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Innovation in Information Technology Services: Framework to Improve the Effectiveness and Efficiency of Information Technology Service Management Processes, Projects and Decision Support Management

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***Abstract*—**In a dynamic market of Information Technology (IT) Service and with high quality demands and high performance requirements in decreasing costs, it is imperative that IT companies invest organizational effort in order to increase the effectiveness of their Information Technology Service Management (ITSM) processes through the improvement of ITSM project management and through solid support to the strategic decision-making process of IT directors. In this article, the author presents an analysis of common issues of IT companies around the world, with strategic needs of information unmet that provoke their ITSM processes and projects management that do not achieve the effectiveness and efficiency expected of their results. In response to the issues raised, the author proposes a framework consisting of an innovative theoretical framework model of ITSM management and a technological solution aligned to the Information Technology Infrastructure Library (ITIL) good practices guidance and ISO/IEC 20000-1 requirements. The article describes a research that proves the proposed framework is able to integrate, manage and coordinate in a holistic way, measurable and auditable, all ITSM processes and projects of IT organization and utilize the effectiveness assessment achieved for their strategic decision-making process increasing the process maturity level and improving the capacity of an efficient management.

***Keywords*—**Innovation in IT services, ITSM processes, ITIL and ISO/IEC 20000-1, IT service management, IT service excellence.

I. Introduction

THE ITSM is the group of skills and capabilities that IT organizations utilize to assure quality, effectiveness and efficiency in the services provided to their clients. IT organizations are available to deliver more value as they increase the level of process maturity [2] through the improvement of these three factors. However, this creates a complex scenario and customers' demands for better results in the efficiency and effectiveness of ITSM. Therefore, as the IT service providers expand their size and scope, the greater the difficulty to manage the IT delivery services in an effective and efficient way which jeopardizes the quality and value supplied to its customers.

The main subjects of the article are the IT Services, the ITSM [10] Processes, the good practices for ITSM [10] activities provided by ITIL [6] and ISO/IEC 20000-1 [11], and an analysis of the improvement opportunities in the decision-making process [8], [15], and effectiveness assessment and management performance of ITSM [10] process of IT service companies through a new framework to manage processes and projects of the ITSM system.

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II. IT Service Companies' ITSM [10] Common Issues

The top 20 IT service companies in the world share characteristics of size, international scope and customer types. The capability to deliver high quality and value results is directly linked to the organizational capability to manage their ITSM [10] processes. Based in the high volume of services within the public catalogues [13] of top IT companies, the high amount of human capital and the amount of customers (+100 big local and international clients); the IT organizations must face a complex scenario in process and project structures and customers' demands in deadlines and quality [9].

Therefore, the common issue observed in IT companies is the low organizational capability to manage their ITSM [10] processes and projects in an efficient and effective way which results in a low level of Process Maturity [2]. IT organizations must increase their process maturity level through the improvement of ITSM [10] project management [17] with focus on the business strategy, not only the operation processes but in regard to a holistic view of all ITSM [10] activities. In consequence, it is observed that the majority of complex IT companies do not prioritize the integration of all processes and projects as a business strategy, nor as a powerful tool to increase the value delivered to their customers. This problem is fed by the lack of technological solutions [16] capable to support integration, management and coordination of information in a measurable and auditable way, in order to support the ITSM [10] decision-making process [1]. The article describes how IT service companies can reach a Level 4 of the Process Maturity Level [2] <ITIL Maturity Model: level 0 (chaos), level 1 (initial), level 2 (repeatable), level 3 (defined), level 4 (managed), level 5 (optimized)> if they improve their capability of an effective and efficient management through a new framework and a

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technological solution [16] capable to manage, integrate and coordinate information in a holistic way, measurable and auditable of all ITSM [10] processes and projects, and also use this to support ITSM [10] strategic decisions [8], [15].

A. Rationale: Strategic Needs and Objective

The baseline defined in the article is the fact that most IT organizations do not achieve their efficiency and effective goals established for ITSM [10] project management [17] because of non-satisfied strategic needs of information and a lack of a technological solution [16] standards, reusable, scalable and robust to proactively support the IT direction in the decision-making process [8], [15]. The common IT strategic needs observed can be grouped in four categories:

Strategic IT data needs: Strategic IT data must be available in real time and through a dynamic behavior integrated with ITSM [10] processes and projects. Most IT companies that do not have the infrastructure necessary to centralize the required information for different work teams and process leaders within the organization, and present problems to achieve the performance and quality agreed [9] with their clients. ITSM [10] data groups are composed of processes data (compliance controls of ISO/IEC 20000-1 [11]), project data (resources to accomplish ISO/IEC 20000-1 [11] controls), roles and responsibilities data (with a defined measurable system for effectiveness) and balance scorecard data for ITSM [10] decision support.

