IT Service Management: Analysis and Proposition of the ITIL Model in a Brazilian Federal University

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Abstract— Service management is critical to balancing the relationship between institutional resources and management processes, improving IT value and promoting strategic alignment between top management and the responsible department. This paper focuses on analysing the aspects of IT Service Management at a Federal University, aiming to present its theoretical conception and the practical aspects involved in IT Governance. The methodology used consisted of the application of maturity models capable of determining how well the University knows and applies the practical aspects of the ITIL library. During the research it was possible to observe a low level of maturity and the lack of adherence to the governance standards, where some aspects showed an urgent need for intervention to improve the institutional conditions. Finally, with institutional maturity and knowledge of the current service management process, it was possible to present an intervention proposal that sought to optimize the relationship between the IT workforce and the responsible department in the University. This adequacy sought to enhance the technical staff, while promoting improvements in resource management and providing user-oriented and aligned IT management principles in the ITIL library.

Keywords— IT Service Management, Institutional Maturity, ITIL Library, Customer Service Process.

I. INTRODUCTION

In recent years, Technological Innovation and advances in Information Technology (IT) have impacted the way social, economic and cultural relations take place. Businesses and governments have realized the advantages that this area provides to the organizational environment and have invested in improving and evolving their participation in the business environment. As IT has a multifaceted approach, involving different foci of actuation, several challenges arise regarding its planning and control, encouraging organizations to invest more and more in the adoption of governance practices, seeking in Corporate Governance a flow of actions to direct and to control IT(FERNANDES;ABREU,2014; MAGALHÃES; PINHEIRO, 2007).

In this context, IT has taken on a role that for a long time has remained beyond its competence. In many organizations, it has always been seen as an operational area with no strategic importance and represents a low return investment when compared to other areas. In contrast to this reality, the current scenario shows a strong participation in the strategic context, having a prominent role in the planning, measurement and institutional alignment(FERNANDES; ABREU, 2014; WEILL; ROSS, 2004).

As IT is a relatively new area and made up of a series of interconnected agents, it becomes a tool that requires control and planning. In this sense, organizations have applied strategies previously defined for Corporate Governance, thus achieving the so-called IT Governance.

IT Governance seeks alignment with organizational objectives, supporting the strategic planning of the organization, always seeking to deliver value to its users. One of IT Governance line of action is Service Management. A good example is the ITIL framework, which has focus and specifications directly related to management. ITIL defines a series of good practices aimed at planning IT resources in order to enable better management(FERNANDES;ABREU,2014;MAGALHÃES; PINHEIRO, 2007).

The Federal University of Grande Dourados (UFGD) is a public institution focused on higher education. In order to carry out its activities, UFGD uses a set of IT tools and resources, some of them being arranged in its Plan of Institucional Development(UFGD, 2013).In this sense, the objective of this study is to explore the institutional characteristics of the UFGD, seeking to point out possibilities for improvements capable of improving the current condition of IT service management.

In order to do this, the existing definitions in the ITIL library were used in the current context of the institution, allowing a comparison between the best practices defined by the model and the current condition of the UFGD's IT service management.

Finally, the institutional maturity in relation to the ITIL library is presented, as well as proposals for improvement for each of the analyzed aspects. Alongside this, an improved model is showed, based on institutional conditions.

II. THEORETICAL FOUNDATION

2.1 ITIL Model

The ITIL Model supports the view that organizations are increasingly dependent on IT to achieve their organizational goals. The IT services need to be reliable and of high quality, this requires a good level of management so that availability and reliability are guaranteed(COUGO, 2013; MAGALHÃES; PINHEIRO, 2007).

In this sense, IT Service Management becomes a structure of policies, processes and functions that aim to meet the objectives of the organization by offering and supporting information technology services. ITIL was created to systematically and cohesively disseminate proven practices in IT management, and its approach is based on service quality and the development of effective and efficient processes(MAGALHÃES; PINHEIRO, 2007; WEILL; ROSS, 2004).
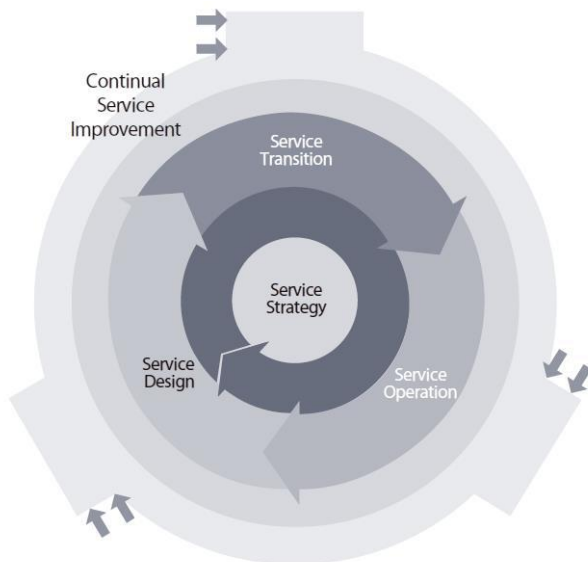

Fig.1: ITIL Model Lifecycle (Cannon, 2011 e Cestari, 2011)

Each of the processes defined in ITIL refers to an area of IT, some of them being: The development of a service, the infrastructure management, the offer and the support to services, among others. With a service-focused approach, ITIL can describe the best IT service

management practices independently of the organization's structure, which is reflected in standards of good practice rather than a rigid definition of processes(FREITAS, 2010; NIETO et al., 2012).

As can be seen in Fig 1, the model has five distinct phases, with Service Strategy as the core, Service Design, Service Transition and Service Operation as stages orbiting the core, supported by the Continuous Service Improvement, with each phase, having its specific objectives:

➢ **Service Strategy**: Helps transform Service Management into Assets to meet the organization's strategic objectives. It is at this stage that strategic decisions are made about the services that will be developed(CANNON, 2011).

➢ **Service Design**: Guiding the design of IT services to ensure quality and customer satisfaction and the cost / benefit ratio in the provision of services(HUNNEBECK, 2011).

➢ **Service Transition**: It serves to guide the development of resources for the implementation or modification of new services in the Service Operation, ensuring that the objectives defined by the Service Strategy and planned in the Service Design are being effectively carried out to control and minimize the risks of failures or service disruptions(RANCE, 2011);

➢ **Service Operation**: It seeks to guide how to achieve efficacy and efficiency in the delivery and support of the services, to guarantee the value expected by the client and the fulfillment of the strategic objectives of the organization(CANNON; WHEELDON, 2011);

➢ **Continuous Service Improvement**: Identify results and guide service improvement by joining efforts with Strategy, Design, Transition, and Service customers to create or maintain the value of services(LONG, 2012).

