

Article

The PI2M-ITGov - Panel of Indicators for Monitoring and Maintaining the Information Technology Governance (and its Framework and Tools) for an effective IT Management

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Abstract: Due to IT resources - Information Technology being very expensive and vital for the survival of Organizations in today's highly competitive world, it is essential to know how these are being applied and what effective results are being achieved. Thus, as is done in other Areas of Management, applying a Set of Indicators – related to IT – can help in assessing the performance scenario and subsidize decision-making in the event that initiatives need to be replanned. In this way, this work proposes the PI2M-ITGov - Panel of Indicators for Monitoring and Maintenance of Information Technology Governance, being the same, result of the development of research for Post-Doctorate. The PI2M-ITGov covers 12 (twelve) IT Areas and applies 36 (thirty-six) Sub-KMIs - Key Monitoring Subindicators. This research was built following the DSR - Design Science Research flow and the constructs and artifacts created (Guidelines and Worksheets) are available at the links provided. The simulation (through a Case Study), in a real world of the proposals presented here, showed an acceptable level of the tools as an effective planning resource.

Keywords: IT management; IT Governance; IT Management Areas; IT Strategic Alignment; KMI - Key Monitoring Indicators; Case Study; DSR - Design Science Research.

1. Introduction

The set of guidelines, that comprise the controls that enable the monitoring of IT initiatives and the assessment of their compliance with the expectations outlined in the Organization's Strategic Planning, is called IT Governance.

Peter Weill [1] is one of the prominent authors in the field of IT governance, emphasizing the importance of IT being perceived as a sustainable area that generates results (revenues),

rather than merely incurring costs (expenses). According to Weill, IT should strongly focus on ‘aligning its initiatives with the business’.

In the words of Rockart *et al* [2]:

“- In sum, the load of IT on organizations is heavier than ever before and the management of it is more complex.”

The Organizations currently can be classified into two distinct domains: 1) Those that utilize information technology (IT) resources for their operations; and 2) Those that serve as providers of IT resources. Figure 1 visually illustrates this division, emphasizing the differentiation between these two domains.

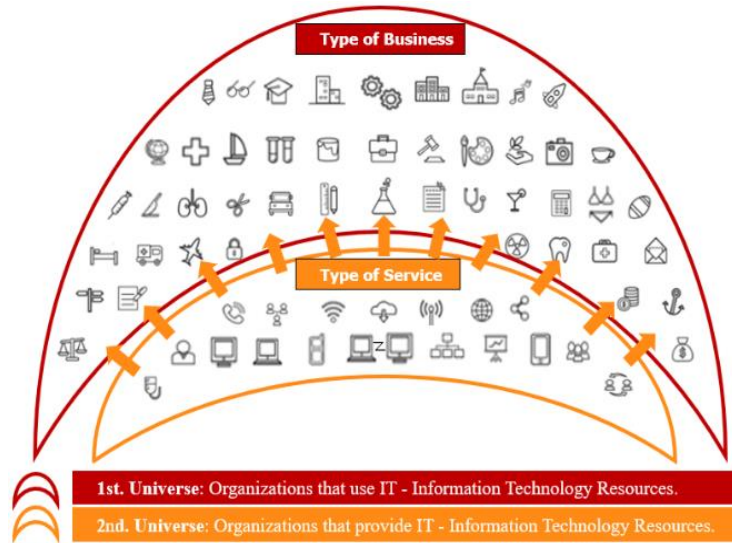


Figure 1. Enterprise domains.

In both cases, even the Organizations belonging to the Second Category (IT Resources Providers) have an internal administrative area that functions similarly to companies in the First Category (IT Resources Users). This internal administrative area also needs to effectively manage its performance and actions to ensure the success of the overall business.

Consequently, both Domains – without exception – make significant investments in IT, which are expected to yield tangible results for the business. Whether operating in the industrial, commercial, or financial sectors, Organizations aim to maintain a competitive position in the globalized business environment.