Framework needs: In order to achieve an integrated management of ITSM [10] processes and ITSM [10] projects it is necessary to have a single framework that allows the organizations identify the relationship among the SMS components, the activities to achieve the SMS goals and the information workflow expected during the management of ITSM [10] processes.

Training support information needs: it is important for a complex organization with high HR rotation to establish a defined training support system for ITSM [10] process leaders to grow the knowledge base.

ITSM [10] indicators and metrics needs: The needs described before can be summarized in a single group of strategic data based in indicators and metrics that support in real time [7] ITSM [10] decision making process to IT companies directors [8], [15] regarding process management, project management [17], business IT risk management and ISO/IEC 20000-1 requirements [11].

From the strategic needs described, the main objective pursued by the author is to define a framework (ITSM [10] model) and a baseline for a technological solution [16] (SMS tool) to help IT companies with complex ITSM [10] scenario in adhere to ITIL good practices and ISO/IEC 20000-1 requirements; and improve their capability to integrate, manage and coordinate in a holistic way, measurable and auditable, all ITSM [10] processes and ITSM [10] projects with a standardization of the effectiveness assessment for the strategic decision [8], [15] making in order to achieve a level four of maturity [2] with direct impact in the current capacity of efficient and effective management.

III. ITSM [10] Framework

IT companies not certified in ISO/IEC 20000-1 [11] or with a low maturity level [2] of ITSM [10] process management, must align and coordinate their organizational effort to the international standards requirements. This demand creates strategic needs of information for the improvement of the IT service. The strategic information is based in a group of ITSM [10] components with integrated, dynamic, centralized and availability characteristics; an ITSM [10] project management [17] methodology; the capacity to support the training to ITSM [10] processes leaders and the ability to obtain indicators and metrics in real time to support decision making process to decrease the risk in project and delivery of IT services.

In this article, we present an ITSM [10] framework that reconfigures the implementation procedure of the SMS into IT companies, changing the focus from technical and operative aspects to a focus in a holistic management of processes [3], achieving results as an integrated package and not only based in individual efforts. The framework is based in two information sources: the SMS Policy which defines the strategy and the SMS Tool which integrates all ITSM [10] necessary data.

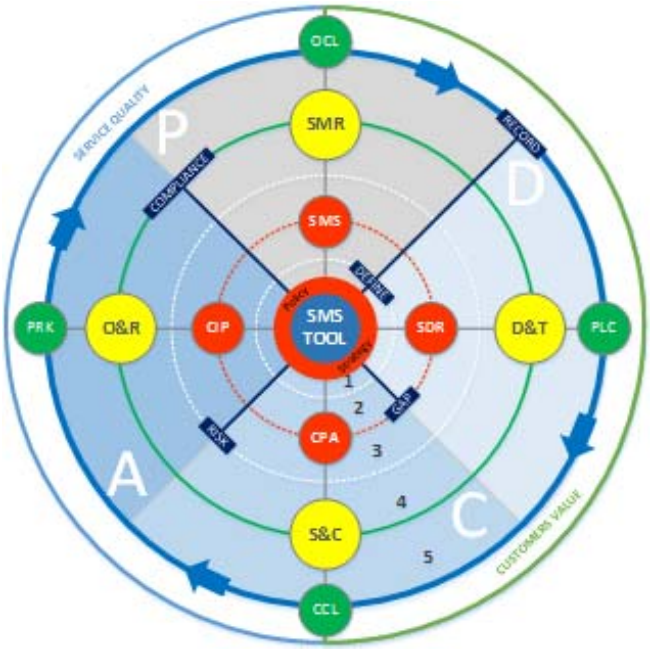


Fig. 1 ITSM [10] Framework

It is established by ITSM [10] Activities that create an interrelationship with the Process Maturity Level achieved during the lifecycle of the ITSM [10] processes and projects. It is formed by Maturity Layers in compliance with the Process Maturity Level [2] where each layer contains the interaction with its components and activities. The framework is based in the PDCA model where each stage defined contains a sub-model of interaction among components, activities and layers in relation with the lifecycle of the ITSM [10] processes and projects.

