

# SINIS-LA Method for IT Alignment Considering Service Level Management

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## ABSTRACT

**Background:** Organizations have to align a wide variety of organizational goals and strategies to achieve business goals, growth, and survive. In addition to ensuring the alignment between strategies in place and indicators with business goals, IT service organizations must keep the quality of service by fulfilling Service Level Agreements (SLA) sealed with their clients. **Objective:** We present SINIS-LA, which supports elicitation, alignment, and monitoring of business goals, indicators, and strategies focused on controlling SLA of the IT services provided. **Method:** We created SINIS-LA by applying Design Science Research (DSR). **Results:** SINIS-LA was used by the IT service management team at an IT service organization. By using SINIS-LA the team achieved IT alignment and monitored it. SINIS-LA was considered applicable for identifying, reviewing, and monitoring service goals, strategies, indicators, and related SLA. **Conclusion:** The results showed evidence that SINIS-LA supports the definition and monitoring of the alignment of goals, strategies, indicators, and SLA in an IT service organization.

## CCS CONCEPTS

• **Applied computing** → **IT governance; Business-IT alignment; • General and reference** → **Measurement; Metrics.**

## KEYWORDS

IT Services, SINIS, Measurement, Indicators, QOM+Strategies

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## 1 INTRODUCTION

Seeking organizational survival and growth, organizations must align a wide variety of goals and strategies to achieve their business goals. The alignment helps all parts of the organization move in the same direction, promising numerous benefits, such as the effective use of resources and concentration of efforts on actions that interest and support the business [7]. In addition to ensuring the alignment of strategies and indicators with business goals, organizations that provide IT (Information Technology) services must comply with the service levels agreed with customers. We can understand an IT service as delivering a specific value from a supplier to a customer. The Service Level Agreement (SLA) exists to seal the agreement between the service provider and its customer. Thus, in addition to describing the service that the provider will deliver, the SLA documents the expected level of service and the responsibilities of both parties involved [1]. If the IT service contracts are not written adequately, the organization will suffer. It is not surprising that the appropriate writing of SLA get considerable attention both in the academy and among practitioners [13]. Many times, organizations neglect the need for SLA indicators, even if they exist, and require monitoring. After SLA negotiation phase, monitoring allows to follow up its performance and guarantee that the service complies with the agreed SLA [22].

Continuous process evaluation and improvement help to raise IT awareness of supporting the achievement of business goals. However, there is still little practical guidance for organizations on how to do this [18]. The IT-business alignment is a broad and complex phenomenon, which has been explored by the literature in partial approaches, focusing on specific aspects, and lacking operational tools for its implementation [2]. In addition to being aligned with the business, IT also needs to monitor the sealed agreements with its customers. If monitoring is not continuous, even if the goals are strategically aligned, the effort to define appropriate goals may be lost in the dynamism of so many changes [6].

This paper presents the SINIS-LA (Select Indicators for IT Services and Service Level Agreements) method, an extension of the SINIS [24] method (and, consequently, the QOM+Strategies [7]). SINIS was designed to support the selection of IT service indicators in line with the organization's goals. In addition to explicitly considering the SLA that IT needs to comply with its customers, SINIS-LA also supports monitoring the strategies defined to achieve business

goals. The research method used to build SINIS-LA was Design Science Research (DSR) [15, 25]. We carried out interviews and employed an exploratory case study with industry practitioners to support the definition of SINIS-LA. After defining the method, we applied SINIS-LA in a large Brazilian public service provider. The results obtained showed that SINIS-LA met the described purposes.

After the introduction, the paper presents the theoretical framework (Section 2), the research method (Section 3), SINIS-LA (Section 4), the results obtained with the case study (Section 5), and, finally, the final considerations (Section 6).

## 2 BACKGROUND

### 2.1 Service Level Management

Defined as an ITIL's [1] area of expertise, the Service Level Management (SLM) negotiates, agrees, and documents appropriate IT service goals with the business and then monitors and reports on the delivery of the agreed service level. The SLM process aims to ensure that all operational services and performance are measured consistently across the IT organization and that the services meet customer expectations and needs. The leading information provided by the SLM process is the Service Level Agreement (SLA).

