Selecting a Software Tool for ITIL using a Multiple Criteria Decision Analysis Approach

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Abstract

The opportunity to improve service quality using ITIL has led many organizations to invest in the implementation of this framework. Selecting a software tool for ITIL is still one of the most difficult decisions due to lack of meaningful evaluation criteria and guidelines to help on that decision, making this, one of the most important and error-triggering steps in this way. A multi-criteria value model to evaluate software tools for ITIL using a multi-criteria decision analysis (MCDA) approach based on MACBETH is then proposed to address this problem. A focus on the functionality of the tool to extract criteria from the literature to assess four representative software solutions for ITIL in the market is made along with its demonstration in a company of the bank sector. Finally, using Moody and Shanks Framework, the proposed method is evaluated showing that is suitable for evaluating software tools for ITIL.

Keywords: ITSM, ITIL, Software Selection Method, Multiple Criteria Decision Analysis, MACBETH.

1. Introduction

Information Technology Infrastructure Library (ITIL) is “the most widely accepted approach to Information Technology Service Management (ITSM) in the world” [21] as a consequence of the increased need to improve service quality to costumers with cost-effectiveness to face today’s challenges like economy difficulty, constant innovation, competitive markets and demanding costumers.

ITIL appeared in the late 80’s as a set of best practices with a unique goal: provide guidance on achieving service excellence [21], leading many companies to invest on its implementation. However, this isn’t an easy task and many studies try to understand how this can be done and what can improve its success.

The importance of good quality software to implement ITIL processes [11] turns its selection a crucial step on ITIL implementation and one of the most difficult decisions to make since there is still lack of methods to support it.

Therefore, this paper addresses the difficulties to evaluate software tools for ITIL in order to acquire them, which influences the ITIL implementation.

To address this problem, a Multiple Criteria Decision Analysis (MCDA) approach [8] is proposed, based on MACBETH method [3,4], [7] to build a multi-criteria value model [15], [29] to evaluate software tools for ITIL.

The proposed multi-criteria evaluation model was demonstrated in a company of the bank sector that wanted to select a software tool to help implementing four ITIL processes: incident management, request fulfilment, problem management and change management. The software solutions assessed and compared were BMC Remedy, ServiceNow, ZenDesk and JIRA SD. At

the end, an overall value score was obtained for each option as a quantification of their attractiveness for the company, after testing each tool and analyzing their documentation.

To evaluate the proposal, Moody and Shanks Framework [20] was used along with feedback of the decision makers (DM), concluding that the proposed method is suitable for evaluating software tools for ITIL.

The structure of this paper is deeply connected with the steps of Design Science Research Methodology (DSRM) which was the framework that conducted this research in Information Systems (IS) to create and evaluate an artefact that could solve organization problems [13].

2. Problem

This section presents the research problem and justifies the value of its solution, corresponding to the problem identification and motivation step of DSRM.

Since its appearance in the 80's, ITIL has become a popular framework to improve service quality in the world [21]. Many benefits from its adoption were identified, being more than service quality improvement and going from reduction in IT downtime to raising of IT staff morale [12], [14], [19], [23], which all led to an increased interest on its adoption in many countries [2], [9], [18], [22], [26], [30].

Besides those benefits and the wide range interest on ITIL adoption, many organizations are still far from a full adoption of this methodology or didn't have implemented it at all [30].

Difficulties in implementation are one of the greatest and most impactful barriers to ITIL adoption identified by Shang and Lin [25], mostly because ITIL offers a set of best practices but doesn't provide advice on how to put them in practice [1]. In order to overcome these obstacle, research has been made on ways to help companies successfully adopt ITIL, being critical success factors (CSFs) crucial elements in this matter, and careful software selection one of the most important CSFs as concluded by Eikebrokk and Iden [11].

Besides the existence of some ITIL tools' categorization proposals [16,17], those still lack meaningful criteria and there isn't a method to help companies select a software tool for ITIL.

The research problem is then the difficulty that companies face when choosing software for ITIL that takes into account ITIL criteria and company's preferences.