The problem at hand revolves around how management can effectively apply governance processes, particularly those recommended by IT Governance techniques. It is crucial to adopt a proactive approach to administration control, rather than a reactive one, in order to anticipate and prevent misalignments between the actions of the IT Department and the initial planning. Failure to address these misalignments can result in non-compliance with the Organization's expected outcomes.

In light of this reality, as highlighted by one of the authors [3] in this Research, significant challenges need to be addressed to effectively implement IT Governance and strive for high-quality indices. The doctoral thesis presents Figure 2, referred to as the ‘puzzle’ of the Governance Process, illustrating these challenges. Overcoming these

challenges is essential to successfully implement IT Governance and achieve desirable quality metrics.

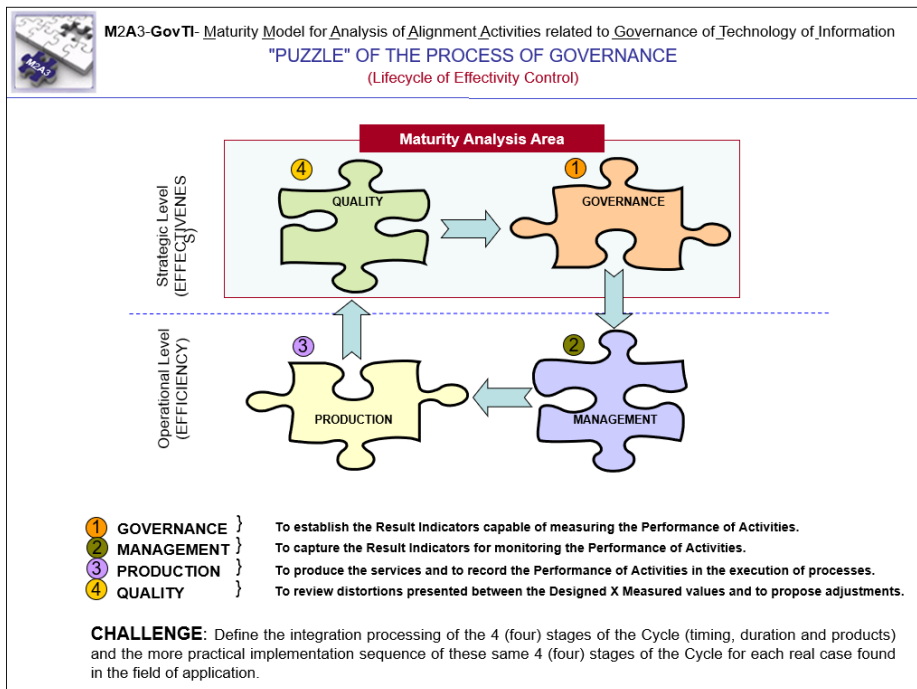


Figure 2. Process of governance ‘puzzle’ [3].

Consequently, it becomes evident that monitoring IT Governance activities requires an initial and meticulous planning phase (Structuring), followed by effective management (Administration), and rigorous governance (Control) processes.

To address this challenge, the Panel of Indicators for Monitoring and Maintaining Information Technology Governance (PI2M-ITGov) Method, developed through research and presented in this article, aims to fulfill the management’s need in this field. It provides a Panel of Indicators that can measure the degree of alignment between the actions implemented by the IT Department and the Organization’s Strategic Planning. This enables decision-makers to identify and rectify any distortions, thereby guiding the organization back to the correct course of action.

Its Artefacts were created (such as a Spreadsheet, a Guideline, Forms and other Tools), in order to make, this first and initial proposal became from theory to practice in a real operational environment. Their links are provided and mentioned in the context of this paper.

Additionally, it is also important to note that the PI2M-ITGov Method ensures the maintenance of confidentiality and privacy of personal data. The Method does not handle information that possesses sensitive content or characteristics, thereby safeguarding the privacy of individuals involved.

2. Applied Methodology

This Research Project was guided by the Design Science Research (DSR) methodology and its principles. Also, this adheres to the Process Flow of DSR as recommended by Wieringa [4], with graphical adaptations made by the authors, as depicted in Figure 3.