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The framework presented in the article is an iterative model [3], where all the components and activities are linked during the lifecycle of the ITSM [10] process or ITSM [10] projects in the evolution through the defined layers and the PDCA stages. At the last layer, the framework establishes the Quality of Service and the Value to Clients generated by all components and activities as a final product of interaction and relationship during the lower layers and the PDCA stages.

The main objective of the framework is based in the principles of CSI which allows the organizations a better management of service continuous improvement assessing the current needs of improvement and executing actions to improve in an iterative process, the effectiveness and efficiency of the value to the customers through an improved service delivery and quality excellence [9]. Fig. 1 presents the ITSM [10] Framework with all the components defined.

A. Policy, Strategy and Components of the ITSM [10] Framework

At the center of the framework is the Technological solution [16] (SMS Tool) as the data source that satisfied the strategic needs of information defined. The SMS Tool is limited by the SMS Policy and the Strategy of each IT company. Both, the Policy and Strategy define the focus of the organization to the quality, the service and customer satisfaction over the technical and operational issues.

Fig. 2 presents all the ITSM [10] framework components (Instruments, Teams and Success Metrics).

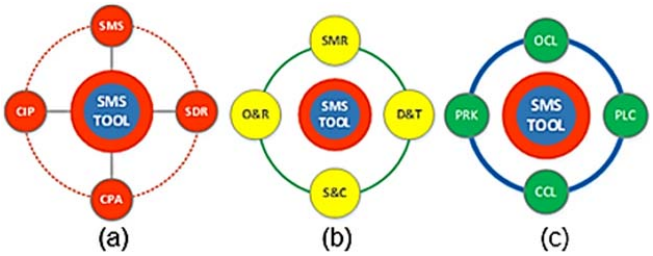


Fig. 2 (a) Instruments of the ITSM [10] Framework, (b) ITSM [10] Teams, (c) Success Metrics of the ITSM [10] Framework

The red circles placed in the middle of the framework are the Instruments used in the lifecycle of ITSM [10] processes and projects delivery teams. These instruments are four (SMS, SDR, CPA and CIP) and they correspond to the basic requirements for a Level 2 of Maturity. The SMS (Service Management System) is the unique point of access to all processes, procedures, activities and roles definitions. The SMS is the instrument that makes the documents available to all the organization. The SDR (Service Delivery Review) is the space of the service review through indicators and metrics presented to all organization stakeholders to assess the service efficiency and effectiveness and the opportunities of improvement. The CPA (Corrective and Preventive Actions) are the registered corrective and preventive actions to solve any issues in the service delivered. The CIP (Continual Improvement Plans) are the detailed steps to solve the actions identified.

The yellow circles placed between the center and the exterior limit of the framework represent all the roles and responsibilities in the IT organization grouped in four categories based in the functions, scope and goals. These components are the ITSM [10] Teams and are strategically grouped to maximize the relationship and cooperation and improve synergy between them. The SMR (SMS Representatives) is the team of ITSM [10] directors, service managers, project managers and quality managers. Its purpose is to compliance to the requirements of the clause 4 of ISO/IEC 20000 [11] establishing, controlling, managing and communicating the SMS to the organization. The D&T (Design and Transition) is formed by the process leaders with focus in the design and transition of service. Its purpose is to compliance to the requirements of clause 5 and sub-clauses 6.4, 6.5 and 7.2 of ISO/IEC 20000-1 [11]. The leaders in the D&T are related to the service transition, finance management, capacity management and supplier management. The S&C (Support and Control) groups the process leaders in charge of the activities of support and control of the SMS. Its objective is compliance clauses 6.1, 6.2, 6.3 6.6 and 7.1 of the standard and its leaders are related to service level management, report services, continuity and availability management, information security [12] and business relationship management. The O&R (Operation and Resolution) is the last team defined and it is formed by ITSM [10] specialists in incident and service request management, problem management, configuration management, change management and release management. The O&R team is focus to operation activities with purpose of compliance the requirements of sub-clauses 8.1, 8.2, 9.1, 9.2 y 9.3.

