Fit-Gap Analysis: Pre-Fit-Gap Analysis Recommendations and Decision Support Model

LAHLOU Imane, MOTAKI Nourredine, SARSRI Driss, L'YARFI Hanane
Nationale School of Applied Sciences of Tangier
Tangier, Morocco

***Abstract*—Enterprise Resource Planning (ERP) system has been defined as a configurable Commercial Off-The-Shelf (COTS) system integrated into multiple business functions. For most companies, adopting ERP has become necessary to maintain market competitiveness. However, ERP implementation is still critical because project success depends on multiple parameters and involves several stakeholders. This article deals with the Fit-Gap analysis stage, which is an essential step in ERP implementation. This study was carried out through a literature review and interviews with experts to gather information and support stakeholders toward a successful Fit-Gap phase. It presents a set of recommendations for clients and consultants to consider before starting the Fit-Gap Analysis phase, and it presents an approach, with a decision support model represented as Business Process Modelling Notation (BPMN) based on several parameters to be used during the Fit-Gap Analysis stage to bridge gaps. The results obtained are intended for clients and consultants to make the most rational decision to bridge gaps based on the recommendations found, the approach and the decision support models presented.**

Keywords*—ERP systems; misfit; customisation; fit-gap analysis

I. Introduction

Information systems are at the company's core [1]. Indeed, an information system is composed of workers, processes, systems, applications, databases, and rules. It is accountable for storage and information processing. It provides information to the employees [1]. Successful company management is attainable by providing the right information to the right person. However, an efficient information system helps to have a productive and competitive company. Many enterprises have and use an Enterprise Resource Planning (ERP) system for its managerial characteristics.

ERP is a software package that automates and integrates a company's business processes [2]. Nowadays, Small and Medium-sized (SMEs) and Large Enterprises are adopting these systems for their many organisational advantages.

Scientific research has focused on ERP implementation since it is a significant phase in its life cycle. Researchers have also emphasised some key success factors, given the high degree of failure rate cited in previous research and observed in the field [3] [4] [5] [6].

Several success factors for the implementation project have been mentioned in the literature, among which we found that the ERP was not adapted to the company's business processes. Indeed, the ERP does not always meet the customer's needs. Here, we notice a gap, or what is also known as a misfit, between the system and the company's business process. Therefore, this gap can be bridged in several decision-making [7]:

- Entirely adopt the ERP standards and completely abandon its processes (we called this the vanilla method) through the Business Process of Re-engineering (BPR).
- Waive some of its established requirements.
- Find workarounds to bridge this gap (this may be achieved by introducing other applications or manual work).
- Customise the ERP system to fit the company's processes.

The company should decide the strategy to align the ERP systems with the customer needs and business processes, which will inevitably be a project success factor. Leading and evaluating this decision-making is an interesting aspect to consider. Therefore, it is going to guarantee the project's success. Making the right decision is a key factor to avoid falling into a standard problem of ERP systems implementation i.e., over-customisation.

ERP over-customisation is a classical issue. Several research pathways have approached the issue from different angles to address it, in a theoretical or empirical way. However, the tools and methods that have been developed only propose a partial solution to the problem. Hence, the need to develop a new study includes a solution to solve the entire issue. Even though scientific research has a keen interest in this problem, it is still topical to find companies that do not handle having a system set up correctly to meet their needs. The cause is often because of unsuccessful management of gaps.

This article deals with the Fit-Gap Analysis phase by presenting first, the literature review concerning this phase; Second, recommendations to be taken into consideration before starting the Fit-Gap Analysis stage. And finally, an approach and decision support model to address gaps.

II. Literature Review

To define this study and understand the proposed problem, the following section discusses some points that are directly related to the subject through a literature review i.e., ERP misfit, misfit types, Fit-Gap Analysis, ERP customisation, and synthesis.

A. ERP Misfit

ERP misfit is a derivation of a broader concept called Task Technology Misfit (TTF) to explain the gap between ERP systems in terms of technology and the organisation's requirements [2]. Fig. 1 explains it in an illustration form [8]. Indeed, several studies have used this concept to have improved clarification regarding ERP misfit [9] [3] [10]. Therefore, it would be wise to learn more about the TTF and investigate the topic to have a better understanding of ERP misfit.

The TTF theory shows the degree of Information Technology (IT) capability to support user requirements. It is important to state that information systems can only have positive effects on the system or the user performance if they align with the user requirements in terms of tasks [11]. It is, therefore, clear that TTF is an excellent system performance indicator and even better than user satisfaction or technology use [12].

The projection of the TTF theory on ERP systems is, therefore, being the ERP misfit. To have an efficient ERP and better use of it, it is important to have a high degree of fits and consequently a very low degree of misfits. The primary cause of failure in implementation projects reports this ERP misfit with the customer's requirements [13]. This is a real problem to be taken seriously when implementing an ERP in a company. This is because it could cause much more damage than poor performance or reduced flexibility and agility [14]. It could also lead to large financial losses on the scale of hundreds of millions of dollars, or even near-bankruptcy [15].

B. Misfit Types

Many studies have classified misfits according to several categories and different angles, ranging from broad categories to subcategories. There are perceived misfits and real misfits [16]. It remains significant to distinguish the two misfits to know how to solve them [17].

Perceived misfits are misfits that do not cause any difficulty in the business or taxes. They are usually caused by ERP systems functioning ignorance, unrealistic customer expectations, and resistance to change. No matter how well the ERP technically works, it can still face opposition. So having motivated users and cooperation from the business team is crucial [18].

Real misfits are the true inadequacy of the ERP systems with the customer needs, including imposed misfits and voluntary misfits [15]. The imposed misfits are therefore due to either an obligation set by the authorities or by industrial standards [19], contrary to the voluntary misfits, which are company choices to distinguish itself in the market [7].

There are two other misfit types that can be considered subcategories of the previous types, "deep structures" and "surface structure" [20]. The deep structure type is at the core of misfits. They occur when things, properties, states, or transformations are erroneous or represent deficiencies in the system [21]. In addition, surface misfits can cause mismatches if the software does not offer the proper format for reports, provide the appropriate roles to access information, or have a suitable user interface [7].

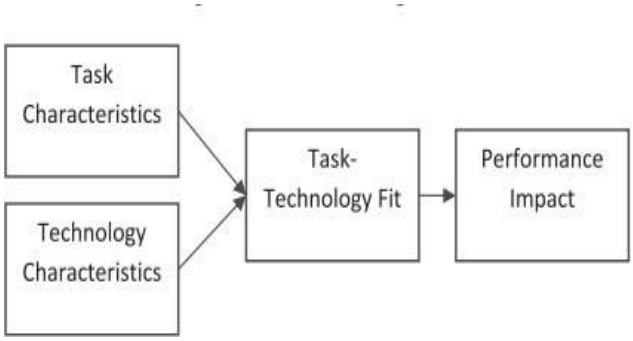


Fig. 1. Task Technology Misfit Diagram.

