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Abstract. *Background*: Measurement is a key process to support organizations in management and improvement of processes, products and services. Indicators are measures used to monitor whether a goal is reached, increasing feedback and objectivity on judgment and helping organizations to focus attention and effort on what matters. IT services literature, such as libraries, frameworks, standards, and maturity models, requires proper identification of critical business process and definition of relevant measures to support decision-making. However, there is no clear direction about what should be those critical business processes and indicators. IT service departments often spend time and effort measuring without being sure about what the measurement results represent and organizations consider the indicators selection as a difficult task. *Aims*: We conducted this work aiming to answer the research question: "How to support selection of IT services indicators in different organizational levels and aligned to business goals?" *Method*: Considering this scenario, we proposed SINIS, a method to help organizations select indicators for IT services in several levels in alignment to business goals. SINIS was created based on concepts from process improvement models and approaches related to IT Services Management. We evaluated SINIS in the IT Infrastructure and the IT Security areas of a global large company. *Results*: By using SINIS IT, Infrastructure was able to define indicators and an appropriate set of strategies aligned with IT Service goals in which teams could focus work and IT Security was able to better understand and document indicators, associate them to business goals and strategies and discard those ones that were not considered useful. *Conclusion*: SINIS was evidenced as applicable to different IT Service areas, supporting definition of strategies and indicators for members to work on that could help attending IT service and business goals, instead of working in several and unfocused initiatives..

Keywords: Measurement, IT Services Quality, Maturity Models, GQM+Strategies, MR-MPS-SV, CMMI-SVC, COBIT Goals Cascade.

Resumo. *Contexto*: A medição é um processo essencial para apoiar as organizações na gestão e melhoria de processos, produtos e serviços. Indicadores são medidas usadas para monitorar o alcance das metas, tornando mais objetiva a avaliação e o julgamento do resultado, e ajudando as organizações a concentrarem atenção e esforço no que realmente importa. A literatura sobre serviços de TI, que inclui bibliotecas, padrões e modelos de maturidade, requer a identificação adequada dos processos críticos de

negócio e a definição de medidas relevantes para a tomada de decisões. No entanto, não há uma direção clara sobre quais devem ser os processos e indicadores. Muitas vezes os departamentos de serviços de TI gastam tempo e esforço medindo sem terem certeza sobre o que os resultados da medição representam, e consideram a seleção indicadores como uma tarefa difícil. *Objetivos*: Este trabalho foi realizado para responder à questão de pesquisa: "Como apoiar a seleção de indicadores de serviços de TI em diferentes níveis organizacionais e alinhados aos objetivos de negócio?" *Método*: SINIS foi proposto para ajudar as organizações a selecionarem indicadores de serviços de TI em vários níveis e alinhados aos objetivos de negócio. Criado com base em conceitos de modelos de melhoria de processo e abordagens relacionadas ao gerenciamento de serviços de TI, o SINIS foi avaliado em departamentos de Infraestrutura e Segurança de TI de uma empresa global de grande porte. *Resultados*: Com o SINIS, o departamento de Infraestrutura conseguiu definir indicadores e estratégias que a equipe pudesse trabalhar sem perder o foco nos objetivos de serviços de TI, e o departamento de Segurança conseguiu documentar e entender melhor os indicadores já existentes, associá-los aos objetivos e estratégias de negócios e descartar aqueles que não foram considerados úteis. *Conclusão*: O método SINIS foi evidenciado como aplicável a diferentes áreas de serviços de TI, apoiando a definição de estratégias e indicadores para as equipes trabalharem no que poderia ajudar a atender os objetivos do negócio, ao invés de medir por medir e trabalhar em diversas iniciativas sem foco.

Palavras-chave: Medição, Qualidade de Serviços de TI, Modelos de Maturidade, GQM+Strategies, MR-MPS-SV, CMMI-SVC, COBIT Goals Cascade.

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1 Introduction

The service sector (involving information, health, education, tourism, entertainment, and others) has been recognized as the largest economic sector in developed countries and as an expanding sector in emerging markets (TIEN and BERG, 2006). This scenario has led organizations to shift from traditional production-based business models to new service-based ones (ENGELMANN, 2008). In this sense, many organizations have started to use IT (Information Technology) to build service capabilities into their products, in order to be able to provide more accurate and faster service to customers (MAGIO et al., 2009).

Services involve delivering value to customers by facilitating the results they want to achieve without forcing them to take on the costs and risks of ownership. IT Service management is a set of specialized organizational capabilities for providing value to customers through services. Its practice has been growing by adopting an IT management service-oriented approach to support applications, infrastructure and processes (OGCa, 2011).

Guidance on how to implement and improve IT Service maturity practices is a key factor to improve service performance and customer satisfaction (FORRESTER et al., 2010). The use of suitable measures can help to monitor processes executed for delivering services and to support initiatives to improve managing the processes involved with IT Service. Measurement activities can help organizations monitor the performance of their projects and processes, leading to a high-maturity scenario. Thus, it is necessary to identify the processes to be measured and the measures to be used.

Effective service measurements should cover meaningful indicators,[1] in order to be able to verify the achievement of goals (ECKERSON, 2011, BARCELLOS et al., 2012). In this sense, the selection of the processes to be measured and the measures to be used should be aligned with organizational goals, so that measurement results can provide relevant information for decision-making and business support.

The IT Service literature does not provide clear guidance or strict suggestions about which processes and measures should be considered for measurement. Moreover, properly selecting measures and indicators is not a trivial task. Even if a measures database is available, it is still not easy to select the proper measures and identify indicators for IT Service (PARMENTER, 2015). Several factors contribute to the difficulty in selecting measures and indicators for IT Service, including: (i) lack of approaches to guide the selection of IT Service indicators, (ii) lack of practical examples involving IT Service indicators, and (iii) lack of measurement capabilities in IT supporting tools (JÄNTTI et al., 2010) (LEPMETS et al., 2014).

In the Software Engineering area, there are several proposals to aid organizations in measuring and improving software-related processes. GQM+Strategies (BASILI et al., 2005) is a goal-oriented measurement approach that supports identifying goals at organizational levels, defining strategies (initiatives, such as projects or other actions) to achieve the goals, and identifying measures/indicators to monitor strategies and goals. By establishing strategies aligned to organizational goals, it is possible to identify the processes involved, and measure and improve them. In addition, teams

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[1] In this work, we use the definition of indicator given by BARCELLOS *et al.* (2010a, 2010b, 2010c, 2012), which states that an *indicator* is a measure directly used to verify the achievement of goals.

can focus on initiatives which are truly related to organizational goals, and understand how their work is aligned to those goals and how their work will be measured.

In view of the above, we developed SINIS (a Method to Support Defining Goals, Strategies and Indicators for IT Service), which applies principles from GQM+Strategies to help organizations define the proper goals, strategies and indicators for IT Service derived from and aligned to business goals. SINIS proposes a process which guides the steps to be followed by organizations in order to select IT Service indicators, along with a set of templates, checklists and examples to help organizations perform the SINIS process.

