construction of IT Service Catalogs

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Abstract— **The high amount of IT services offered to organizations for boosting and maintaining their business goals makes it difficult to determine the quantity, description and the attributes of these services. This paper presents a framework to support the construction of IT Service Catalogs. The framework consists of a diagnostic assessment questionnaire, a maturity model and a set of services that guide the organization in the construction of an IT Service Catalog.**

Index Terms—IT Service, IT Service Catalog, IT Governance, ITIL, COBIT.

I. INTRODUCTION

Information Technology (IT) is an essential component for organizations and has been widely and intensely used in their strategic and operational levels. Nowadays, IT is seen not only as a technology that supports businesses, but also as an element that has a strategic role in the organizational scenario [1].

IT Governance intends to support the alignment between organizational IT goals and business goals. It consists in a set of tools for the specification of decision rights and responsibilities in an organization, seeking to encourage desirable behaviors in the use of IT and to help corporative governance in the process of decision making [2].

Given the large offer of IT resources and services to organizations, there is a need of documentation, constant updates and continuous improvement of the information on those services. The knowledge of IT service attributes such as the goal, resource usage, responsible parties, criticality and problem solutions allow IT to guarantee that a service IT is fully compliant and aligned to the organizational goals.

According to a study performed by the consulting company Enterprise Management Associates [3], among IT leaders, the main benefit of the Service Catalog were: IT alignment with the business, service standardization, improvement in the quality of service, highest agility in the communication with support and cost and work flow reduction.

According to Smith [4], another great advantage of the IT Service Catalog is to allow IT managers to demonstrate the efficacy of the IT department to the rest of the organization, improving its visibility to other business areas.

Among the main problems caused by the lack of an IT Service Catalog are: the complexity of the service organogram; delays in the acquisition of goods and services; undocumented information lost after the exchange of a team member and the difficulty of getting service from the Service Desk, imparting a bad image to the IT Department. The Service Desk must be the sole way to manage requisitions and service calls [5].

According to reports made by the Axios Systems organization [6], the lack of an IT Service Catalog tends to make clients requests to be lost. Moreover, these clients do not know either where to request services or which services may be requested. These facts do not allow the value that must be transmitted by an IT service to be easily known by prospective users. Even with all the mentions from ITIL [12] to the IT Service Catalog, there are no detailed models or standards that can be used as reference to build it [7]. This is a problem, because organizations lack guidance for the development of an element that is crucial to its governance.

This paper presents a framework for the construction of IT Service Catalogs called GAIA IT Service Catalogs. This framework is important for IT governance because it allow existing IT services to be aligned with the organization business, demonstrate to superior areas which services are offered and allows the IT department to control and manage all offered services.

The proposed framework details not only the service identification and attribute recording processes, but also helps to achieve the business goals

The GAIA framework is made of three elements. First of all, there is the diagnostic evaluation questionnaire, responsible for evaluating the current organizational scenario. It is accompanied by a Maturity Model that has five levels that allow the organization to follow up gradually its performance in the construction of an IT Service Catalog. We also have a set of services called Framework Services which are responsible for the tasks of maintenance and advancement through the maturity models.

In order to validate the proposed framework, we will present in this paper a case study performed in a furniture company from the state of Paraná that has close to 500 employees.

This paper is organized as follows: section 2 will deal with the theoretical foundation on recognized IT practices. Section 3 will present the GAIA IT Service Catalogs framework. Section 4 will present the case study for the application of the framework in a specific organization and finally, section 5 will present some final remarks.

II. THEORETICAL FOUNDATION

This section presents the main concepts used in the construction of the proposed framework. First, we present the frameworks for IT Service Management and IT Governance, such as ITIL and COBIT, followed by the concepts of maturity models. Finishing this section, we present definitions form IT services and IT Service Catalogs.

A. IT Governance

IT Governance is the set of organizational structures and processes that involve the higher management, IT managers and business managers in the process of decision making on the use of IT, the coordination of actions that come from those decisions and in the monitoring of their results. Main IT Governance goal is to promote the alignment between strategies and operations in the areas of IT and business [2].

IT Governance consists in aspects of leadership, organizational structure and processes that assure that the IT area supports and improves the goals and strategies of the organization [8]. According to Soula [9], IT Governance is the single area that brings together IT, business and services, defining the common guidelines, policies and rules that the business and IT use to conduct their practices.

COBIT [8] is accepted as a framework that helps organizations implement auditable processes and performance metrics. Its mission is to research, develop and promote an international set of practices for IT that is widely accepted. According to COBIT, there are five focus areas for IT Governance, which are:

- Strategic alignment: intends to guarantee the bond between business plans and IT, defining, maintain and validating the IT value proposition;

- Value delivery: this is the execution of the IT value proposition, concentrating on optimizing costs and providing the intrinsic value of IT;

- Resource management: refers to the better usage of investments and the IT resource management (information, infrastructure and people);

- Risk management: transparence over risks for the organization and insertion of risk management activities into the company's daily routine;

- Performance measurement: monitors the implementation of the strategy, project conclusion, resource usage, performance process and service delivery.

The current version of the COBIT framework, 5, defines that the concept of IT Governance is part of the concept of Corporative IT Governance, which includes aspects related to Corporative Governance, IT Functional Governance and IT Business Governance. COBIT 5 included, besides the previous COBIT version (4.1), which was exclusively focused on IT Governance, other ISACA (the organization that maintains COBIT) publications, such as the Val IT and Risk IT [8].

This way, the concept of IT Corporative Governance is presented as an evolution of the concept of IT Governance, covering aspects related to IT Corporative Governance (regulatory conformity and controls), IT Functional Governance (analyzing the performance of IT as a department) and IT Business Governance (focusing on the alignment between IT and business). The principles of COBIT 5 are:

- Satisfying the needs of the interested parts, such as users, clients, executives, stakeholders, etc.;

- Covering the organization from head to toe, mapping the organization functions and not only the IT area;

- Applying a single framework, integrating all the frameworks used in the organization (ITIL, COBIT, ISO 20000, ISO 27000, etc.);

- Make a holistic view possible, creating a view of the whole and of all involved elements (information, persons, policies, etc.);

- Separate Governance from Management, defining the processes that are focused on IT Governance and the processes related to IT Service Management.