There is another misfits classification made by Soh et al. by grouping the most common mismatches into three categories: input, processes, and output misfits [21].

Input misfit is the inability of the ERP systems to capture different objects, attributes, or documents in the ERP database [22]. It is a misfit concerning the data entries and the diverse relationships between the entities in the data model [21]. It is natural that the absence of certain elements, in terms of data, will lead to severe software deficiency and will affect its performance [2]. Therefore, input misfits can be included in the deep misfit category [16].

Process misfit refers to, the incompatibility between the business requirements and the ERP systems in terms of required processes and procedures [21]. ERP is supposed to represent the workflow activities of the enterprise as they are in the real world. This inability to model them in the ERP system is a process misfit. Typically, that will affect information quality, presenting the user with poor quality or illogical information [2]. This misfit category is also included in the deep misfit [16].

Output misfit is the incompatibility between the ERP systems and the business requirements, in terms of information format presentation, interface content, or reports. The information which is poorly presented to the user will take an extended amount of time to be understood and could eventually be misinterpreted [23]. Therefore, output misfits can be included in the surface misfits [16].

Another category can be added to the three other types. Established by Soh et al, it is the latent structure [20] containing three additional categories proposed by D.M. Strong and O. Volkoff, i.e., role misfit , control misfit, and organisational culture misfit. In this article, only input, process, and output misfits are treated. Fig. 2 represents misfit types according to Eli et al., Joost A. A. van Beijsterveld and Willem J. H. van Groenendaal and Tan Shiang-Yen et al. [7] [16] [2].

C. Fit-Gap Analysis

Fit-Gap Analysis is a critical phase in the ERP life cycle. It is used for ERP systems selection and to generate inputs for the design phase [24]. Therefore, we note high-level Fit-Gap analysis in ERP pre-implementation and detailed Fit-Gap Analysis during implementation projects [25]. Fit-Gap Analysis is conducted by several stakeholders: ERP vendors, consultants in charge of the implementation project, and customers who will implement the ERP systems [26].

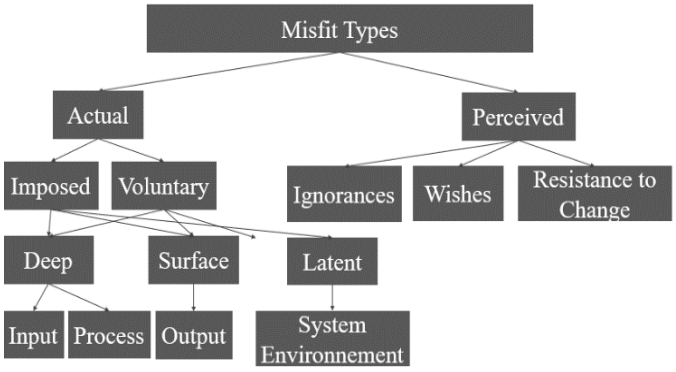


Fig. 2. Misfits Type.

In high-Level Fit-Gap Analysis, the aim is to select the most suitable ERP systems for the company [8]. It is based on a fit between the customer requirements and the ERP systems capability. It is, therefore, a matter of minimising the gap between the ERP systems and the customer needs by selecting the ERP that best meets these criteria. The right choice will increase the chances of successful project implementation.

The high-Level Fit-Gap Analysis can be done by following these steps [11]:

- a review of customers' business needs and ERP systems capabilities.
- the selection of a comparison approach.
- a comparison of business needs with ERP systems capabilities and the documentation of fits and gaps.

Once the most suitable ERP is selected, the company can move on to the next phase, which is the detailed Fit-Gap Analysis. Indeed, this phase is critical. It is about collecting all the misfits and fits between the ERP and the customer requirements. As soon as the set of gaps is determined, it should be resolved by a successful implementation of the project [24]. The gap resolution can be done either by customising the ERP system or by adjusting to business processes. The detailed Fit-Gap Analysis is therefore used to determine the degree of change that needs to be made to both the softwares and the company [27].

D. ERP Customisation

Customisation is a term used to refer to ERP modification to align with customer needs [28] [29] [30]. The customer specifies his business requirements. If the ERP meets them, there will be no need to customise the system. Otherwise, the client is left with several alternatives, among them, ERP customisation [31]. To make such a decision, several parameters come into play. We often find the cost-benefit aspect as key [32]. However, some important parameters are not always taken into consideration by stakeholders. For instance, S. Koch and K. Mitteregger insist on the study maintenance and its costs to decide whether to customise ERP systems or not [33].

Despite the many benefits that ERP customisation can bring, such as increasing the local efficiency of the company [34], and user satisfaction [35], most scientific research remains categorical about minimising customisation to achieve a successful implementation project [36] [37]. Indeed, customisation increases the duration of the implementation project. It can generate bugs and update issues. One can even say that it can jeopardise the many benefits that ERP can bring [2] [38]. However, it is still usually necessary. The question one might ask is, what limit must never be exceeded to not sway towards over-customisation?

E. Synthesis

In the literature there are various studies proposing several techniques and methods to provide a solution to ERP misfit, several evaluation methods have been proposed to treat the issue partially.

Numerous studies proposed to study the relationship between ERP customisation and system maintenance. S. Koch and K. Mitteregger conducted a study to evaluate the relationship between customisation degree and support effort [33]. While B. Light presented, two cases, describing customisation performed and the maintenance implications [28].

S. Parthasarathy and S. Sharma realised the research on the customised ERP efficiency. They adopted a quantitative method using Data Envelopment Analysis model [37]. The purpose is to examine customised ERP efficiency and the relationship between customisation degree and ERP package efficiency [37].

Customisation can also impact ERP quality. S. Parthasarathy realised an empirical study based on framework and advanced a set of hypotheses to establish the relationship between the customisation carried out by ERP vendors and ERP resulting quality [31].

Customisation has also to take into account different types of ERP systems. Elin Uppström et al. proposed different options for Cloud ERP and One-premise ERP and discuss the difference between there [39].

C. S.-P. Ng treated the relationship between ERP alignment types, operational characteristics, degree of system use, user satisfaction, and system benefits [35].

Hustad et al. have described the different types of misfits and types of tailoring [7].

Table I (Appendix) is a synthesis of these studies carried out in the previous research about the Fit-Gap Analysis phase, ERP misfit, and ERP customisation.

Based on the research related to ERP misfit, Fit-Gap Analysis, and ERP customisation, it is clear that there is a need for a study that takes into account all of this research to support consultants and clients during the pre-Fit-Gap Analysis phase and the Fit-Gap Analysis.

III. Research Methodology

This study aims to avoid redundant errors in previous projects in the Fit-Gap Analysis phase. A set of recommendations are presented concerning Fit-Gap Analysis. This recommendation should be reviewed before starting this stage. Later in this paper, an approach and a support model are

presented as Business Process Modelling Notation (BPMN) to support stakeholders in this phase. These two main objectives can be formulated as three questions:

RQ1: What are the recommendations that should be reviewed before starting the Fit-Gap Analysis phase?