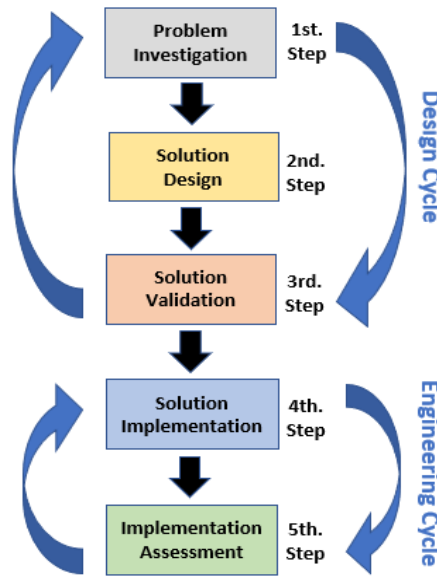


Figure 3. The Design Science Research flow: adapted by authors from Wieringa [4].

The following steps in this Article, albeit with some text size limitations, will cover Steps 1, 2 and 3 (of the Design Cycle), which implement the conception and construction of the solution, and Steps 4 and 5 (of the Engineering Cycle), which adapt the applicability of the solution to the real world, although, the complete development of the DSR Flow is detailed in the links provided throughout this text.

3. Problem Investigation (DSR’s 1st. Step)

As mentioned in Section 1 ‘Introduction’, this Research aims to address the need for a tool within IT Governance that can manage a dashboard to guide the alignment of IT initiatives with Corporate Strategic Planning.

To assess the existing literature related to the research objectives, a bibliographic search was conducted. Detailed information regarding the search results can be found in the ‘1. Problem Investigation/*Investigação do Problema*’ folder accessible via the following link <https://drive.google.com/drive/folders/1sFa5845Wcxr7KXQIH9hePXxN0WdRKchV?usp=sharing>.

Nine databases were searched, namely ACM, IEEE, MIT, Research Gate, Scholar Google, SciELO, Science Direct, Scopus, and Web of Science (WoS). The search keywords used were ‘IT Governance NOT Social NOT Health NOT Education AND Performance Indicator AND Spreadsheet AND Guideline’. The exclusion criteria of ‘NOT Social NOT Health NOT Education’ were applied to filter out articles not directly linked to the business domain, such as banking/financial, industry, and services.

Of course, the papers those were focused on these 3 areas (Social, Health and Education) and in their business tools, what means no in its final targets as to support Social, Health or Education problems in its main themes, were also considered because, in this interpretation, these can be sort as integrating the areas of banking/financial, industry, and services as well.

Additionally, the search was limited to the last decade (2012–2022) to ensure relevance and up-to-date information.

The initial search in the ACM database yielded only seven occurrences, which did not align with the research focus. Subsequent searches in IEEE, MIT, Research Gate, Scholar Google, and SciELO databases resulted in zero occurrences, while Science Direct yielded only two occurrences. In response to these limited results, two additional databases, Scopus and Web of Science, were searched, but no relevant articles were found.

Based on the analysis of these search results, which demonstrated the lack of literature on this specific topic, it became evident that the research should proceed. It was determined that there was a significant gap that could be filled by concluding this research in the planned format. The intention is to generate practical material that can effectively assist IT managers in their work and activities.

4. Solution Design (DSR's 2nd. Step)

As a way of delimiting the scope of this study – among the various existing possibilities – the Theory of Number 12 as described by Tesla [5] which highlights the significance of this ‘magic number’ in various elements of the universe, served as the inspiration for the establishment of a quantitative framework for IT work processes. Following this line of reasoning, IT work processes were organized into 12 IT management areas, which became the focal point for the creation of indicators.

To determine the 12 IT management areas, in addition to delimiting the scope of this study within 12 areas according to Tesla's Theory (as the initial idea already mentioned above), the empirical experience of the Authors (who have each worked in the IT field for almost 5 decades) was considered, as well as a criterion based on the identification of IT work processes that had published and recognized maturity level assessment models was applied.

These 12 areas, which had corresponding maturity level assessment models, were subsequently renamed as IT monitoring areas. For each of these areas, 12 key monitoring indicators (KMIs) were created, with 3 sub-KMIs for each one, resulting in a total of 36 sub-KMIs for the proposed solution.