The principle "Separate Governance from Management", in special, approaches several of the concepts detailed in this paper, because even though the IT Service Catalog is a concept most notably related to IT Service Management, it will also bring clear results to IT Governance. IT Service Management includes all the life cycle of all IT services and manages them in an integrated way, but this is most preeminent inside the IT Department. The other business areas of the organization, since they have a less technical view, will better understand if they are helped by the concepts of IT Governance. This way, all the involved parties, even though they are not from the IT department, will have a clear and unique view of the IT services that are available: the IT Service Catalog.

For the IT Governance to exist, it is important to evaluate activities and risks that must be managed. Usually, these activities are organized according to responsibility domains: planning, building, processing and monitoring. In the COBIT model [8], these domains are called:

- Evaluate, Direct and Monitor, ensure the establishment and maintenance of the IT Governance framework, the delivery of benefits and the risk and resource optimizations and the transparence to the interested parties;

- Aligning, Planning and Organizing: manage strategy, budget, resources, suppliers and security;

- Build, Acquire and Implement: manage projects, changes, knowledge, assets and configuration;

- Deliver, Serve and Support: manage the operations, service requisitions, incidents, problems and continuity. In this domain, COBIT defines its requirements for the IT Service Catalog;

- Monitor, Evaluate and Measure: manage the performance, conformity and control systems.

The standard ISO/IEC 38500, which is also concerned with IT Governance, supplies a set of definitions for IT Governance, making the other areas understand and fulfill the legal, regulatory and ethical obligations when using IT in the organizations [10]. It is important to point out that the standard is applicable to every organization, independent of their size or business goal. Both COBIT and ISO/IEC 38500 present concepts, orientations and policies that are more visible to business areas, but do not detail the way the IT services are managed.

In the next subsection, we will demonstrate a framework and a standard for IT Service Management.

B. IT Service Management

For higher adherence of the processes of IT Governance in the organizations, the IT Service Management (ITSM) is used. ITSM is responsible for the alignment of information technologies necessary to fulfill the organizational needs and also for managing efficiently the supply of IT services with the assured quality [11]. The most used framework for this goal is ITIL.

ITIL [12] is a library of IT Service Management good practices which was created by the British government as a way to ensure the quality of the services it provides and consumes. It approaches the IT services during its life cycle and is divided into phases, which help manage the services in an adequate way. ITIL defines that IT Governance is expressed as a set of strategies, policies and plans, with the following activities:

- Evaluate: activity that refers to the performance evaluation in the daily organizational environment;

- Direct: relates to the communication of strategy, policies and plans;

- Monitor: where the responsible parties for the organizational governance become able to determine whether the situation is being dealt with correctly and if there is some kind of exception;

The ITIL practices are gathered into five books published by the IT Service Management Forum (ITSMF), which are:

- Service Strategy [13]: identifies the business needs and decision making processes related to the offered services;

- Service Design [14]: focus on the integration of business needs with IT services, based on the information of the service strategy. The information obtained in this phase are stored in a service catalog for the whole organization to know;

- Service Transition [15]: deployment of services defined in the design phase, making its operation feasible;

- Service Operation [16]: follow up of the service during its operation. During this phase, the information stored in a Service Catalog is relevant for those that need the services may be able to find them;

- Service Continuous Improvement [17]: creation of a reference for the evaluation and improvement of the processes and managed services, keeping its alignment with business needs. During this process, the service catalogs must be updated and their development frameworks must guarantee that their process is efficient and effective.

According to Soula [9], with the passing years, ITIL has represented much more than a series of books on IT Service Management, because it has been widely increased by the contribution of consultants, professors and suppliers of technologies and products.

COBIT and ITIL, which are both responsible by the alignment between IT Governance and IT Service Management, neither compete between themselves nor are mutually exclusive. The reality is the opposite: they should be used together as part of a global management in an organization. COBIT is positioned at a higher level, is driven by business requirements and includes all IT activities and focuses on what should be achieved, instead of how to actually achieve it. Meanwhile, ITIL offers organizations the best practices to manage and improve their processes, by offering high quality IT services at justifiable costs [9].

The standard ISO/IEC 20000 [18] was created in order to help IT Service Management. This was the first standard internationally recognized for IT Service Management.

This standard is published in two parts. The first, ISO/IEC 20000-1, describes the requisites for development and implementation of an IT management system. The second, ISO/IEC 20000-2, explains the best practices for IT Service Management.

Both parts are in accordance with ITIL and describe how to implement IT services that drive and support the business goals of the organization, not stopping only at the technology needs.

ISO 20000 proposed some requisites for the IT Service Catalogs. The standard defines that the IT Service Catalog must present all the services and that they must be assured by service level agreements. The standard also establishes that the information in the IT Service Catalog must be always up to date and that each IT service must have a name, the responsible parties, contact means and update times. Last, ISO 20000 mentions that the IT Service Catalog is a key document to define the client expectations and that it must be easily accessible and also widely available both for users and support areas.

The main benefits from ISO/IEC 20000 are:

- Reach international standards of best practices on IT service management;

- Develop IT services that drive and support the organization business goals;

- Integrate persons, processes and technologies to support the organization business goals;

- Implement controls to measure and keep the levels of IT services.

Both the ITIL framework and the ISO/IEC 20000 standard are a great help to identify and compose the attributes of IT services that later will make the IT Service Catalog.

Even though there are frameworks and standards of IT Governance and IT Service Management such as COBIT, ISO/IEC 38500, ITIL and ISO 20000, most organizations that decide to implement them end up failing, and others do not fulfill the proposed time schedule. Empirical evidence show that most organizations underestimate the time, effort, risks and costs of implementing the frameworks. The many different changes that are needed in the culture and structure of the organization make it difficult to bear with the costs of external consulting and training in projects where there is a significant barrier between what is proposed by the frameworks and the standards and realities of the organizations [11]. The framework GAIA IT Service Catalog proposes a model for the organization to build its IT Service Catalog and become more able to adopt other existing frameworks and standards such as ITIL and COBIT.

C. Maturity Models

The framework proposed here includes, among other elements, a Maturity Model to determine in which stage of development of the IT Service Catalog the organization is. In this section, we present the maturity models on which the Framework GAIA IT Service Catalog was based.

The maturity models seek to establish process evolution levels called maturity levels that characterize stages on the improvement of process implementation in the organization [19].

A maturity level may be considered an evolutionary step for the improvement of the organizational process as a whole and consists on specific and generic practices that make a predefined set of process areas. The fulfillment of corresponding goals for these process areas is a prerequisite to reach the corresponding maturity level [20].