RQ2: What are the parameters to consider during the Fit-Gap Analysis phase?

RQ3: Which decision support model should be used to address the gap?

Furthermore, this study was conducted based on a literature review. It uses Kitchenham et al. methodological guidelines [40] [41]. The relevant literature on the Fit-Gap Analysis stage, ERP customisation, and ERP misfit were reviewed, summarized and supplemented with information available from case studies and surveys. We also identified the recommendations to be considered before the Fit-Gap Analysis stage and the most important parameters to bridge gaps through the literature. We could establish this study by following three main steps: planning, conducting, and reporting.

Moreover, theoretical findings related to Fit-Gap Analysis were combined with ERP practical recommendations to derive insights.

Subsequently, we conducted interviews with experts in ERP systems: consultant in the digital transformation of financial services, legal services, and HR management, SAP BO Project Manager, and Associate Manager SAP – S/4HANA certified. The interviews were based on a questionnaire (Appendix).

Fig. 3 explains the methodology followed in diagram form.

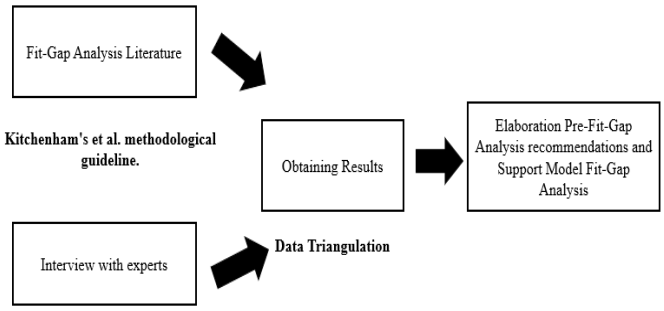


Fig. 3. Illustration of the Methodology Followed.

To establish a model for companies and consultants, some key indicators need to be defined:

- accessible and understandable,
- easy to understand and implement, and
- representative of reality and adaptable to implementation projects.

IV. Result and Discussion

After the literature and experts recommendations, Pre-Fit-Gap Analysis recommendations are established to consult and consider before initiating the Fit-Gap Analysis. An approach and a decision support model to support stakeholders during the Fit-Gap Analysis are conceptualised using BPMN. Fig. 4 presents the study results.

This study will support the consultants and the customers throughout the Fit-Gap Analysis phase consequently the failure rate of the implementation project will be reduced. The first step is to give them recommendations to consider before starting the Fit-Gap Analysis stage to avoid redundant mistakes in previous implementation projects. The second step is to present an approach and a decision support model to prepare them for the Fit-Gap Analysis phase to bridge gaps.

A. Pre-Fit-Gap Analysis Recommendations

Pre-Fit-Gap Analysis recommendations are intended for both the customer and the consultants. They will be handy to prepare the stakeholders for the Fit-Gap Analysis phase and support them in making the most rational decisions, thus, avoiding mistakes that could lead to failure. Pre-Fit-Gap Analysis recommendations are presented and discussed in the eleven recommendations below.

1) Minimise customisation while trying to realise that there is a trade-off between effort and value: As mentioned, several times in the literature, customisation generates an additional cost and increases the implementation project duration. Studies have converged on a single result: customisation should be minimised to succeed [42] [43] [3]. T. Sommers and K. Nelson analysed the responses of 86 organisations, confirming this result [3].

S. Parthasarathy and S. Sharma have shown through their studies that low customisation would increase ERP efficiency. According to this study, the best situation for better system efficiency in terms of productivity is adopting the ERP standards, with minimal customisation [37].

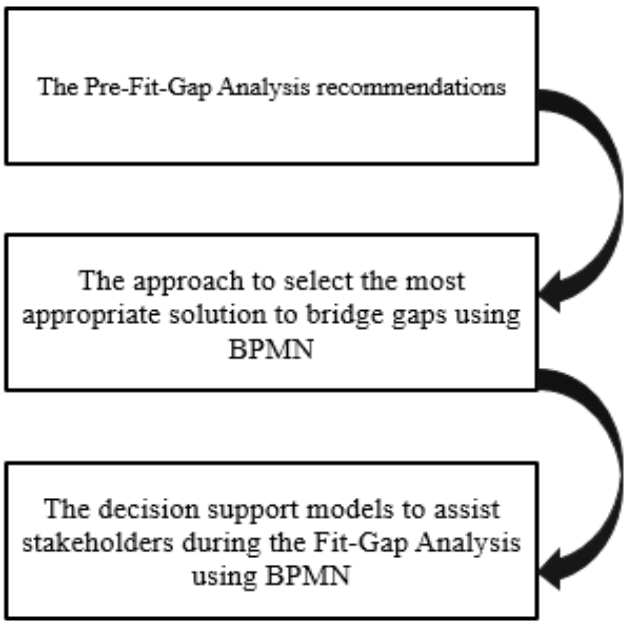


Fig. 4. Illustration of the Study Results.

Customisation risks are that it introduces errors into the system, making updates more difficult and increasing maintenance costs [2] [33]. A study result made by S. Koch and K. Mitteregger shows that there is a correlation between customisation and ERP support effort. Therefore, increasing the customisation degree will increase the support effort specifically for the help desk [33].

It is clear from the previous studies regarding ERP customisation and the success factors of the implementation project that minimal customisation would be the most appropriate for ERP implementation success. Therefore, before starting the Fit-Gap Analysis phase, both the business team and the consultants should be aware that customisation should be minimised. It should be used only in case of extreme necessity and in exceptional circumstances, such as losing competitiveness in the market [37].

It is, therefore, making a compromise between effort and benefit by trying to minimise the ratio between effort and benefit. However, the effort has been defined in several ways and estimated with different methods. S. Koch and J. Mitlöhner proposed a study reviewing the literature on effort estimation methods for ERP projects, their validations, and limitations [32].

2) Train the internal team on the operation and ERP systems functionalities: Several studies have investigated the Critical Success Factors (CSF) of the ERP implementation project [3] [4] [5] [6]. Given the number of failures that have occurred over the years, Muscatello et al. reported that 40% of the implementation projects are partially successful while 20% fail [44].

Among the CFSs found in the literature that leads implementation projects to success, there is training [45]. This is a vital component of the project. However, there are two stages of training. A training session for the business team before starting the Fit-Gap Analysis phase, and another training session for end-users. Both steps are crucial for the implementation project to be successful. However, this article is more concerned with the first one.

Training can also increase user satisfaction. It is an investment that brings individual benefits and advantages to the entire company [5]. Indeed, this concerns SMEs and large organisations. Laukkanen et al. reported in their study that SMEs have poor knowledge of the ERP systems and that this should change [46].

The Business team should be trained on the ERP systems and their functionalities before starting the Fit-Gap Analysis phase to have a positive attitude towards its implementation. This would increase its acceptance by project stakeholders and end-users [47]. And therefore, training is an excellent approach to reducing resistance to change [46], thus avoiding over-customisation. It is also a way of involving the users and the business team in the implementation project, especially the Fit-Gap Analysis phase, that leads to better system optimisation and consequently a better use of the system [48].