In this sense, the IT Services Operation is highlighted, which concentrates the activities of an IT team at an operational level. Many of the actions defined in this process are present in the institutions IT departments, but without structure or planning. Based on this assumption, it is sought to identify the level of institutional maturity of the UFGD based on the ITIL and PMF (Process Maurity Framework) models.

III. MATURITY MODELS

They are responsible for describing the evolution of a given entity over time, can be an organization, process or an organizational function. In general, maturity models are based on people, organizations, functional areas, and processes that evolve towards a more mature direction,

traversing several stages(KLIMKO, 2001; VITORIANO; SOUZA, 2015).

By collecting data and analyzing results, it is possible to make improvement recommendations and action plans to reach higher levels of maturity. In the words of Klimko (2001), the advantage of maturity models lies in their simplicity, which facilitates understanding and communication.

There are several maturity models for different application types ranging from simpler to more sophisticated. In relation to IT Service Management, more specifically to ITIL, Pereira e Silva (2010)point to the PMF model as being the most suitable for calculating maturity.

3.1 Maturity levels

The PMF adopts five levels of maturity to qualify the state of the processes: Initial, Repetitive, Defined, Managed and Optimized. Hunnebeck (2011)classifies each of these according to **Fig. 2** and **Table 1**:
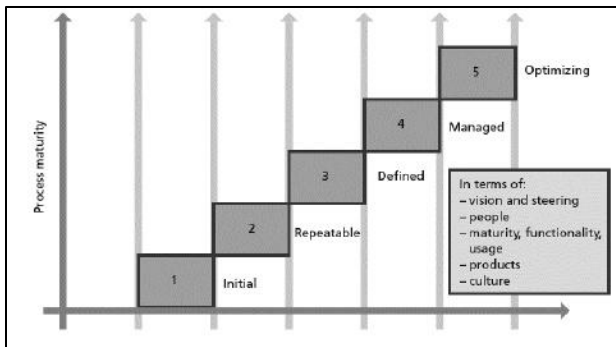

Fig. 2: Process Maturity Framework(Hunnebeck, 2011)

Table.1: Maturity Levels of ITIL v3 Processes and Functions

Level	Description
Level 1 (Initial):	The process is recognized, but there are few activities within its scope. Alongside this, there are no resource allocation or budget for the it.
Level 2 (Repetitive):	The process is recognized, but it does not arouse due interest within the organization. As a consequence, it receives few resources and the related activities do not have coordination, being carried out in an irregular way, without direction and with low effectiveness.
Level 3 (Defined):	The process is recognized and documented, but there is no formalization as to its acceptance and recognition within the organization. However, in this case, the process already has a person responsible, has goals and formalized, having allocated

resources seeking efficiency and effectiveness. Reports are prepared on the activities carried out, allowing for future analysis.

Level 4 (Managed):	The process is completely recognized and accepted throughout IT, with a focus on service delivery. Goals are aligned with those of the organization. It is fully mapped, managed and proactive in nature, having its interfaces established and documented.
Level 5 (Optimized):	The process is fully recognized, having goals and objectives aligned with those of IT and business, being part of daily activities, and actions are performed for continuous improvement as part of the process.

Source: AdaptedfromHunnebeck (2011)

III.1 PMF Dimensions

To perform the maturity level classification, the PMF model uses the levels discussed in the previous section along with some aspects that govern the processes. These, in the work ofHunnebeck (2011) e Silva (2012)are called the Dimensions. The great advantage in the use of dimensions is the possibility of systematically evaluating the categories that directly influence the quality of the executed processes. The dimensions used in the PMF model and their characteristics are presented in **Table 2**:

Table.2: Dimensions Process Maturity Framework

Dimension	Description
Vision andGuidance	They have a relationship with the objectives that the organization determines, being directly linked to the available budget and the setting of goals.
Processes	It is how the organization structures itself to achieve its goals. In this dimension, isolated or segmented actions are analyzed in well-defined processes.
People	It concerns the interaction between the professionals involved in the execution of the activities. Analyze whether there is integration or isolation between team members. These characteristics determine the levels of collaboration and sharing of information
Technology	It deals with the presence of an architecture capable of providing the integration between people and processes.

Culture	It synthesizes the set of ideas, values, beliefs, practices and expectations shared among the organization's employees.

Source: Adapted from Hunnebeck (2011)

The level of process maturity is directly related to the maturity of the respective dimensions, that is, maturity is decomposed into five strands, encompassing a systemic view of what actually influences process quality. In addition, this segmentation provides a detailed view of the components that interfere in maturity, allowing managers to act in a timely manner in each dimension, establishing priorities of the way of acting, thus facilitating the strategy to increase maturity(LLOYD; RUDD, 2008; SILVA, 2012)

IV. METHODOLOGY

In order to carry out the survey of the institutional maturity of the UFGD, questionnaires were applied that involved two different approaches. Focusing on the search for maturity recognition, the direct people responsible for the IT activity at the institution were interviewed, as shown in **Table 3**. For this purpose, the PMF model was used as a semi-structured questionnaire(CRESWELL, 2010; VITORIANO; SOUZA, 2015).

Table.3: IT Departments at UFGD

Department	Occupationarea
DAU	Responsible for managing support, monitoring, control and quality of IT activities
DDS	Responsible for the planning, development, maintenance and implementation of institutional systems
DGPTI	Responsible for the management, planning and maintenance of IT processes and hiring
DSSTI	Responsible for network infrastructure, datacenter and IT security equipment

Source: (UFGD, 2016)

In order to calculate the maturity of each dimension of the PMF model, as described previously, the mathematical model adopted is a simple arithmetic mean, described through **Equation (2)**, inspired by the work ofMorgado e Carvalho (2015):

$$M_A A_1 = \frac{\sum_{j=1}^{4} A_{1j}}{4} \quad (1) \quad (2)$$

Where,

$M_A A_1$: Arithmetic mean of the scores obtained for the first question.

A_{1j}: First question, where j = 1, 2, 3, 4 each of the respondents.

Dim: Vision and Guidance Dimension.

$M_A A_i$: Arithmetic mean of the questions about Vision and Guidance, where $i = 1, 2, 3, 4 \; e \; 5$.

In this way, to calculate the maturity of the ITIL Model processes, a weighted average is used between the maturity of each of the dimensions, defined by the previous model, and the weight defined for each one of them. A mathematical model, inspired by the work ofMorgado e Carvalho (2015)and that exemplifies how the calculation is performed is described by **Equation (5)**.