These levels have different classifications in the different methodologies studied, such as the *Organizational Project Management Maturity Model*, OPM3, based on the PMBOK guide and is composed of four levels: Standardized, Measure, Control and Continuous Improvement [21].

Other model referenced was the CMMI (*Capability Maturity Model Integration*), described by the *Software Engineering Institute* (SEI), which defined the levels: Initial, Managed and Under Optimization [22].

In most of the consulted models, the position of an organization into the maturity models is defined according to a series of questions. To answer them, the IT team assumes that the organization has no management level and starts the questionnaire in its lower classification, seeking to determine

the current level and which necessary measurements are required to advance in the proposed scenarios.

The consulted models also present stages in which an organization may be positioned, the differences between those stages and also the organization goal as to the level it wants to reach.

In Section III we will present the Maturity Model of the framework GAIA IT Service Catalog. This model was created based on the concepts demonstrated in this subsection and will present five maturity levels. The main goal of the creation of a Maturity Model inside a framework is to allow the organization to visualize all the phases in the process of build an IT Service Catalog.

D. IT Services and IT Service Catalog

ITIL [12] defines that an IT service is a service that is provided for one or more clients by a service provider, supports this client business and is composed by a combination or people, processes and technology. IT services must be defined by service level agreements that specify the IT service and its support levels.

According to ITIL [16], based on IT Management, there is Service Management, which is the set of abilities in the organization that provides values in the form of services, being a professional practice supported by an extensive body of knowledge, experience and abilities.

With the goal of constant improvement and extension of the existing structure, the need to increase the capacity of a service makes a detailed documentation an imperative requirement of the system. Based on this data, the administrator may visualize which is the impact of the necessary changes to the service, dependencies, users, peak usage hours and high availability, so that this service is extended and supports a larger array of resources.

Some of the attributes of an IT service, according to the ITIL definition [14], may be seen in Figure 1. The goal represents the description of the IT service, presenting clearly the expected result. The resources may be classified as the configuration items and the infrastructure necessary for the IT service to work. The priority is connected to the impact that a lack of availability in the IT service has on the organization and on the business goals. The support contacts and users are information pertaining to the persons that keep the IT service and use it, respectively. At last, the reports and backup may present the contingency plans for the IT service and the means to evaluate these processes [14].

Figure 1. Examples of attributes of an IT service according to ITIL.

Based on the documentation needs and given the quality criteria established by ITIL and COBIT, an organization must develop a service catalog to become fully compliant.

The goal of an IT Service Catalog is to provide a simple and central source of consistent information on the available services, assuring that the responsible parties can visualize their attributes, the business processes they deal with and the expected level of quality [23].

COBIT [8] has a specific chapter to define, manage and assure the organization's IT Service Catalog, described in the domain Deliver, Serve and Support.

According to COBIT, it is necessary to define and manage the service levels, because the effective communication between the IT management and the business clients on the services is made possible by a well defined and documented agreement. This agreement includes the IT services and the expected service levels, including monitoring and the relevant reports to the interested parts. All this information may be kept in a Service Catalog that serves not only as a source of information but also as a repository of agreements that can be renegotiated according to the needs of the parts.

The IT Service Catalog must manage also the third party services, defining clearly the roles, responsibilities and expectations in the outsourcing contracts. The effective management of outsourced services minimizes business risks associated to suppliers that do not fulfill their role [8]. An example of the need to renegotiate described above is the increase and occasional change of personnel both in the team that delivers a service and in their users. This requires a document of organizational policy in the IT Service Catalog, in order to level the knowledge of all members in the group that make the IT services to achieve the expected business goal.

The IT Service Catalog is a key element to an organization, because it allows for cost reduction and transparency, caused by the standardization and automation of the processes delivery. Once the documentation of IT Services is centralized, it becomes clearer to visualize the necessary investment in order to provide them [24], besides making it easier to maintain the business standards. These factors contribute to the increase of value of the IT Department in the organization, as perceived by the other areas.

One of the main processes to build an IT Servie Catalog is to identify the IT Services [25].

There are many ways to identify the IT Services of an organization. Hubbers et al. [26] define that the main means are the business processes decomposition, the IT infrastructure analysis, the available applications analysis, the department goals analysis and the assets analysis.

In order to facilitate the IT services identification, it is possible to classify them into groups, making the search more efficient. Kieninger et al. [27] propose the creation of ten groups to classify IT services, described below:

- Standard Application Services: the IT services more used in the workstations, such as office applications, e-mail client applications and others;

- Specific Application Services: the IT services that are specific to the organization or to specific departments, such as ERP software or graphic design applications;

- Workstation Services: configuration of user computers that relate to the organization, such as network configuration and the creation of user accounts;

- Internet Services: the configurations and restrictions to the use of Internet to specific users or departments;

- Intranet Services: configuration, permissions and restrictions relating to the use of internal organization network services;

- Knowledge Base Services: access to the knowledge repository on the available services and resources;

- File Sharing Services: access to public and organization specific files repository;

- Printing Services: accesses and permission referring to the organization printers;

- IT Call Management Services: also called service desk, it is responsible for logging the users' support requisitions;

- Special Devices Services: responsible for the specific devices such an copiers and multimedia projectors;

- Backup Services: the existing security copies and existing configurations.

In order to define a standard initiative to implement an IT Service Catalog, Arcillaa et al. [28] propose a model that guides the organization in developing internally its own catalog, using its culture as key element and classifying the IT services into the groups: hardware, e-mail, Internet, applications, backup, quality management and telephony.

Other recent work in the area deals with the classification of IT Services. Based on the review of IT Service Catalogs from many different IT service providers, Rabbi [29] proposed the following groups to classify IT services: support, operations, training, consulting, outsourcing, integration and developing and other services.

The classification of IT Services into groups is used by the GAIA IT Service Catalogs framework in order to make it easier to identify those services.

The groups presented by the related work will serve initially to guide the IT service search in the whole organization. In the higher maturity levels of the proposed framework, the identified IT services will be linked to a set of IT service groups which will make it easier for the users to understand which IT services are offered.

These identification processes allow gathering the requisites to all IT services that the organization needs to reach its business goal. Based on those definitions, we present the goal of the IT service catalog: subsidize the decision making process of the organization related to the

existing and needed services portfolio so that it can reach its business goals, documenting all its attributes and changes.

III. FRAMEWORK GAIA IT SERVICE CATALOGS

This section presents how the framework GAIA was developed.