To ensure precision in the analysis, three key monitoring sub-indicators (sub-KMIs) were developed for each of the 12 IT monitoring areas, leading to a total of 36 sub-KMIs within the proposed solution. The data collected to determine the percentages for these 36 sub-KMIs were derived from aligning the results with the highest maturity levels (ranging from 3 to 5) identified in the considered maturity level assessment models.

The research process involved the application of technical and professional knowledge by one of the authors, combined with the principle of empiricism, as described by Locke [6].

This approach allowed for an analysis of the data to determine whether the maturity level assessment models under investigation could be aligned with an IT management area, which in this case is referred to as IT monitoring areas.

Even when the framework which the maturity level assessment models was based could have more than just one IT area focus it was considered, to make possible the application of the idea behind this proposed study and its resulted model, its main focus (e.g.: CobiT® which is one of the Maturity Model searched by this paper).

Despite the availability of 26 maturity level assessment models, the aim was to maintain the framework within the limit of 12 IT monitoring areas. Descriptions of these models can be found in the ‘2. Solution Design/Projeto da Solução’ folder in the provided link <https://drive.google.com/drive/folders/1sFa5845Wcxr7KXQIH9hePXxN0WdRKchV?usp=sharing>.

As a result of these research activities, Figure 4 was created, presenting the identified maturity models that guided the definition of the 12 IT monitoring areas considered by the PI2M-ITGov. Additionally, these 12 IT monitoring areas were categorized into 3 IT monitoring groups for ease of interpretation and application of their activities: the planning monitoring group, the execution monitoring group, and the control monitoring group.

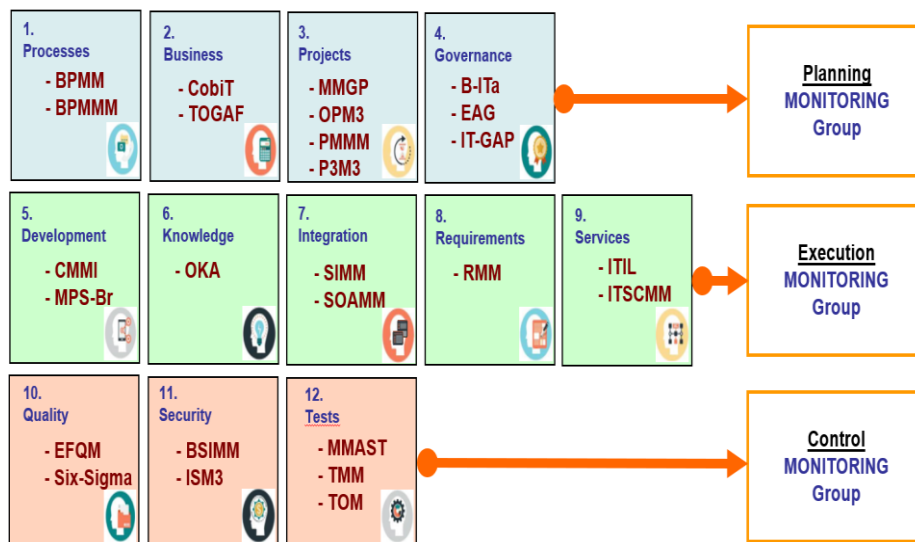


Figure 4. The 12 monitoring areas considered by the PI2M-ITGov.

After conducting the research and evaluating the requirements, it was determined that the KMIs applicable to each of the 12 IT monitoring areas would be established in order to achieve the highest maturity levels (ranging from 3 to 5) of the maturity level assessment models considered.

The GQ(I)M framework, developed by Goethert & Hayes [8], is widely recognized in the literature as a valuable approach for constructing indicators. This framework follows a structured process consisting of four components: goal, question, indicator, and measurement. Figure 5 exemplifies the workflow of this framework, illustrating its step-by-step approach to indicator construction.