The green circles placed at the top of the framework represent the main indicators and metrics of the ITSM [10] Framework and they are the success criteria based in the effectiveness and efficiency degree achieved in each stage of the PDCA model. The Success Metrics are grouped in four categories. The OCL (Organization Compliance Level) is an indicator defined by the compliance degree of all the organization regarding the ISO/IEC 20000-1 [11] controls, controls evidence, components tasks and general status of the standard. The indicator provides a general status of the ITSM [10] organizational health. The PLC (Process Leads Compliance) is the indicator that defines the compliance degree of all process leaders regarding the compliance goals of the ISO/IEC 20000-1 clauses [11]. The metric provides a general status of the effectiveness and efficiency of each role regarding its functions. The CCL (Control Compliance Level) defines the compliance degree of each ISO/IEC 20000-1 [11] specific requirements.

The indicator provides the general status of the evidence compliance and it help to calculate the CLS (Compliance Level Status) by the average of all partial results. The PRK (Project Risk) is the indicator that defines the actual risk of the ITSM [10] project. For this framework, an ITSM [10] project is a group of activities in a defined time in relation to the ITSM [10] goals with limited resources and success objectives defined and documented. Among the ITSM [10] projects are

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the internal and external audits of the SMS, ITSM [10] compliances assessment for one team or client, service migrations, new services, changes in the service delivered, service decommission, ISO/IEC 20000-1 [11] certification and maintenance; and continuous improvement projects.

B. Activities and Stages, Maturity Levels and Layers of the ITSM [10] Framework

The activities and stages defined in the framework act as an interface between the components through the lifecycle of the ITSM [10] projects and processes. The stages are funded in the PDCA model and define the project or process lifecycle with specific activities to plan, do, check and act, while results are collected from the compliance indicators, the corrective and preventive actions from the service review and the action plans of SMS improvement. The activities are grouped in five categories that include Definition, Applicability Analysis, Risk Assessment, Compliance management and Improvement Record distributed in the stages.

The Define activity represents the lowest level of maturity and its objective is to define timelines, scope, roles, responsibilities and all the objectives of the projects and processes of the ITSM [10]. The GAP activity (Applicability Analysis) represents a level 2 of maturity and it is oriented to the scope analysis and the projects resources. The result of this activity are documented success criteria for the ITSM [10] processes. The Risk activity represents a level 3 of maturity and is based in the calculation of ITSM [10] project risk through the PRK indicators presented before. The Compliance activity is oriented to the gathering of evidences and the execution of service review, identification of corrective and preventive actions, and definition of improvement plans. These activities represent a level 4 of maturity and include calculation of effectiveness and efficiency indicators and results communication. The Record activity is the focus to the recording of the service improvements and represents the highest level of maturity and summarizes all the interactions and relationships among the previous stages. This activity is in direct contact with the final assessment of service quality and the value to the customers.