A. Overview

The framework GAIA IT Service Catalogs includes the whole development process of an IT service catalog, from the initial positioning of the organization until its complete deployment. Figure 2 shows a general overview of the framework.

The upper part of the figure represent the elements that compose the framework: the diagnostic evaluation questionnaire, the maturity levels and all Framework Services. The lower part represents the technical basis that was used to build the framework.
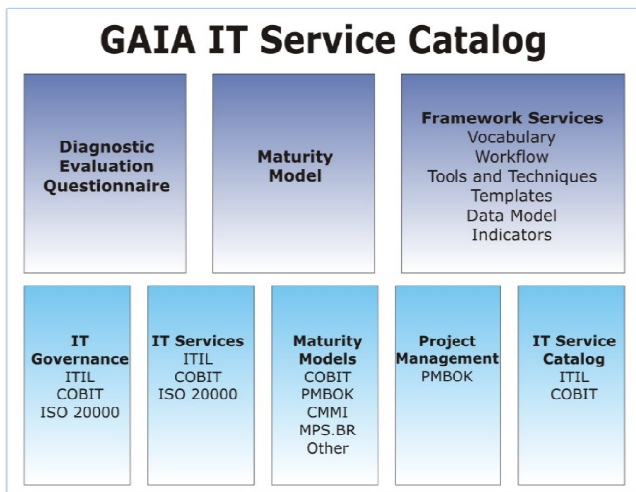

Figure 2. An overview the GAIA IT Service Catalog Framework

The main goal of the GAIA framework is the construction of an IT Service Catalog by the IT Department, assuming that it has knowledge of the environment in which it works and also of the organization culture. Its main differential is, then, its adaptability to every culture, distinguishing itself from the proprietary applications that exists in the market, in which the organization only fills in a model already defined and which is not always compliant to its needs and reality.

B. Diagnostic Evaluation Questionnaire

The first step in the process is the Diagnostic Evaluation Questionnaire (DEQ). It determines in which stage the IT Service Catalog of the organization is.

The IT team, when beginning to answer the questionnaire, must assume that the organization is in the lowest possible level, with the goal to determine the current level and the actions necessary to advance in the proposed scenarios.

The proposed questionnaire intends to gather information on the organization on how much information on the existing IT services it already has. Since we did not find in the literature a questionnaire relating only to the information on IT services, this paper presents a full questionnaire based on COBIT, ITIL and in the IT Governance Development Questionnaire proposed by Briganó [30].

Table 1 shows a sample of questions pertaining to services that can be applied to determine the current organizational scenario and the goals for each question. The first column represents the maturity level to which the question pertains. The second column contains the question of the respective level and the third presents the goal for each question.

TABLE I. EXAMPLES OF QUESTIONS FROM THE DEQ.

Maturity Level	Question	Goal
1	What is the amount of services offered internally by the IT department? Are there descriptions of those services?	The question helps to conclude if it is possible to determine precisely the amount, name and description of all the services in the organization
1	How many services are outsourced by the IT Department? Are there descriptions of those services?	The question help determine if the description and name of all outsourced IT services are known.
2	How is documented the list of existing services and their goals?	The question helps to determine if there is a database or document that describes all the services and their goals.
2	Is there a record of the responsible for the business areas to which the service belongs and a way to contact them?	The question helps to determine if every contact in every business areas is recorded, as well as the way and hours to find them.
3	How are defined the policies of usage for each cataloged service?	The question helps determine if policies are specified and if their understanding is an obstacle for the user to start using the service.
3	What is the level of understanding that the client has on the external requisites for each service to be delivered?	The question helps determine if there is full understanding from the clients of the dependencies for the IT department to deliver the service.
4	How are defined the service level agreements between the IT department and its suppliers?	The question helps determine if agreements are formally defined and constantly revised for effective enforcement.
4	How is defined the policy of registering a service by the IT department before its offer?	The question helps determine if only after IT Department participation and catalog registration the service is released to the public.
5	How is performed a continuous improvement of the service requisites	The question help determine if the IT Department periodically

	of infrastructure and configuration?	analyses the possible improvements and gets together with the business areas to evaluate them.
5	How often is verified if there is in the IT Catalog another service that fulfills completely or partially a new demand?	The question helps determine if there is a periodic verification process of the available resources in the existing and new services.

The questionnaire proposed in the framework is made of 47 questions, each with four different answers. Table 2 shows an example of a question in the questionnaire and its possible answers. The answers cover different possibilities for each proposed question, going from the answer that describes a situation far from ideal to the one that describes a fully satisfactory situation.

In the case of the question and answers in Table 2, for instance, answer "a" represents a situation in which the organization has no control on the responsible persons from the business areas that relate to the service. Answers "b" and "c" show situations where there is some control and documentation but there is room for improvement. Answer "d" shows a scenario where the control and documentation of the responsible parties from the business areas have been recorded in a fully satisfactory way. When the respondent checks the option that represents the ideal situation, we consider that the answer to the question was totally affirmative and that the goal of this question is fully reached by the organization. These answered questions will help the conclusion of the Framework Services helping achieve the goals of each maturity level.

TABLE II. EXAMPLE OF QUESTION IN THE DEQ WITH THE POSSIBLE ANSWERS.

	Is there a record of the responsible for the business areas to which the service belongs and a way to contact them?
a	There is no definition of the business areas to which a service belongs. .
b	There is a record of the contact person from the business area, but not of the responsible persons.
c	The responsible persons from the business areas are recorded, but there is no description of the ways to contact them.
d	All contacts from the business areas are recorded and the ways and times to contact them are fully described.

The DEQ from the GAIA framework, complete with all its 47 questions, can be accessed and answered through the GAIA Diagnostic Evaluation Tool at the Web address http://www.gaia.uel.br/gaia_ad/. In order to use this tool and consequently answer the DEQ proposed in this paper, it is necessary to fill a brief form. The initial screen from the DEQ is shown in figure 3.
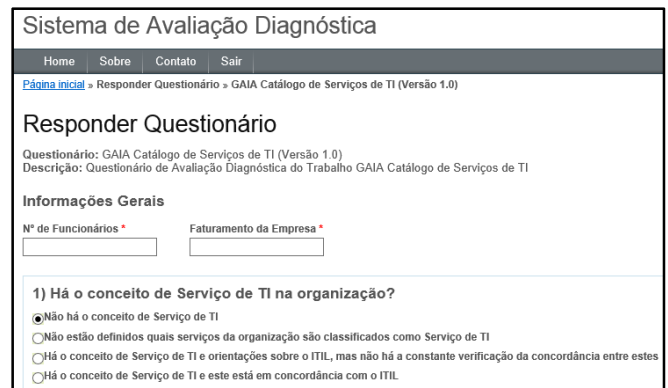

Figure 3.   Initial screen from the DEQ

C. Maturity Model

The GAIA framework maturity model was developed based on the recognized practices of CMMI, MPS.BR, COBIT and OPM3, and was proposed with the goal of translating the organizational scenario into the understanding of the concepts of the IT Service Catalog [31].   The methodology used in this paper for the positioning of the organization into the Maturity Model is based on the methodology of Briganó [30], Mesquita [31] and Gaffo [32].

