2010

Proposal of an Artifact that Supports the IT-Governance Control Process

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Journal:	*18th European Conference on Information Systems*
Manuscript ID:	ECIS2010-0067.R1
Submission Type:	Research Paper
Keyword:	IT capabilities, IT governance, IT compliance, IT service management

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Abstract

Tasks regarding IS-strategy implementation can be allotted to the scope of IT-Governance. However, literature scans reveal a lack of guidance on how these tasks are to be accomplished. Unfortunately, most strategies fail during this step as they receive no proper implementation due to a lack of control, i.e. the ability to direct the IS-strategy implementation by knowing actions to be taken, how to proceed and to envisage outcomes of implementation processes. Therefore, the contribution of this research in progress is an artifact that supports the IT-Governance control process. The proposed artifact is based on knowledge sharing and implemented by an ontology. It is validated by an industry case. Additionally, participants were interviewed to assess their perceived usefulness of the artifact. The results indicate a broad appreciation of the approach.

Keywords: IT-Governance control process, knowledge provision, capabilities, ontology

1 INTRODUCTION

A significant contribution to meet organizational challenges can be made by Information Systems (IS) (Casolaro & Gobbi 2007; Mukhopadhyay & Kekre & Kalathur 1995; Brynjolfsson 1996), if IS provides capabilities that are required by the organization (Bhatt 2003; Devaraj & Kohli 2003; Lee 2001). This can be achieved by aligning the IS-strategy to the organization's strategy (Kearns 2001; Chan & Sabherwal & Thatcher 2006, p. 27), which means to adjust priorities, goals, and objectives of the IS-strategy to the priorities, goals, and objectives of the firm's business strategy (Chan 2002; Chan et al. 1997; Roepke & Agarwal & Ferratt 2000). In general, proper alignment involves both, strategic and operative aspects as proposed by Henderson's and Venkatraman's alignment model (Henderson & Venkatraman 1989). Therefore, an IS-strategy requires a proper implementation to allow the provision of required capabilities to the organization.

Aspects regarding IS-strategy implementation can be allotted by the following categories to the scope of IT-Governance (IT Governance Institute (ITGI) 2006, p. 167; Weill & Ross 2004, p. 2, 8; de Haes & van Grembergen 2004) : *First*, the definition of objectives inferred from the IS-strategy. *Second*, managing the process of operationalizing abstract objectives. *Third*, tracking the attainment of objectives by analyzing the implementations' compliance to the defined IS-strategy (Johannsen et al. 2007, p. 22). These implementation related tasks of the IT-Governance are summarized by the term *control.* That provides the capability to direct the IS-strategy implementation by knowing actions to be taken, how to proceed and to envisage outcomes of implementation processes.

However, IS-strategy implementation lacks guidance on how assigned tasks within the scope of IT-Governance are to be accomplished. Literature scans failed to reveal assistance regarding the implementation of an IT-Governance control process that provides capabilities as discussed above. Specifically the way down to implementation lacks explicit analysis in literature (Simonsson & Johnson & Wijkström 9.7.2009, p. 2). Unfortunately, according to Lehner and Pryor et al. most strategies fail during this step as they receive no proper implementation due to a lack of control (Lehner 2004, p. 461; Pryor et al. 2007, p. 3).

Therefore, the contribution of this paper is a proposal how to provide required control capabilities within the scope of IT-Governance, which will be formerly referred to as *IT-Governance control process*. Specifically an implementation of the *knowledge provision sub-process* is presented in this paper. It is a core element of the proposed design of the IT-Governance control process, because the underlying concept is based on improving the sharing of specific knowledge among processes (Eppler & Seifried & Röpnack 1999). This approach roots back to the theory described by Nonaka et al. (Nonaka & Takeuchi 1995), exemplifying the role of knowledge to continuously innovate and finally create competitive advantages (Nonaka & Takeuchi 1995, p. 6). Since control is particularly based on transparency (Beimborn et al., p. 3), the process' main purpose is to provide required knowledge in an accessible way to all processes or individuals involved. Since this is a core concept of the taken approach, the contribution is focused on the knowledge provision aspect implemented by a *knowledge provision sub-process*, which allows evaluating the research by an industry case.