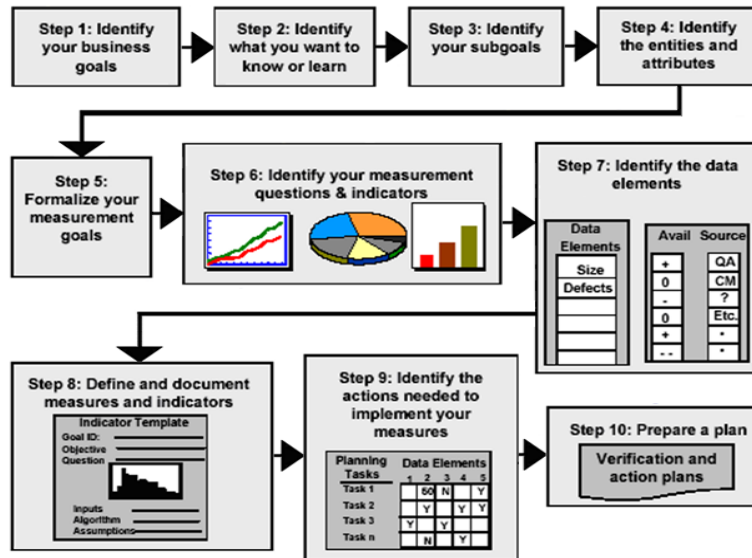


Figure 5. GQ(I)M – Goal, question, indicator, and measurement from Goethert & Hayes [8].

During the synthesis process following the research, it was observed that three requirements were common and essential for attributing the highest maturity levels (ranging from 3 to 5) of the maturity level assessment models considered. These requirements were related to achieving satisfactory (1) performance of activities, (2) complying with schedule and budget, and (3) meeting quality requirements.

These three evaluation criteria also aligned with the proposal put forward by one of the authors [3, p. 180–189] of this research in their doctoral thesis. They suggested reducing the Likert [7] scale, which typically has five levels of evaluation, to just three levels (referred to as the AJMM table) for greater precision in assessment. The three levels of evaluation in the AJMM table were defined as: 1st = Ok, 2nd = Ok with Restriction, and 3rd = Not Ok.

In accordance with the previously mentioned indicator construction technique and the planned approach, the assembly of the three sub-KMIs for each of the 12 IT monitoring areas was carried out as follows: one sub-KMI for the assessment of work results, one sub-KMI for the assessment of delivery commitment, and one sub-KMI for the assessment of customer satisfaction.

The following Section presents the content of the three sub-KMIs, which are replicated for each of the 12 identified IT monitoring areas. The placeholder ‘???’ will be replaced by the monitoring area code ranging from 1 to 12:

- KMI ?? – 1. WR (Work Result) = Percentage of work concluded.
- KMI ?? – 2. DC (Delivery Commitment) = Percentage of work concluded and delivered on schedule planned and within the estimated cost.
- KMI ?? – 3. CS (Customer Satisfaction) = Percentage of work concluded and delivered on schedule planned and within the estimated cost, which in addition, received the definitive acceptance (and not provisional).

It is apparent that sub-indicator 1, WR, has the least demanding requirements among the three sub-indicators. Sub-indicator 2, DC, has moderate requirements, as it establishes that the volume of sub-indicator 1, WR, has fulfilled its restriction. On the other hand, sub-indicator 3, CS, is the most demanding, as it requires the cumulative fulfillment of both the volumes of sub-indicator 1, WR, and sub-indicator 2, DC.

5. Solution Validation (DSR's 3rd. Step)

To calculate the sub-KMI, which represents the resulting data as a percentage for the KMI %, the following equation can be utilized.

$$\left\{ \frac{\sum \text{inspected numbers} - m (\text{maximum goal} - \text{minimum goal})}{2} \right\} = .100\% \cdot W^1 \text{ or } : W^2$$

¹ When the percentage of the KMI (initial) is positive, the weight of significance (W) will be multiplied to increase the degree of high importance (increase the positive value determined) in the formation of the KMI (final).

² When the percentage of the KMI (initial) is negative, the weight of significance (W) will be divided to decrease the degree of low importance (decrease the negative value determined) in the formation of the KMI (final).