3) Ensure operational departments' involvement: Department managers should be involved in the implementation project and especially Fit-Gap Analysis. It is not the consultants who have to decide on ERP customisation. The internal experts of the company should also be involved in this decision. The idea is not to rely heavily on the consultants, but to lead the project together by engaging the internal team more [43].

The operational department's involvement would conduct to a better ERP acceptance. This would lead to project ownership and participation in the organisation's improvement and subsequently reduce resistance to change. The company will ensure that the project is both technical and managerial success.

4) Work in harmony between internal and external teams: A Fit-Gap Analysis is carried out in teams by several stakeholders. To succeed in the Fit-Gap Analysis and achieve the fixed goals, it is essential to have cohesion within the team.

It is challenging to build the client's trust in external experts especially when client believes that they will maximise customisation to increase implementation cost since it is billed by the hour [43]. However, trusting the consultants is essential because they know the ERP systems better and can suggest improvements to the business.

Trust can only be established between internal and external teams by following certain aspects:

- having greater transparency of both parties, and
- making sure that the consultants have enough experience and knowledge of the business.by putting in place business team training.

Conflict management is also an important factor in Fit-Gap Analysis success. It allows for better group cohesion and better trust between stakeholders which opens the possibility for several solutions to the problems [49].

G. Chen et al. considered three approaches to conflict management: cooperative, competitive, and avoiding [50]. The cooperative approach allows better teamwork based on mutual help and spontaneous communication between team members. This approach also permits an exchange of ideas that stimulates creativity and innovative solutions [49].

The competitive approach is another alternative used when leaders expect very high performance. They prefer to use conflict to choose the best-performing ideas. This approach creates a competition between the stakeholders which limits the Fit-Gap Analysis phase's success [49].

The avoiding approach is based on solving problems early before they become serious issues. Leaders who use this approach tend to pay special attention to the professional needs of their subordinates. This is a conflict prevention approach. However, this method does not resolve the conflict but dissipates it [49].

It is better to adopt the cooperative approach that will push for better cohesion and communication and stay away from the avoiding approach that limits stakeholder's productivity. This

way, leaders will have high expectations; hence they will employ the competitive approach which can be beneficial if used moderately [49].

5) Know the technical implementation type desired by the client: After selecting the solution that will best fit the customer's needs, a selection of deployment options is then made. The company faces several deployment options that highly depend on the system's location and other criteria chosen by the client. These criteria can be IT footprint reduction, customisation degree estimated, or update frequency (SAP Consultant). It is, therefore, crucial to be aware of deployment options chosen by the company before starting the Fit-Gap Analysis phase, as it has a direct relationship with it. But before explaining this point further, we need to get acquainted with the existing deployment options by taking the example of a leader in the ERP market, which is SAP.

There are three types of deployment options that SAP offers to its customers, on-premise, hosted private cloud, and public cloud. With an on-premise deployment, the customer deploys the licensed SAP software in its on-premise data center, i.e. the ERP is loaded and runs on the company's infrastructure, such as servers, networks, computers, etc. [46]. The customer opts for perpetual user rights for the software. He also becomes responsible for the associated hardware, implementation, and ongoing operations. Besides, on-premise ERP offers freedom of customisation [46] [51].

The second option is hosted private cloud, which is an environment entirely dedicated to the system and data of a single customer but managed by SAP. It is a deployment either through a perpetual license or a subscription commitment. That means the company can have its license or buy it from SAP and host it at SAP. SAP, in this case, also offers management and application service. Alternatively, the company may opt for a subscription but still decide to have its dedicated environment. In this deployment option, the company also has freedom of customisation (SAP Consultant).

The third option is the public cloud. This is a shared environment between several customers, and the software is present as Software As A Service (SAAS). SAAS is accessible through a browser [5]. Here, the company opts for a subscription-based commitment while SAP manages the software. In this deployment, the customer does not have much freedom of customisation because the source code is shared between several customers (SAP Consultant).

We have seen that some deployment options present more freedom of customisation, namely on-premise and hosted private cloud deployment, while SAAS offers less flexibility in terms of customisation. That's why it is important to know what deployment type the company has opted for before starting the Fit-Gap Analysis phase. There is no point in considering source code customisation if it is not possible with a SAAS deployment. Fig. 5 explains the different deployment options offered by SAP.

6) Evaluate the time and budget required for the implementation project: A project is a set of actions to be carried out in a predetermined time, putting in place human and material resources, that are budgeted for, and resulting in a pack of deliverables [2].

In any project, it is a question of time and budget. Before starting the Fit-Gap Analysis phase, it is essential to know the pre-defined time and budget to not exceed them. It is a question of ensuring that the solutions were chosen in the Fit-Gap Analysis phase regarding these two criteria.

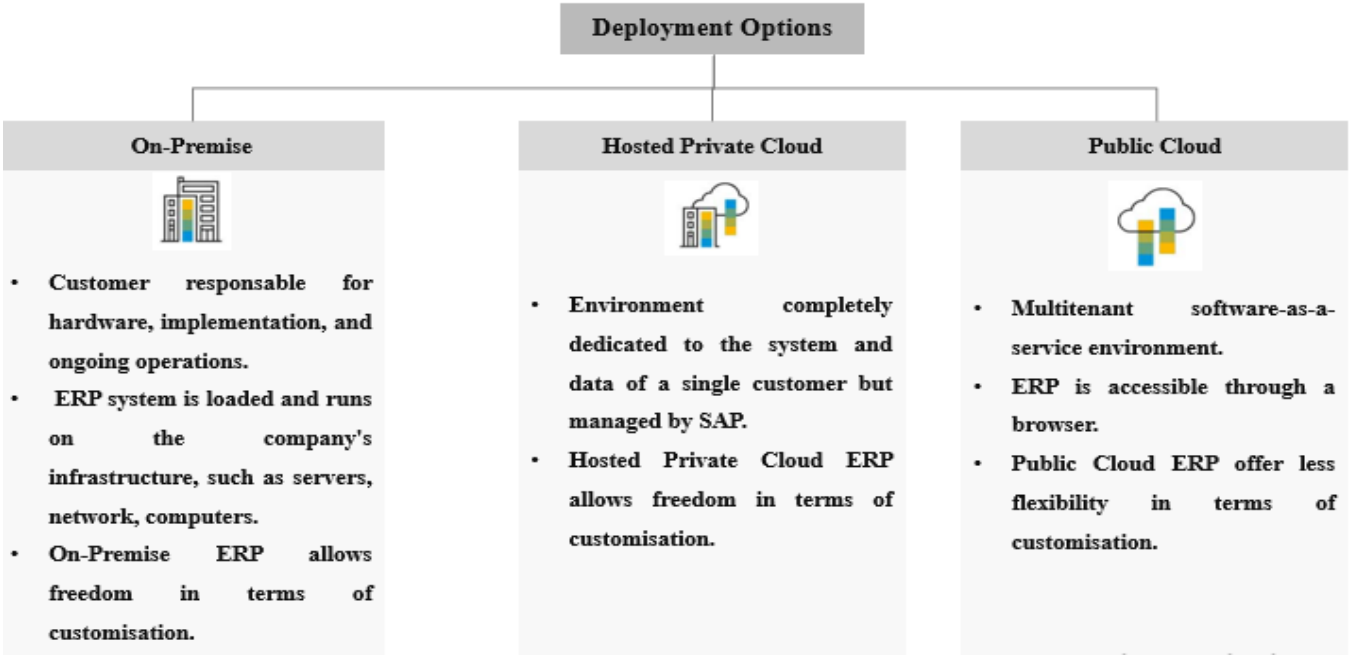


Fig. 5. Deployment Options.