3. Related Work

This section defines the objectives of a solution from the knowledge of the state of the problem and possible solutions, corresponding to the definition of the objectives for a solution step of DSRM.

An ITIL background is first provided (Section 3.1) to then give an overview of the research on ITIL tool selection and its importance (Section 3.2). Afterwards, a summary of some of the most used MCDA approaches is made (Section 3.3) to then explain the objectives of the solution (Section 3.4).

3.1. ITIL

ITIL is a set of good practices to be applied on infrastructure, operations and management of IT services with its origin in the UK during the 1980s by the Office of Government Commerce (OGC) to promote efficient and cost-effective IT operations as a consequence of the growing dependence on IT.

ITIL is now a popular framework in the world, having its most recent version published in 2007 and updated in 2011. In this last version, it is given more importance to the lifecycle of the service, covering all IT parts of organizations and supporting necessary components to deliver services to the costumer.

Five components constitute the core of ITIL v3, being them: service strategy, service design, service transition, service operation and continual service improvement.

3.2. ITIL Tool Selection

Careful software selection is now a well-known CSF for ITIL implementation. Studies like those from Pollard and Cater-Steel [22] and Tan et al. [28] have pointed the importance of this CSF, the same way Somers and Nelson [27] had in their work on CSFs for ERP implementation in 2001.

Later, in 2012, the influence of ITIL software quality on ITIL implementation was investigated by Eikebrokk and Iden [11], integrating answers from firms of Nordic countries such as Sweden, Norway, Denmark and Finland to assess the maturity of ITIL processes, analyze ITIL tool's application and evaluate the usefulness and usability of ITIL software tools. Then, the relationship between ITIL software quality and level of ITIL implementation was explored.

Their findings showed that, besides being common to implement a corresponding ITIL software tool when implementing ITIL processes, most firms had an implementation of the tool above halfway. It also evidenced the usefulness of those tools, with many being considered as a good help on aligning firms' needs with ITIL's recommendations as well as a way to perform processes more efficiently and improve results of ITIL implementation.

The importance of ITIL compliant tool selection as a crucial step to successful implementation of ITIL is also mentioned by Ahmad et al. [1], in their road map. An ITIL compliant tool can automate and expedite ITIL processes that otherwise would be very complex and time consuming. Associated with the large number of ITIL tools developed as a response to the increased popularity of ITIL, these results support the importance of a good selection of the software that can best help company's ITIL implementation.

To make this task easier, research has been made on ways to evaluate ITIL tools. Kralik and Lukas [16] proposed a way to categorize ITIL tools, dividing them in three basic categories: availability (way of licensing, which can be: free software, open source software or proprietary software), number of main functions (multi-functional or specific function) and main purpose (event and remote management, monitoring, service desk, service lifecycle, service portfolio and management, cloud, information security or others). Another model, this one specific for free and open source tools for modeling and support of IT service management according to ITIL, was proposed by Kralik et al [17]. In this model, tools are evaluated according to four criteria: user friendliness, specifications, requirements for free and open source project (license, appropriate documentation, version in which the product is available, community and trial version) and product functionality.

Besides this effort, there is still lack of meaningful criteria and a method to help companies decide which software tool for ITIL can best support an ITIL implementation and fulfill their priorities.

3.3. Multiple Criteria Decision Analysis

Multiple criteria decision analysis (MCDA) is "a collection of formal approaches which seek to take explicit account of multiple criteria in helping individuals or groups explore decisions that matter" [8]. In this subsection, a summary of some of the most used MCDA methods is provided.

Outranking Methods. For each criterion, partial preference functions are defined, which may correspond to natural attributes on a cardinal scale, or may be constructed as ordinal scales, not needing to satisfy all the properties of value functions. Only the ordinal preferential independence is necessary. In this method, if there is enough evidence to justify that an alternative *a* is least as good as another alternative *b*, taking all criteria *i* into account, we can conclude that *a* outranks alternative *b* if $zi(a) \geq zi(b)$ for all criteria *i* [8].