A small spreadsheet has been created to simulate this formula and can be accessed in the folder '3. Solution Validation/*Validação da Solução*' in the link <https://drive.google.com/drive/folders/1sFa5845Wcxr7KXQIH9hePXxN0WdRKchV?usp=sharing>.

6. Solution Implementation (DSR's 4th. Step)

To facilitate the assessment of IT governance in a given situation using the PI2M-ITGov assessment, two artefacts have been developed and are available for use in the folder '4. Solution Implementation/*Implementação da Solução*' in the link <https://drive.google.com/drive/folders/1sFa5845Wcxr7KXQIH9hePXxN0WdRKchV?usp=sharing>.

These artefacts include the MS[®] Excel spreadsheet entitled 'PI2M-ITGov - Spreadsheet {V.01c} Edition=_____+Scenario=_____ ' and the accompanying guidelines 'PI2M-ITGov - Guidelines {V.01c}'. The guidelines provide instructions on how to complete the spreadsheet and interpret its results.

Appendix A of this article presents the four main tabs of the MS[®] Excel spreadsheet. The first tab displays the data entry cells, while the other three tabs contain graphs for interpreting the results. The 'INSTRUCTIONS' tabs, which provide guidance on data entry and analysis of status icons, are not displayed.

In the same link, it is also possible to find the form for each KMI, which consists of two frames. The first frame is used to record the goals established during the evaluation planning phase in collaboration with the strategic management department. The second frame is used

to record the actual data captured in the field during the execution phase of the PI2M-ITGov evaluation.

To facilitate identification, it is suggested to copy the fields 'Edition' and 'Scenario' from the spreadsheet's header to the file name, which will help in organizing and identifying the content of the spreadsheet in the directory or archive folder.

The layout of the cells in the MS[®]-Excel spreadsheet follows the predefined order of the 12 IT monitoring areas, divided into the three IT monitoring groups: planning monitoring group, execution monitoring group, and control monitoring group.

The current version of these artefacts, at the time of publication of this article, is V.01c, representing the third revision (letter 'c') of the first version (number '01'). Further updates and improvements may be made available in the same link following subsequent revisions.

The previous revisions (letters 'a' and 'b') were identified during the execution of the fifth and final stage of the DSR, which will be presented in the next topic. This stage involved a case study conducted over three rounds until reaching the current version in the third and final round.

It is important to note that the instructions provided in the 'PI2M-ITGov - Guidelines {V.01c}' document are based on the results obtained from simulating the implementation of this method in a real corporate environment, as described in Section 7 'Implementation Assessment (DSR's 5th. Step)'.

The Chronogram (created in MS[®] Project) used to coordinate the execution of step 4 of the DSR is available in the same link under the folder '4. Solution Implementation/Implementação da Solução'. Although it is already filled, it can be copied and reused, as it provides average duration data for the tasks that can be replicated.

7. Implementation Assessment (DSR's 5th. Step)

To assess the effectiveness of the solution, a simulation was conducted in a Brazilian Government Agency, consisting of three rounds. The outcomes of this simulation were utilized in the development of the guidelines, as mentioned earlier, which can be accessed through the provided link.

The results obtained from the simulation are presented in the spreadsheet titled 'PIM2-GovTI - Spreadsheet {V.01c} Edition=2021 2nd.Quarter+Scenario=Organizational Restructuring' available in the folder '5. Implementation Assessment/*Avaliação da Implementação*' in the link <https://drive.google.com/drive/folders/1sFa5845Wcxr7KXQIH9hePXxN0WdRKchV?usp=sharing>.

Additionally, in the same link, a form for each KMI (KMI Form) with two frames is available where the first frame captures the goals defined during the evaluation planning phase in collaboration with the Strategic Management Department, as part of the application of the PI2M-ITGov method. The second frame records the actual data collected in the field from the business areas during the execution phase of the PI2M-ITGov evaluation.

As mentioned in the initial summary of this research work, the PI2M-ITGov method can

be utilized to (1) assess the performance status of an IT area.

Furthermore, it can also be used to (2) compare the results of suppliers as a means of supporting decision-making, particularly in the context of proof of concept (POC) evaluations for contracting or renewing commercial agreements.