Once the Diagnostic Evaluation Questionnaire is finished, it is necessary to position the organization into the maturity levels. To determine this position, we evaluate, at first, all level 1 questions. If anyone of them does not fulfill completely the question goals, represented by the answer "d" in the example of Table 2, this will be the maturity level into which the organization will be classified. Hence, in order for Level 1 to be fully completed, the organization must have answered "d" to all questions of this level.

If all Level 1 questions were answered with the alternative "d", then the Level 2 questions are evaluated. Following the same concept used in Level 1, if all questions of the Level 2 are answered with the alternative "d", it is necessary to evaluate the questions of Level 3, and so on, until we reach Level 5. In summary, the DEQ begins at level 1 and the position in the maturity model is identified when there is at least one question that is answered with the alternative "a", "b" or "c".

In Section IV, we will demonstrate how the maturity level is identified based on the answer to the questions of the DEQ.

Next, we present the levels into which the organizations may be classified, as well as the goals and questions to be solved for them to advance in the construction of an IT Service Catalog.

- Level 1 – No management. In this level there are many services offered by the IT department, but there is no way to determine how many and which ones, their functionalities or even which services are outsourced and which are provided internally. The main focus in this level is to identify and quantify all services offered by the IT department;

- Level 2 – Partially Managed; the services are identified, but this information is not kept in a document or database with the existing services and

their goals, with access control and general availability;

- Level 3 – Managed: there is a repository into which the existing services are registered, but there is no description of requisites, configurations, responsible parties, support and users. In this level, it is necessary to define the result expected by the organization according to the possibilities of the IT staff and offer a description of the requisites, configurations, users, support and responsible parties contacts.

- Level 4 – Managed and audited: the existing services are recorded in a repository with their respective attributes of data, information on the last changes and a registration policy. In this level, all services should be registered in a historic database. Besides, all new service should be registered first in the IT Service Catalog and become available for use only after this registration;

- Level 5 – Continuous Improvement: all existing services are registered and continuously updated. New services are registered in the catalog before they become available. The IT department should create a update policy for IT service data in the catalog. Moreover, the IT department should evaluate the improvements to be applied.

Based on the scenarios found in the organizations and once they are positioned in the maturity levels, the workflows and processes for advancement can be determined, as shown in Figure 4.
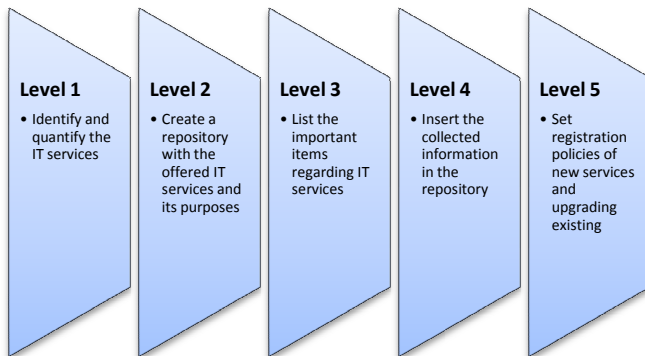

Figure 4.   Maturity Levels of the GAIA IT Service Catalog Framework .

D. Framework Services

After performing the Diagnostic Evaluation Questionnaire for your organization and becoming aware of its position in the maturity levels, there are many tasks that must be performed for the advancement in the maturity levels, as well as for the maintenance of the processes already performed and to reach continuous improvement. For this cycle to be part of the routine and culture of the organization, the GAIA framework offers the Framework Services [32] that are described in Figure 5.

Each one of the Framework Services presented in Figure 5 has a set of attributes and processes so that all tasks performed are kept, structured and documented.
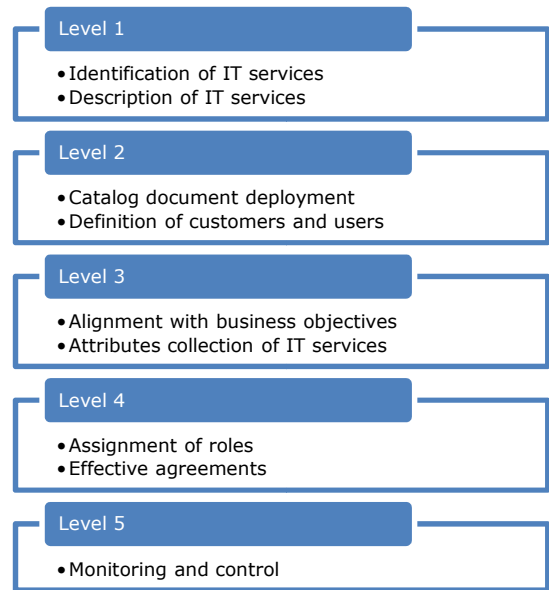

Figure 5.   Framework Services organized by maturity levels.

Each Service Framework is composed by the following attributes:

- Data models: data collected in each IT service that will be recorded into the IT Service Catalog;

- Workflow: the processes performed in each Framework Service;

- Vocabulary: terminology, nomenclatures and acronyms pertinent to each Framework Service;

- Templates: consist on the document models that each Framework Service includes;

- Tools and techniques: includes all the activities and tasks that will help the IT Department to complete each Framework Service;

- Performance Indicators: definition of metrics to measure the compliance with the requirements of the Framework Services.

Figure 6 shows an example with the details of the Framework Service called "Description of the IT Services", containing   each attribute described in the previous paragraph and its respective content.