The remainder of the paper is organized as follows: First, the research design is introduced, including an initial design proposal of the IT-Governance control process. Second, the implementation of the knowledge provision sub-process by an ontology is explained. Third, the validation case and gathered results are presented. Finally, limitations of the results are discussed and conclusions are summarized.

2 RESEARCH DESIGN

The IT-Governance control process reflects a complex set of organizational capabilities. Thus, straight implementation seems not to be a feasible research approach regarding time and scope. However, the issue can be resolved into distinct parts following the separation of concerns strategy, which hides complexity by means of abstraction mechanism (Markiewicz et al. 2002, p. 111). The separation of concerns approach considers multiple aspects of a system in isolation first, whereas through stepwise composition the overall system design is attained. This iterative process allows focusing development on individual concerns. Furthermore, the understanding of the overall system is facilitated by the stepwise development of suitable local solutions (Giese & Vilbig 2006, p. 136). Thereby, the research focuses on distinct aspects at a manageable scale and scope (ITIL Service Strategy, p. 21). By application of the separation of concerns approach as a general process design of an IT-Governance control process is chosen. It serves as initial point for the research. The design follows the process-oriented concept as it is standardized by the ISO 9000 (ISO 9000), which includes the definition of sub-processes with clear task assignments. The initial design proposal is shown in Figure 1:

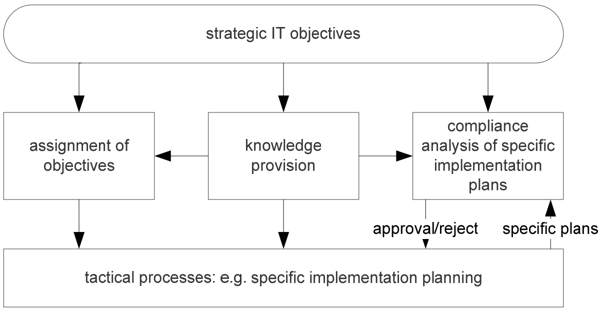


Figure 1. Proposal for IT-Governance control process design

Primary inputs are strategic objectives within the scope of IT-Governance. The output of the control process is primarily used as input of subordinated processes of the IT-Governance, e.g. tactical/operative processes in charge of developing specific implementation plans, i.e. vertical separation of concerns. Furthermore, the control process is divided into sub-processes (horizontal separation of concerns): The *assignment of objectives sub-process* identifies related objectives and assigns the task of implementation planning to a tactical process capable to handle given objectives. The responsibility to assign objectives to experts with case adequate domain knowledge is embedded in this sub-process. The *assignment of objectives sub-process* needs input from the *shared knowledge process* to be able to assign closely related objectives to a tactical process that is capable of creating an implementation plan. The *compliance analysis of specific implementation plans sub-process* approves or rejects specific plans for implementation of strategic objectives. Basic principles applied by the *compliance analysis sub-process* are: First, the analysis, if a specific plan reflects the shared understanding of considered objectives. Second, the assurance that a specific plan violating identified dependencies of strategic objectives will not be approved. Both principles rely on a shared understanding promoted by the *shared knowledge provision sub-process*.

The *knowledge provision sub-process* is the core element within the proposed IT-Governance control process design. It ensures a shared understanding of objectives among interacting processes. Therefore, this contribution is focused on aspects regarding the implementation of this sub process, which allows using the approach within an industry case for evaluation.

The characteristics of the knowledge to be provided by the *knowledge provision sub-process* are further defined by a requirement specification that is deduced of the proposed IT-Governance control process design and the theory described by Nonaka et al. (Nonaka & Takeuchi 1995):

- Sharing knowledge among individuals participating in the IT-Governance control process.
- Inference of dependencies among objectives that ease the identification of implementation sequences based on shared knowledge. As a result, the compliance analyses will be based on a transparent source of decision.
- Elicitation of knowledge that is relevant to:
    - Understand each objective in terms of creating a shared vision.

- Understand the purpose of each objective in terms of understanding the capabilities an organization will gain if the objective is attained.
- Being aware of capabilities that are required in order to attain a specific objective.