The MS® Excel spreadsheet discussed earlier primarily focuses on objective (1) mentioned above. However, to address objective (2) and provide an immediate assessment of a POC, the PI2M-ITGov KMIs can be applied in the manner depicted in Figure 6 (for evaluating service provider enterprises in the field of systems development, specifically as a software factory [FSW]) and Figure 7 (for evaluating service provider enterprises in the field of project management, particularly as a project management office [PMO]).

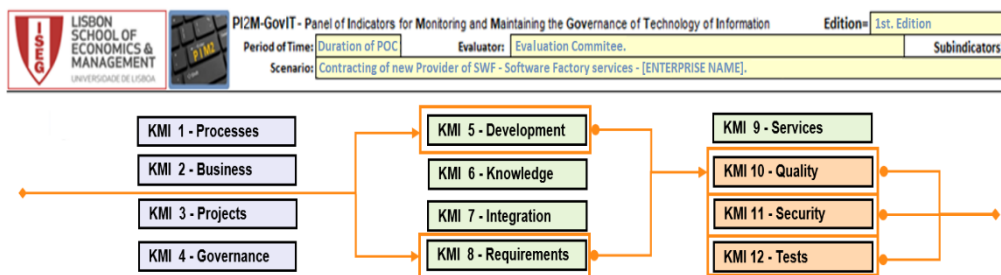


Figure 6. Example of proof of concept (POC) to build a comparative framework in system development.

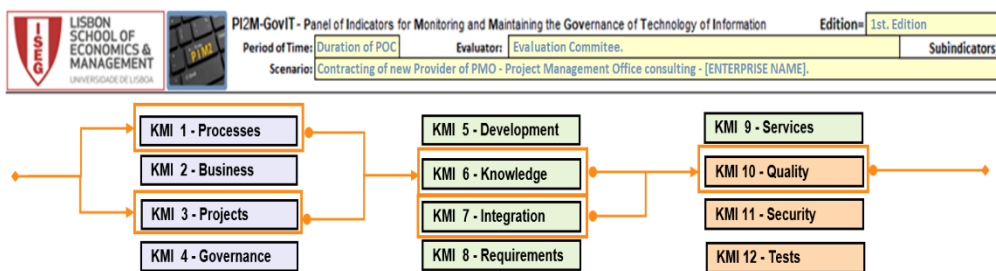


Figure 7. Example of POC - Proof of Concept to build a Comparative Framework in Project Management.

In both examples, the assessment of sub-indicator 2. DC should focus solely on the deadline criterion, excluding the cost criterion. In a POC evaluation, cost evaluation is not typically a common factor.

Furthermore, in both examples, regarding sub-indicator 3. CS, the term ‘customer’ represents the evaluation committee responsible for applying the final acceptance criteria for the POC presented by the assessed supplier.

For these examples, the maximum goal and minimum goal for the KMIs should be the same. Since the POC has a short duration and aims to achieve a specific outcome, the maximum goal and minimum goal reflect the singular target value that the evaluated supplier must meet.

8. Conclusion

This research adhered to the principles of a scientific method by following the steps of DSR, including the application of a case study consisting of three simulation rounds to validate the constructs and artefacts created (guidelines and spreadsheet).

Based on the evaluation, it can be concluded that the PI2M-ITGov, which is a Panel of Indicators for Monitoring and Maintaining the Information Technology Governance, effectively serves as a practical tool for executing the necessary procedures in IT management.

While the PI2M-ITGov was constructed in a structured manner, its continued use and feedback from users will likely lead to new versions with added functionalities and improvements.

The author welcomes and appreciates users who provide feedback and share their experiences in using the PI2M-ITGov. This feedback will contribute to enhancing the quality of the method.