SLAs are sealed contracts between the service provider and their customer, defining the quality attributes of the service and the acceptance criteria for the service to be contracted. According to ISO/IEC [16], independently of the SLA defined between provider and customer, there are general service quality attributes such as: availability, capacity, performance, security, confidentiality, scalability, adaptability and portability. To evaluate and improve the service quality, the quality of the processes realized to providing services must be evaluated. An SLA should describe the IT service and service level goals, in addition to the roles and responsibilities of the parties involved. The following is an example of SLA: "The CONTRACTING PARTY must have the AVERAGE TIME OF ATTENDANCE less than 6 hours for CRITICAL category incidents opened by the CONTRACTOR". The contract must specify both the AVERAGE TIME OF SERVICE and the category of the CRITICAL incident.

Controlling the quality indicators enables the monitoring of SLAs. SLA management requires maturity of the organization and awareness of its benefit by its employees. According to Mirobi and Arockliam [19], periodic meetings can be used to monitor service levels and use indicators to discuss whether strategies are in line with goals. Setting the service level will be useless unless the organization collects the measures and monitors success. Measuring the service level determines the organization's ability to achieve its goals and identify the root cause of availability or performance problems.

### 2.2 IT-Business Alignment

A limitation of the area of knowledge about IT alignment with the business is that few practical studies support its implementation [2, 26]. The alignment between IT and the business exists when an organization's goals, strategies, and processes are in harmony and supported by information systems [3]. The success of the strategic alignment depends on adequately implementing the strategic plans.

However, besides communication challenges, the dynamism inherent to the business environment can lead to misalignment, with incompatible business goals and IT strategies [4].

Some methods associated with IT alignment influenced the construction of SINIS-LA: Control Objectives for Information and Related Technologies (COBIT), GQM+Strategies, and SINIS (Selection of IT Service Indicators).

The Cobit Goals Cascade [17] includes a mechanism to derive the company's goals into IT goals and facilitating goals, which must be specific, actionable, and personalized. Derivation allows you to define and align particular goals at each level of the organization. COBIT emphasizes and integrates IT governance and management with corporate governance and is aligned with the ITIL [1] library and the ISO/IEC 20000-1 [10] standards.

GQM+Strategies [7] presents an alignment mechanism between high-level goals (business), low-level strategies, and goals (software, service, or others). Providing actionable concepts and steps to link goals and strategies in an organization, GQM+Strategies supports measurement-based decision making. In GQM+Strategies, the term strategies refer to projects, actions, or initiatives undertaken to achieve the organization's business goals. The organization can execute one or more strategies to achieve a goal. Context factors are characteristics, and the premises are the organization's uncertainties. The organization can define one or more strategies to support the achievement of each objective. Strategies are prioritized based on contextual factors and assumptions. The main output of GQM+Strategies is an integrated view of its components called the GQM+Strategies Grid, which includes goals, strategies, and respective measurement models.

The SINIS (Select Indicators for IT Services) method [24] was created to support the selection of IT service indicators and strategies in line with the organization's goals. SINIS explores the application of GQM+Strategies in IT services, providing practical guidelines that include a process and instruments (checklists, templates, and examples) to support the execution of each activity in the process. The method helps the moment of selection but does not support continuously monitoring the indicators and results of the defined strategies.

## 3 RESEARCH METHOD

The research method used to build SINIS-LA was Design Science Research (DSR) [15, 25]. We have chosen DSR because the approach provides the interaction between developing an artifact that improves something for stakeholders and empirically investigating the performance of an artifact in a context [25]. The DSR [15] is an interactive process including three significant cycles: Relevance Cycle, Design Cycle, and Rigor Cycle. Therefore, we carried out cycles of experimentation in the IT service industry to build SINIS-LA. The execution of the DSR cycles as a whole took about two and a half years. The cycles were executed in parallel, each one lasting approximately one year.

The *Relevance Cycle* involves defining the problem to be addressed, the research requirements, and the criteria for evaluating the research results. The problem comprises the need for IT service

providers to define IT alignment and monitor service level strategies, indicators, and agreements. We defined seven requirements for SINIS-LA, as follows.

- R1: Allow the identification of indicators and strategies at different levels of the organization to facilitate the reporting of correct information for each level of decision-making;
- R2: Provide alignment between indicators and business goals at different levels;
- R3: Provide procedures and tools (such as checklists, templates and examples) to support execution;
- R4: Allow the reuse of indicators, including SLA, for monitoring;
- R5: Adopt a consistency of measurement terminology and Service Level Management in order to promote common understanding among the participants involved;
- R6: Allow the identification of SLAs of existing IT services and impacts on goals and strategies; and
- R7: Allow SLA of existing IT services to relate to impacts on goals and strategies.