The stated requirements emphasize on the following modes within the process of knowledge sharing according to Nonaka et al. (Nonaka & Takeuchi 1995, p. 225): First, the externalization of knowledge by elicitation according to certain interpretation criteria. Second, the internalization of knowledge by providing a structured and explicit documentation of gained knowledge. Thus, the documentation serves as an accessible source for connected processes.

The *knowledge provision sub-process* is implemented by an ontology that is used for sharing the relevant knowledge of a domain. According to Gruber, ontologies are explicit specifications of conceptualizations (Thomas R. Gruber 1993, p. 199). Thus, an ontology serves as a concept that describes elements and relations within a specific domain of interest (Kabilan et al. 2007, p. 634). General purposes of using ontologies are discussed by Visser et al., of which two of five purposes are knowledge related: knowledge acquisition and knowledge exchange (Visser & Bench-Capon 1998, p. 30). According to Noy et al. (Noy & McGuinness, p. 1), the use of ontologies for knowledge related issues can be addressed by four major aspects: First, sharing a common understanding in a domain of interest. Second, enabling the reuse of domain knowledge. Third, making domain assumptions explicit. Fourth, analyzing domain knowledge. In order to support the presented research, domain specific knowledge is gained from domain experts. Furthermore, the elicited domain knowledge is shared among participants of the IT-Governance control process. Therefore, the building of an ontology is indicated.

Guidance for the construction is indicated since the process is comparable to software development in respect to its structure and complexity (G'abor 2007, p. 107) . In order to select a construction method, the ontology's type has to be determined in advance, because there is a linkage among ontology building processes and certain types of ontologies (Pinto & Helena Sofia & João P. 2004, p. 441). Most common types are *representation* for knowledge representation ontologies, *general* for universal and highly reusable ontologies and *domain* for application specific ontologies (G. van Heijst & A. Th. Schreiber & B. J. Wielinga 1997). In the present case, the domain knowledge is gained and embodied in an ontology for knowledge sharing. Therefore, the type *representation* is chosen. The most prominent methodologies for the creation of such ontologies are compared by Pinto et al. (Pinto & Helena Sofia & João P. 2004). As a result of their analysis, Methontology is considered as reasonable choice for the construction of ontologies. It uses, according to Beck, the most consented terminology (Beck & Pinto, p. 22) . Methontology has proven its applicability by successful application in several research projects (Gómez-Pérez 2004, p. 141–142; López & Gómez-Pérez & Sierra 2000; Corcho et al. 2005; Mikosa & Ferreira 2007; Park & Sung & Moon 2008). Methontology is based on an incremental life cycle concept taking into account that specifications tend to be incomplete in early development stages. Thus, several development iterations might be necessary until all requirements of users are sufficiently supported (Fernández & Gómez-Pérez & Juristo 1997, p. 35). In this paper results of the first iteration are presented.

Finally, the proposal is used in an industry case in order to analyze the artifact's fitness for purpose. Additionally, participants' experienced usefulness of the proposal is measured to gather a first hint regarding the acceptance in the means of technology acceptance.

3 CONSTRUCTION

The ontology is specified to share relevant knowledge required by the *knowledge provision sub-process.* One challenge within specification is to determine a sufficient level of the ontology's granularity (Guarino 1998, p. 7) . It expresses the amount of details to be embodied in the ontology. In general, there are two complementary starting points: First, beginning with a coarse ontology and conducting refinements as necessary. Second, starting from a fine grained ontology and reducing the amount of elements if they are not relevant. A so-called *middle out approach* can be taken as a compromise, i.e. to start somewhere in the middle of the mentioned opposites (Pinto & Helena Sofia & João P. 2004, p. 447). This approach can be implemented by starting at the ontology's instance level. It allows the involvement of domain experts in the specification process, even if they are not familiar with the ontology engineering. The proposed general solution is explained in Figure 2 that shows the ontology at instance level:

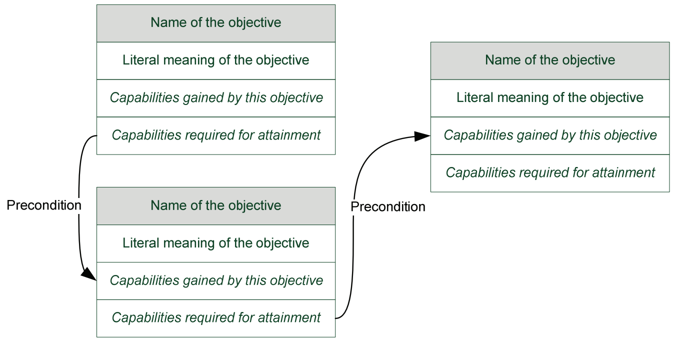


Figure 2. Solution idea: Example at the ontology's instance level

Objectives are denoted by unique names. The *literal meaning* of the objective is a general explanation of the respective objective. This includes, if necessary, definitions of terms and the objective's scope. The main question for elicitation is "What is the meaning of the objective?". The activity for gaining this kind of information is defined within the ontology as *literal interpretation*. The *capabilities gained* by the objective's attainment express its purpose. The main question for elicitation is "Which capabilities will the organization gain by attaining this objective?". This interpretation mode is defined within the ontology as *purposive interpretation*. The *capabilities required for attainment* express preconditions that are necessary for implementing the objective. The main question for elicitation is "Which capabilities are required to attain the objective?". This interpretation mode is defined within the ontology as *hierarchical interpretation*, because it is a preparation to determine an objective's role within a system of interrelating objectives. The interrelations of objectives are embodied within the ontology by *preconditions*. A *precondition* associates objectives requiring capabilities for implementation that are provided by other objectives.

The idea was tested in cooperation with an industry partner in the field of IT Service Management, which is in the scope of IT-Governance (Deutscher 2009; IT Governance Institute (ITGI) 2008, IT Governance Institute (ITGI) 2006). Table 1 presents an excerpt of the test results, whereas two example objectives are taken from the incident management process according to the ISO 20000 standard (ISO 20000, p. 13):

Objective:	Procedures shall define the recording of all incidents.
Literal meaning:	The recording of incidents should be defined by procedures. A bypass of event message processing is to be excluded. An incident is provided by a customer, for example via mail, telephone, or fax. The incident will initiate the opening of a new ticket and all required information will be recorded by the service desk.
Capabilities gained:	Incidents embodied by the same message type will be recorded uniquely. The recording is independent of individuals. The procedures serve as basis for a workflow that can be supported by IS. All information for incident processing is recorded. All information for statistical purposes like metrics documenting the fulfillment of service level agreement is recorded.
Capabilities required:	The requirements for incident processing need to be available and reviewed on a regular basis. Input from service level management and operations management is required.
Objective:	All incidents shall be recorded.
Literal meaning:	All incidents are to be recorded. An incident may be a false report, fault or a note: False report: A non-agreed service or performance is not met. E.g. Operator error, the system may be overcharged. E.g., The system is used outside its specification. Fault: An agreed service characteristic is not met. E.g., No Availability is due to hardware failures. E.g., Databases are not available so that a customer order cannot be processed. Note: The agreed services are delivered, but the customer addresses from his point of view a proposal for improvement.

Capabilities gained:	No incident gets lost. The complete recording allows creating reliable statistics for the coordination of improvements. Accumulations of quality deviations can be identified and the issue can be clearly addressed to responsible units / teams.
Capabilities required:	It has to be defined how and what is to be recorded. This information has to be updated, if changes occur.

Table 1. Sample result of the concept's application in ITSM within the scope of IT-Governance

Table 1 provides the following information: The capabilities required by the second objective can be provided by implementing the first objective. Therefore, the second objective has the first objective as precondition. In general, an objective may have any number of preconditions. The identification of preconditions is performed after all objectives have been interpreted according to the specified interpretation modes. The result of the construction stage is the class model shown in Figure 3:

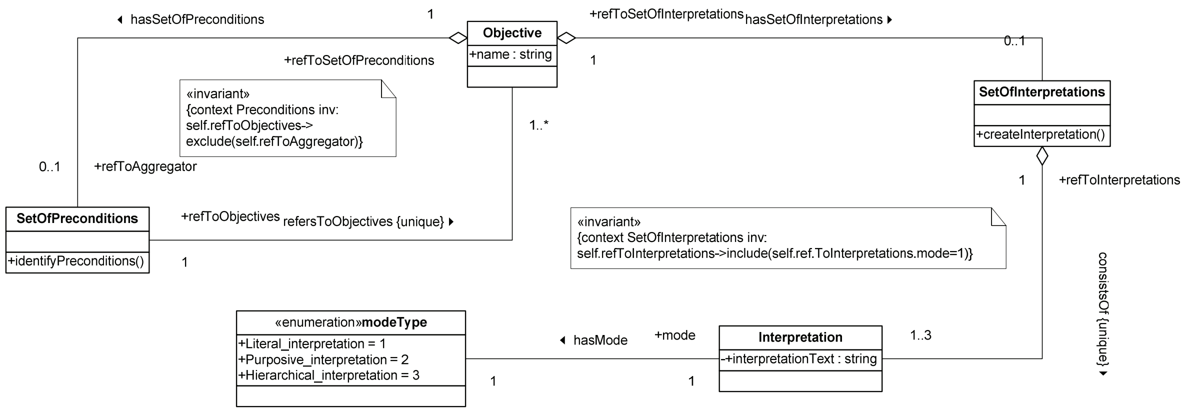


Figure 3. Meta-ontology of the specification

It represents a meta-ontology whose instances implement the specified ontology: An objective may have a set of preconditions that may contain any number of references to other objectives. In order to avoid circular references, an invariant in the context of preconditions is introduced. Furthermore, an objective may have a set of interpretations. Each interpretation corresponds to a mode as defined in the specification. If necessary, additional interpretation modes can be added dynamically. The second invariant within the context of interpretations ensures that an objective initially receives a literal interpretation. The reason for this enforced order is the result of conducted observations during the ontology's use in the project: A shared understanding of an objective's meaning supports the identification of required and provided capabilities. Required knowledge is embodied to instances of the ontology by structured interviews as follows:

1. Identification of objectives for interpretation.
2. Identification of domain experts to be consulted in interviews.
3. Conduction of interviews by using the interpretation modes and identification of preconditions.
4. Optional: Visualization of the ontology as proposed in Figure 2 in the *specification* and completely pursued in the *artifact* validation as depicted by an excerpt in Figure 4.
5. Review of the knowledge with domain experts and rendering of corrective actions as needed.

This procedure was successfully applied at the cooperation partner for a project conducted for validation purposed as presented in the next section.

4 VALIDATION

The evaluation consists of two aspects: First, a verification to confirm proper implementation of the specification. Second, a validation to check whether the provided artifact is suitable for the solution of assigned tasks (Balci & Sargent R. G. 1982, p. 621; Carson 2002, p. 52). The verification focuses on technical regards and is performed by testing the solution (Sommerville 2007, p. 97).The created present ontology of the knowledge provision sub-process was tested by ontology engineers using scenarios. These scenarios were previously developed in cooperation with domain experts. The evaluation was continued by the validation, since the ontology passed the prior step. A practical application is required in order to check the artifact's fitness for purpose. It allows the assessment of two main criteria to indicate a successful validation (Ören 1981, p. 180): First, the substantial fitness criterion as indicator for utility. It is based on the artifact's result accuracy within its intended field of operation. Second, the credibility criterion as indicator for the user acceptance within the intended domain of application. Furthermore, the evaluation was guided by a document that is based on a proposal of Law et al. (Law & Kelton 2000, p. 276). It contains all relevant aspects of the creation process. The validation of the implementation of the knowledge provision sub-process was performed in cooperation with an industry partner in the context of IT Service Management (ITSM), which is in the scope of IT-Governance (Deutscher 2009; IT Governance Institute (ITGI) 2006, IT Governance Institute (ITGI) 2008). The industrial company provides consulting services for ITSM referring to the practices of the IT Infrastructure Library (ITIL) and the ISO 20000 standard. Several certified ITIL and ISO 20000 experts were available for interviews in the validation case, providing domain specific expertise.

The major goal of the cooperation partner's IS-strategy is the development of customer centric service provision. The project is impelled by the aim of providing IT services at a higher quality level at competitive cost by the application of ITSM principles according to the ISO 20000 standard. The approach for goal implementation was further delineated by two challenges:

<u>First challenge</u>: Solving known problems within IT Service provision to allow quick wins.