Customisation may be seen by some as a solution that does not require an enormous cost in the short term. But it is a tremendous investment in the long- term compared to a BPR. If the company cannot implement BPR, it commits to allocating resources in the long term after the ERP is implemented [52]. To control the Total Cost of Ownership (TCO), the company should follow a structured framework to justify the radical changes that the ERP imposes [52].

Before considering any solution to bridge the gap, it is required to evaluate its cost and duration. It is, therefore, necessary to know the time and cost in the short and long term that each solution will generate to respect and best utilise the client's resources.

7) Learn about the standards proposed by the vendor: ERP systems are integrated software composed of business processes that are recognised as best practices in the industry [44]. It is critical to be aware of these standards that the ERP offers to aim at improving the company's business.

Indeed, these standards can improve business processes because they are the best practices identified across many industries. It is not only a matter of avoiding costly and risky customisation, but about improving the company's performance by adopting these practices. For this reason, it is decisive to choose the ERP that contains the standards that best fit the company's business. This is done by implementing an ERP systems selection strategy. For instance, ERP selection criteria using critical decisions analysis [53].

Before starting the Fit-Gap Analysis phase, it is essential to determine all possibilities offered by the chosen system, especially if it improves the company's performance.

8) Know flexibility degree of the system: Flexibility has been a multidimensional construct, representing the ability of a system to make the necessary readjustments to respond to environmental changes without making significant sacrifices to the company's performance [54]. Then, it is simply up to the adaptability of the system to change.

M. W. Mudie and D. J. Schafer studied ERP flexibility as an information system and not just its technical aspect [55]. They, therefore, cited two of its major components, the technical infrastructure, and the human infrastructure. The technical infrastructure is composed of applications, data, and technological configuration, while the human infrastructure is composed of knowledge, and skills required for the effective management of information technology resources in the organisation [56].

This article focuses on the technical aspect of flexibility as an element to be considered before the Fit-Gap Analysis phase. According to Byrd and Turner, the technical infrastructure flexibility includes integration and modularity [56].

Thus, before starting the Fit-Gap Analysis phase, it is crucial to evaluate the modularity aspect of the system. Duncan defined modularity as the ability to add, change and remove any software, hardware, or infrastructure data component with ease and without overall damage [57]. The idea is to evaluate what options the system offers in terms of configuration in case of a gap before considering source code modification. Once again, it is about studying all the possibilities available to resolve the gap before considering source code customisation.

9) Know the company's information technology infrastructure (IT infrastructure): IT infrastructure is the portfolio of resources that are used and shared by the company, whether at a technical or organisational level [58], allowing data to be exchanged within and with other companies. The company's IT infrastructure enables data development and use and the anticipation of future business requirements [55].

It is, therefore, significant to determine the IT infrastructure that the firm has to recognise the company's resources in human and technical capital before starting the Fit-Gap Analysis phase. This would affect solution selection to bridge the gap. Sometimes, the company cannot consider a BPR solution if it does not have certain human resources. This is also the case for the ERP customisation that requires some IT knowledge that the company should have or seek to have.

10)Know the Fit-Gap Analysis phase impact on the system maintenance: Before discussing the relationship between system maintenance and the Fit-Gap Analysis phase, it is important to define what system maintenance is. After the ERP systems implementation, it then moves to the next phase, the operation, and maintenance phase. According to Stefan Koch and Kurt Mitteregger, system maintenance begins with the vendor and first version delivery and ends with the entire product retirement. It comprises all changes to the system after it is operational. However, a distinction should be made between corrective, adaptive, and product care maintenance [33].

There is an unavoidable link between maintenance and ERP implementation projects. Hence there is a relationship between the Fit-Gap Analysis phase and maintenance [52]. The annual maintenance cost can reach up to 25% of the implementation project. This is partly because of customisation, which causes additional long-term maintenance costs. ERP vendors neither encourage this practice nor support any customisation requested by the customer [29]. The maintenance is costly because of customisation and is entirely borne by the customer [52].

It is essential to know that with each update or improvement applied to the ERP systems, all customisation should be reviewed, reapplied, and retested [59]. This becomes more complex when the person who built the customisation is not available to review, reapply or retest it. If the customer decides not to apply these updates, he may be held responsible for all the bugs in the system [52].

The literature has also emphasised the importance of communicating and collaborating with external stakeholders, especially the ERP system's vendor, to maintain the system successfully [33].

The customer should not forget that even with successful implementation, improper management of its maintenance can be costly, and can even prevent the customer from realising

ERP systems benefits. It can also cause daily transactions to fail [60].

Before starting the Fit-Gap Analysis phase, it is important to know the maintenance cost, the strategy to deal with it, and to consider it when choosing a solution during the Fit-Gap Analysis phase to estimate long-term TCO.

11)Know the company's operational characteristics complexity: The company's operational characteristics have been defined as the quantity and/or data complexity to be processed, the reports produced, the databases, and the operational processes interacting with other operational processes of different departments. For a multinational company, operational characteristics complexity increases. This is normal given data size and the frequent interaction with other business units, customers and supplier numbers [35].

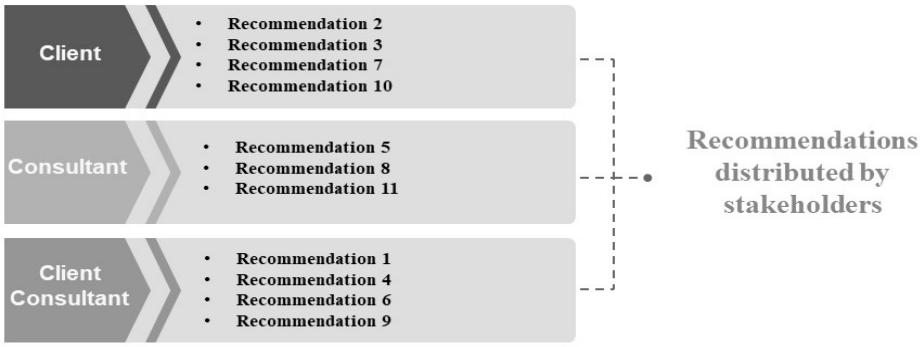
Ragwusky and Gefen have shown that ERP systems for large structures are better suited and adjusted for multinationals, hence companies with high operational characteristics' complexity [61]. This was confirmed by the study conducted by Celeste See-Pui Ng. It showed that when operational characteristics complexity increases, this is associated with a better fit with the ERP systems, whether it is in terms of processes, interfaces, or data [35]. This result should be taken into consideration by the stakeholders. Before starting the Fit-Gap Analysis phase, it would be interesting to know the company's operational characteristics complexity to estimate the fit between the ERP systems and the customer's needs.