(3)

$$MatProc = \frac{P_1 \left(\frac{\sum_{i=1}^{5} M_A A_i}{5} \right) + P_2 \left(\frac{\sum_{i=1}^{5} M_A B_i}{5} \right) + P_3 \left(\frac{\sum_{i=1}^{5} M_A C_i}{5} \right) + P_4 \left(\frac{\sum_{i=1}^{5} M_A D_i}{5} \right) + P_5 \left(\frac{\sum_{i=1}^{5} M_A E_i}{5} \right)}{P_1 + P_2 + P_3 + P_4 + P_5}$$

Being$P_1 = 2$for Vision and Guidance dimension, $P_2 = 3$for Process dimension, $P_3 = 2$for People dimension, $P_4 = 2$for Technology dimension and $P_5 = 1$ for Culture dimension, we have:

(4)

$$MatProc = \frac{2 \left(\frac{\sum_{i=1}^{5} M_A A_i}{5} \right) + 3 \left(\frac{\sum_{i=1}^{5} M_A B_i}{5} \right) + 2 \left(\frac{\sum_{i=1}^{5} M_A C_i}{5} \right) + 2 \left(\frac{\sum_{i=1}^{5} M_A D_i}{5} \right) + 1 \left(\frac{\sum_{i=1}^{5} M_A E_i}{5} \right)}{2 + 3 + 2 + 2 + 1}$$

(5)

Where,

$$MatProc = \frac{2 \left(\frac{\sum_{i=1}^{5} M_A A_i}{5} \right) + 3 \left(\frac{\sum_{i=1}^{5} M_A B_i}{5} \right) + 2 \left(\frac{\sum_{i=1}^{5} M_A C_i}{5} \right) + 2 \left(\frac{\sum_{i=1}^{5} M_A D_i}{5} \right) + \left(\frac{\sum_{i=1}^{5} M_A E_i}{5} \right)}{10}$$

$MatProc$:

Process maturity.

$M_A A_i$: Arithmetic mean of the questions about Vision and Guidance, where$i = 1, 2, 3, 4 \; and \; 5$.

$M_A B_i$: Arithmetic mean of the questions about Process, where$i = 1, 2, 3, 4 \; and \; 5$.

$M_A C_i$: Arithmetic mean of the questions about People, where$i = 1, 2, 3, 4 \; and \; 5$.

$M_A D_i$: Arithmetic mean of the questions about Technology, where$i = 1, 2, 3, 4 \; and \; 5$.

$M_A E_i$: Arithmetic mean of questions about Culture, where$i = 1, 2, 3, 4 \; and \; 5$.

4.1 Maturity Levels

When finalizing the calculations using the PMF model and the guidelines established in the previous sections, the result obtained will vary from 0 (zero) to 5 (five), according to the scores assigned by the selected respondents.

$$Dim = \frac{\sum_{i=1}^{5} M_A A_i}{5}$$ To classify the level of maturity of the organization analyzed,Silva (2012)makes a correlation between the scores obtained and the five levels of maturity of the PMF model. This correlation is made using the score obtained in the

maturity calculation using two decimal places, which identifies the level of maturity. Score variation and correlation with maturity level are available in **Table 4**.

Table.4: Process Level of Maturity

Score	Level	
Less than or equal to 1,9	1	Initial
Greater than or equal to 2 and less than or equal to 2,9	2	Repetitive
Greater than or equal to 3 and less than or equal to 3,9	3	Defined
Greater than or equal to 4 and less than or equal to 4,9	4	Managed
Equalto 5	5	Optimized

Source: Adapted fromSilva (2012)

V. RESULTS AND DISCUSSIONS

The maturity survey was carried out according to the theoretical framework, using the evaluation method defined by the PMF model. For the context of UFGD, the functions set out in the IT Service Operation process analyzed were Service Center, Technical Management, Operations Management and Application Management.

5.1 Service Desk

In the case of the UFGD Service Desk, Table 5 summarizes the maturity for each of the Dimensions analyzed and their classification in relation to the PMF model.

Table.5: Maturity of the Dimensions of the Service Center UFGD

Dimension	Maturity	Classification
Vision andGuidance	1,10	Initial
Processes	0,60	Initial
People	1,20	Initial
Technology	1,35	Initial
Culture	0,95	Initial

Fonte: Dados da Pesquisa

The result obtained, when compared to the maturity levels shown in **Table 4**, reveals a deficit condition, classifying the UFGD Service Center dimensions as Initial, since none of the grades obtained was greater than 1.9. In **Graph 1** the maturity of each one of the analyzed dimensions is arranged.

Graph1: Service Desk Maturity

Source: Research Data

With the results it is possible to obtain institutional maturity over the analyzed function as a whole. In this case, the collected data go through the calculation described in the methodological procedures through **Equation (5)**, being:

$$MatProc = \frac{2.(1,1) + 3.(0,6) + 2.(1,2) + 2.(1,35) + (0,95)}{10}$$

(6)

$$MatProc = 1,00$$

(7)

As indicated by the maturity of the Service Center Function, the UFGD needs to make greater efforts in the planning and execution of the activities. It is necessary to define processes and improve the allocation of resources, be they financial or human. **Table 6** presents the diagnosis of Maturity for the UFGD Service Center Function.

Table.6: UFGD Service Desk Maturity

Maturity	Maturity Assessment
1,00	Level 1 - Initial
	The process is recognized, but there are few activities within its scope. Alongside this, there are no allocation of resources or budget for the same

Source: Research Data

Together with the understanding of the maturity of the Service Center, the research gives subsidies to point out the causes that lead to the score obtained in the analyzed dimensions. **Table 7** summarizes those that most impact on the result obtained.

Table.7: Causes for UFGD Service Center Maturity

Dimension	Causa
Vision andGuidance	➢ Lack of planning under the IT capabilities of the Service Desk ➢ There is no service level agreement to the support

	execution	
Processes	➢ The existing process is not formally established, documented and modeled on BPMB ➢ The process does not have a standards manual	
People	➢ The number of servers is insufficient ➢ The staff were not trained for the work they perform	
Technology	➢ The tools that make up the process do not have integration ➢ The management reports are not generated automatically	
Culture	➢ There is no communication channel for the staff to collaborate in the process ➢ The process does not have the proper publicity	

Source: Research Data

Following the survey of the causes that influence the institutional maturity of the Service Center, it is possible to point out some opportunities for improvement, such as:

➢ Perform the analysis and modeling of the work process of the UFGD Service Desk, formalizing the process established and publicizing it
➢ Establish a communication plan capable of properly integrating the staff involved in the Service Desk.
➢ Identify the IT workforce available at the UFGD.
➢ Establish a manager, able to control and monitor the process by aligning its execution to institutional goals.
➢ Train the IT workforce for the integrated execution of the activities of this Role.