In the example presented in Figure 6, it is possible to realize that in the Data Model will be defined the name of the IT Service and its description. In the workflow, we will present the detailed process for the search for IT Services in the whole organization, including all its phases. As to the vocabulary, we will detail the meaning of the term IT Service and also the term business area, keeping a clear and unified definition for all the involved parties. In the templates, we will present an example of a cataloged IT service with its name and description. Tools and techniques will include the activities that will help the IT Department to implement the search workflow for IT Services in the organization. At last, the Performance Indicator will present how many IT services were cataloged.
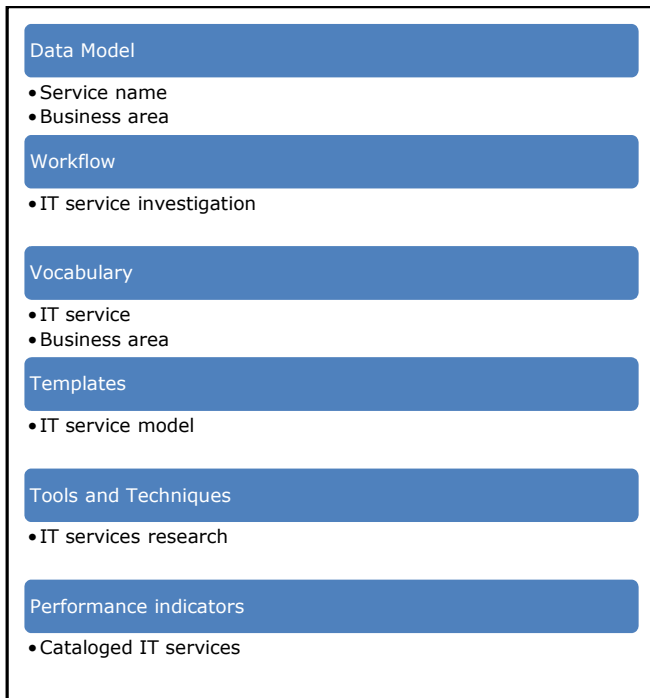
Figure 6.   Attributes of the Framework Services.

allows us to determine the stage the organization is in the process of construction of an IT Service Catalog.

After applying the DEQ, we will be able to determine the maturity level the organization is in and which Framework Services it has not complied with. We will also be able to demonstrate which tasks should be performed to advance for the higher maturity levels and for the complete fulfillment of the Framework Services.

When we complete the Framework Services at the level in which the organization is classified, we will be able to advance to the higher maturity level, performing then the Framework Services of this new level. In the case study we intend to evaluate the current maturity level of the organization and perform the Framework Services relating to this level that were not fully performed by the organization. Hence, our goal is to make the organization able to proceed to the next maturity level.

The organization used in the case study is a furniture industry with close to 500 employees. It has a heterogeneous IT scenario, made of the operating systems Windows, Linux and UNIX, wireless networks, an ERP system, institutional site, online sale system, Business Intelligence systems and many other services.

Among the problems usually found in the organization were: high amount of IT services with no identification, difficulty to support the existing services, lost information due to personnel exchange and complexity of the service organogram.

The main goals for the execution of the project included identifying all the existing services and their respective descriptions, creating an information repository about the services and planning the future tasks so that all the service data can be registered for the duration of the project. The main motivations were increasing control and management over the organization IT infrastructure.

IV. CASE STUDY

In order to apply the proposed model in a real environment, we performed a case study in a furniture industry that does not have IT as its main business focus.

The case study was structured according to Yin [33], which defines the following steps: design and planning of the case study, preparation for data gathering, evidence gathering, gathered data analysis and reports.

Based on this proposal and following the orientations found in the work of Mesquita [34], the case study in this work was defined in three steps:

- Design and Planning of the Case Study: detail the description of the application scenario and how the case study will be applied and which will be its goal;

- Application of the Case Study: provide details of the application and the necessary data for evaluation of the results;

- Results and discussions: presentation and analysis of the results of the case study.

B. Case Study Application

The organization IT team answered the Diagnostic Evaluation Questionnaire and, as a result, we verified that the organization was at the first maturity level - "N1 – No management". This way it was necessary to perform the following Framework Services: "Identification of IT Services" and "Description of IT Services". Figure 7 represents how much the organization meet the requirements of each Framework Service based on the amount of questions answered according to the ideal situation.

As shown in Figure 7, the Framework Services belonging to Level 1 "Identification of IT Services" and "Description of IT Services" were not fully compliant, what proves that the organization is at Level 1 – No management.

In order to comply with the requisites of Level 1, we began to perform a full execution of the Framework Services "Identification of IT Services" and "Description of IT Services"
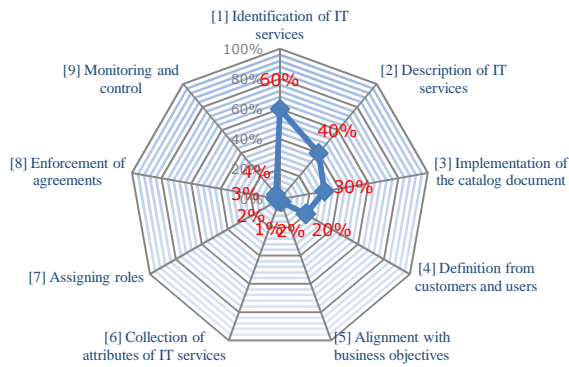
A. Design and Planning of the Case Study

Given the definitions proposed by the GAIA framework described in Section III, the first step in the case study will be the application of the DEQ in the organization, because it

Figure 7. Level of compliance of the Framework Services at the organization under evaluation.

The Framework Service "Identification of IT Services" was performed initially with the IT department of the organization, which knew a large part of the information on the IT services that existed in the organization.

The scan in search for IT services in the organization was performed as follows:

- Phase 1 – In this initial phase, the IT staff verified in the Datacenter which software were installed in the servers, such as ERP system, E-mail server, Business Intelligence, File Server, Printer Server and others;

- Phase 2 – In this step, the IT staff that does not have a service desk system, verified the e-mail archive for each member to check for messages that were related to support calls, such as problems in hardware, software and configuration;

- Phase 3 – In this step, the IT staff started to adopt two initial solutions for the control of support systems. In the first, simple text files were created informing that the call was open, whose required the service and information on the reported problem and how it was solved. In the second solution, as a complement, users were asked to open their calls preferentially through e-mail, whenever possible, when it becomes clearer the times and authors of the requirements;

- Phase 4 – At this phase, the IT staff verified which IT services were available to the organization and were not hosted locally, such as Cloud Computing, external Webmail and financial queries;

- Phase 5 – In this step, since the organization that was the target of this case study has a Process Department, this helped to expand the understanding of the business process and identifying the IT services that these processes encompass;

- Phase 6 – In this step, we evaluated together with the other departments of the organization which specific IT services were used and which were not always made available by the IT staff;

- Phase 7 – Completing the identification phase in each sector, we evaluated all the workstations to identify the installed software;

- Phase 8 – In this phase, we analyzed the asset records that the organization keeps on hardware and software, such as invoices for hardware, computers and records of software licenses. This phase helps identify the IT services that were acquired but are not still being used or are not used anymore;

- Phase 9 – Finalizing the Service identification, we considered that even after all other tasks, it is common to have other IT services that are not registered in the initial version of the IT Service Catalog, either because they are seldom used or because the IT department was not informed about them. It was established, then, that this search for IT services should remain under way by the IT team for a few more weeks, which represents this final identification phase.