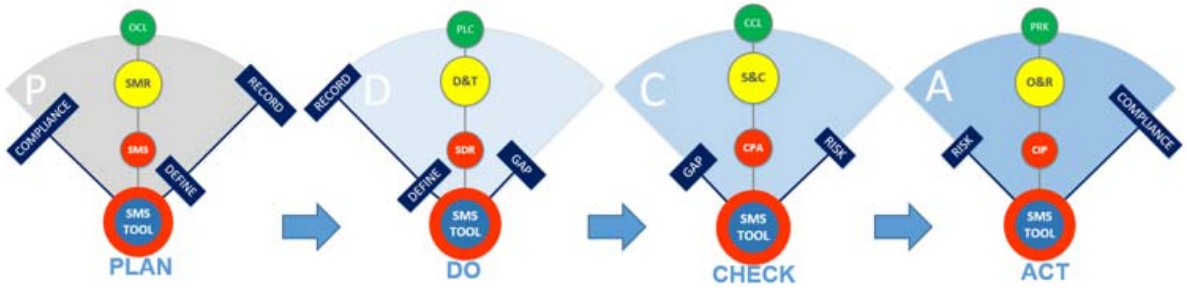


Fig. 3 Instruments of the ITSM [10] Framework

Fig. 3 presents all the activities during the four PDCA stages aligned with the PDCA model in ISO/IEC 20000-1 [11]. The PLAN stage involves the ITSM [10] SMR team, responsible for the management, definition, documentation and review of the SMS. During this first stage are executed the tasks of initial definition, compliance assessment and improvement record. The success criteria of this stage are defined by the OCL indicator. During the DO stage, the ITSM [10] D&T team is involved. This team is responsible for the execution of the plans of the previous stage through the design and transition service. This stage utilizes the SDR instrument to execute activities of definition validation, analysis and record consulting. The success criteria of the DO stage are based in the PLC indicator. The CHECK stage involves the ITSM [10] S&C team who is responsible for the review of the design and transition activities and the control of the operational activities. During this stage, preventive and corrective actions are identified to execute validation tasks from the GAP and RSK activities. The success criteria of this stage are defined by the CCL indicator. The last stage is ACT. During the ACT activity, the ITSM [10] O&R is involved and is responsible for the operations activities and service delivery. This stage results are the assessment of effectiveness of the improvement plans through project risk alerts and compliance of the standard requirements. The success criteria of the stage are defined by the PRK indicator.

The Maturity Layers of the ITSM [10] framework are based in the five Maturity Levels [2] of ITIL [6] good practices. These layers represent the maturity of the framework components in a specific stage during the lifecycle in an ITSM [10] project. The maturity layers are named as the maturity levels [2]: 1-initial, 2-defined, 3-managed and 4-optimized. Each layer is divided by the activities related. The red layer defines the interaction level of the ITSM [10] instrument. The white layer defines the intermediate status of maturity or transition. The green layer defines the level of interaction of the ITSM [10] teams. The blue layer defines the level of interaction of the ITSM [10] success criteria through the defined indicators.

C. ITSM [10] Framework Continuous Improvement: Quality and Value

The last element of the ITSM [10] Framework is the highest degree of effectiveness and efficiency expressed in two concepts linked to the IT companies' strategies. The end service quality and the value delivered to the customers are the components that establish the external limit of the framework and the objective is to accomplish the execution to all tasks,

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activities and relationship among all framework components. The service quality and customer value define the service continuous improvements and act as a support and validation to the maturity level [2] achieved by the organization.

IV. SMS Technological Solution Workflow

The technological solution [16] defined for the ITSM [10] framework is oriented to execute the activities and stages defined to manage all the lifecycle of an ITSM [10] project and manage ITSM [10] processes through the components, activities and ITSM [10] maturity layers. Fig. 3 presents the workflow of the SMS Tool in relation to ITSM [10] projects and the compliance control for ISO/IEC 20000-1 [11] requirements for ITSM [10] processes. The workflow adjusts to the PDCA model and all the components of the proposed ITSM [10] Framework.

V. Verification of the Framework

For the verification of the framework the author presents an analysis of IT companies performance before and after the implementation of the ITSM [10] Framework proposed. Table I presents the definition of the investigation variables used to validate the framework and Table II presents the investigation sampling details.

TABLE I
Verification Variables

Variable	Description	Success Value	Fail Value
ML	Total Maturity Level of the Organization	L4	L2
OCL	Organizational Compliance Level	>=90%	<70%
OCLT	Organizational Compliance Level Trend	Positive	Negative
CLS(X)	Compliance Level Status of Clauses. Clauses X = {4;5;6;7;8;9}	>=90%	<70%
CCL(X.Y)	Compliance Level Status of Sub-Clauses from Clauses X.	>=90%	<70%
PLC(Z)	Process Leads Compliance. Teams Z = {SMR; D&T; S&C; O&R}	>=90%	<70%
PRK	Total Project Risk	LOW	MEDIUM
Audit LVL	ISO/IEC 20000 audit level achieved	>=4	<=3
ML(N)	Maturity Level of Sub-Clauses. N = {4;5; 6.1; 6.2; 6.3; 6.4; 6.5; 6.6; 7.1; 7.2; 8.1; 8.2; 9.1; 9.2; 9.3}	>=4	<=3
Audit FGP	Audit Finding: Good Practice	>=1	0
Audit FOP	Audit Finding: Opportunity of Improvement	<=5	>5
Audit FOB	Audit Finding: Observation	<=5	>5
Audit FNC	Audit Finding: Non-Conformity	<=5	>5
Audit FCC	Audit Finding: Critical Non-Conformity	0	1