<u>Second challenge</u>: Implement only those objectives of the ISO 20000 that are required to solve a specific known problem. Thus, a case dependent partial implementation is approached.

These challenges were taken by the use of the proposed artifact. First, an ontology of the objectives given by the ISO 20000 standard was created. The knowledge was embodied by using the interpretation modes presented in section Construction. Second, dependencies among objectives were identified by linking objectives that require certain capabilities with objectives that provide such capabilities (see example provided by Table 1). Additionally, the results were visualized in a map that shows dependencies between objectives (see Figure 4). It follows the idea introduced in Figure 2 within the Construction section.

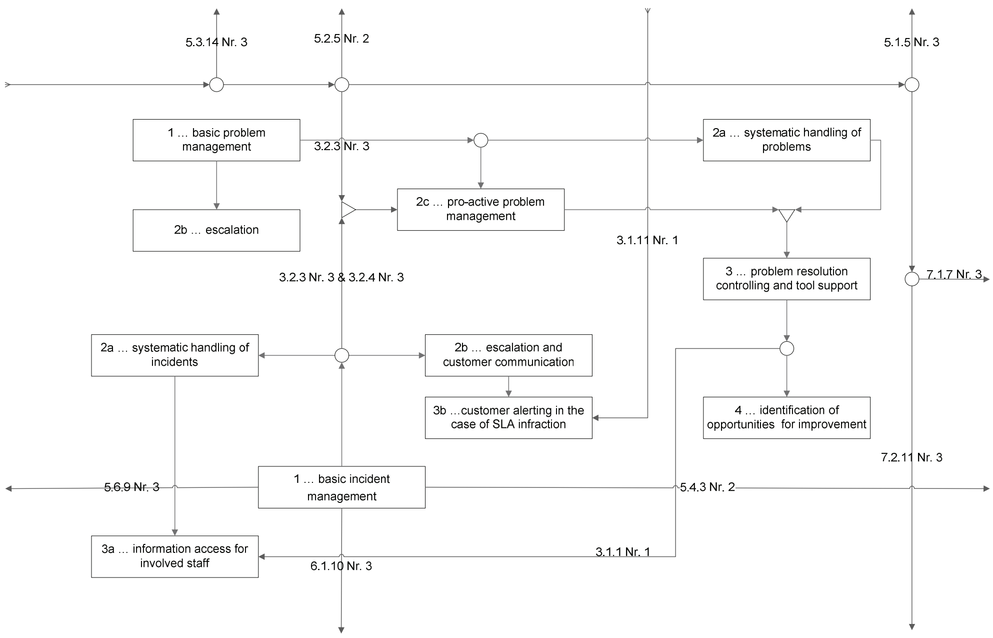


Figure 4. Excerpt of dependencies between objectives of an ITSM implementation map – created in this research.

The directed graphs between the boxes represent dependencies between objectives. They are inferred based on the gained knowledge by purposive and hierarchical interpretation modes. The shown boxes represent groups of dependent objectives that provide relevant capabilities to the IT and its organization. They are identified with domain experts of the cooperation partner based on dependencies in the ontology. For example, *basic problem management* consists of the following ISO 20000 requirements (ISO 20000, p. 13): (Procedures shall define the recording of all problems; All identified problems shall be recorded; Procedures shall define the updating of all problems; Changes required in order to correct the underlying cause of problems shall be passed to the change management process; Procedures shall define the formal closure of all problems). Creating such groups of dependent objectives provides two benefits: *First*, the visualization of complex ontologies is eased due to a reduced number of elements to be drawn. *Second*, more high-level capabilities are defined by creating groups that ease the selection to solve the needs/lacks that are identified. The circular shaped line connector serves as distribution point for one dependency. For example, *basic problem management* serves as precondition for *pro-active problem management* and *systematic handling of problems*. The rectangular shaped line connector denotes an alternative regarding the path that can be taken for implementation (understood as logical or). For example, *problem resolution controlling and tool support* can be implemented by *pro-active problem management* and/or by *systematic handling of problems*.