Figure 8 represents the service search workflow performed in the organization.

The Framework Service that follows is called "IT services description". This way, after identifying the IT services that the organization has, it is necessary to understand them more easily, both to the IT Department that will be responsible to support them and to the business areas and management. This description should avoid technical terms, understood solely by the IT staff, because we seek a unified understanding of the IT service between those who provide the services and those who use them and, possibly, helping also eventual processes auditing.
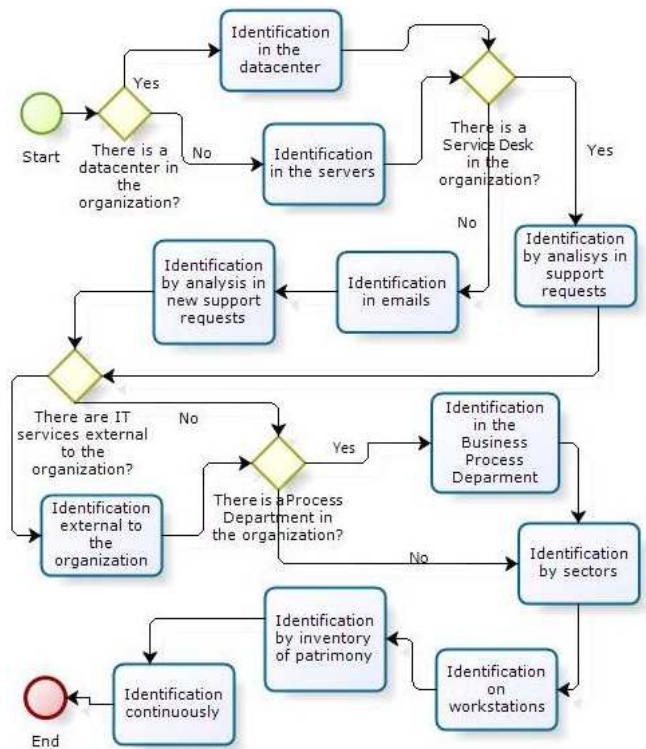

Figure 8. Workflow of IT Services Search.

In Figure 9, it is possible to see an example of IT service identified in each of the phase shown above. The first columns show each of the phases of the search workflow and the second column shows an example of an IT service found in each of those phases.
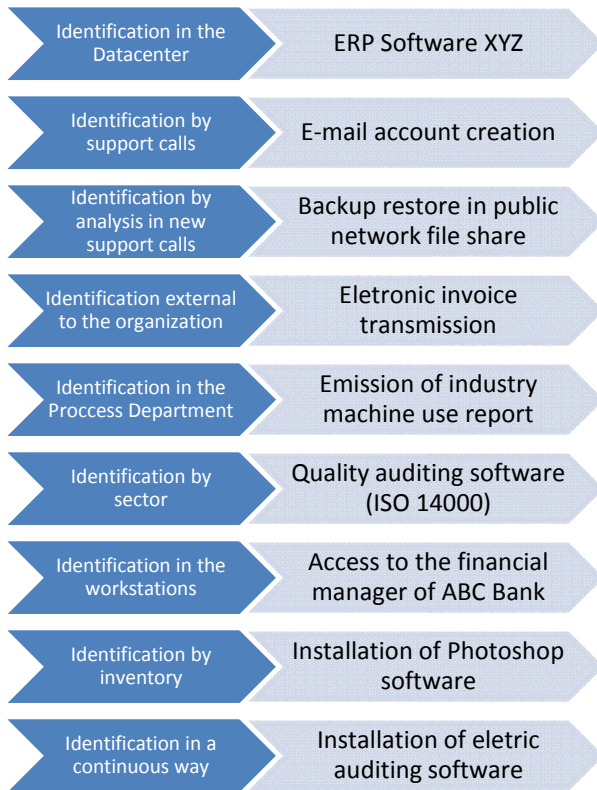
Identification in the Datacenter	ERP Software XYZ
Identification by support calls	E-mail account creation
Identification by analysis in new support calls	Backup restore in public network file share
Identification external to the organization	Eletronic invoice transmission
Identification in the Proccess Department	Emission of industry machine use report
Identification by sector	Quality auditing software (ISO 14000)
Identification in the workstations	Access to the financial manager of ABC Bank
Identification by inventory	Installation of Photoshop software
Identification in a continuous way	Installation of eletric auditing software

Figure 9.   Examples of IT services found in each phase.

In the second service of the framework, "Description of the IT services", we perform a process similar to the previous service. It is necessary that each identified service be described. In this service, the IT staff will use their clear and concise understanding on the IT services together with the information from those who use them. This process was performed in all identified IT services.

Afterwards, in Figure 10, we show two examples of IT services and their respective descriptions.

C. Results and Discussions

After applying the GAIA Service Catalogs, it was possible to quantify and describe all the IT services available at the organization. After those services were enumerated and described, it was easier to identify to which business areas each of those services belongs.

We identified a total of 135 IT services. The next step in the IT Service Catalog deployment is to detail each of those IT services, according to the Framework Services belonging to the higher maturity levels.

In figure 10 we can see examples of IT services identified at the organization and their respective descriptions.

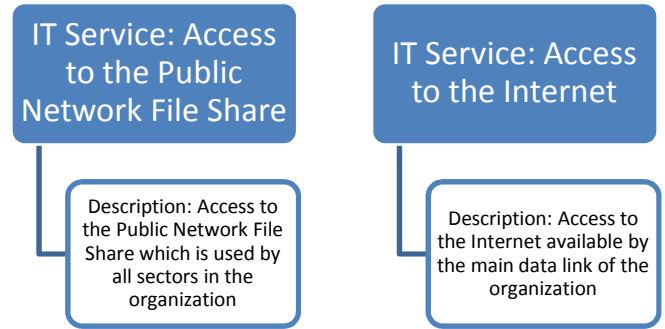| IT Service: Access to the Public Network File Share | IT Service: Access to the Internet |
| Description: Access to the Public Network File Share which is used by all sectors in the organization | Description: Access to the Internet available by the main data link of the organization |

Figure 10. Examples of identified and described IT services.