Analytical Hierarchy Process (AHP). This method uses additive preference functions to evaluate alternatives. First, a hierarchy of criteria (value tree) and identification of alternatives is made. Then, assuming ratio scales for all judgments, pairwise comparison is used to score

alternatives on each criterion and weight the criteria. Finally, using weighted summation of its scores on the different criteria, an overall score for each alternative is obtained, allowing to compare all the alternatives [8], [24].

Measuring Attractiveness by a Categorical Based Evaluation Technique (MACBETH). MACBETH is a method for multicriteria value measurement [15], [29]. For each alternative, the DM quantifies its relative attractiveness with the help of semantic judgments about the differences in attractiveness of several stimuli. Two elements are compared at a time, in an initial, iterative questioning procedure that requests only a qualitative preference judgment. The consistency of those answers is then automatically verified by the MACBETH decision support system [5]. By solving a linear programming problem, this system can also generate a numerical scale, representative of the DM's judgments, and weighting scales for all criteria [3,4], [7].

Contrary to the other methods, outranking methods do not allow preference scales to be obtained for each alternative since there is no aggregation value function, which is a negative aspect on this approach.

AHP turns this feature possible, since global scores can be generated to represent overall preference upon the alternatives, but, there are some issues concerning the conversion from the semantic to the numeric scale used in this method [6], [10].

MACBETH has a big advantage for multi-criteria value measurement. Scoring alternatives and weighting criteria only requires qualitative judgments, instead of quantitative ones as in other methods. The overall values of the alternatives can be then automatically computed by its powerful decision support system, applying the additive model, that can also make robustness and extensive sensitivity analysis.

3.4. Objectives

Since the problem stated in Section 2 consists on the difficulty that companies face when choosing software for ITIL that considers ITIL criteria and company's preferences, the main objective of this proposal is to create a method that helps companies address this problem, balancing necessary elements for ITIL implementation and company's specific preferences. This method must be easy to apply and provide understandable results that can support DM's decisions.

4. Proposal

This section corresponds to the design and development phase of DSRM, in which the desired functionality of the artefact that aims to solve the problem is determined followed by its creation.

Taking into account the multiple criteria that must be considered when addressing the problem stated in Section 2, the proposal uses the MACBETH method to evaluate the options against those criteria, which result from a literature review on ITIL implementation studies.

The proposed method consists in four main steps:

A) Identify the criteria and define their performance levels. This first step consists on identifying the criteria to evaluate the software tools for ITIL. For this proposal a focus on the functionality is proposed to compare tools according to their core, including processes and people along with technology.

Three groups of criteria are proposed in this method:

Processes: Besides being useful to provide help on aligning company's needs with ITIL's implementations, tools are also a way to perform processes more efficiently [11]. Three criteria compose this group, being them: information (data used by processes), activities (tasks that

compose the processes) and measures (quantification of the processes' performance using metrics and key performance indicators (KPIs)).

Exporting Formats: It is important, for each ITIL tool, to consider how data can be extracted from processes, reports and knowledge base to be used outside. This group is then composed by one criterion: exporting formats, which is applied to tickets, reports and knowledge base to make an analysis on the compatible exporting formats for their data.

Costumers: Considering the customer view over the ITIL tool by emphasizing "the broad reach of ITSM beyond the concerns of IT infrastructure to viewing IT as a service organization that supports end-to-end business operations" [22] is also important, following ITIL core philosophy. The criterion of this group focuses on data available to costumers which come from diverse sources like knowledge base, processes and their metrics.

Each tool is assessed according to the presence of each criterion as recommended by ITIL best practices. The levels of performance are then defined considering the percentage of ITIL recommendations in the tool for the corresponding criterion: level A (>= 75%), level B (50% - < 75%), level C (25% - < 50%) and level D (< 25%). In any case, a DM can add more relevant criteria and change the number and range of performance levels to customize this method to more specific organization's needs.

This step can also be less human dependent if criteria and performance levels to be applied become standardized. That way, every company would use the same criteria and number of performance levels, automating this step.