SINIS can help organizations which are just starting IT Service measurement as well as organizations which have already started it and want to review or improve their defined goals, strategies or indicators. In the first scenario, SINIS can guide organizations on defining IT Service goals, strategies and indicators aligned to their organizational goals. In the second scenario, SINIS can help organizations to review their defined IT Service goals, strategies and indicators, in order to select the ones which are aligned to goals of the organization, as well as define any new ones which may be needed.

To develop SINIS, we started by performing incremental learning cycles based on Design Science Research (HEVNER, 2007). Each cycle consisted of an investigative study performed to obtain knowledge relevant for developing the SINIS approach. Five studies were performed. First, we carried out a systematic literature survey to identify measures suitable for IT Service measurement (TRINKENREICH et al., 2015a). This study provided a set of measures which can be used as input to various SINIS activities. Second, we performed a case study at a large company to investigate aspects which should be considered when selecting IT Service indicators (for instance, the same indicator may be related to several IT Service) (TRINKENREICH and SANTOS, 2014). Third, we performed a case study at an organization to evaluate the measures identified in the systematic survey of the literature, and to identify new measures to be used by the organization. This case study allowed us to improve the set of measures identified in the systematic survey. Also, we investigated impacts among processes involved in IT Service (TRINKENREICH and SANTOS, 2015a). Understanding the impacts among processes involved in IT Service is important to establish proper strategies for achieving IT Service goals. Fourth, we performed an action research involving the use of GQM+Strategies to select indicators related to the processes involved in IT Service (TRINKENREICH and SANTOS, 2015b). This study showed us that GQM+Strategies could be applied in the IT Service domain, but some extensions would be necessary. Finally, we performed a case study using qualitative analysis to investigate how to define or select strategies to achieve IT Service goals. The use of causal analysis techniques was found to be a way of identifying the aspects on which strategies for achieving IT Service goals should be focused.

After the incremental learning cycles, we developed SINIS itself, and then we conducted a case study to evaluate its use in the IT Infrastructure area of a large company (TRINKENREICH et. al, 2015c). The results revealed several limitations and various opportunities for improvement. Based on these results, we evolved SINIS to a newer version and conducted a new case study applying it in the IT Security area of the company, which is presented in this paper.

In this paper, we present SINIS and results of its use in the IT Security area of a large company. This paper is structured as follows: Section 2 provides the background for the paper, Section 3 presents SINIS, Section 4 addresses evaluating SINIS, Section 5

discusses the results obtained, Section 6 presents related works, and Section 7 presents final considerations.

2 SINIS – A METHOD TO SELECT GOALS, INDICATORS AND STRATEGIES FOR IT SERVICES

SINIS is a method to support organizations in selecting indicators and strategies for IT Service in alignment with organizational goals. The method provides clear information about strategies, projects, initiatives or actions that contribute to achieving goals. As discussed in the previous sections, SINIS reuses knowledge provided by other proposals, being based mainly on GQM+Strategies (BASILI et al., 2005) and COBIT Goals Cascade (ISACA, 2012). In fact, SINIS could be understood as an extension of GQM+Strategies for the IT Service domain.

SINIS consists of a process comprising a set of activities to be performed to select relevant IT Service indicators, along with a set of templates, checklists and examples to support performing these activities.

Considering that SINIS involves IT Service and measurement-related activities, we suggest that SINIS should be applied by personnel familiar with IT Service processes and measurement in general; however, no knowledge of the related methodologies used as foundations for SINIS is required.

Figure 1 shows an overview of SINIS. The SINIS process is composed of four phases. Below we describe SINIS phases and activities, and also present several templates which may be used in selected activities.
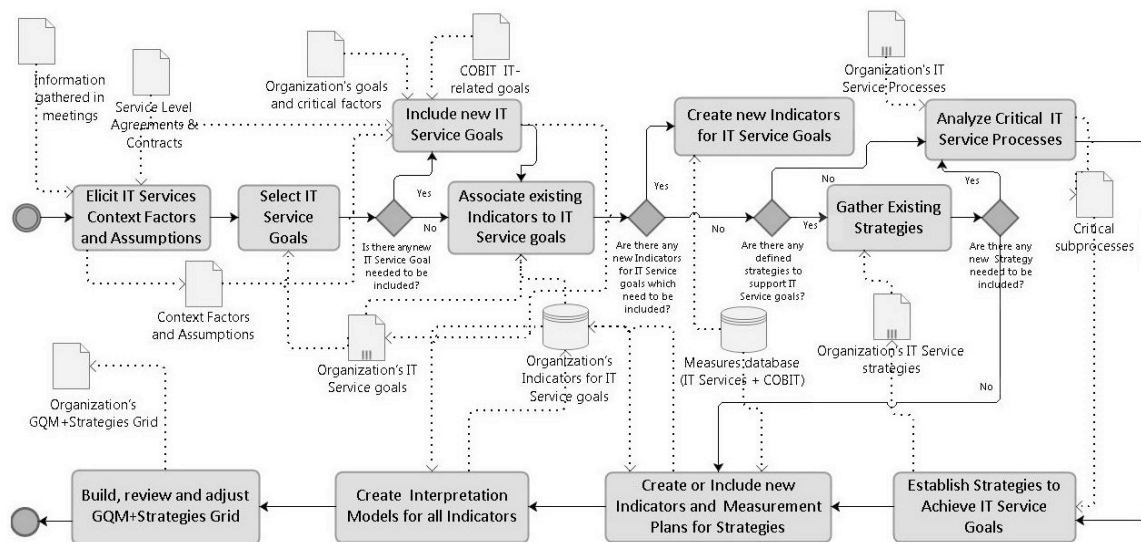

Figure 1 – Overview of SINIS

2.1 Phase (i): Elicit Context Factors and Assumptions for IT Service

This phase involves obtaining relevant information about the organization and the IT Service department which can influence the selection and definition of goals, strategies and indicators.

IT Service goals and strategies are defined within the context of the organization, where options are limited by the capabilities, issues or constraints of the organization. Thus, it is necessary to identify context factors and assumptions. Context factors are aspects which are factually known (e.g., the organization needs to improve service availability) and assumptions are aspects which are believed to be true, but with little or no evidence (e.g., in the organization, IT Service costs cannot be increased). Context factors and assumptions provide useful information to define the scope of the IT Service goals and strategies to be considered. In addition, differentiating between what we factually know and what we believe to be true will help later to properly interpret measurement data and find potential reasons for strategies which did not succeed (BASILI et al., 2005).

Documents (such as service level agreements and contracts) can be used as a source for identifying context factors and assumptions. If documents are not available, meetings with stakeholders of the organization can be used to gather information. Examples of questions which can be used to elicit context factors and assumptions include (PETERSEN et al., 2015, PARMENTER, 2015, BASILI et al., 2005): What is the scope of the department? Who are the clients of the department? What can be gathered from existing service level agreements and contracts and client satisfaction reports about the services provided?

A list of questions to be used during interview to identify Context Factors and Assumptions is provided in Table 1, a template in Table 2 and examples in Table 3 bellow.