Fig. 6 lists all the pre-Fit-Gap analysis recommendations according to the different stakeholders.

B. Approach to be followed during the Fit-Gap Analysis Phase

To assist stakeholders to manage the Fit-Gap Analysis phase, we designed an approach based on the findings of D. Pajk and A. Kovačič [8] and Gattiker & Goodhue [17] (Fig. 7 and Fig. 8).

First, a comparison between the customer business need and ERP systems capability to identify a set of misfits and the fits should be done. We are not going to treat the fit case because it does not pose a problem. We are going to deal with the misfit case. It is a question of categorising it into perceived misfit or actual misfit. In case it is a perceived misfit, i.e., either resistance to change, wishful thinking, or ignorance of how the ERP works, it should be solved through training and human resource management. If it is a real misfit, the proposed model should be as follows.



Recommendation 1: Minimise customisation while trying to realize that there is a trade-off between effort and value.

Recommendation 2: Train the internal team on the operation and ERP system functionalities.

Recommendation 3: Train the internal team on the operation and ERP system functionalities.

Recommendation 4: Work in harmony between internal and external teams.

Recommendation 5: Know technical implementation type desired by the client

Recommendation 6: Evaluate the time and budget required for the implementation project

Recommendation 7: Learn about the standards proposed by the vendor

Recommendation 8: Train the internal team on the operation and ERP system functionalities.

Recommendation 9: Know the company's information technology infrastructure (IT infrastructure).

Recommendation 10: Know Fit-Gap Analysis phase impact on the system maintenance.

Recommendation 11: Know the company's operational characteristics complexity

Fig. 6. Pre-Fit-Gap Analysis Recommendations according to the Stakeholders.

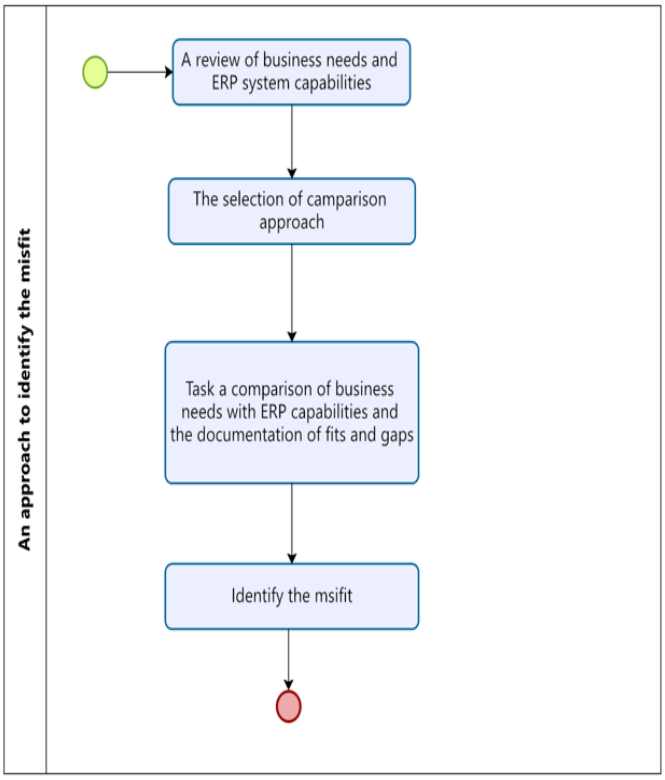


Fig. 7. An Approach to Identify the Misfit according to D. Pajk and A. Kovačič.

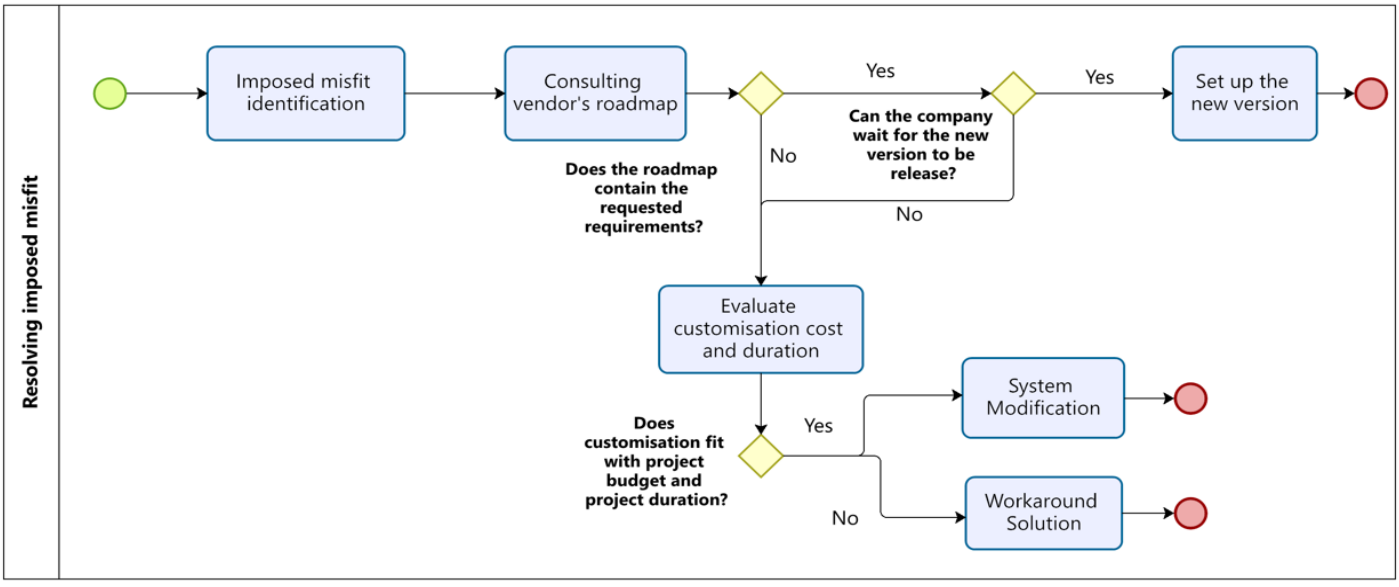


Fig. 8. The Proposed Approach to Selecting the Appropriate Method to resolve the Gap.

Fig. 8 shows the approach to be followed in the Fit-Gap Analysis phase according to D. Pajk and A. Kovačič [8] and Gattiker & Goodhue [17] and subsequently proposed model application to bridge the gap.