The first challenge was taken by searching the ontology for objectives that provide capabilities required to solve an existent well known problem: The cooperation partner identified the need to improve the resolution processes that are intended to resolve service disruptions and thereby restore usual service provision (ISO 20000). Specifically, options were considered that could reduce cost of the resolution processes. The results highlight a lack of support in documenting *known errors.* A *known error* is a service disruption for which the cause is found or a workaround exists. Issues cannot be identified as reoccurring for which solutions are on hand without documentation of *known errors*. This results in high resolution times through not using gathered experiences. Therefore, the specific need in this case is to reduce cost by an improved support in documenting *known errors.* Scanning the ontology for such capabilities reveals the objective *problem resolution controlling and tool support* (see Figure 4) as potential option. Its implementation results in a database that embodies all *known errors.* The database reduces the time required to identify an issue as reoccurrence and act accordingly. This decision is based on knowledge that is embodied in the ontology by the *purposive interpretation*, which specifies the capabilities gained by implementation of a certain objective.

The second challenge was taken by tracing dependencies in the developed map (see Figure 4): The implementation of the objective *problem resolution controlling and tool support* has several preconditions. They can be fulfilled by other objectives within *problem management*, a sub-process of the *resolution processes* (ISO 20000). The map is used in order to identify additional objectives – representing required capabilities: Several dependency-paths can be traced by starting the navigation at the identified objective *problem resolution controlling and tool support.* Required objectives are *pro-active problem management* and *systematic handling of problems*. Again, these objectives require themselves other capabilities for implementation. Thus, dependency-paths can be traced to *basic problem management*. They are initial points for a process development within the resolution processes. Therefore, all objectives mentioned above are required to implement *problem resolution controlling and tool support*.

The cooperation partner implemented *problem resolution controlling and tool support* in compliance to the identified dependency-paths. As a result, the total cost of the resolution processes were lowered through improved access to a *known errors* database (see Figure 5).

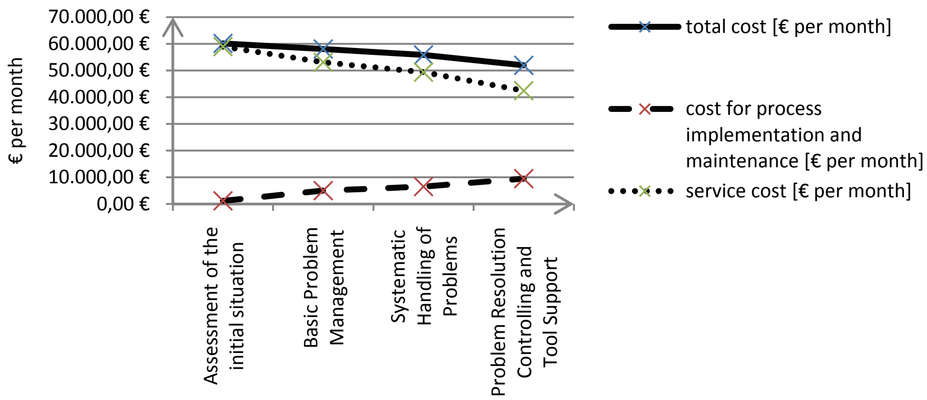
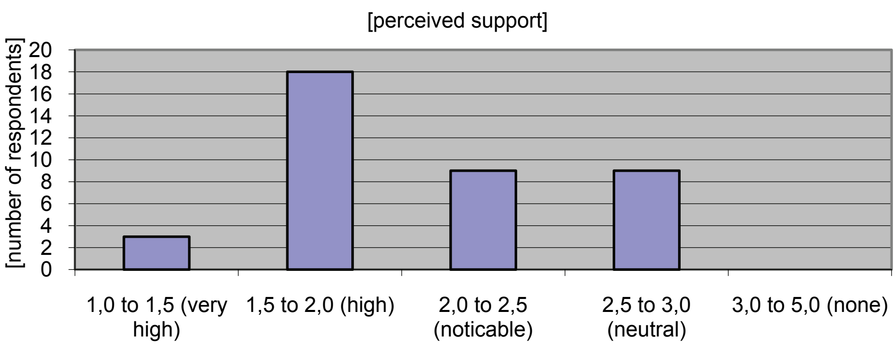


Figure 5. Change of resolution processes' total costs through implementation of improvement options selected according to the ITSM implementation map created by the proposed artifact.