Table 1 - SINIS questions to support elicitation of IT Services Context Factors and Assumptions (based on (PETERSEN *et al.*, 2015; PARMENTER, 2015; BASILI *et al.*, 2005))

	SINIS questions to support elicitation of IT Services Context Factors and Assumptions
1	What is the scope of considered IT Services department about?
2	Which clients/customers does IT Services department support?
3	What can be gathered from existent service agreements with customers for service delivery?
4	What can be extracted from issues root cause on history reports about provided services?
5	What can be extracted from customers' satisfaction reports about provided services?
6	What can be linked to IT Services from organization Vision, Mission and Values statements?
7	Which are the organization's goals?
8	Which organizational aspects can be associated to IT Services? For example organization economic, social, political, market trends, environmental and technological aspects.
9	Which are the perceived IT Services critical success factors?
10	What can be used from existent measurement models, data, baselines and targets?

Table 2 - SINIS template for Context Factors and Assumptions

Context factors	
Context factor	\<Description of context factor - what is factually known – related to IT Services \>
Context factor source	\<Description of source from where the context factor was obtained\>
Date	\<Date when context factor was taken as true\>
Responsible	\<Person responsible for describing this context factor\>
Assumptions	
Assumption	\<Description of assumption - what we believe is true but have little or no evidence about – related to IT Services \>
Assumption source	\<Description of source from where this assumption was obtained\>
Date	\<Date when assumption was considered\>
Responsible	\<Person responsible for describing this assumption \>

Table 3 - SINIS examples of Context Factors and Assumptions for IT Services

Context factors	
Context factor	Incident management process includes an activity to evaluate if problem management process needs to be invoked to find a definitive solution for a workaround implemented
Context factor source	Incident Management process description version 1.1
Date	August/2015
Responsible	Bianca Trinkenreich
Assumptions	
Assumption	Technical resources are available to be contacted and join a crisis conference room until issue is solved.
Assumption source	There is an on-call schedule for technical resources available in Intranet page, but we don´t have sure if people will immediately pick the phone when contacted on off-hours.
Date	August/2015
Responsible	Bianca Trinkenreich

2.2 Phase (ii): Define IT Service Goals and Indicators

This phase involves gathering, defining and reviewing IT Service goals based on organizational goals. In addition, it addresses defining indicators to monitor the identified IT Service goals.

Select IT Service Goals:

During this activity, existing IT Service goals are reviewed to select those which are aligned to organizational goals and which have already been measured (i.e., there are measures and data related to them). Information about IT Service goals can be obtained from analyzing documents or interviewing IT Service department managers.

SINIS provides a checklist to support reviewing and selecting IT service goals, provided in Table 4. In addition to examining organizational goals, data can be gathered by analyzing documents or conducting open interviews with managers responsible for the IT Service department. SINIS does also provide an example of a reviewed IT Service goal, as presented in Table 5.

Table 4 - SINIS questions to support review of an existent IT Service Goals (based on (BASILI *et al.*, 2005))

	SINIS questions to support review of an existent IT Service Goals
1	Is the goal scope related to something that IT Services department is able to deliver?
2	How is the service goal related to organization's goals?
3	Which IT service process is related to the goal?
4	Is the goal to Maintain, Increase or Reduce something?
5	What is the object the goal is related to?
6	In which quantity is the goal achieved?
7	What is the timeframe to achieve this goal?
8	Who is the primary responsible for goal attainment?
9	What relevant constraints may prevent goal achievement?

Table 5 - SINIS example of a reviewed IT Service Goal

SINIS example of a reviewed IT Service Goal	
IT Service Goal before review:	*Cost Reduction with Security Incidents*
1	Is the goal scope related to something that IT Services department is able to deliver?	*Yes*
2	How is the service goal related to organization's goals?	*Aligned with Cost Reduction organization goal*
3	Which IT service process is related to the goal?	*Incident Management*
4	Is the goal to Maintain, Increase or Reduce something?	*Reduce*
5	What is the object the goal is related to?	*Cost with incident solution solving*
6	In which quantity is the goal achieved?	*It is not clear*
7	What is the timeframe to achieve this goal?	*One year*

8	Who is the primary responsible for goal attainment?	*IT Security Manager*
9	What relevant constraints may prevent goal achievement?	*Increase the number of users, Unexpected Security Issues*
IT Service Goal after review:		*Reduce 10% the cost with IT Security incidents solution*

Define New IT Service Goals

This activity consists in defining new IT Service goals, following SMART principles: Specific, Measurable, Achievable, Relevant and Time-Bound (DRUCKER, 1954). In addition, goals should not be broad or vague. They should be broken down into specific results, written using words which clearly describe the results to be achieved as evidenced by indicators (BARR, 2014).

A list of questions to be used during interview to identify IT services goals is provided in Table 6, a template in Table 7 and examples in Table 8.

The template is based on GQM+Strategies (BASILI et al., 2005) and requires information regarding the Balanced Scorecard (BSC) dimensions (KAPLAN and NORTON, 1996) related to the IT Service goal. BSC dimensions are helpful in subsequent activities which involve reusing COBIT Goals Cascade indicators (ISACA, 2012), since they classify goals by BSC dimension. In addition, it is relevant to identify related processes involved with IT Service because measures associated with them might be useful as indicators (GUSMÁN et al., 2010).

Table 6 - SINIS questions to support elicitation of IT Service Goals (based on (PETERSEN *et al.*, 2015; BASILI *et al.*, 2005))

SINIS questions to support elicitation of IT Service Goals	
1	What is the scope of considered IT Services department about?
2	What are the clients/customers that considered IT Services department delivers for?
3	What can be gathered from existent service agreements with customers for service delivery?
4	What can be extracted from issues root cause on history reports about provided services?
5	What can be extracted from customers' satisfaction reports about provided services?
6	What can be linked to IT Services from organization Vision, Mission and Values statements?
7	What are organization's goals?
8	What can be associated to IT Services from organization economic, social, political, market trends, environmental and technological aspects?
9	What does IT Services department plan to execute in next period (year for example)?
10	What future can you figure for IT Services department in following years?

11	How does IT Services department wants to grow, having new clients or/and proving services based on new competencies?
12	What is definition of success for IT Services department?
13	Does IT Services department need or desire to improve any aspect of service delivery?