Having pointed out the failure of the structure of points representing the Service Desk and presented some suggestions for improvement, it is up to the UFGD Corporate Governance, with the IT department to establish an action plan aiming at mitigating the identified flaws.

5.1 Technical Management

The Technical Management focuses planning activities and study of institutional needs, being able to organize the best arrangement between the possibilities that this infrastructure can offer and the institutional demand. In general, this ITIL Model Function serves to coordinate the allocation of resources, being able to provide subsidies that justify the acquisition of IT infrastructure, Software or increasing the workforce in the organization. **Table.8:** summarizes the calculation of the grades obtained for this function from the ITIL model.

Table.8: Maturity of UFGD Technical Management Dimensions

Dimension	Maturity	Classification
Visão e Orientação	1,10	Initial
Processos	0,65	Initial
Pessoas	1,25	Initial
Tecnologia	0,80	Initial
Cultura	1,35	Initial

Fonte: Dados da Pesquisa

Based on the parameter defined in **Table 4**, the maturity reached in this case is classified as Initial. This reflects a reality where there is a lack of planning and integration between the IT department and UFGD Corporate Governance. In **Graph 2** shows the maturity of each one of the analyzed dimensions.

Graph 2: Technical Management Maturity

Source: Research Data

The scores obtained in the dimensions of the Technical Management provided information on the institutional maturity analyzed as a whole. In this case, as happened with the Service Center, the collected data goes through the processing described in **Equation (5)**. In a simplified approach, the calculation is demonstrated by:

$$MatProc = \frac{2.(1,1) + 3.(0,65) + 2.(1,25) + 2.(0,8) + 1.(1,35)}{10} \quad (8)$$

$$MatProc = 0,51 \quad (9)$$

As indicated by the maturity of the Technical Management Function, the UFGD must carry out the planning for execution of the activities of this function. **Table 9** consolidates the diagnosis of the UFGD Technical Management.

Table.9: Technical Management Maturity

Maturity	Maturity Assessment
0,51	Level 1 - Initial
	The process is recognized, but there are few activities within its scope. Alongside this, there are no allocation of resources or budget for the same

Source: Research Data

As in the Service Center, the research provides information capable of pointing out the factors that most influence the maturity obtained. **Table 10** summarizes what most impacts on the result obtained.

Table.10: Causes for UFGD Technical Management Maturity

Dimension	Cause
Vision andGuidance	➢ There is no planning for staff training ➢ There is no scope for the knowledge needed for the IT staff to perform ➢ IT scope are not known
Processes	➢ The process is not modeled or formally established ➢ The process does not have a standards manual
People	➢ Roles and responsibilities are not defined ➢ There is no communication flow nor is a responsible person defined ➢ The number of workforce is insufficient ➢ The servers are untrained or do not know the role
Technology	➢ The tools that make up the process do not have integration ➢ The management reports are not generated automatically
Culture	➢ There is no communication channel for the staff to collaborate in the process ➢ The process does not have the proper publicity

Source: Research Data

When conducting the survey for causes that influence the maturity on the Technical Management, based on the good practices of the ITIL model it is possible to point out some opportunities for improvement:

➢ Modeling of UFGD Technical Management, including the IT workforce and the study of assets available within a unified process, giving publicity to it.

➢ Establish a communication plan capable of properly integrating all the people involved in IT activities and encourage them to take part in the department decision-making.

➢ Identify the IT workforce available in the UFGD and integrate them into the defined process.

As in the Service Center, the article presents the main flaws of the Technical Management of the UFGD and presents some suggestions for improvement, it is up to the UFGD Corporate Governance, together with the IT department, to establish an action plan capable of seeking to eliminate the flaws pointed out.

V.1 Operation Management

Operations Management is responsible for the treatment of actions that require low level of planning with simple project preparation and with little or no financial allocation. These activities are mainly planned on a daily basis and have high capacity for automation.

When considering the conditions of UFGD, it can be observed again a low performance for this function. The mean of the analyzed dimensions was below 1.9, which presents the institution again with Initial maturity level compared to the parameters defined by the evaluation model set forth in **Table 4**. In **Graph 3** the maturity of each of the dimensions analyzed.

Table 11 summarizes the institutional maturity for the Operations Management function.

Table.11: Maturity of UFGD Operation Management Dimensions

Dimension	Maturity
Vision andGuidance	1,35
Processes	0,20
People	1,25
Technology	0,50
Culture	1,05

Source: Research Data

Graph3: Maturity of Operation Management

Source: Research Data

In order to understand in detail the results obtained, we performed the calculations for maturity of the Operations Management Function as described in Equation (5). In a simplified approach, the calculation is performed by

$$(10)$$

$$MatProc = \frac{2.(1,35)+3.(0,20)+2.(1,25)+2.(0,5)+1.(1,05)}{10}$$

$$(11)$$

$$MatProc = 0,435$$

As the maturity of the Operations Management Function indicates, the UFGD must carry out planning for execution of the activities. It is required to define a process and plan the allocation of resources. **Table 12** consolidates the diagnosis of the UFGD Technical Management.

Table.12: Maturity of UFGD Operation Management

Maturity	Maturity Assessment
0,435	Level 1 - Initial
	The process is recognized, but there are few activities within its scope. Alongside this, there are no allocation of resources or budget for the same

Source: Research Data

As in the Central Service and Technical Management Functions, it was possible to obtain information capable of pointing out the factors that most influenced the maturity obtained for Operations Management. **Table 13** summarizes those that most impact the outcome.

Table.13: Maturity of UFGD Operation Management

Dimensão	Causa
Vision andGuidance	➢ There is no planning for staff training ➢ There is no scope for the knowledge needed for the IT staff to perform ➢ IT scope are not known
Processes	➢ The process is not modeled or formally established ➢ The process does not have a standards manual
People	➢ Roles and responsibilities are not defined ➢ The number of workforce is insufficient ➢ The servers are untrained or do not know the role
Technology	➢ The tools that make up the process do not have integration ➢ The management reports are not generated automatically
Culture	➢ There is no communication channel for the staff to collaborate in the process ➢ The process does not have the proper publicity

Source: Research Data

As in the Service Center and Technical Management, after conducting a survey of the causes that influence the maturity of Operations Management, using the good practices of the ITIL model, it is possible to point out some opportunities for improvement.