With the definition of verification variables and verification sampling, the author collected and analyzed input data from the scenarios before and after the implementation of the ITSM [10] Framework; and regarding the high amount of data results and because of the purpose of this article, it is only presented as the final average results and data comparison from both scenarios to review the framework performance. Table III presents the average results of the maturity assessment by process of the Historical Data Sampling (HA: Historical Audits), and the Experimental Data Sampling (VA: Verification Audit). Table IV presents the average results of all good practices, opportunities of improvements, observations and non-conformance found for both audits processes (HA and VA). The graphical comparison between both average results is presented in Figs. 4 and 5. The final average result of the verification assessment is defined by the variables Audit LVL (Assessment Level Achieved) and ML (Maturity Level Achieved). Table V presents the final average results for both audit processes (HA and VA) with a solid evidence of improvement from a non-successful scenario in HA to a successful scenario in VA.

TABLE II
Verification Variables

Sampling	Variables	Scope	Period
Historical Data Sampling: Data of the process maturity before the implementation of the ITSM [10] Framework.	ISO/IEC 20000-1 audit results and reports.	5 global IT companies assessed in 10 top customers.	6 months before the implementation of the Framewor.
Experimental Data Sampling: Data of the process maturity after the implementation of the ITSM [10] Framework.	Described in Table I	5 global IT companies assessed in 10 top customers.	30 days after the implementation of the Framework

TABLE III
Process Maturity Assessment (HA versus VA)

Variable	Process	HA	VA
ML(4)	SMS General Requirements	2.2	4.2
ML(5)	Design and Transitioning of Services	2.4	3.8
ML(6.1)	Service Level Management	3.3	4
ML(6.2)	Service Reporting	2.8	4
ML(6.3)	Service Continuity and Availability Management	2.8	4
ML(6.4)	Budgeting and Accounting for Services	3.3	4
ML(6.5)	Capacity Management	2.9	4
ML(6.6)	Information Security Management [12]	2.7	4.3
ML(7.1)	Business Relationship Management	2.0	4
ML(7.2)	Supplier Management	3.0	4
ML(8.1)	Incident and Service Request Management	3.5	4
ML(8.2)	Problem Management	2.0	4.3
ML(9.1)	Configuration Management	3.1	4.5
ML(9.2)	Change Management	3.5	4
ML(9.3)	Release and Deployment Management	2.7	3.8
	AVERAGE	2.81	4.06

TABLE IV
Findings Summary (HA versus VA)

Variable	Description	HA	VA	Goal
Audit FGP	Good Practices	1	10	>=1
Audit FOP	Opportunities of Improvement	6	4	<=5
Audit FOB	Observations	6	2	<=5
Audit FNC	Non-Conformance	8	1	<=5
Audit FCC	Critical Non-Conformance	2	0	0

TABLE V
Results Comparison (HA versus VA)

Audit LVL (Historical Audit)	Audit LVL (Verification Audit)
2	4
2	4

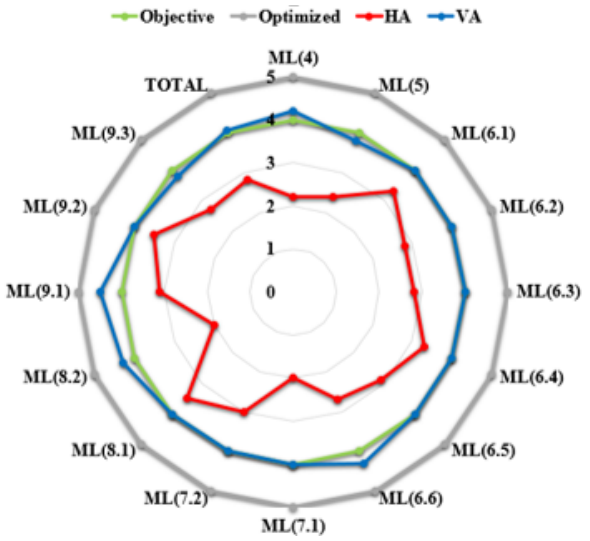


Fig. 4 Process Maturity Level (HA versus VA)