Table 7 - SINIS template for IT Services Goal

SINIS template for IT Services Goal	
IT Services Goal	<Name of the IT Services goal>
Activity	<Is the goal to Maintain, Increase or Reduce?>
Object	<What is the object the goal is related to?>
Magnitude	<What is the quantity of goal to be achieved?>
Time Frame	<When should the goal be achieved?>
Responsible	<Who is the primary responsible for goal attainment?>
Constraints	<What relevant constraints may prevent goal achievement?>
COBIT IT-Related Goal	<One of 17 available IT-Related Goals from COBIT: • Alignment of IT and business strategy • IT compliance and support for business compliance with external laws and regulations • Commitment of executive management for making IT-related decisions • Managed IT-related business risk • Realized benefits from IT-enabled investments and services portfolio • Transparency of IT costs, benefits and risk • Delivery of IT services in line with business requirements • Adequate use of applications, information and technology solutions • IT agility • Security of information, processing infrastructure and applications • Optimization of IT assets, resources and capabilities • Enablement and support of business processes by integrating applications and technology into business processes • Delivery of programs delivering benefits, on time, on budget, and meeting requirements and quality standards • Availability of reliable and useful information for decision making

	• IT compliance with internal policies
	• Competent and motivated business and IT personnel
	• Knowledge, expertise and initiatives for business innovation>
BSC Dimension	<Finance, Customer, Internal or Learn and Growth>
IT Service Process related	<Process that can impact goal achievement>

Table 8 - SINIS example of IT Service Goal

IT Services Goal	
IT Services Goal	Reduce Incident Resolution Time
Activity	Reduce
Object	Time to Solve Incidents
Magnitude	10%
Time Frame	Annual
Responsible	IT Services Infrastructure Department
Constraints	Do not increase cost
COBIT IT-Related Goal	Delivery of IT services in line with business requirements
BSC Dimension	Customer
IT Service Process related	Incident Management

Associate Existing Indicators to IT Service Goals:

During this activity, all indicators in use are gathered and analyzed, and then it is verified whether indicators are associated with any IT Service goals. Since indicators are already being collected and analyzed, data should be gathered from existing measurement documentation and from meetings. Analyzing documentation and holding open interview meetings with stakeholders responsible for measurement can support this activity. Indicators which are aligned to an IT Service goal should be documented using the SINIS template shown in Table 2. Indicators which are not aligned to any IT Service goal should be discarded, bearing in mind that an indicator name and description may simply need to be rewritten in order to provide greater clarity about its association with an IT Service goal. Since information requirements describe the information needed to monitor measurement goals (BARCELLOS et al., 2012, MCGARRY et al., 2002), during this activity, information requirements related to indicators should be evaluated to associate each existing indicator with an IT Service goal.

Create new Indicators for IT Service Goals:

During this activity, new indicators should be defined and associated with each IT Service goal. New indicators should be defined when the existing ones are not able to

provide the necessary information, or when there is no indicator. Reusing indicators can help to reduce the effort, time and cost of this activity. In this sense, example measures suggested in the COBIT Goals Cascade process (ISACA, 2012) and the IT Service list of measures (TRINKENREICH et al. 2015a) can be reused or can inspire new measures.

A template for Indicator Measurement Plan is shown in Table 9, an example is shown in Table 10 and a checklist to support derivation of IT Service Goals in indicators is provided in Table 11. An indicator should be reviewed if at least one answer is "No". Indicators should be based on standard definitions and terms so that all the people within organization can communicate in one language (ECKERSON, 2011).

Table 92 - SINIS template for Indicator´s Measurement Plan

SINIS template for Indicator´s Measurement Plan	
IT Services Goal related	<Name of the IT Services goal - Same to match IT Services Goal>
Measurement Goal	<What is going to be controlled: Maintain, Increase or Reduce?>
Information Need	<What is the information need attended by the measurement?>
Indicator	<Name of the indicator to monitor the recorded goal>
Measurable entity type	<What entity type is being measured by the indicator?>
Base measures	<Measures from which the indicator is obtained (if applicable)>
Measure calculation formula	<Formula used to calculate the indicator (if applicable)>
Measurement procedure	<Procedure to be followed to collect and store data for the indicator>
Measurement responsible	<Role performed by people in charge of collect and store data or tool that collect and record data without manual intervention>
Measure unit	<Measurement unit in which the indicator is expressed>
Measurement moment	<Activity on which measurement should be performed>
Measurement periodicity	<Frequency of measurement >

Table 10 - SINIS example for Indicator´s Measurement Plan

SINIS example for Indicator´s Measurement Plan of IT Services Goal	
IT Services Goal related	Reduce Time in Crisis
Measurement Goal	Reduce
Information Need	How many hours were spent in crisis?
Indicator	Number of hours in crisis (NHC)

Measurable entity type	Crisis
Base measures	Time spent in a crisis (TSC); Number of crisis (NC)
Measure calculation formula	$NHC = TSC_1 + TSC_2 + \ldots + TSC_{NC}$
Measurement procedure	TSC: Extract data from incident report and conference call report NC: Extract data from incident report
Measurement responsible	Service continuity analyst
Measure unit	Hours

Table 11 - SINIS checklist to support derivation of IT Services Goals in indicators (based on (DRUCKER, 1954; BROOKS, 2006; ECKERSON, 2011))

SINIS checklist to support derivation of IT Services Goals in indicators		
1	**Specific**	Does the indicator measure a specific process or part of a process? If indicator measures more than one process, are both process owners aware of their responsibility about achieving this indicator result?
2	**Measurable**	Is the indicator measurable? For example, if you need to measure how long users spend on the phone with service desk opening an incident, there might be some kind of PABX to report calling times or something like this.
3	**Achievable**	Is the indicator target achievable? For example, if target is to have service desk calls ending in 3 minutes, but attendant has a long form to fill with user information or a service management application to use that is slow and consumes most or more than 3 minutes, this target is not achievable.
4	**Realistic**	Is the indicator realistic? For example, if there are many reasons for an incident to be in "Waiting" status (Waiting for user call back, for next level support, for new version installation), it does not make sense to have an indicator simply about how long an incident is in waiting status.
5	**Timetable**	Is the indicator timely? For example, if service desk measurement of customer satisfaction is collected quarterly, but analysis need to be done once a month, there will not be a timely measurement, because during two months there will be no data for analysis.

SINIS checklist to support derivation of IT Services Goals in indicators		
6	Aligned	Is indicator aligned with any IT service goal?
		For example, an indicator "Amount of incidents solved with expired SLA" can be related to IT Services' Goal "Increase Incidents Solved On Time"
7	Owned	Is the indicator designed and owned by an individual or a group to evaluate its outcome?
		For example, an indicator "Percentage of machines with antivirus up to date" is owned by antivirus specialist from security team.
8	Predictive	Is it possible (even in future) to use a statistical technique for this indicator to predict future outcomes based on current levels of activity so indicator owner can see whether it are going to meet targets by the end of measurement defined period?
9	Actionable	Are there known and possible actions to improve performance if indicator outcome performs under or over expected limits? It doesn't make sense having an indicator to measure a goal if users cannot change the outcome.
10	Easy to understand	Is indicator name and measurement plan straightforward and easy to understand to all involved stakeholders?

2.3 Phase (iii): Elicit Strategies to Achieve IT Service Goals, Indicators and Interpretation Models

This phase involves identifying processes which are critical to IT Service, and root causes for the main issues to be resolved by strategies for achieving IT Service goals (which were defined based on organizational goals). In addition, this phase addresses defining indicators to monitor defined strategies and their respective interpretation models.

Gather Existing Strategies: During this activity, if the organization already has a list of existing IT Service strategies planned or on course to achieve IT Service goals, these strategies are gathered and reviewed. If not – or if the organization feels that there is a need for other strategies to achieve IT Service goals – then new strategies should be defined during the subsequent activities. Data should be gathered from existing documentation and meetings records. Analyzing documentation and holding open interview meetings with IT Service department managers and teams can support this activity.