➢ Modeling of the work process of the Operations Management in the UFGD, giving publicity and formalizing the means of communication to carry out its activities.

➢ Establish a communication plan capable of properly integrating all the people involved in IT activities and encourage them to take part in the department decision-making.

➢ Establish a manager with ability to control and monitor the process, aligning it with the institutional goals.

➢ Training and qualification of the IT staff oriented towards their activities.

The results show the need to understand and apply the good practices of ITIL. It is necessary to formulate a process with well defined rules and roles.

5.2 Application Management

Application Management is the role responsible for planning and implementing the applications that support the organization's business processes. In general terms, it should be part of IT service planning, so that they are able to keep the business processes under operational conditions.

As a result, poor institutional performance is evident. For this function, the UFGD did not reach the minimum score to leave the Initial level of maturity, when it has its performance compared to the definition given in **Table 4**. **Table 14** summarizes the institutional maturity for each of the analyzed dimensions of the Application Operations.

Table.14: UFGD Application Management Dimensions

Dimension	Maturity	Classification
Vision andGuidance	1,10	Initial
Processes	0,80	Initial
People	1,30	Initial
Technology	0,55	Initial
Culture	1,25	Initial

Source: Research Data

In order to elucidate the level of institutional maturity on the parameters defined in the ITIL and PMF models for Application Management, the maturity of each of the dimensions analyzed is shown in Figure 4.

This condition reflects a reality of the factors exposed that corroborate the need to invest in actions to shape the functions to the strategic alignment, raising resources and seeking a greater participation of the IT area in institutional decisions.

Graph4: Application Management Maturity
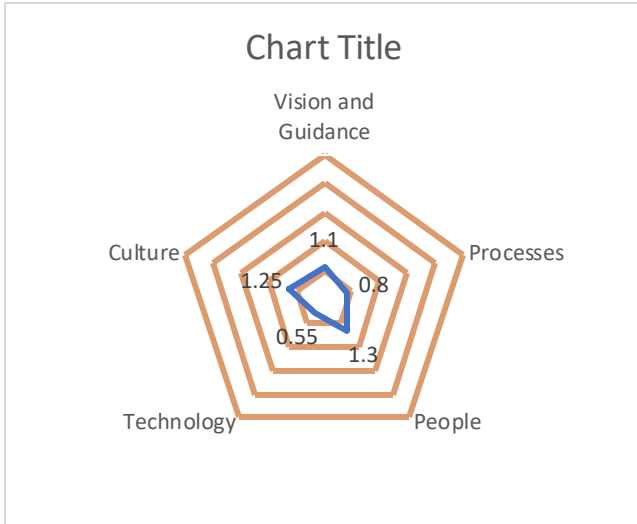
Source: Resource Data

In order to understand the results obtained, the calculations were performed to obtain the maturity of the Application Management Function as described in **Equation (5)**. In a simplified approach, the calculation is performed by:

$$MatProc = \frac{2.(1,1) + 3.(0,8) + 2.(1,3) + 2.(0,55) + 1.(1,25)}{10} \tag{12}$$

$$MatProc = 0,95 \tag{13}$$

The UFGD needs to carry out the planning for execution of the activities. It is necessary to define the process and plan the allocation of resources, whether financial or human. **Table 15** consolidates the diagnosis of the UFGD Technical Management.

Table.15: UFGD Application Management

Maturidade	Avaliação da Maturidade
0,95	Level 1 - Initial
	The process is recognized, but there are few activities within its scope. Alongside this, there are no allocation of resources or budget for the same

Source: Research Data

As with the Service Center, Technical Management and Operations Management Functions, the survey provided information that proposed factors that most influenced the maturity achieved for Application Management.

Table 16 summarizes what the biggest impact on the results had obtained.

Table.16: Maturity of the UFGD Application Management

Dimension	Cause
Vision andGuidance	➢ Leadership lack of understanding about the importance of Application Management. ➢ Lack of resource planning under the responsibility of Application Management ➢ Lack of agreement on the service level to answer the requests made
Processes	➢ Lack of modeling, such as the operating rules. ➢ No publicationtousers
People	➢ The number of workforce is insufficient ➢ The servers are untrained or do not know the role
Technology	➢ Lackofprocessautomation tools ➢ The tools that make up the process do not have integration ➢ The management reports are not generated automatically
Culture	➢ There is no communication channel for the staff to collaborate in the process ➢ Users do not know the Application Management

Source: Research Data

As in the Service Desk, Technical Management, and Operations Management, after conducting a survey of the causes that influence the maturity of the Application Management, using the good practices of the ITIL model, it is possible to point out some opportunities for improvement.

➢ Modeling Applications Management work process in UFGD, publicizing and formalizing the media for carrying out its activities.

➢ Establish a communication plan capable of properly integrating all the people involved in IT activities and encourage them to take part in the creation of policies to be applied in Application Management

➢ Establish a manager with ability to control and monitor the process, aligning it with the institutional goals.

➢ Train both the IT workforce for the execution of activities and users to understand the activities of this Role and the possibilities it offers.

The result obtained demonstrates the need to understand and apply the good practices of ITIL to the context of

Application Management. It is possible to observe some actions in this sense, however work is still needed to create a process with well-defined rules and attributions.

VI.   ITIL MATURITY IN UFGD

So far the research has demonstrated the maturity levels of each of the functions separately. As described in the theoretical framework, these four functions built a set of services available to users.

Initially, the low level of institutional maturity could be observed. All functions had averages of below 1.9, and their maturity level was defined as Initial. As shown in **Graph 5** and in previous topics, the UFGD demonstrates recognizing and applying the principles of the functions analyzed, but in a very superficial and misaligned way. The initiatives implemented are insufficient and uncoordinated, reflecting a lack of knowledge and application of own governance concepts, which are not part of a strategy or alignment according to the parameters defined in the ITIL library.