We established the requirements based on aspects indicated in the literature and practical experiences. We defined requirements R1 and R2 based on [7], which emphasizes that the measurement must be aligned for organizational goals and cascaded at different levels of the organization to provide useful information for each level and the organization as a whole. We defined requirements R3, R4, and R5 by the recommendations of instruments to support the alignment of goals, indicators, and strategies [7], in addition to tools for monitoring SLA, using specific indicators [23]. Regarding requirement R5, we kept the measurement terminology already used in SINIS (based on the Reference Software Measurement Ontology (RSMO) [5]). About the Service Level Management, we revised the terms used in SINIS-LA to be adherent to concepts and relationships of the Service Grounding Ontology (UFO-S) [20] appropriate for service level management. We defined requirements R6 and R7 to support the impact the SLA can cause in business' scope [14], and IT service management [13, 23] with the strategies and goals.

We used TAM [9] to support the evaluation of the method and evaluated the Feasibility and Usefulness of SINIS-LA for its use in supporting the identification and monitoring of goals, strategies, indicators, and SLA. The criteria to reach Feasibility comprise evaluating if SINIS-LA can be executed according to its description, delivering what it proposes (alignment and monitoring of goals, strategies, indicators, and SLA) and if its execution requires efforts considered acceptable. The criteria to reach Usefulness comprises evaluating if SINIS-LA offers benefits for the organization to monitor ongoing actions for IT alignment, specifically in SLA.

The *Design Cycle* involves developing and evaluating artifacts to support the solution of the monitoring problem in the SLM context identified in organizations providing IT services. We created the first version of SINIS-LA at the end of the Design Cycle after three learning cycles. Each cycle contributed to obtaining knowledge and relevant inputs for the development of SINIS-LA.

We started the first learning cycle with a literature review on IT and business alignment, eliciting and monitoring indicator goals and strategies, IT Services, SLM, and SLA. The literature review was fundamental to acquire knowledge on the research topic to

identify the context of the problem and delimit the scope of the research. Still, in this cycle, we used a commitment-based core ontology on services (UFO-S) [20] to understand the IT Service's taxonomy, context, and the dynamics of providing IT services. The UFO-S was also used to inspire elaborating checklist instruments about interpreting SLM/SLA information into IT service contracts.

In the second learning cycle, we mainly carried out two actions. The literature review on the use of GQM+Strategies by organizations found several studies reporting the applicability of GQM+Strategies and new proposed extensions, including SINIS. We identified common problems, challenges, and opportunities for improvement in the reports on the use of GQM+Strategies and related extensions. The SINIS was applied to a service management team of a public organization that provides IT services [12] to support the alignment between goals, strategies, indicators, and SLA. As a result, the organization could align its context factors, assumptions, indicators, strategies, and IT services goals. During this study, we identified some possible improvements to evolve SINIS.

In the third learning cycle, we carried out two new actions. We conducted semi-structured interviews with IT service managers of organizations that provide IT services. This study aimed to identify gaps and problems in the current situation experienced by the industry and the way of working that lead to compliance with the strategies and monitoring of SLA compliance. The findings provided by the interviewees guided the creation of SINIS-LA in the treatment of SLA and support of monitoring. Finally, based on the results of this cycle and the previous ones, we developed the proposal for the SINIS-LA method with the procedures, instruments, checklists adapted for monitoring and focusing on SLM/SLA.

Finally, the *Rigor Cycle* refers to the use of knowledge generation. Rigor is achieved by using fundamentals and methodologies from a knowledge base based on research and added knowledge generated by research to understand the knowledge base—the main fundamentals of knowledge related to IT Services, measurement, and evaluation methods as a case study. The main contribution to the knowledge base is SINIS-LA itself. The case study carried out showed the method's usefulness and made it possible to identify suggestions for improvement. In addition, there was a positive practical effect in monitoring alignment and SLA for the team that applied it.

## 4 THE SINIS-LA METHOD

The SINIS-LA method is composed of 10 activities, as can be seen in Figure 1, which also shows the main input documents and expected outputs. More information and details about the method's activities, such as all inputs, outputs, templates, and support documents, can be found in SINIS-LA technical report [11].

SINIS-LA, similarly to SINIS [24], is meant to be applied by IT service managers or similar roles. However, it is important to notice that the execution of some activities can involve other participants. Activities can be also executed by other IT service professionals as appropriate, or even by the project team to have a structured view about which projects, activities, initiatives or practical operational actions (i.e., strategies) can be taken to achieve goals.

We describe SINIS-LA activities as follows.