Strategies should be analyzed in terms of their results if they are related to achieving an IT Service goal. When the name or description of a strategy is not clear, it should be rewritten to clarify how it aligns with a goal. However, when a result of an existing strategy does not contribute to any goal, it should be reformulated or it should stop being executed, to avoid wasting efforts working on a strategy which is not aligned to achieving any goals. Table elow provides a SINIS template for documenting strategies.

Analyze Critical IT Service Processes: SINIS uses analysis of critical processes involved in IT Service as a way to support defining strategies to achieve IT Service goals.

The main goal of process mapping in SINIS is to promote discussion with domain experts to find proper strategies instead of performing a complete process redesign. Superfluous processes are identified for removal only if they do not impact any IT Service goal. Problems should be identified and prioritized and root causes should be investigated to support understanding what can be executed as SINIS strategies to achieve IT Service goals.

A critical process is a process which can impact business goals, a failed process, or a process which might fail (HUXLEY, 2003). In this activity, processes identified in the previous phase as being related to IT Service goals are mapped and analyzed to find the critical processes which strategies should focus on. Relationships should be analyzed between the processes being mapped and other processes, to help find causes and effects for difficulties which the organization is having in achieving IT Service goals. This makes it possible to identify critical processes which the strategies should focus on, in order to identify opportunities for improvement by selecting strategies for achieving IT Service goals. This activity is performed after defining IT Service goals (and not before), in order to analyze only the processes which are related to those goals, avoiding wasting costs and time by analyzing all the processes.

The SINIS approach recommends that the processes related to IT Service goals should be modeled to provide a detailed view about how the processes related to IT Service goals are being executed and to provide insights about finding critical sub-processes for establishing strategies. In addition, relationships should be investigated between processes involved in IT Service goals and other processes, to identify critical cause-and-effect relationships which should be considered when identifying critical sub-processes for establishing strategies (TRINKENREICH and SANTOS, 2015b).

In the sub-activity "Map and Identify Critical Sub-processes in Processes Related to IT Service Goals", the SINIS approach involves classifying IT Service goals per IT Service process in order to map those processes and help finding which parts (sub-processes) or relationships with other processes are impacting goals and should thus be focused on by strategies.

The SINIS approach does not specify whether process mapping should be more or less detailed, or whether it should be represented by input/output flows or other representations, nor does it require a specific software application. What's important is that process mapping should be sufficiently understandable to allow identifying critical sub-processes or possible conflicts, issues, difficulties or problems which might impact goals, thus suggesting that these would make good candidates for strategies to achieve related IT Service goals. Sub-processes identified during this phase will be candidates for defining strategies in the next phase. Questions which could be asked to help identify critical sub-processes include: Which sub-processes of processes involved in IT Service related to the selected IT Service goal have the highest potential for improvement? Is there a plan for improving them? Which processes are currently not performing well? Which processes have strong correlation with goal results? Which processes are important for stabilizing performance? Which processes pose significant risks for a goal, or might prevent it from being achieved? Which processes serve as key inputs to a goal? Which processes will be executed frequently enough to provide sufficient data for analysis? Which processes consume a greater amount of effort to be performed?

After gaining clear knowledge about the target process, an investigation should be carried out on which part of the process (sub-process) is impacting IT Service goals and can thus be addressed by strategies.

Using the SINIS approach, remediation does not involve a complete process redesign, but rather a root-cause investigation to better understand which part of the process is impacting the achievement of a related IT Service goal and can thus be identified as critical, making it a candidate for strategies in the next phase.

The SINIS approach considers negative events to be anything which impacts the organization's ability to achieve IT Service goals, and causes (either direct or contributing factors) are candidates for being selected when defining strategies in the next phase. Therefore, to support executing the sub-activity "Identify Root Cause for Issues in Critical Sub-processes" the SINIS approach recommends, in no particular order, using various tools and techniques to support finding the root cause for a problem in a critical process, such as analyzing documents and records, holding interviews, brainstorming, or using flowcharts, the Five Whys, cause-and-effect analysis, or Pareto analysis (ROBITAILLE, 2004).

An example of a mapped IT Service overall process (Incident Management) is shown in Figure 2, including relationships with other processes.
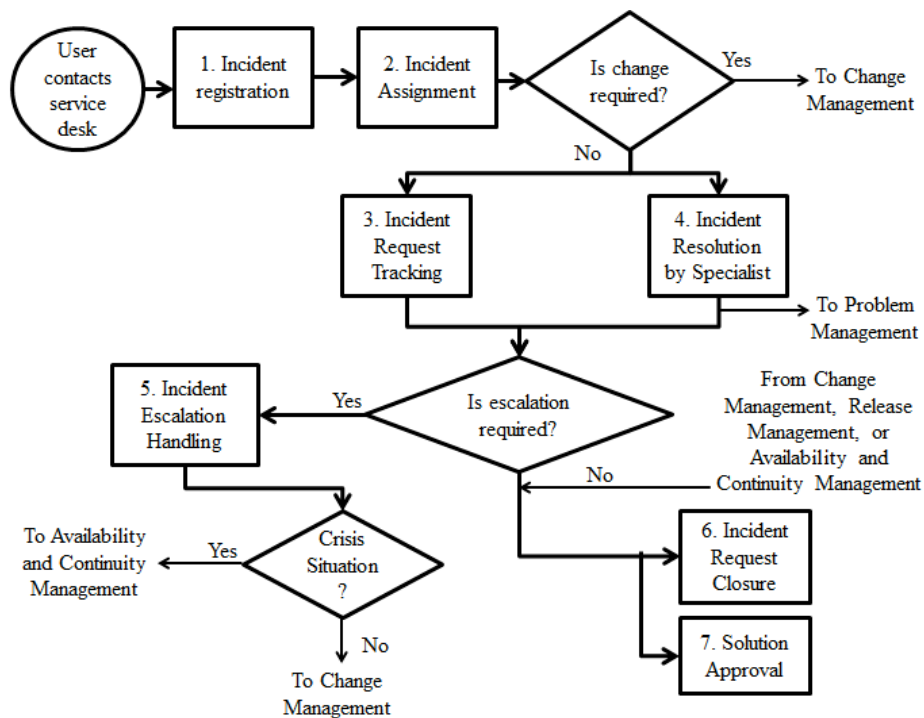

Figura 2 - Mapping of Incident Management overall process (TRINKENREICH et al., 2015c)

A checklist to be used during identification of critical sub-processes is provided in Table 12, a template in Table 13 and an example in Table 14.

Table 12 - SINIS checklist to support identification of IT services critical sub-processes (based on (FORRESTER *et al.*, 2010; PETERSEN *et al.*, 2015))

	SINIS checklist to support identification of IT services critical sub-processes
1	Which sub-processes of IT Services processes related to selected IT Services Goal have the highest improvement potential? Do you have a plan to improve them?
2	Which sub-processes of IT Services processes related to selected IT Services Goal are not working out good today?
3	Which sub-processes of IT Services processes related to selected IT Services Goal have strong correlation with goal results?
4	Which sub-processes of IT Services processes related to selected IT Services Goal are important to stabilize performance?
5	Which sub-processes of IT Services processes related to selected IT Services Goal can provide major risks to goal or stop it of being accomplished?
6	Which sub-processes of IT Services processes related to selected IT Services Goal serve as key inputs to goal?
7	Which sub-processes of IT Services processes related to selected IT Services Goal will be executed frequently enough to provide sufficient data for analysis?
8	Which sub-processes of IT Services processes related to selected IT Services Goal represent more consumed effort to be performed?