Graph.5: Maturity of ITIL Functions in UFGD
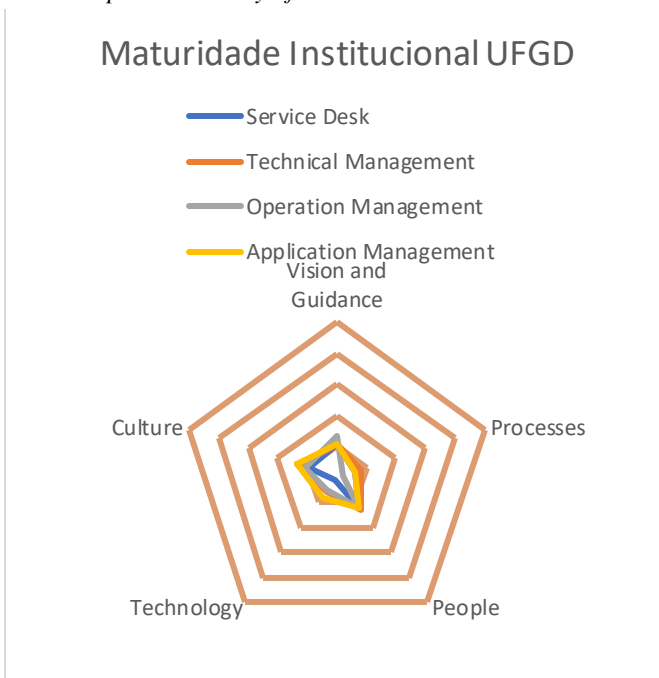
Source: Research Data

Much of what is operating in the UFGD comes from a model where the IT department has an exclusively operational focus, where IT actions are not part of the strategic planning of the organization. Given this condition, the interviewees pointed out as the main causes for the current level of maturity of the UFGD the factors set out in Table 17:

Table.17: Causas para baixa Maturidade Institucional

Function	Main Causes of Low Maturity
Service Desk	➢ Reduced staff; ➢ Inefficiency of human and material resources; ➢ Limited view of the role of IT by the Administration ➢ Lack of integration between the different IT teams ➢ Lackof IT Planning
Application Management	➢ Lack of Linkage between the goals of the organization and the objectives of the Role ➢ Absence of an administrative vision, aimed at continuous improvement ➢ Low perception about the importance of automation for the management of services
Operations Management	➢ ReducedStaffing ➢ Deficiencyofinternal communication ➢ Absence of an administrative vision, aimed at continuous improvement ➢ Lack of integration between the different IT teams
Technical Management	➢ ReducedStaffing ➢ Absence of an administrative vision, aimed at continuous improvement ➢ Lack of integration between the different IT teams ➢ Lackof IT Planning

Source: Research Data

By consolidating the results obtained in the previous sections through the PMF model, it was possible to obtain a systemic view of the condition of the Functions of the ITIL Model in UFGD. The use of the model was able to extract, through its dimensions, the necessary improvements to raise the level of maturity of the ITIL Functions in UFGD, and it is possible to point out the following actions as initial steps to increase the institutional indicators.

➢ Elaboration of a plan of actions to increase maturity in each of the Functions analyzed.
➢ Defining a responsible manager for each of the functions, and prior training is required to coordinate the alignment process with the principles of the ITIL model.
➢ Modeling the processes for each function seeking to integrate the functions that are related.

➢ Establish a communication plan between functions and processes within the IT department.
➢ Train the IT involved servers about the ITIL library
➢ Periodic valuation and investment in sectors that demonstrate lower maturity.

The organization of the ITIL functions seeks to align the technical teams, providing greater control and ensuring that IT is able to provide the necessary support for business processes, making the most of available IT resources and minimizing the costs involved

6.1 Resources and Capabilities

Understanding the importance of adopting good practices presented in the theoretical framework, the research seeks now to diagnose the current condition of the technical staff available at the UFGD, seeking to identify opportunities for improvement considering the resources and capacities currently available.

6.1.1 Academic formation

With regard to academic training, as the profile defined by the research takes into account the performance in IT, it is expected a greater number of graduates in courses such as Computer Science, Information Systems or courses aligned to this area.

This scenario is confirmed in the UFGD, in the analyzed frame 30.8% are graduated in Computer Science, another 20.5% are trained in Systems Analysis and 15.4 in Information Systems. At the same time, it is possible to observe the occurrence of graduates in other areas that have no relation with TI. It was possible to find 1 Administrator, 2 graduates in Mathematics and 1 Pharmacy. In general, the academic profile of the staff meets the requirements of its area of operation, giving subsidies for the work being done.

6.1.2 Public tender and designation

As the research delimited its focus of action to the IT staff of UFGD, we sought to understand how the selection process of these was given. About 35.9% reported having tendered for Information Technology Analyst, this being a job position for higher education level with profile and attributions dedicated to IT with IT designation specified in the UFGD IT department.

Another part of the group, 25.6% reported having been hired as a Computer Laboratory Technician. Another 15.4% reported occupying the position of Information Technology Technician. In addition, it was possible to find other positions in IT activities, among them: Laboratory Technician of Mathematics 5.2%, Laboratory Technician Didactic Multimedia 2.6%, Technician of Laboratory of Geotechnology 2.6%, Assistant in Administration 2, 6% and Manager 2.6%.

6.1.3 Performance

Regarding the performance, it is observed that the section that concentrates the largest number of technicians is the IT department, with 48.9% of those interviewed said to work in this unit. As well a smaller number, about 38.6% work in an academic unit, and another 7.8% declared to work an administrative unit.

6.1.4 Training

When asked about the level of training, interviewees showed a disturbing picture. About 33.3% of the respondents stated that they had never received any training courses in the area of IT. Another 30.8% performed between 1 and 2 courses at the most, which would be too little considering the number of participants and the time in which they work in the UFGD. These two slices represent more than half of the technical staff who received little or no training for the activities they perform

To complete the data, about 5.1% reported having received between 2 and 3 courses and 30.8% received 3 or more. Although one-third of respondents report having received a significant level of training, this privileged share does not reduce the negative impact of the majority of UFGD's IT workforce having a low level of training.

6.1.5 Knowledge about IT Governance

Regarding knowledge about good practices in governance framework such as ITIL, 51.3% of respondents stated that they knew it superficially, but were not able to respond if any of the suggested practices were implemented. Another 33.3% stated that they knew absolutely nothing about governance frameworks.

To complete the picture, 10.3% stated to know a little about the frameworks, seeking to follow the recommendations they know. However, without formally instituted processes, the actions carried out are restricted to the scope of the work place. Along with these, another 5.1% declared to know the governance frameworks and works for their promotion within the institution.

6.1.6 Work Process

About 38.5% of the respondents stated that they had a defined workflow, where the activities were reported to the IT department and later assigned to them. As for the others, about 35.9% stated that they did not participate in any workflow, receiving the requests in various ways and meeting the demands according to the possibility. This condition portrays a reality in which there is no type of management, it is impossible to calculate the waste of the work force, as well as the negative view that the users have regarding the performance of the technicians.

For 20.5% the workflow was defined by the server itself, without the intervention of the IT department or other staff in the area, which shows a precarious performance, without any technical support.