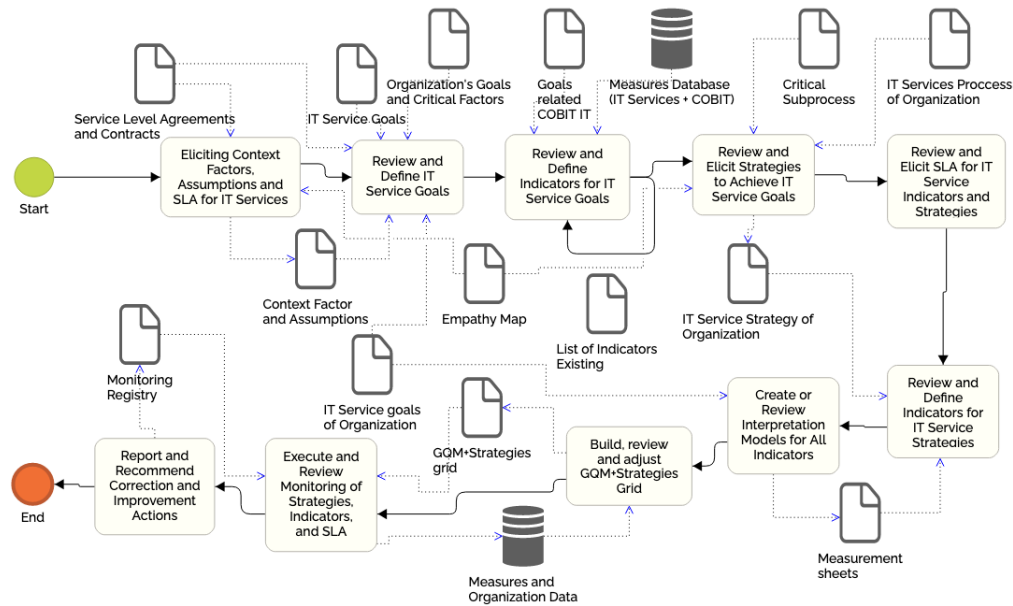


Figure 1: SINIS-LA activities

The first task of the activity "Eliciting Context Factors, Assumptions and SLA for IT Services" is gather information about the organization and the IT service department that can influence the selection, definition, and monitoring of goals and strategies indicators and SLA. Both official documentation (e.g., standards and contracts, strategic plan, service catalog) and other data (e.g., e-mails, guides to good practices, and technical reports) are sources and input for this task.

After collecting data, the organization’s departments with relevant relationship with the processes of IT services must be characterized. The responsibility for assignments, problems, and needs in each area impacted by (or that impacts) IT and SLA services must also be identified. We adapted the Empathy Map [12] to characterize the areas of the organization (example in Figure 2), created in the case study that we present in Section 5. The empathy map is used in the following elicitation activities of the method.

In addition to consulting existing documentation and empathy maps, meetings with stakeholders in the organization’s areas can support the identification of Context Factors and Assumptions for each department. For this and other tasks, checklists to support elicitation provided by SINIS can be used. For the elicitation of the IT Service SLAs, the organization’s documentation regarding IT service contracts and the SLAs described in the contract must be consulted. SINIS-LA presents a checklist to support this task, containing questions such as: What is the scope of delivery of the IT Service department? What information can be collected from existing SLAs and customer contracts? Are there or should there be reports of defined frequency on the levels of services reached? What is the most critical thing that needs to be accomplished by IT service strategies? Are there essential SLAs not defined in contracts that need to be fulfilled?

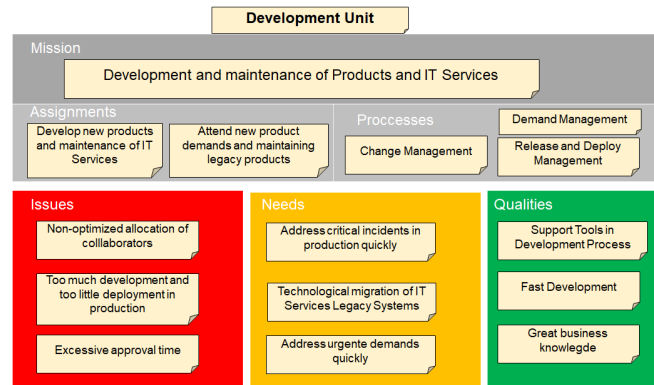


Figure 2: Example of empathy map for the development team

After that, one should "Review and Define the IT Service Goals" already existent in the organization and include new ones that were not previously explicit. At that moment, the indicators associated with the goals are defined, and other indicators are created when the existing ones cannot provide the necessary information. In the end, the Indicator Relationship Map (adapted from ASM.Br [8]) must be created, which presents the relationship between the indicators among themselves and with the IT Service and strategic goals.