C. Decision Support Model

We conceptualised a decision support model to support the stakeholders to manage gaps (Fig. 9, Fig. 10, Fig. 11 and, Fig. 12 in Appendix). It is based on the misfit type, the development cost, the implementation project time, the vendor's roadmap, the uniqueness of the business processes, the criticality, frequency of the tasks, human infrastructure, and finally the data compatibility with the partners.

To apply the model, we require categorising the identified misfit. First, we need to know whether the misfit is perceived or real. Once in front of an actual misfit, it needs to be sub-categorised as either imposed misfit or voluntary misfit.

1) Imposed misfit: We are going to initially deal with the first case, which is the imposed misfit (Fig. 9 in Appendix). This misfit is what the authorities or industry standards impose. The company should comply with its requirements. However, customisation should be minimised. Therefore, before considering it, they should to look for other alternatives like consulting the vendor's roadmap, which may contain the imposed requirements.

If customisation is required, it should be analysed in terms of cost and time. It can be kept if it fits with the project duration and project budget. If not, a workaround can be proposed. It could be a third application or manual work. Fig. 9 (Appendix) explains the process to follow in the case of a realmisfit imposed.

2) Voluntary misfit: When it is a voluntary misfit, i.e., a misfit chosen by the company not imposed, the stakeholders should move on to another sub-categorisation and see if it is a surface misfit or a deep misfit (Fig. 10, Fig. 11, and Fig.12 in Appendix). If it is a deep misfit, it is then a misfit input or a misfit process.

In case it is an input misfit (Fig. 10 in Appendix), the vendor's roadmap should be consulted to see if it contains the requirements desired by the company. In case it does not, the task frequency and criticality concerned should be assessed. Assuming that the tasks are critical and frequent, customisation should be considered. Supposing not, the organisation should adapt to the system. Fig. 10 (Appendix) explains the model to be followed in the case of an input misfit.

Assuming that it is a misfit process (Fig. 11 in Appendix), then the vendor's roadmap should be consulted. If it does not contain the customer's requirements, the uniqueness of the business process in the market should be assessed. Supposing that it is a unique business process, customisation should be considered. If it is not, the company can start BPR while ensuring there is an adequate human infrastructure and no resistance to change. Fig. 11 (Appendix) explains the model to be taken in the process misfit case.

In the surface misfit case, it is, then, a question of misfit output (Fig. 12 in Appendix). The importance and coordination of the data format concerning the partners should be assessed.

In case the company's data format is already coordinated with the partners, customisation should be considered. Where the data format is not coordinated with the partners, the cost and time needed for the customisation should be discussed. And it may be possible to change the system and adapt it to the client's current format if this does not need an enormous investment. In case the company's data format is already coordinated with the partners, customisation should be considered. Fig. 12 (Appendix) explains the process to solve the gap in the misfit output case.

V. Conclusion and Future Work

The Fit-Gap Analysis is a crucial phase in the ERP implementation project. Identifying all the points leading to the success of the Fit-Gap Analysis is essential to technical and managerial success. Through the literature and business expert recommendations, we were able to collect a set of recommendations to be considered before the Fit-Gap Analysis phase. These recommendations should be consulted by both the consultants and the internal team.

These recommendations address the key points to consider before starting the Fit-Gap Analysis phase. They cover technical aspects, such as knowledge of the software's flexibility, technical implementation, system maintenance, minimisation of customisation, and the company's IT structure. Furthermore, a managerial aspect such as training, involvement of internal stakeholders, trust between consultants and internal team through improving communication, a better understanding of the standards proposed by the ERP, and a deeper insight of the company's functioning.

To assist the stakeholders in the implementation project to make the most rational decision in solving the gap based on the misfit type, we proposed a decision support model considering several parameters to bridge the gap: the development cost, the time of the implementation project, the vendor's roadmap, the business processes uniqueness, the adequate human infrastructure, the criticality and tasks frequency, and lastly data compatibility with the partners.

This model minimised customisation while respecting the company's resources. Therefore, before considering the system customisation, it is necessary to search for other ways to bridge the gap, such as consulting the vendor's roadmap, as it may contain the requirements requested by the customer. If customisation is considered, it is necessary to study its cost and time aspect before applying it. It is therefore improving the company's performance while bridging the gap.

This study can be improved by conducting a case study in the field to merge it. We can also address another aspect of the Fit-Gap Analysis phase. This is the evaluation of the chosen solution to bridge the gap through performance indicators and a post-Fit- Gap Analysis risk management study.

This study can also be refined by discussing the introduction of other technologies that can complement the ERP system and then solve ERP system issues, especially gaps. One such technology can be the blockchain. However, it is necessary to do an in-depth study of the blockchain technology since this technology is still in its early stages and requires seeing how it can complement the ERP system.

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APPENDIX

TABLE I. CENSUS OF ARTICLES

Articles	**Research Questions addressed by the articles**
[35]	Does ERP system alignment influence system usage, user satisfaction, and system benefits?
	Do operational characteristics types influence the alignment of the ERP system, the degree of customisation, and system use?
	How does ERP system quality and/or service quality affect the relationship between ERP alignment types, operational characteristics, and degree of customisation in terms of system use, user satisfaction, and system benefits?
[33]	Does the degree of customisation have an influence on the maintenance and the degree of support? If so, is the influence positive or negative?
[8]	How do the reference models contribute to the Fit-Gap Analysis?
[16]	How do recognize the real misfit from those that are perceived?
	How to manage and understand the implementation of an ERP?
[31]	What impact does customisation have on ERP quality?
[37]	What is the relationship between ERP customisation and efficiency?
	How we can measure ERP system efficiency?
[62]	How can we know the degree of customization required for an early ERP implementatio
[7]	What are the different types of misfits? What are the types of tailoring?
	Is there a relationship between tailoring types and misfit types?
	What are the internal factors influencing making decisions process?
[39]	What changes need to be made to existing customisation options?
	What new ERP customisation options are available?
	Are the existing ERP customisation options viable for Cloud ERP?
[24]	What is the company's customisation impact preferences on the gap resolution strategy?
[63]	How we can establish customisation choices using nominal group technique and analytical hierarchy process?
[43]	Why do some companies adopt a very high level of customisation?
	What are the factors that drive ERP customisation?
	How do these factors lead to customisation?
[17]	What are the needs of consultants and software engineers in terms of requirements elicitation in the ERP domain?
	Can we provide a tool-based approach to requirements elicitation in the ERP domain?

	Can the tool-based approach support the daily work of consultants?
[28]	What customisation types are carried out to ERP software?
	Why do organisations undertake ERP software customisation?
	How might customisation impact future maintenance of the ERP software?
[33]	What is the relationship between the amount of customisation and the resulting support effort?
[15]	What are package-organisation misalignments?
	Why do package-organisation misalignments arise?
	When do organisations customise packages and when do they adapt to the package instead?
[43]	What are the factors that push ERP system customisation?
	How do these factors lead to ERP system customisation?
[49]	How do different transformational leadership behaviors influence the adoption of different conflict management methods and, consequently, influence the performance of ERP customisation projects?