6.1.7 Control Tools

Regarding control technologies to identify, classify or respond to requests, 56.4% answered using the tool provided by the IT department, OTRS (Open Ticket

Request System), even with some level of difficulty. Moreover, a total of 15.4% stated to make a satisfactory control of their activities with their own tools (e-mail and spreadsheets), however for 10.3% these tools have not met their needs. This condition reinforces the need to change the current process so that the tool used can contemplate the management of the activities of the staff, giving them the means to control their activities by improving the service provided.

VII. OVERVIEW OF THE WORKFORCE

According to the data presented in the previous sections, the UFGD has a technical staff capable of promoting the improvement in IT services without the need for large financial investments. According to the above, the institution does not adhere to ITIL library standards, while at the same time revealing an environment where actions do not form a well-defined pattern or process.

Fig. 4 represents the current flow that the requests follow. Clients do not have a defined communication channel. Instead of they may ask a unit technician to service without the intervention or knowledge of the IT department. Only in cases where the technician needs support or permission to perform the service, the IT department interacts with the request.

In general terms, what is observed is that the institution has the necessary conditions to implement a good management of IT services. As the research shows, the staff has adequate training and is present in adequate numbers. What the institution lacks is awareness of IT Service Management, a condition that was evident when analyzing the institutional maturity of the ITIL library. In this way, the work points to the model presented in **Fig. 5** as a suggestion to change the current process so that it is able to adhere, even if in a primary form, to good ITIL practices, taking advantage of the available structure and resources.

Considering the experience brought by the ITIL library and the observation of the process established in the UFGD, it is clear that the Client is the agent responsible for initiating the request, being the only one able to attest its compliance.

As recommended in the ITIL library, a request can be made from a variety of means of communication, being available in these phases, the currently available call system (OTRS), the sending of an e-mail message or a telephone call. With these resources, the client is able to inform the need for a service, reporting the problem and the current need. The Client's performance model in the presented proposal is exemplified in **Fig 3**.
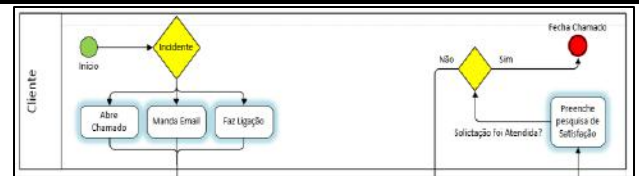

Fig.3: Customer Service at the Service Desk (The Author)

With the possibility of opening an order, the customer also interacts in the closing process, responding to a satisfaction survey and informing the level of quality of the service received. The level of satisfaction should serve as a parameter to evaluate service delivery, and it is possible to reinsert the call in the service process if the user deems it necessary.
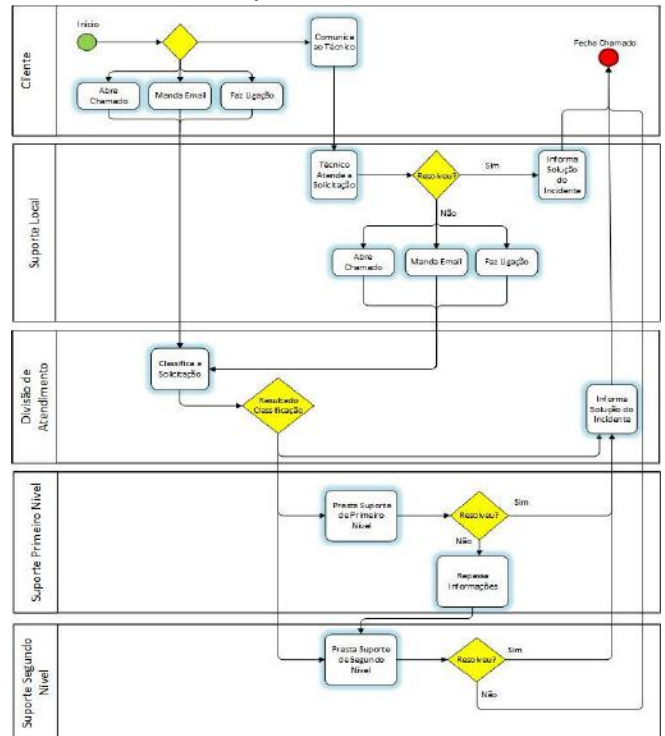

Fig.4: Current IT Service Process of UFGD (O Author)

The constant assessment of the quality of calls serves as feedback on the work of the Service Desk team, serving to evaluate the process instituted and possible improvements that can be applied.
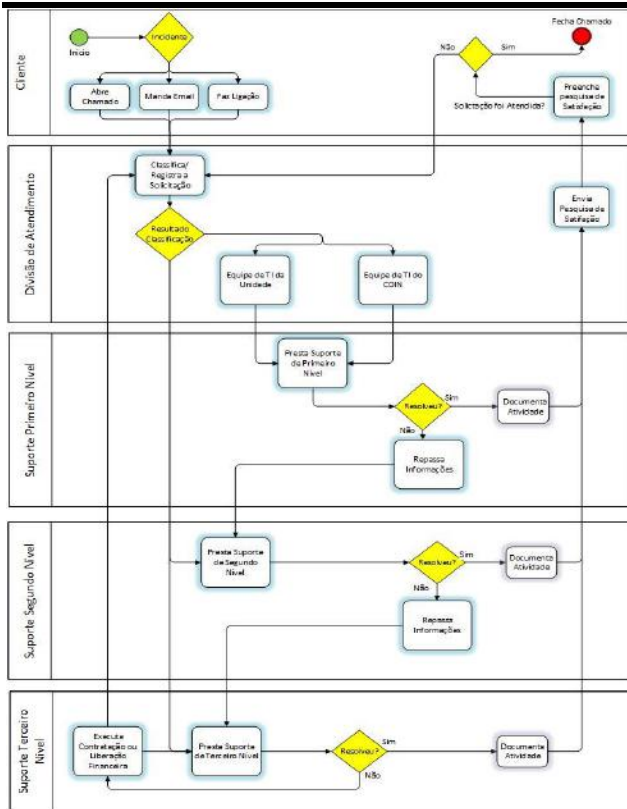
Fig. 5: Proposed Service Process of the Service Center of the UFGD (O Author).