In the activity "Review and Elicit Strategies to Achieve IT Service Goals" it is necessary to initially collect the IT Service Strategies that already exist in the organization. Then, one must analyze the critical IT service processes to eventually find new strategies and establish strategies and related indicators in the following tasks. When defining strategies, contextual factors and specific

assumptions for those strategies must be identified and related. The SLAs related to the strategies should also be described in the Strategy Register. Finally, indicators should be selected or created and associated with the identified strategies.

In the activity "Revise and Elicit SLA for Service and IT Strategies and Indicators," one must initially identify and revise the SLA for indicators associated with IT service strategies. Then, the SLA must be associated with the strategies. This action is necessary because there may be SLA impacting a strategy, but it is not associated with any indicator associated with it. The empathy map should be used to support collecting the activities' data and evidence of relationship with the SLAs due to the mission information, attributions, processes, problems, and needs already mapped for the areas of the organization.

The next step is "Review and Define Indicators for IT Service Strategies" ensuring consistency between the recorded data. Next, interpretation models are elaborated, determining how the data should be interpreted to inform decisions about IT service strategies and achievement of goals. At the end of the activity "Create or Review Interpretation Models for All Indicators" (related to goals and strategies of IT services), Measurement Sheets (based on ASM.Br [8]) will be created, including the following information: measurement objective, information need, indicator, type of measurable entity, basic measurements, measurement calculation formula, measurement procedure, responsible by the measurement, measurement time and measurement periodicity. In addition, analysis procedures based on relationships with other indicators and criteria must be informed, and measurement and analysis procedures and graphical representation of the indicator.

In the activity "Build, review and adjust GQM+Strategies Grid" the context factors, assumptions, objectives, strategies, indicators and SLA are organized in a GQM+Strategies grid to provide an overview of the results produced during the phases and previous activities. The Indicator Relationship Map is an input for building relationships between strategies and indicators. Figure 3 shows an example of a grid (based on the case study in Section 5). Contextual factors, assumptions, IT service goals (on a red background), indicators (on a blue background), strategies (on a gray background) and SLA (on a white background) can be seen in the figure. The relationships of the IT service objectives are edged in red for easy identification. The other edges representing the relationships are in blue or gray, also for easy viewing.

At the end of the activity, the GQM+Strategies Grid is reviewed and adjusted according to the organization's needs and the IT alignment's understanding. With the aid of identification on the empathy map, stakeholders must recognize and validate the construction of the grid so that it is applicable, has integrity, precision, and consistencies in the identified elements and relationships. In addition, discussions can point to possible discoveries and opportunities for improvement. During this phase, if any adjustments are necessary, they can be done in the previous activity, and then continue to apply SINIS-LA again from that point until the end.

In the activity "Execute and Review Monitoring of Strategies, Indicators, and SLA" it is necessary to define what needs to be monitored, when it needs to be monitored, perform the monitoring and analyze the data collected from the indicators. Thus, enough inputs are generated to make decisions about strategies, goals, and even

improvements in monitoring and applying the method itself. The monitoring plan to be created must contain the following information: Goal; Scope; Frequency; Historic; Responsible Information; Measurement Sheets; Communication Policies. We provide a checklist to support the monitoring with the following questions: What strategies mainly impact the organization's IT service goals? What are the most worrying indicators for the organization's departments? What are the strategies (and respective indicators) of the most critical IT service goals? Does the monitoring cost outweigh the gains for action that the organization can take within the monitored scope? Will the teams be able to carry out the monitoring at the defined frequency? What are the most critical SLAs in the organization that needs to be monitored, including related strategies and indicators? What is the most appropriate and capable frequency to monitor and take action for the desired scope? What is the risk and impact of not monitoring specific indicators, strategies, and SLA?

Monitoring is carried out in pre-determined cycles in the Monitoring Plan. The instructions on the Measurement Sheet must be followed to collect data for the indicator and include in the Monitoring Log. The completed record must also present the analyzes performed, the executive summary, and the actions to be performed. Finally, the activity "Report and Recommend Correction and Improvement Actions" is carried out. The steps to be carried out included in the Monitoring Registry are disclosed to the competent stakeholders defined in the Monitoring Plan.