As mentioned in the planning of the case study, the goal was to make the organization to complete only the goals of one maturity level (in this case, the first one). At the end of the case study, even after completing only the first level, it was possible to observe that the organization already had clear information on the services delivered by the IT Department, a factor that allowed this department to increase its recognition in front of the management and the other business areas.

The main difficulty found by the IT staff was the absence of a Service Desk in the organization, making it impossible to use a history of support requests to verify which IT services were less used and that, for this reason, could have been missed by the steps performed in the case study.

The concept of Service Desk is approached in the third level of the GAIA framework, because of the need of IT services in the organization to be well justified. The concept of creating simple text files to register calls and the preference for e-mails instead of using the phone was a simple and temporary solution, but allowed the IT department to visualize the need for a catalog of IT services.

Besides reaching the main goal of this work, the construction of an IT Service Catalog with the identification of all IT services, the IT department achieved the following benefits:

- Identification of IT Services previously unknown by the IT staff;

- Identification of IT Services that should not be present in the organization;

- Identification of high cost IT Services that were not used anymore by the organization;

- Identification of IT services that were purchased but still were not used due to lack of documentation or training;

- Identification of IT Services versions that were not supported anymore by the suppliers, representing a problem concerning support and security;

- Visualization of all IT services in the datacenter;

- Standardization of software and IT environment homogenization, avoiding different versions from different suppliers solving a single problem;

- Ease of support by grouping IT service calls.

All those benefits show that the IT department now understands better the work environment and the organization IT services. Moreover, it has become clearer to other departments all the processes the IT department deals with.

Last, it is necessary to emphasize that the GAIA framework made it possible to begin the construction of an IT service catalog in an organization that is not focused on IT. What is more remarkable is that the IT department which was previously seen as something that only supports other departments, now can clearly present which IT services are provided for the organization to reach its business goal. This first construction phase of the IT Service catalog. which was achieved by the execution of the two initial Framework Services, introduced in the organization the concepts of IT Service Management. This is a good starting point to several other applications, either from the GAIA framework or from other aspects covered by ITIL and by the ISO/IEC 20000 standard.

This way, we demonstrate that the goal of this work was achieved: introduce the concepts of IT Service Management and build an IT service catalog in organizations, no matter which is its business focus.

V. FINAL REMARKS

The proposal presented in this paper intends to help build an IT Service Catalog based on the best practices of IT Service Management and IT Governance, proposed by ITIL, COBIT and ISO 20000. The GAIA framework allows, after the application of the DEQ, to position the organization into the proposed maturity model. The Framework Services are built by tasks, maintenance orientations and advancements in the maturity levels.

The benefits from an IT Service Catalog are well proved. Nevertheless, ITIL and ISO 20000 neither present a model or standard to build an IT Service Catalog nor provide instructions on how to document the existing IT services.

No matter which is business focus of the organization in which it is applied, the GAIA framework allows for information gathering that translate how much the organization really know of its services in order to allow for the construction of an IT Service Catalog. After this information gathering, it presents the scenario in which the organization is in and also the higher scenarios that should be strived for.

For the validation of the proposed framework, we presented a case study in a furniture industry from the state of Paraná that has close to 500 employees. After applying this framework in the organization, we could determine that it was positioned in the first proposed maturity level. After performing all the tasks of Level 1, the organization was ready to be inserted in the next level (Level 2), requiring only a simple conference of the requisites of Level 1, which could be determined by a new application of the DEQ.

Performing the Level 1 Framework Services allowed a complete scan of the IT services in the organization. Then, the organization obtained a knowledge base that contains all IT services that, as a priority, the organization needs and others that perform specific tasks that were often not visualized as necessary for the organization to achieve its business goals.

The continuous improvement process is achieved by each revision and update performed in the IT Services Catalog, which does not achieve its goals if it is treated as a static document/database. The IT Services Catalog must be treated as a continuously updated information source on what is offered by the organization.

Finalizing this initial application of the framework, the main result achieved by the organization was to have a document with all IT services identified and described. Since the construction of an IT service catalog includes many attributes that are present in the higher maturity levels and their respective Framework Services, the organization is already ready to apply the questions of Level 2. This will allow for enrichment of the composition of the IT services attributes, adding value to the IT Service Catalog.

Besides achieving the main goal of this work, building an IT Service Catalog with all the services identified and described, other benefits were achieved, such as the identification of services that the IT department did not know existed and also other IT services that could be not be made available, such as downloaded applications and non licensed software.

Another result highlighted by the IT staff was the identification of IT services in versions that were not more supported by the suppliers, which represented a security risk. Last, they highlighted the easiness of visualization of all IT services in the datacenter, making it easier to plan for eventual infrastructure maintenance.

All these benefits demonstrated that the IT Department now understands better the work environment and the IT services provided. Moreover, it has become clearer to present to the other areas all the processes they deal with. Besides achieving a complexity reduction in the services organogram, the identified and described IT services were afterwards used as a database for the creation of a Service Central, which could be used by the Service Desk as a single point of communication with the users.

The case study performed was important for the validation of the proposed framework, and allowed us to identify the following issues:

- The application of the Diagnostic Evaluation Questionnaire allows to gather information on how much knowledge and organization has about an IT service catalog and about its IT services and their respective attributes;

- The positioning of an organization in the maturity model before and after the application of the GAIA framework creates an overview on the knowledge the organization has about the existing IT services. As we noted in section IV, it was proved that the initially identified level (Level l) was equivalent to a lack of identification in the IT services and that the current

level (Level 2), represents the fact that IT department now knows the amount of IT services the organization has and knows how to describe them;

- Performing the Framework Services helps build the IT service catalog and includes framework concepts and worldwide accepted standards of IT Governance and IT Service management.

For those reasons, the organization insisted on highlighting that after the application of the framework they have a clearer vision of the IT department.

The future work needs to use the concepts demonstrated in this paper to validate the IT Service catalog built in the organization, as well as following up the climb to higher levels of the proposed maturity model and helping perform all Framework Services in each on those levels for the complete construction of an IT Service Catalog.

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