B) Weight the criteria and evaluate their performance levels. In this step, a value function is built for each criterion from the preferences of the DM. For each criterion, two reference performance levels are defined ("neutral" and "good"). Then, using MACBETH semantic categories: very weak, weak, moderate, strong, very strong, or extreme, the DM judges the differences in attractiveness between each two levels of performance, choosing one or more of those categories. Finally, M-MACBETH, the decision support system, uses a linear programming problem to generate a numerical value scale, representative of the DM's judgments.

Each criterion is also weighted according to ranks attributed by the DM. First, their neutral-good swings are ranked, then, just like happens with performance levels, the DM uses the MACBETH semantic categories to judge the difference in attractiveness between each two neutral-good swings, which M-MACBETH uses to create a weighting scale for all criteria. In the end, the DM can validate the proposed weights, adjusting them if necessary.

This is a step that needs a lot of human interaction, turning it both manual and automatic (supported by a calculating system). Contrary to the first step that can be totally automated using standard criteria and performance levels, this is a step that translates the company's preferences, making human interaction a crucial element. By making their judgments, companies specify which criteria and performances best match their needs according to what was defined in the previous step. Only the generation of numerical scales for each criterion and the criteria weights are automated.

C) Test the tools and analyze their documentation. In this third step, tool testing is made for each criterion using free trial versions, which have the purpose of allowing some tool evaluation before obtaining them. Since these versions can present some limitations compared to the paid ones, their documentation is also analyzed to obtain additional information. Using the ITIL recommendation, a mapping between each tool and the ITIL best practices for each criterion is made, using the percentage scales defined in step 1 for the performance levels.

Companies which apply this method don't need to execute this step by themselves since specified analyses are periodically made by credited consulting organizations to assess software tools according to ITIL recommendations. This way, results could then be automatically

inputted and updated into a tool that supports the execution of this selection method, having the performance values for each ITIL tool prepared to be used in the next step of this method.

D) Analyze the results. With the performance levels for each criterion attributed to all the alternatives, their conversion into value scores must be done. In this last step, value functions built in step 2 for each criterion are used for this purpose. Using weighted summation of its value scores, an overall value score is obtained for each alternative, achieving a final ranking of alternatives. Finally, sensitivity and robustness analyses are made to support a possible recommendation. All the calculations are made by the support system, being human independent. However, after sensitivity and robustness analyses, human interpretation and decision is necessary to validate the results and make changes on DM's judgments in step 2, if necessary.

Besides being applied to ITIL tool selection, this method can be applied to other business fields and tool types. The first step can have every set of criteria and performance levels as input, which can also be standardized and applied by every DM in the respective business field. The second step just needs DM's judgments about what criteria are the most and less relevant to them and their ranking of performance levels. The third step can also be automated if the performance values can be the result of assessment by specialized entities. Finally, the last step is just applying the DM's judgments to the performance values for each alternative, leading to global results for each of them. However, DM's interaction is necessary to validate the results and make possible changes in his/her judgments.

5. Demonstration

This section demonstrates the use of the artefact to solve one or more instances of the problem, corresponding to the demonstration phase of DSRM.

The main objective of this proposal is creating a method to help companies choosing software for ITIL, taking into account ITIL criteria and company's preferences. Based on this, a company from the bank sector that wanted to implement four ITIL processes and had doubts about the software to use, was selected. The four processes that this company wanted to implement were: incident management, request fulfilment, problem management and change management.

The software solutions assessed were BMC Remedy, ServiceNow, ZenDesk and JIRA SD, which were selected because of their representativeness in the market as consequence of characteristics like antiquity, usability, popularity and potential of expansion.

A) Identify the criteria and define their performance levels. In this first step, meetings with the company's DM were made to validate the criteria and performance levels to be used in the model. All the proposed criteria and performance levels were joint with the four selected ITIL processes or the three data sources on which they would be applied. The result was a validated mapping between the list of criteria and the selected processes or data sources (see **Table 1**).