## 5 EVALUATION OF SINIS-LA IN INDUSTRY

SINIS-LA was applied in a case study to define and monitor the alignment of IT (goals, strategies, indicators, and SLA) in an IT service management department of a public organization providing IT services. Due to confidentiality restrictions, the name of the organization and the professionals involved and the entire contents of the case study, such as goals, strategies, and indicators, were not characterized.

Section 5.1 presents the planning and execution of the case study, Section 5.2 presents a results' discussion, and Section 5.3 presents limitations and threats to validity.

### 5.1 Planning and Execution

We defined the research question "Is the use of the SINIS-LA method feasible and useful for monitoring and aligning IT services in the context of SLA compliance?"

Organization A is a Brazilian public organization providing IT services to more than 3000 employees distributed geographically in several offices in the Brazilian states. The organization has IT service contracts (development and maintenance, hosting, consulting, e-mail provision, and others) with dozens of public and private institutions. In these contracts, SLAs are systematically monitored, and the organization is liable to punishments in case of non-compliance.

Team A, coordinated by the team leader and composed of 10 professionals, applied the method in full. Among its attributions can be highlighted service management (software systems and IT services) in production (operation), execution of processing routines, incident handling, systems consulting, meeting adaptive, corrective,

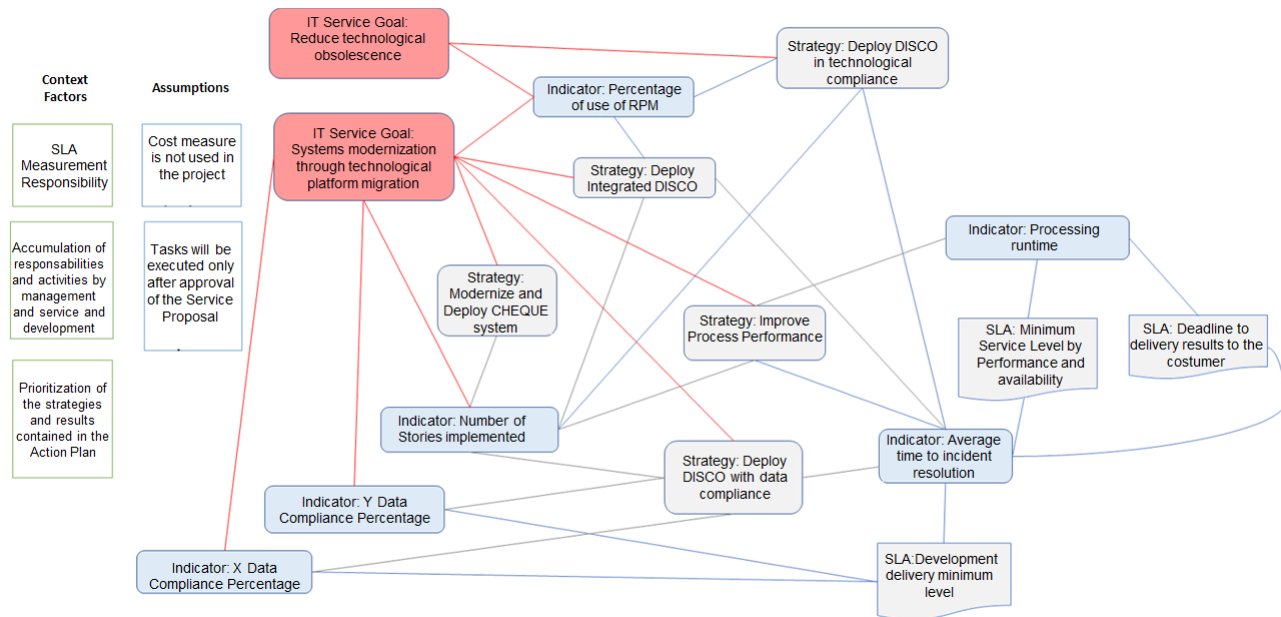


Figure 3: Example of GQM+Strategies grid adapted to consider SLA

and evolutionary maintenance demands. The activities of defining and monitoring the SLA are not the responsibility of Team A, although the team's work is directly involved in the compliance with the SLA since it is the team responsible for the IT service. In addition, Team A is responsible for executing and managing strategies (projects) established to achieve business objectives, according to results defined annually in an organizational action plan. Compliance with SLA and some decision-making based on indicators can be conflicting. As the team deals with IT service of high criticality and impact for the company's business and great value for the client, in Team A, there is periodic (weekly) monitoring involving senior management with the discussion of indicators, current status of strategies, and actions in progress. The lack of monitoring mechanisms and routine is a criticism made by the team members. The team also complained about a lack of connection between strategies and indicators. Moreover, they mentioned the need to connect strategies with possible impacts about being (or not) compliant with the indicators or the SLA of current contracts.