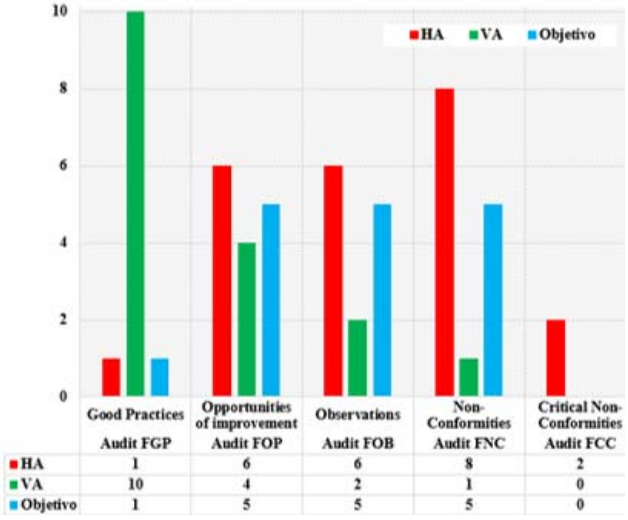


Fig. 5 Findings Summary (HA versus VA)

A. ITSM [10] Framework Implementation Results

The experimental activities and analysis of results in scenarios where IT companies do not implement a formal ITSM [10] Framework versus the scenario where these IT companies implement a formal model to manage ITSM [10] processes show the major improvement the organization can achieve in their IT service delivery quality, value to customer, effectiveness and efficiency. Figs. 6-9 evidence the improvement registered after the experimental activities and the verification of the ITSM [10] Framework hypothesis.

VI. Conclusions

The group of IT companies sampled for the verification of the proposed Framework present a meaningful case of the current issues in global IT organizations with complex structures regarding the objectives of IT process management to delivery of IT services with high quality [9] results and in compliance with international standards and customers' demands. The main and evident conclusion is the result of the verification activities that prove in a tangible, measurable, auditable and verifiable way, the improvement of the Maturity Level of Processes [2] (from level 2 to level 4), the improvement of the capabilities of effective and efficiency management through a theoretical model and a technological solution [16] focus in the integration, management and coordination of all the ITSM [10] processes and project of complex IT companies in order to obtain significant improvement in the strategic decision [8], [15] making process. Therefore, the hypothesis and objective of the article is verified successfully [5]. Besides, it is observed an impact to the organizations through an increase of competitive advantage [18] based in the ITSM [10] framework with tangible benefits in relation to ITSM [10] project management [17] savings and the possibility to increase the organization management capability [14] and innovation capacity [4] regarding an improvement of the capabilities of the strategic decision [8], [15] making process as a competitive advantage [18], quality [9] and value improvement.