Table 1. Mapping between assessment criteria and process/data sources

Criteria	Process/Data Source
Information	Incident Management
	Request Fulfilment
	Problem Management
	Change Management
Activities	Incident Management
	Request Fulfilment
	Problem Management
	Change Management
Metrics/KPIs	Incident Management
	Request Fulfilment
	Problem Management
	Change Management
Exporting Formats	Tickets/Issues
	Reports
	Knowledge Base
Data to Costumer	Incident Management Information
	Request Fulfilment Information
	Knowledge Base Information
	Incident Management Metrics
	Request Fulfilment Metrics

B) Weight the criteria and evaluate their performance levels. In this second step, the M-MACBETH decision support system was used to help the DM define reference performance levels, weight the criteria and evaluate their performance levels.

First, the DM was asked to select neutral (neither positive nor negative) and good (significantly attractive) reference levels. It was defined that all criterion would have the same neutral and good reference levels, which means that if a level A corresponded to neutral reference level in one criterion, all others would have level A as the neutral one. For all criteria, the DM chose level A as the good reference and C as the neutral one.

Then, choosing one or more MACBETH semantic categories, the DM judged the attractiveness differences between each two performance levels. The DM defined that the judgments would be the same for all criteria. **Figure 1** presents the validated DM's judgments matrix and numerical scale computed by the M-MACBETH for the criterion "Information" for the process "Incident Management".

	Inf - Incident A	Inf - Incident B	Inf - Incident C	Inf - Incident D	Current scale
Inf - Incident A	no	very weak	strong	v. strong	100
Inf - Incident B		no	moderate	strong	75
Inf - Incident C			no	very weak	0
Inf - Incident D				no	-25

Fig. 1. MACBETH judgments matrix and numerical scale for criterion "Information".

The numerical scales were anchored on the value scores 0 and 100 which were assigned to the two reference levels "neutral" and "good", respectively. Those scales were proposed by the M-MACBETH decision support system based on the set of judgments made by the DM, who then analyzed and validated them. Using the validated value scales, M-MACBETH computed their value functions.

To weight the criteria, neutral-good swings were ranked by the DM for all the criteria by their overall attractiveness. Then, the DM used MACBETH semantic categories to judge the differences in attractiveness between each two of them. Finally, with those judgments, the M-MACBETH created a weighting scale that was validated by the DM and shown in **Figure 2.**

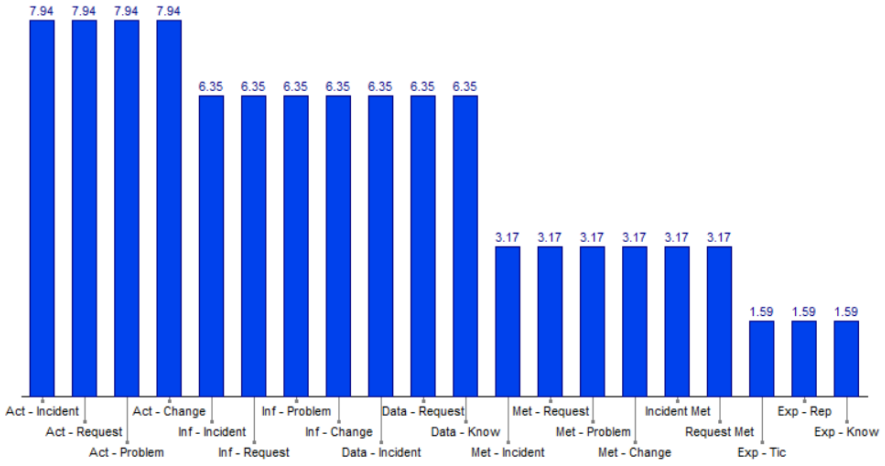

Fig. 2. Weighting scale for the criteria for each process or data source presented in Table 1.

C) Test the tools and analyze their documentation. To test the tools, free trial versions were used, since have the purpose to show some functionality to help the DM make his/her decision. Complementing that, tools' documentation was also analyzed since trial versions have limitations on what can be tested.