Table 13 - SINIS template to document IT services critical sub-processes

SINIS template to document IT services critical sub-processes	
Related IT Services Goal	<Name of related IT Services goal – same inserted in SINIS template for IT Services Goal>
Related IT Services Process	<Process that can impact goal achievement– same inserted in template SINIS template for IT Services Goal>
Name of Critical Sub-process to be addressed	<Name of sub-process (part of related IT Services goal) identified as critical to related IT Services Goal (that can impact success of failure)>
Description of Critical Sub-process to be addressed	<Textual description of sub-process (part of related IT Services goal) identified as critical to related IT Services Goal (that can impact success of failure)>
When critical sub-process was identified	<Date when critical sub-process was identified>
Description of how critical sub-process was identified	<Textual description about how sub-process was identified as critical>

**Table 15 -** SINIS example to document IT services critical sub-processes

SINIS example to document IT services critical sub-processes	
Related IT Services Goal	Reduce Incident Resolution Time
Related IT Services Process	Incident Management, Change Management, Problem Management and Availability and Continuity Management
Name of Critical Sub-process to be addressed	Solve recurrent incidents (Problem management)
Description of Critical Sub-process to be	If applied solution is a workaround, and incident can happen again, a problem record should be opened for root-

addressed	cause analysis. Recurrent issues cause overload support teams and contribute to increase incident resolution time.
When critical sub-process was identified	May 2015
Description of how critical sub-process was identified	Incidents reports were analyzed and grouped by issue description to find recurrent ones. Problem management reports were also analyzed and found that most of recurrent issues are not having a proactive record being opened as process was designed to happen.

A checklist to be used during Pareto diagram creation is provided in Table 16, and an example in Figure 3, showing applications that had more incidents escalated to crisis.

Table 16 - SINIS checklist to support Pareto diagram creation (ANDERSEN and FAGERHAUG, 2006)

**SINIS checklist to support Pareto diagram creation**	
1	Define the problem to be investigated and the list of potential causes that were determined
2	Establish a criterion to be used when comparing possible causes for ranking
3	Define a time period for data collection about causes
4	Collect data and build Pareto diagram
5	Place causes along horizontal axis, from left to right, in descending order of relevance, according to established criterion
6	Point data value on left vertical axis and percentage on the right, draw a curve of cumulative importance along top edges of rectangles
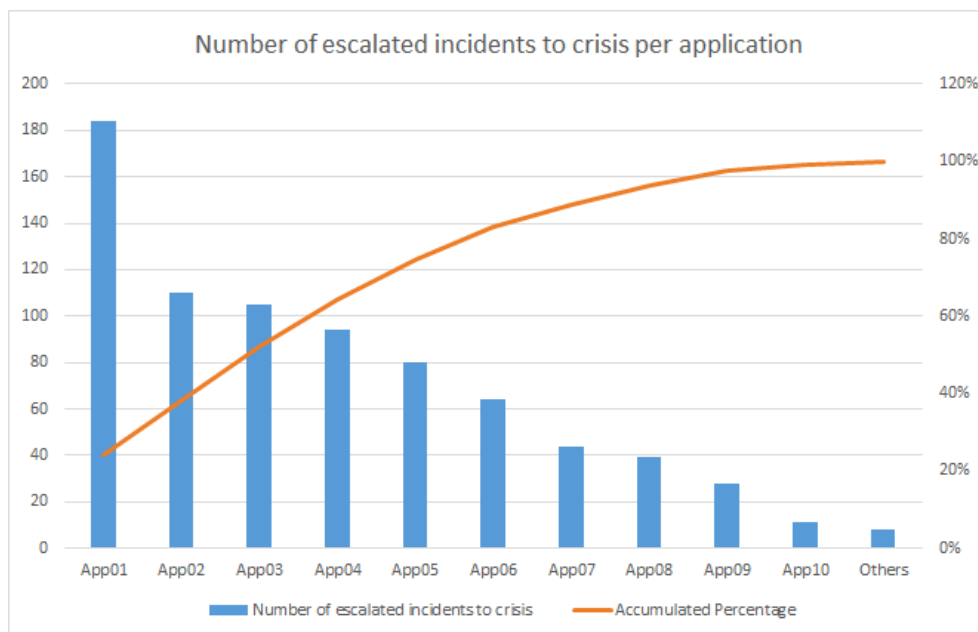
Figure 3 – Example of Pareto analysis showing applications that had more incidents escalated to crisis (Source: The author)

For SINIS, negative events can be anything that is impacting organization on achieving IT service goals, and causes (either causal or contribution factors) are candidates to be selected during strategies establishment in next phase. An example is provided in Figure 4.
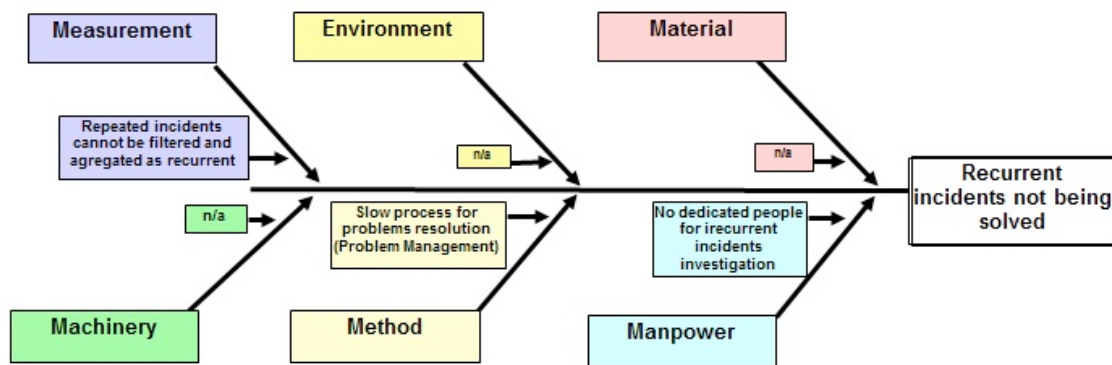
Figure 4 - Example of using Cause-and-Effect diagram to identify factors that are contributing to issue identified in critical sub-process "Solve recurrent incidents" (Source: the author)