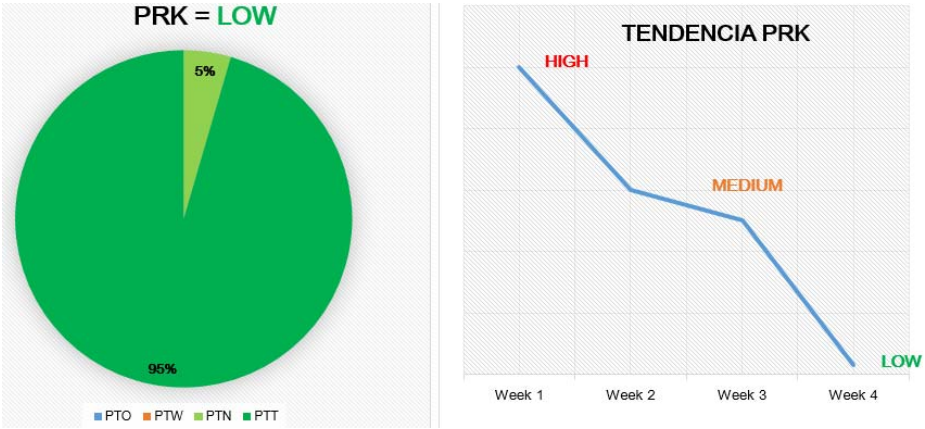


Fig. 6 ITSM [10] Project Risk Average and Risk Trend

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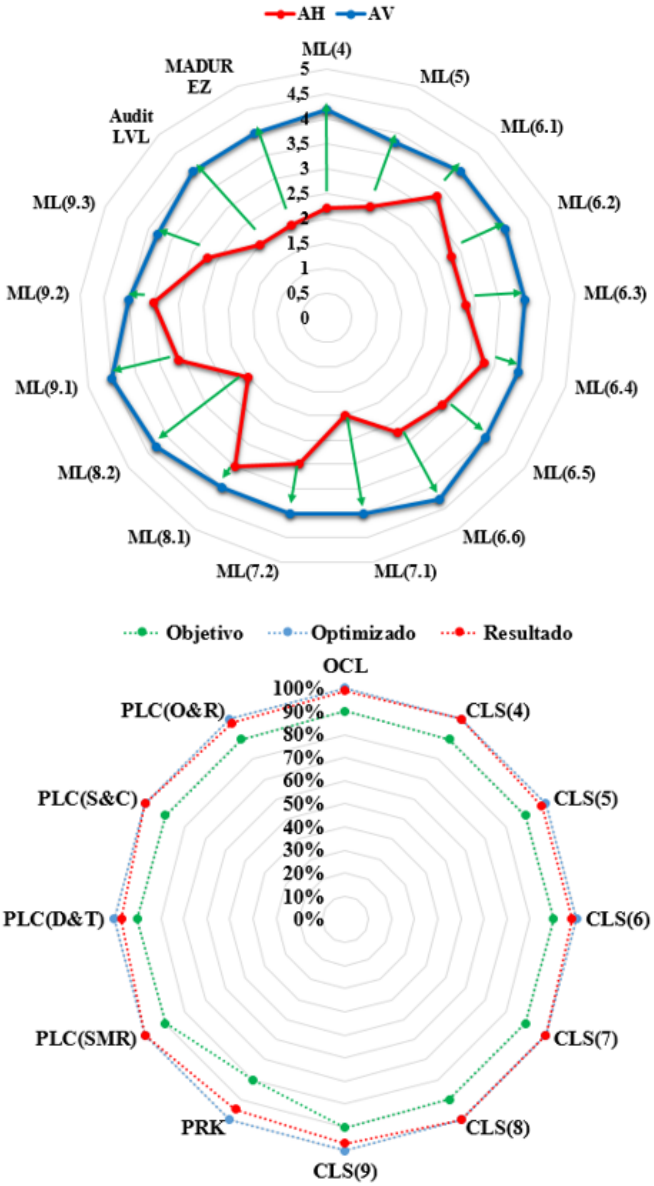
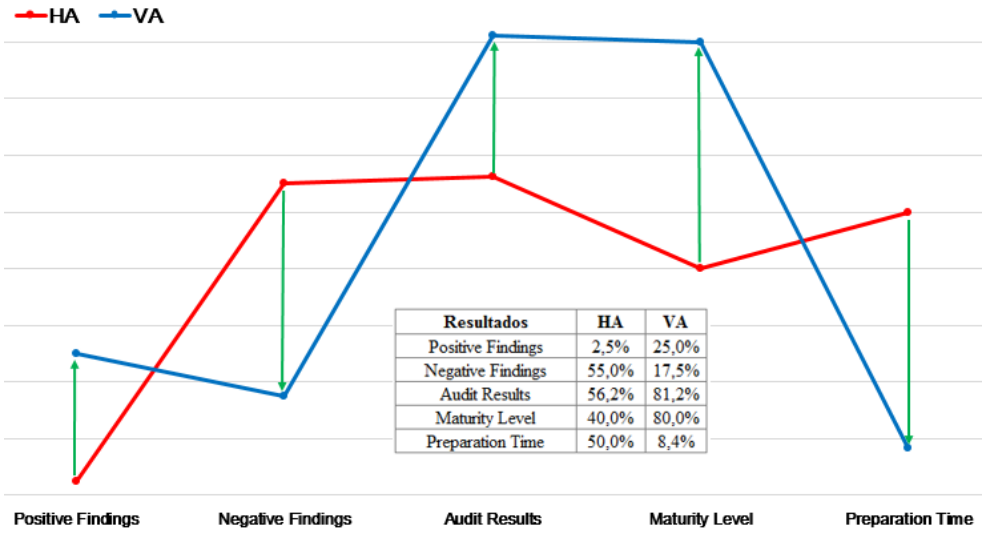


Fig. 7 Improvement in the Process Maturity Level



Fig. 8 Audit Process Improvements



Resultados	HA	VA
Positive Findings	2,5%	25,0%
Negative Findings	55,0%	17,5%
Audit Results	56,2%	81,2%
Maturity Level	40,0%	80,0%
Preparation Time	50,0%	8,4%

Fig. 9 Improvement of the ITSM [10] Effectiveness and Efficiency

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