With this information and looking to ITIL recommendations for each criterion, a mapping between all criteria and ITIL recommendations was made, obtaining the performances for all the four selected tools. The results are presented in **Figure 3.**

ITIL		BMC Remedy	ServiceNow	ZenDesk	JIRA SD
Information	Incident Management				
	Request Fulfilment				
	Problem Management				
	Change Management				
Activities	Incident Management				
	Request Fulfilment				
	Problem Management				
	Change Management				
Metrics/KPIs	Incident Management				
	Request Fulfilment				
	Problem Management				
	Change Management				
Exporting Formats	Tickets/Issues				
	Reports				
	Knowledge Base				
Data to Costumer	Incident Management Information				
	Request Fulfilment Information				
	Knowledge Base Information				
	Incident Management Metrics				
	Request Fulfilment Metrics				

Legend:	
	>=75%
	50% - <75%
	25% - <50%
	<25%

Fig. 3. Mapping between evaluation criteria and ITIL recommendations for the selected processes and data sources.

D) Analyze the results. The performances obtained in the third step were inputted in M-MACBETH. Using the value functions built in the second step, this software transformed the performances into value scores, presented in **Figure 4**, and calculated the overall scores for all selected tools. JIRA SD ranked first with 73.03 overall units followed by ServiceNow with 72.24 overall units. BMC Remedy became third with 69.46 overall units and ZenDesk was the worst with 68.26 overall units. The results clearly show that none has a good performance in all the criteria, since all scores are below 100 overall units. Besides that, JIRA SD has the closest score to the overall score of the hypothetical alternative "Good at all".

Options	Overall	Inf - Incident	Inf - Request	Inf - Problem	Inf - Change	Act - Incident	Act - Request	Act - Problem	Act - Change	Met - Incident
[Good at all]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
JIRA SD	73.03	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00
ServiceNow	72.24	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	75.00
BMC Remedy	69.46	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00
ZenDesk	68.26	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	75.00
[Neutral at all]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weights :		0.0635	0.0635	0.0635	0.0635	0.0794	0.0794	0.0794	0.0794	0.0317
Met - Request	Met - Problem	Met - Change	Exp - Tic	Exp - Rep	Exp - Know	Data - Incident	Data - Request	Data - Know	Incident Met	Request Met
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
100.00	75.00	0.00	75.00	-25.00	0.00	0.00	75.00	100.00	-25.00	-25.00
100.00	0.00	0.00	0.00	0.00	0.00	0.00	75.00	100.00	-25.00	-25.00
75.00	0.00	0.00	-25.00	75.00	-25.00	0.00	75.00	100.00	-25.00	-25.00
0.00	75.00	75.00	-25.00	0.00	-25.00	0.00	0.00	100.00	-25.00	-25.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0317	0.0317	0.0317	0.0159	0.0159	0.0159	0.0635	0.0635	0.0635	0.0317	0.0317

Fig. 4. Overall value scores of the alternatives.

JIRA SD doesn't have the highest score in only three criteria: "Metrics/KPIs" for Incident Management process, "Metrics/KPIs" for Change Management process and "Exporting Formats" for reports. A sensitivity analysis on the weight of criterion "Metrics/KPIs" for Incident Management showed that the weight of this criterion needed to be raised up from 3.17% to 4.3% to see ServiceNow be ranked first and to 9.1% to see ZenDesk on top. The same analysis showed that for the criterion "Metrics/KPIs" for Change Management, the weight needed to be raised up from 3.17% to 9.1% to see ZenDesk be ranked first, and for the criterion "Exporting Formats" for reports the weight needed to be raised up from 1.59% to 4.7% to make ServiceNow the first choice; to 5.1% to put BMC Remedy on top; and to 17.5% to see ZenDesk be ranked first. However, the DM opted to not change the weights.