The procedure for executing the study consisted of following the phases and activities of the SINIS-LA method and using the models, checklists, and examples provided to define and monitor the IT service goals, strategies, and indicators for the service management team.

We evaluated SINIS-LA applying the TAM [9] method. We considered the usefulness (if the use of SINIS-LA provides benefits to the organization) and feasibility (if the execution of the method produces what it proposes to deliver: service goals related and monitored with IT service strategies, indicators, and SLAs). The case study participants and the high-level management associated with Team A reported their impressions of use, suggestions, and criticisms about using SINIS-LA.

The team leader (with the team members, when applicable) executed the method. In case of doubts, he consulted one of the researchers (the first author of this paper). Professionals from other departments of the organization were involved and consulted to collect data during the execution of SINIS-LA, such as the development team, infrastructure team, and service team. The study duration was approximately four months.

## 5.2 Discussion of Results

**5.2.1 Evaluation from Team Leader.** After the execution of the method, we sent a questionnaire based on TAM [9] to the team leader. We also interviewed the division manager to evaluate the result of using SINIS-LA. We adapted the questionnaire to the three perspectives of TAM: usefulness, ease of use, and intention for future use. Each closed question used the following Likert scale: Totally agree (TA); Partially agree (PA); Indifferent (I); Partially disagree (PD); and Totally disagree (TD). Table 1 shows the responses obtained.

Regarding perceived usefulness, the participant reported that the method helps with IT alignment and helps to identify and monitor goals, strategies, indicators, and SLA. Some SINIS-LA tasks are complementary to the ones already performed by the service management team.

The team leader commented that "there are benefits for IT alignment and SLA compliance" and that "it is positive for the team to know the impacts and understand the decisions." Thus, showing that the application of the method has brought benefits, mainly in monitoring.

However, regarding the ease of use, the team leader did not consider the step-by-step activities very practical, including filling out many artifacts and duplicating information. As an intention of Future Use, the participant considered it essential to continue

**Table 1: Answers to the questionnaire - Evaluation of Perceived Utility (PU), Perceived Ease of Use (PE), and Intention of Future Use (IF).**

Type	Question	Answer
PU	Using SINIS-LA supports me in IT alignment tasks.	TA
PU	Using SINIS-LA supports me in service management and SLA monitoring tasks.	PA
PU	Using SINIS-LA supports me in identifying goals, strategies and indicators.	TA
PU	Using SINIS-LA increases the effectiveness of my work in IT alignment.	TA
PU	Using SINIS-LA increases the effectiveness of my service management and SLA monitoring work.	PA
PU	The benefits of using SINIS-LA are clear and objective.	TA
PE	Learning about SINIS-LA was easy for me.	PA
PE	My interaction with SINIS-LA can be clear and understandable.	I
PE	SINIS-LA is flexible to interact.	PA
PE	SINIS-LA is easy to use.	PA
IF	Assuming SINIS-LA is available, I intend to use it regularly in the future for monitoring SLA.	PA
IF	I prefer to use SINIS-LA for strategic planning to support IT alignment.	TA

using SINIS-LA for monitoring the SLA, which depends on constant monitoring to continue with the contractual fulfillment with the client.

**5.2.2 Evaluation from High-Level Management.** The Division Manager (who is the participant's immediate boss) also evaluated SINIS-LA by answering the following questions: (1) What were the obtained benefits from using SINIS-LA? (2) Will the activities in your department benefit from applying SINIS-LA? (3) What can we improve in SINIS-LA?

The Division Manager answered that the benefits of using the method including: "Integrating the teams", "Organizing the indicators with deliveries and contracts", "Prioritizing the delivery of services included in SLA", and "Documenting the actions for monitoring". Regarding his department's activities, the Manager stated the method brought "agility in collecting data about the progress of deliveries and on building indicator reports for senior management". Finally, in the last question about improvement, the Manager consulted the participant and answered: "wipe out activities and artifacts and avoid redundant data", "integrate SINIS-LA into the processes and with the data company systems", and "hard to keep artifacts up to date".

**5.2.3 Research Question Evaluation.** The participants' feedback was considered positive. They recognized the method's results, clarified doubts about using the measurement instruments and concepts, and changed suggestions in the method's description. The participants defined the scope for monitoring and developed an action plan to be followed weekly, always considering the priority of compliance with SLA related to the indicators.