The solid line denotes the total cost that are combined of the service cost itself and the cost for process implementation and maintenance. All cost are periodically accounted taking a 36-month project duration as reference. The project is considered as success, because improvement options conducted lead to a monthly total cost reduction of 8100.00 €. Additionally, the proposal provides guidance on how assigned tasks within the scope of IT-Governance have to be accomplished: The cooperation partner valued the proposal as supportive in selecting adequate investments that provide required capabilities to the organization. In addition, the provided assistance regarding implementation planning based on dependencies increases certainty in selection and required time for this task.

In addition, participants of the use case were interviewed to analyze their individual opinion on the artifact's usefulness. This is considered as pretest for later applications of more sophisticated approaches for assessing user's individual acceptances of technologies, e.g. UTAUT (Venkatesh et al. 2003). These additional results provide insights to further improvement opportunities of this research. Specifically, apart from task related needs, the fulfillment of users' concerns are further analyzed by this step. Therefore, eleven five-point likert items were issued to sample individuals' perceptions. The survey was conducted at the cooperation partner of the validation case. All participants of the project were interviewed (41) whereby the response rate was almost 100 percent. The results of each questionnaire were aggregated, measuring respondents' perceived support of the IT-Governance control process support by the proposal. The aggregation of all results is depicted in Figure 6.



lower quartile x25	1,64
median x50	2,00
upper quartile x75	2,36
mean	2,03

Figure 6. Questionnaire Results: perceived support of the IT-Governance control process support by the proposed artifact for the knowledge provision sub-process.

The domain experts confirmed the artifact's fitness for purpose, because expected results were achieved. Furthermore, a sufficient level of its credibility is given as it was used on a non-obligatory basis by domain experts in the project.

5 DISCUSSION

The conducted validation at our cooperation partner is a case study where conclusions regarding general validity of the solution should be considered with caution. Of course, a repeated application is required to provide more insights in the control process as well as the artifact's behavior in its intended field of application. However, the first results indicate a promising approach to be applicable to other process oriented frameworks for the implementation of IT-Governance related task. In order to strengthen this argument the research is currently continued by application of the artifact in other projects. The results will be used to improve the ontology to enable a better provision of the knowledge provision sub-process as part of the IT-Governance control process.

The aim of the first design approach of the IT-Governance control process is primarily to allow investigating in the aspect of draft implementing the knowledge provision as relevant key process. Additional insights through continued research and the proposal's application will help to refine the process design and to affirm the effectiveness of the conducted separation of concerns within the IT-Governance Control Process. Furthermore, it seems to be interesting to analyze users' valuation of the approach after several repeated applications. By this, stronger opinions regarding opportunities for improvement can evolve, because users become fully acquainted to the approach.

6 CONCLUSIONS

The contribution of this paper is a specific implementation of a knowledge provision sub-process that is part of a proposed initial design of an IT-Governance control process. Since the implementation of an IT-Governance control process is a rather complex issue, it is separated to distinct issues following the separation of concerns principle. The first design proposal allows the identification of a core sub process, i.e. the knowledge provision sub-process. This sub-process is successfully implemented by an ontology and validated by an industry application case. The validation results indicate the positive impact of the artifact on supporting the IT-Governance control process.

The ontology for the knowledge provision sub-process is built according to Methontology, which is an established methodology that guides the development process. This ensures transparency enabling the integration of users who are not familiar with ontology engineering. The ontology and its concept were accepted and understood on an early stage, since all involved individuals participated in the development. Therefore, users were able to focus on the ontology's practical application during the validation.

One major benefit of the taken approach is the unique motivation of participants by a single artifact. It serves as one primary source for gathering experiences. However, individual biases induced by prior experiences cannot be fully excluded, but the artifact motivates participants to adjust or confirm their perceptions.

Several aspects require further elaboration as argued in the discussion since this research is in progress. Summarized, the repeated application of the artifact in the domain of IT-Governance will allow further improvements. For instance, user's perception regarding the artifact's aptness for purpose could be analyzed with elaborate technology acceptance models. The results can provide further insights on how to improve the artifact concerning user's requirements.

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