7.1.1   Customer Service Division – DAU

As part of the organization chart of the IT department and having among its duties the receipt, scheduling and fulfillment of requests, the DAU is responsible for classifying the demands received. It is able to identify the specifics of each call and assign to the team better trained. As the teams are distributed according to their focus of action, DAU concentrates a portion of the workforce responsible for performing first-level calls. In the process presented, this responsibility is shared with the technicians designated in other units, and this division is responsible for the classification and scheduling of the team responsible for the service, whether internal to the IT department or the unit responsible for the demand received. The layout of the Division and its functions are shown in **Fig. 6**.
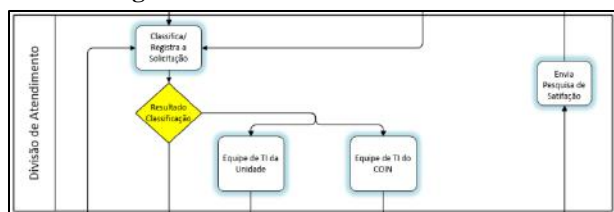

Fig. 6: Customer Service Division (O Author)

In this context of the process, it performs the classification of the demands and the follow-up of the phases of attendance of the call. When it is in the final process, it must pass through the division so that it is sent to the survey of user satisfaction.

7.1.2   First LevelSupport

First level support generally refers to simpler requests that require less technical knowledge or that are already part of the knowledge acquired by the team during the attendance of similar requests that occurred at other times.

First-level calls, although characterized by its low complexity, usually occurs in large numbers and at high frequency. This condition requires that the responsible team has a good number of servers and is able to meet the demands distributed by the organization. As the UFGD has a structure composed of several blocks, the service team at this level must be able to traverse the entire structure, being distributed in a way to optimize its scope of action. The arrangement of the activities of the First Level Support is shown in **Fig. 7**.
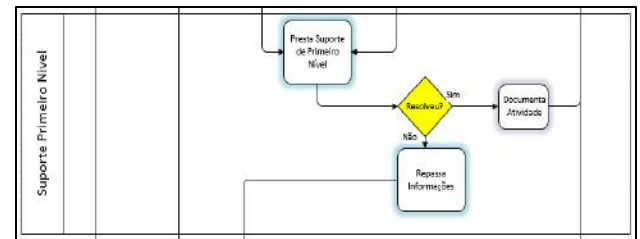

Fig. 7: First Level Support (O Author)

As a suggestion, the crowded team in the Customer Service Division and First Level Support can organize service islands where trained teams would be responsible for requests that were geographically closer. This arrangement assists in the distribution of demands and the agility of answer. The organization model, together with the standard defined by the service process, must be able to establish first level support without major difficulties throughout the institution.

Remembering that this proposal considers the resources available in the institution, the good practices defined in ITIL and improvement of the current process, however there may be factors that are not included in this context and that should be discussed if the proposal is implemented.

7.1.3   Second Level Support

Second-level Support is responsible for solving problems that have no known solution, in addition to carrying out activities that require a higher level of administrative rights.

The process currently instituted for this level of support, but does not provide any documentation guidelines. Another important factor is the relationship with the first level support, which must be improved by seeking to prioritize the execution of managerial functions and reducing their performance in problems whose solution is already known.

Because the changes suggested in the current Service Desk process involve significant changes, it is possible that second-level support is affected. The changes must prioritize the action in problem solving and favor the performance of the first level teams, giving them the necessary subsidies to carry out their activities. The arrangement of the activities of the Second Level Support is shown in **Fig. 8**.
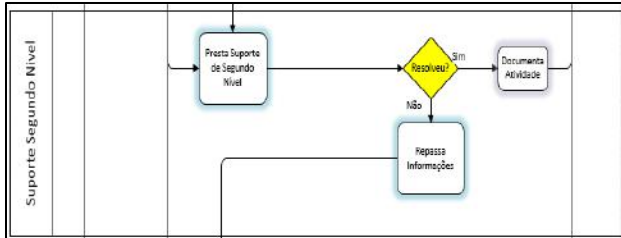

Fig. 8: Second Level Support (O Author)

7.1.4 ThirdLevelSupport

Third-level support is not predicted for in the current process. In the proposal presented it comes into existence, being responsible for receiving all the demands that have already passed the first and second level of support.

Usually requests that reach this level are those that require some sort of financial investment or acquisition, so that beyond the operational scope of the Service Desk performance. The third level is responsible for resolving non-technical issues that prevent the progress of solving the demand received. In general, its participation in the process is quite simple, having its attributions arranged in **Fig. 9**.
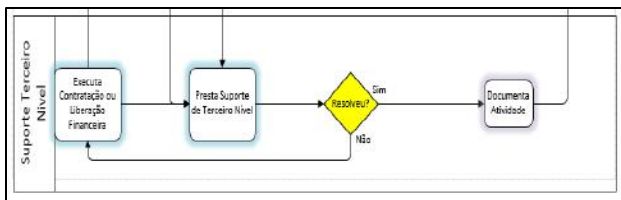

Fig. 9: Third Level Support (O Author)

VIII. CONCLUSIONS

This work aimed to analyze the application of IT Service Management focused on the ITIL library at the Federal University of Grande Dourados. The two main IT governance frameworks and their relationship with each other and Corporate Governance were presented and analyzed.

Understanding the theoretical aspect of the integration between IT and Governance, it was tried to present the importance of the management of IT services and the possible impacts that the lack of this initiative causes to the organization, together with this it was tried to understand how it is possible to classify the maturity of an institution in this respect. In order to do this, the evaluation methods were considered institutional maturity

with reference to the ITIL library and its PMF evaluation framework.

Thus, in view of the low levels of maturity identified during the research, a proposal is proposed that alters the existing process in the IT Service Operation of UFGD. This proposal considers the available resources and good practices of the ITIL model that are applicable in the current institutional context. The model emphasizes the importance of the participation of the IT workforce of the academic and administrative units of the UFGD, emphasizing the integration of these servers to the process proposed in this work.

Alongside this, the factors that may influence the success of the proposal are explicit, emphasizing the need for the participation of the senior management in the change process, the collaboration of the employees that act in IT in the formulation of the work process and improvement of the methods to the alignment of the proposal presented with the institutional principles, since they must influence the path taken by IT as a whole.

In addition, the work presented the level of institutional maturity, exposing a condition in which the UFGD urgently needs to invest in training of its work force, in order to begin the adoption of good practices that the ITIL model defines. The UFGD has sufficient human and technological resources to initiate the alignment of the work process in order to increase its maturity level and promote the constant search for improvement of the process.

By the maturity analysis, it was possible to identify the factors that have a negative impact on each of the analyzed functions. Given this information, it is important that the UFGD is sensitive to defining practical actions that are capable of improving the conditions of the IT environment pointed out in the research.

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