Five Whys technique follows a sequential logic, starting in a final point following a path back, returning to process results and investigating actions that antecede them (ROBITAILLE, 2004). When trying to solve a problem, it helps beginning at the end result, and then start reflecting about what caused that, and proceed with the question five times (SERRAT, 2009). So, this technique objective is to ask a "why" question five times to find root-cause. Questions examples are: "What caused this to happen?", "What happened before it?", "Why did it happen?". Five Ways is usually performed during brainstorm meetings, where contributors use natural curiosity always asking at least five times in a progressive investigation to drive discussion to root-cause (ROBITAILLE, 2004). Three key principles for an effective use of Five Whys technique are: (i) have an exact statement of the problem, (ii) provide correct answers to questions, (iii) have the persistence for basic root-cause (SERRAT, 2009). An example is provided in Figure 5.
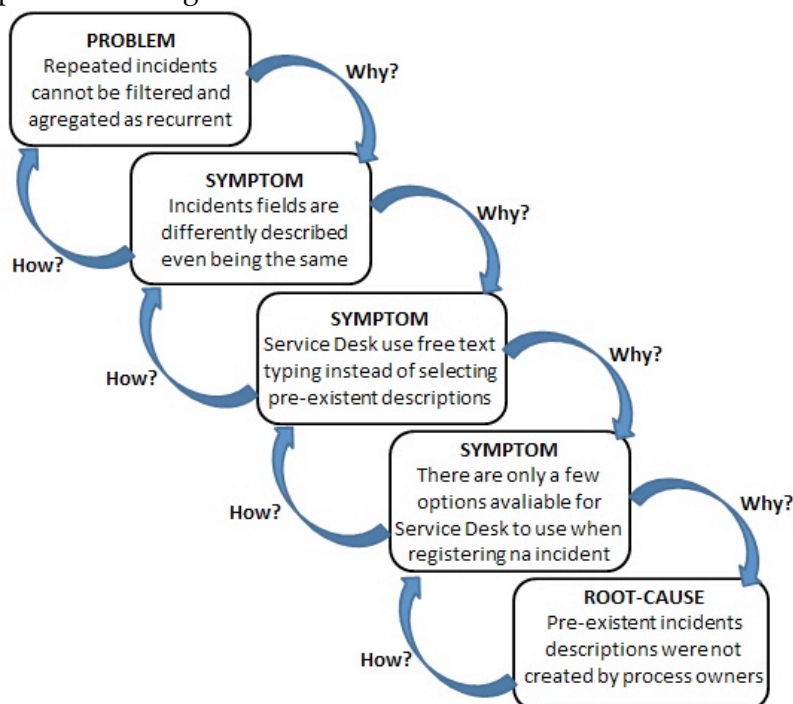

Figure 5 - Example of a Five Why´s diagram to identify root-cause for contributing factor "Repeated incidents cannot be filtered and aggregated as recurrent" found by Cause-and-Effect diagram as contributor to critical sub-process "Solve recurrent incidents" (Source: The author)

Establish Strategies to Achieve IT Service Goals: During this activity, existing and newly defined strategies are reviewed in a new round of brainstorming meetings conducted with the stakeholders responsible for measurement and a moderator, in order to associate them with IT Service goals, discarding or adjusting any strategies which are not associated with any goal.

Strategies represent ways to achieve goals (BASILI et al., 2005), and can be understood as works, initiatives or projects. One or more strategies can be implemented to achieve the same goal. This phase involves determining what needs to be done in order to achieve IT Service goals (PETERSEN et al., 2015) – in other words, how do we get there from here. GQM+Strategies (BASILI et al., 2005) does not provide specific guidance regarding how to support the organization in selecting strategies. The SINIS approach considers that strategies to achieve IT Service goals should focus on processes which impact the achieving of goals – i.e., critical processes – and on removing barriers or solving difficulties which the organization is experiencing in achieving its IT Service goals.

In this activity, based on the results of the root-cause investigation which was performed in the qualitative processes analysis in the previous activity, strategies are defined in order to achieve IT Service goals. While the first SINIS activity defined general context factors and assumptions for IT Service, the current activity elicits specific context factors and assumptions for strategies, comparing them with the general context factors and assumptions to check whether there are any inconsistencies which need to be adjusted.

The suggested template for recording the established strategies is shown in Table 17 and an example is provided in Table 18.

Table 17 - SINIS template for Strategies (TRINKENREICH *et al.*, 2015c)

SINIS template for Strategies	
IT Services Goal	<Name of associated IT Services Goal - same as inserted in SINIS template for IT Services Goal>
Strategy Name	<Project or initiative or strategy name>
Strategy Scope	<Description of scope for strategy>
Start date	<Date for strategy to start>
Finish date	<Foreseen date for strategy to be completed>
Strategy owner	<Person responsible for delivering this project or initiative or strategy>
Strategy sponsor	<Sponsor responsible for funding and supporting the implementation of this project or initiative or strategy>
Strategy complexity	<Complexity for strategy implementation – Low, Medium, High>
Strategy risk	<Risk of implementation for this project or initiative or strategy - Low, Medium, High>
Strategy cost	<Cost to deliver strategy>
Strategy context factors	<Context factors - what we factually know – considered for this project or initiative or strategy>

Table 18 - SINIS example for Strategies (TRINKENREICH *et al.*, 2015c)

SINIS example for Strategies	
IT Services Goal	Reduce Incident Resolution Time
Strategy Name	Improve service-desk scripts
Strategy Scope	Provide training for service owners about how to review service-desk scripts, Create templates covering all different known issues, including set of questions to be done and data to be collected from user during first call, Provide training to service-desk on using new templates and reviewed scripts.
Start date	01/Nov/2015
Finish date	30/Mar/2016
Strategy owner	Service Desk Manager
Strategy sponsor	IT Services Director
Strategy complexity	Medium
Strategy risk	Low
Strategy cost	No Cost – Usage of internal resources only
Strategy context factors	There is an internal team called ITIL Office, with no additional cost, available to provide trainings for service owners about how to review service-desk scripts. Service owners have access to review and create new service-desk scripts, and also templates to be used by service-desk team during users' first call. Service-desk team charges per each attended call, do not charge for having their personnel trained.
	Service owners will be available to work on this strategy.
	Incident Management and Problem Management
	Root-Cause "Pre-existent incidents descriptions were not created by process owners " that was identified for problem "Repeated incidents cannot be filtered and aggregated as recurrent" for critical sub-process "Solve recurrent incidents"

Create or Include New Indicators and Measurement Plans for Strategies: In this activity, similar to the activity "Define Indicators and Measurement Plans for IT Service Goals", strategies are made measurable by specifying appropriate questions and measurement plans to define indicators and how their data collection should be performed. As with that previous activity, in order to reduce effort, time and cost, it is recommended to reuse existing measures by consulting example measures from the COBIT Goals Cascade process (ISACA, 2012) and the IT Service list of measures (TRINKENREICH et al, 2015a), to see if they could be applicable or could inspire new measures.

Create Interpretation Models for all Indicators: In this activity, interpretation models for all indicators (related to IT Service goals and strategies) are created. This activity is executed only at this moment to avoid rework and wasted time in case of discarding or adjusting any indicator. Interpretation models are defined to determine how data collected for the defined indicators should be interpreted to support informed decisions about strategies and achieving IT Service goals. Targets can be defined based on previous service level agreements and contracts, reports or business needs. Meetings with stakeholders of the organization can be used as a way to gather information. Questions used during such meetings could include: What is the expected result (or range) for each indicator in order to achieve the associated goal? If the result is above or below the range, should it be interpreted as good or bad? What was the result for each indicator in the previous measurement period? Who are the personnel responsible for interpreting the results of this indicator? How/when should the indicator be interpreted? Table below provides a template for interpretation models for indicators.