A robustness analysis was also made with M-MACBETH, considering simultaneous variations of ±1% on the weights of all criteria, not allowing negative weights. This analysis showed that JIRA SD continues to be the best alternative within these variations on the criteria weights. **Figure 5** shows the results of this analysis, where the green crosses in the cells mean that the alternative in row, JIRA SD, dominates all the other alternatives in columns BMC Remedy, ServiceNow and ZenDesk.

	BMC Remedy	ServiceNow	ZenDesk	JIRA SD	[Good at all]	[Neutral at all]
BMC Remedy	=		?			+
ServiceNow	+	=	+			+
ZenDesk	?		=			+
JIRA SD	+	+	+	=		+
[Good at all]	▲	▲	▲	▲	=	▲
[Neutral at all]						=

Fig. 5. Robustness analysis.

Taking into account all the defined criteria and the judgments of attractiveness made by the DM, JIRA SD was recommended to the company, since it is the best alternative considering the overall value scores and the sensitivity and robustness analyses.

6. Evaluation

In this section, the adequacy of the artefact to a solution to the problem is observed and measured, corresponding to the evaluation step of DSRM. For that purpose, it was used the Moody and Shanks Quality Framework [20].

Proposing eight quality factors, the Moody and Shanks Quality Framework uses the perspective of stakeholders to evaluate and improve the quality of data models [20]. This framework was applied to the demonstration, using the DM's answers for the eight quality factors. These were the results:

- **Completeness:** The proposal is complete since the used criteria contain all the DM's requirements, and each DM can include or remove criteria and change their performance levels to customize the model to his/her needs.
- **Simplicity:** The proposal is simple since it is easy to follow and apply.

- **Flexibility:** The proposal is flexible since the DM adjust it to his/her organization's strategies.
- **Integration:** The proposal helps organizations make the best decision, being consistent with the problem.
- **Understandability:** The proposal uses concepts of the ITIL language, which turns it easier to understand, but the DM lacks knowledge of the used decision analysis process. Guidance is needed to overcome this difficulty.
- **Implementability:** The proposal implementability is dependent on factors such as organization's policies and laws. The company on which this proposal was demonstrated used this as a decision auxiliary tool,
- **Correctness:** According to DM's intentions, the proposal is valid and correct.
- **Integrity:** The proposal combines interviews and observation with literature review to define criteria and their performance levels. This way, a basis composed by some constraints is introduced upon which the specific organization's needs are taken into account to mitigate possible errors without losing flexibility.

Since the company on which this proposal was demonstrated suffered from the same problem as stated in Section 2, this demonstration allowed to test the proposal in the research problem, revealing that the developed method is suitable for evaluating software tools for ITIL by overcoming this problem.

7. Conclusion

Besides the many benefits ITIL can provide to organizations as pointed in the research literature, and the amount of software alternatives to support its implementation, selecting a software tool for ITIL is still one of the most difficult decisions due to the lack of guidelines and meaningful criteria to help DMs. This is still one of the most error-triggering steps, contributing to the difficulty felt by the companies when trying to implement ITIL, which can lead them to make mistakes and ultimately, abandon their intentions to continue ITIL implementation.

This problem was present in the company on which the proposed method was applied.

To address it, a method to evaluate software tools for ITIL using an MCDA approach called MACBETH was proposed. A literature review was made to extract criteria that would be proposed as a basis to all the decision process, which would then be validated by the DM. Using DM's judgments, the most overall attractive alternative was found and recommended to the company, solving their initial problem.

This method has a particular focus on multi-criteria evaluation process and the core of the tool: functionality, being applied in a company of the bank sector, where four software tools for ITIL (BMC Remedy, ServiceNow, ZenDesk and JIRA SD) were evaluated for the four ITIL processes that the company wanted to implement: incident management, request fulfilment, problem management and change management. With this demonstration and evaluation, using Moody and Shanks Quality Framework, it was concluded that the proposed method is suitable for evaluating software tools for ITIL, solving the stated problem.

For future work, it is necessary an effort on research related to ITIL criteria in order to create catalogues that take into account other ITIL best practices, like recommended roles and knowledge base components. In order to improve this proposal, a software tool specific to evaluate tools for ITIL can be developed.

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