The step-by-step activities of defining (explicitly) and revising the goals, strategies, indicators, and SLA guided the service management team members to know and discuss the identification and selection of the monitoring scope.

The use of the empathy map helped the service management team improve interaction with other departments (who generally

have a different perspective on the indicators and SLA) by better understanding others' responsibilities, challenges, and needs. For example, one department is responsible for publicizing the monthly SLA report. At the same time, the service management team is responsible for delivering the service according to the SLA and according to the organization's strategies. The elaboration of the empathy map facilitated the communication between these departments. The service management team could gather the necessary information for the activities of SINIS-LA, including in the monitoring and directing of the actions of the action plan of the Monitoring Registry.

The team leader said the team became more aware of the reasoning behind the indicators when executing the activities of SINIS-LA and the alignment of IT considering the fulfillment of the SLA of the critical services in production. According to him, "knowing the impacts and understand the decisions is positive for the team".

### 5.3 Limitations and Threats to Validity

We identified some limitations. Different people should evaluate the ease of use, feasibility, and future usefulness. We executed the exploratory case study and the SINIS-LA evaluation in the same organization, despite involving different participants. The service management team agreed with the defined indicators, and SLA for monitoring was considered successful by the service management team. However, they can have been biased by the slow dynamic business context of an IT service provider in the public area with a long-term contract client with a stable SLA.

In addition, there are threats to the validity [21] that need to be considered, as discussed below.

**5.3.1 Construct Validity.** The GQM+Strategies measurement nomenclature used is domain-specific and can lead to misunderstandings. As a treatment, we explained the terminology adopted in SINIS-LA to the participants before executing the case study and clarified their questions.

**5.3.2 Internal Validity.** The researcher works in the organization where the case study was applied and is currently executing one of the strategies selected for monitoring. Thus, there could be an influence on the orientations and clarifications carried out for the team leader. As a treatment, the researcher restricted himself to guiding the use of SINIS-LA based on the provided description, explaining the activities and artifacts available before and during the case study. Some indicators and strategies were not selected due to time constraints, and some templates were not used in their entirety at the participant's option. The scope defined for monitoring was reduced based on the utility for the participating team and the time available to complete the case study. Despite the arrangements, all the planned activities were executed. We did not identify any significant negative impact on the execution of the method.

**5.3.3 External Validity.** The main external validity threats include the researcher's participation and the use of SINIS-LA in a single organization and by a single participant. Thus, the results obtained cannot be generalized or considered conclusive but provide preliminary evidence of the feasibility and usefulness of future use of SINIS-LA.

**5.3.4 Confiability Validity.** The researcher’s participation (first author) poses a threat to the validity of the reliability. To minimize this threat, the case study design and execution was reviewed by another researcher (fourth author). The researcher did not participate in the execution of the case study; he only guided explanations and clarified doubts. We sent a form with semi-structured questions to collect feedback from the team leader and instructed him to comment on his perceptions freely. The TAM [9] method was applied to minimize the threat of not obtaining the required information to evaluate SINIS-LA. Only one researcher analyzed the interview data, but another researcher reviewed data and analysis.

## 6 FINAL CONSIDERATIONS

This paper introduced SINIS-LA, a method to support organizations in aligning and monitoring IT service goals, strategies, indicators, and service level agreements (SLAs). SINIS-LA is an extension of SINIS and consists of a descriptive process and instruments (checklist, templates, and examples) to support the execution of the process. With the inclusion of the SLA element in the IT alignment, it was possible to consider the context of service level agreements of organizations providing IT services to identify and select indicators for IT services in line with the organization’s goals. The activities of elicitation and relating SLA to the indicators, with the support of proposed artifacts, play a fundamental role in the alignment of IT in the context of service level agreements. SINIS-LA guides IT service provider organizations in monitoring services in line with organizational goals in the context of service level agreements, meeting the gap of monitoring IT alignment and focusing on service level agreements.

We evaluated the SINIS-LA method in two ways. The team leader who participated in the case study assessed the method’s usefulness, feasibility, and intention of future use. In a complementary manner, the team’s division manager answered a questionnaire about his impressions of use and the results of SINIS-LA. We evidenced that SINIS-LA can support the definition and monitoring of the alignment of goals, strategies, indicators, and organizations providing IT services.

Future work includes creating a leaner version of SINIS-LA to avoid duplicate information in the instruments indicated in the case study, implementing dynamic forms of data visualization (e.g., dashboards) for monitoring alignment and SLAs, execution of new case studies in the industry, identification of patterns in decision making based on data and creation of computational support to support the implementation of the method.

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