A checklist to be used during elicitation of Interpretation Model of IT Service Goals indicators is provided in Table 19, a template in Table 20 and an example in Table 21 bellow.

Table 19 - SINIS checklist to support for Indicators Interpretation Models

SINIS checklist to support for Indicators Interpretation Models	
1	What is the expected result for this indicator in order to achieve related goal?
2	Between which range is the result considered as achieved?
3	If the result is below the range considered as achieved, should it be interpreted as good or bad?
4	If the result is up the range considered as achieved, should it be interpreted as good or bad?
5	What was the result for this indicator in last measurement period?
6	Who is the responsible for interpreting this indicator result?
7	How should the indicator be interpreted?
8	When should the indicator be analyzed and interpreted?

Table 20 - SINIS template for Indicators Interpretation Model

SINIS template for Indicators Interpretation Model	
Indicator related	<Name of indicator – Same to match Measurement Plan>
Target	<Value expected for the indicator in order to achieve the associated goal>
Range	<Value limits of defined scale according to historical data or organization goal>
Baseline	<Result from the same period last year>

Interpretation model	<Procedure to be followed to analyze data collected for the indicator >
Interpretation Responsible	< Role performed by people in charge of analyze data>
Interpretation Moment	<Activity in which data analysis should be performed>
Interpretation Periodicity	<Frequency in which data analysis should be performed>

Table 21 - SINIS example for Indicators Interpretation Model

SINIS example for Indicators Interpretation Model	
Indicator related	Percentage of security incidents that caused financial loss
Target	688 hours and 30 minutes (annual value)
Range	Reduction
Baseline	750 hours last year
Interpretation model	If value is 5% over target, only follow task plan to reduce. If value is between from 6 to 10% over target, apply financial penalty 1 to service provider and follow task plan to reduce. If value is between 11 to 15% over target, apply financial penalty 2 to service provider and follow task plan to reduce If value is more than 15% over target, apply penalty 3 and cancel contract.
Interpretation Responsible	IT Services Continuity team
Interpretation Moment	During managers performance meeting
Interpretation Periodicity	Every month, accumulated data is analyzed and compared to goal taking same month in previous year as a reference. In the end of the year, total value is compared to total value in the previous year.

2.4   Phase (iv): Build, Review and Adjust GQM+Strategies Grid

During this phase, context factors, assumptions, goals, strategies and indicators are organized into a GQM+Strategies Grid in order to provide an overview of IT Service measurements and help validate and identify items which need to be reviewed. Flexibility is important to allow iterative changes to the GQM+Strategies Grid, to ensure that the overall plan is aligned with and reflects the needs of the organization (MUNCH et al., 2013). Ideally, the grid should present the cleanest possible view. Figure 3 below provides a SINIS template and example grid. The template was designed to facilitate viewing goals, strategies and indicators at different levels on a

single page. In addition, general context factors and assumptions are also included on this same single page, making it possible to verify whether they are up-to-date. Thus, if there is a need to update the context factors and assumptions, the grid provides a convenient view of the goals, strategies and indicators which would be impacted by the changes.

SINIS was evaluated in order to validate if the method was coherent with a real case in industry. SINIS was applied in a case study, where researcher was invited by IT Security department to actively drive procedures to review existent indicators. Even having only one experience for each version and not being able to statistically and effectively prove SINIS applicability, there is evidence that the method is able to provide support during indicators definition for IT Service departments. The researcher was able to collect lessons learned to validate some decisions about SINIS procedures and instruments and others to improve SINIS in future.
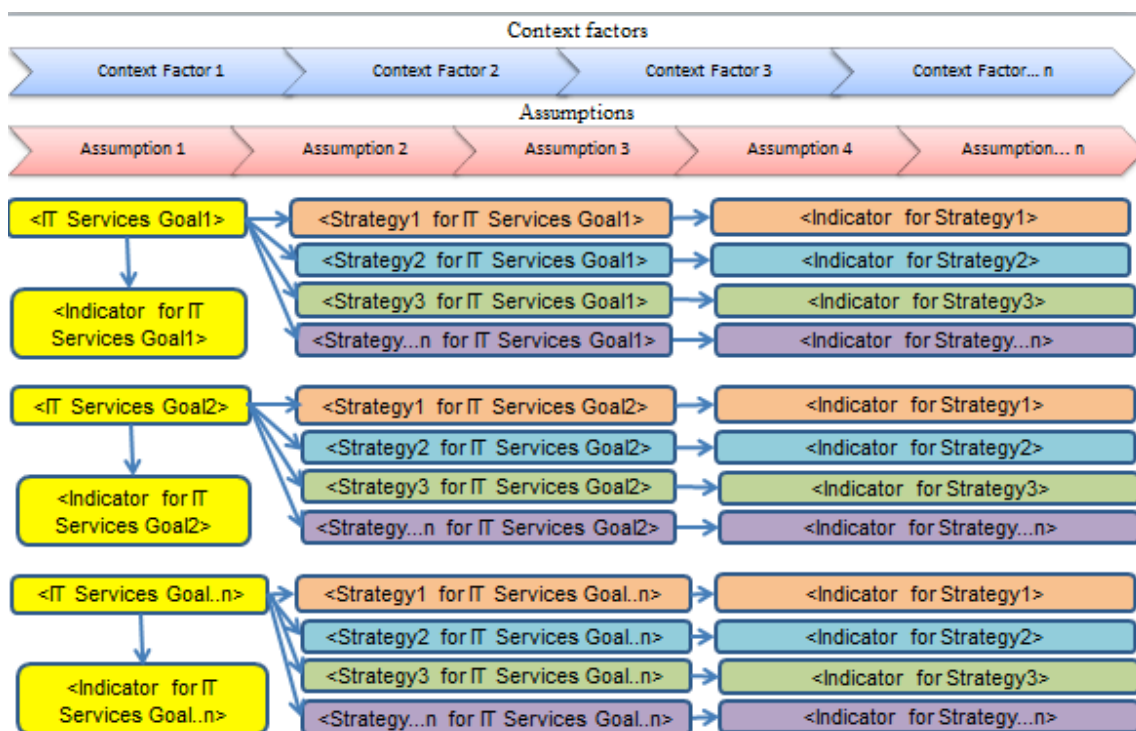

Figure 6– SINIS Template for GQM+Strategies Grid

The GQM+Strategies Interpretation Models and Grid should be presented to all stakeholders at meetings where the information sources, context factors and assumptions should be validated and the applicability, completeness, accuracy and consistency of the goals, strategies and indicators should be evaluated. In addition, discussions can point out potential findings and opportunities for improvement. It is recommended to include personnel who were not involved in applying the SINIS methodology, but who will be eventually be involved in or impacted by the execution or results of the strategies which were defined. During this phase, if any definition needs to be adjusted, it is possible to go back to where the adjustments need to be made, and then continue applying the method again from that point to the end. For example, if an IT Service goal needs to be adjusted, the related measurement plan, interpretation model, and strategies defined to attain that goal will also need to be revisited. This means that traceability should be performed, in order to keep everything consistent after any adjustment has been made.

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