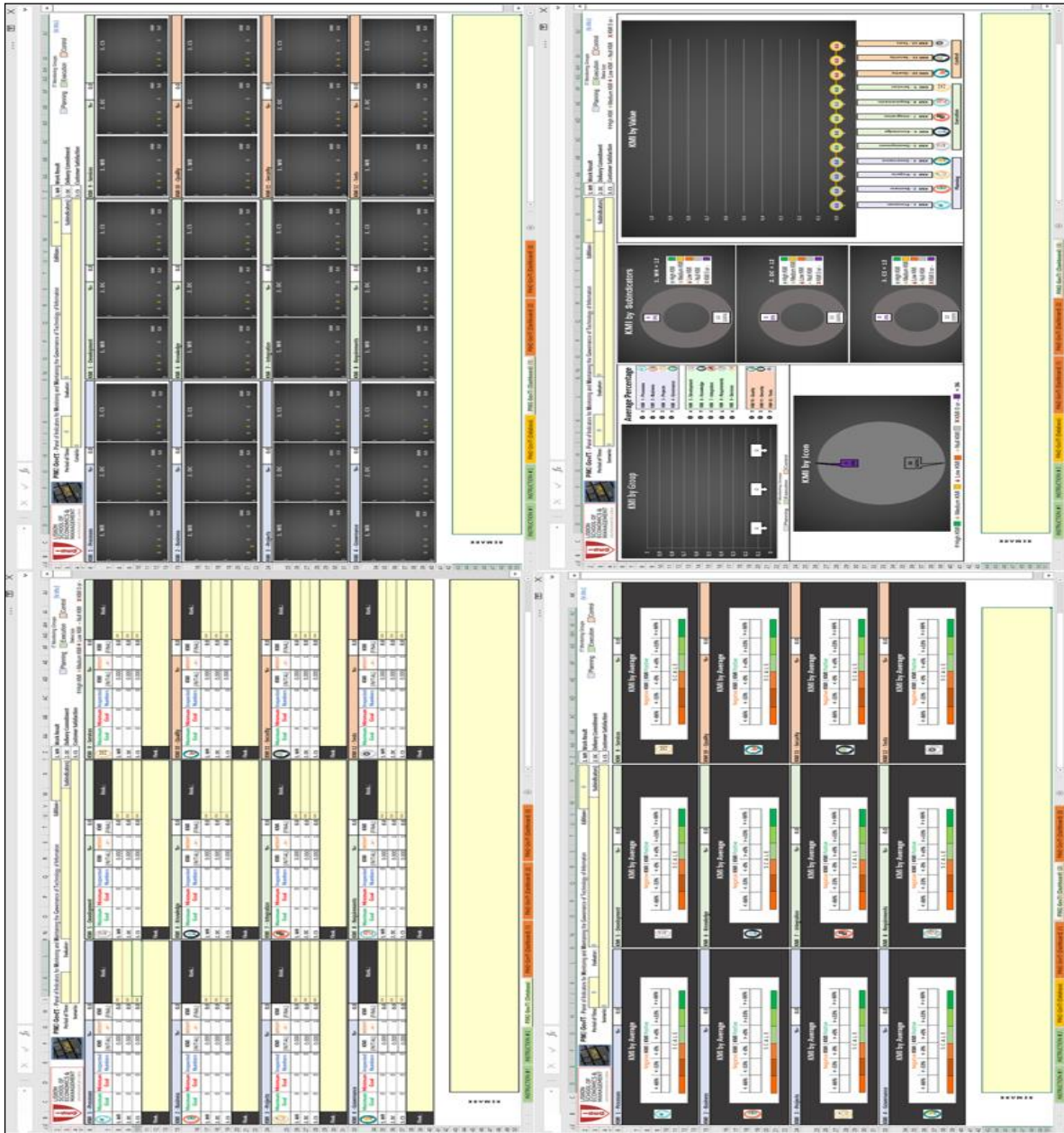
It is recommended to periodically check the provided link for any new updates or revisions that can be downloaded.

Furthermore, the author encourages future contacts and assures that any inquiries will be handled with care and attention. The author is dedicated to guiding interested individuals in implementing the PI2M-ITGov in their organizations and providing necessary support to ensure the success of this initiative.

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Conflicts of Interest: Álvaro Rocha is an editorial board member/editor-in-chief for World Journal of Information Systems and was not involved in the editorial review or the decision to publish this article. All authors declare that there are no competing interests.

Appendix A: MS® Excel Spreadsheet of PI2M-ITGov



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Graphic Abstract