1) In which company do you work?

2) How many years of experience do you have in ERP systems integration? How many years of experience do you have in ERP systems integration?

3) How many years of experience do you have in ERP systems integration?

4) What are the parameters on which we should base to resolve actual misfit?

Parameters	Description and Explanation
-	
-	
-	
-	
-	
-	
-	
-	
-	
-	

5) How we can resolve perceived misfit?

6) What approach are you using to bridge the gap?

Questionnaire:

7) What are your recommendations to consider before starting the Fit-Gap Analysis phase in order to be successful?

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-

8) What are your recommendations to consider during the Fit-Gap Analysis phase in order to be successful?

-
-
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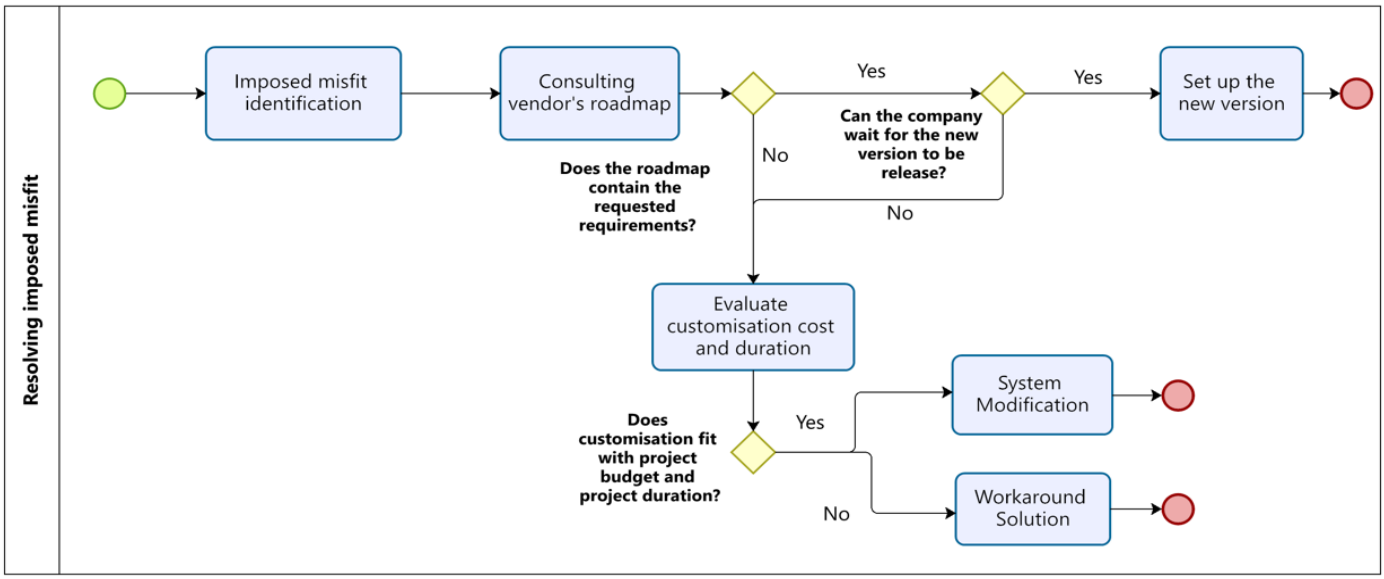

Fig. 9. Resolving Imposed Misfit.

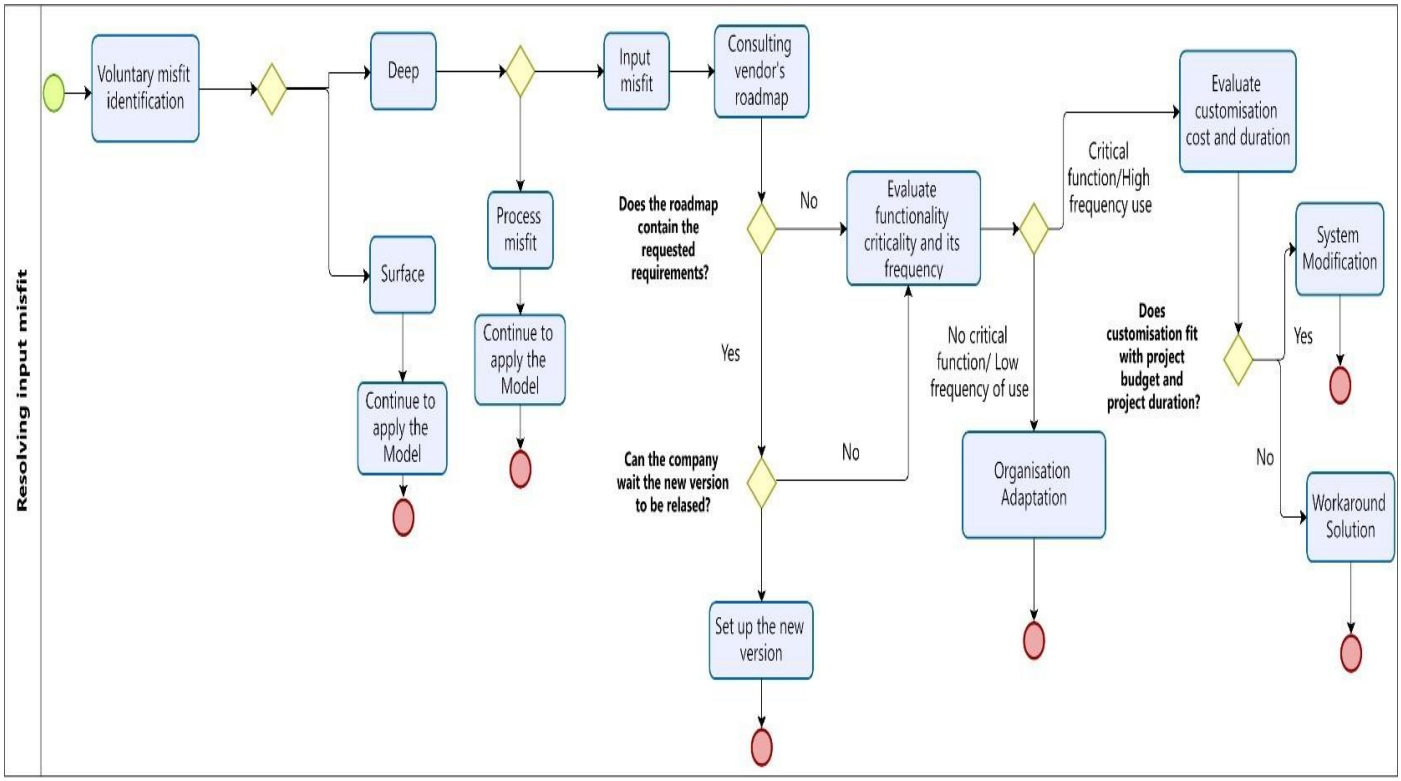

Fig. 10. Resolving Voluntary Misfit (Input Misfit).

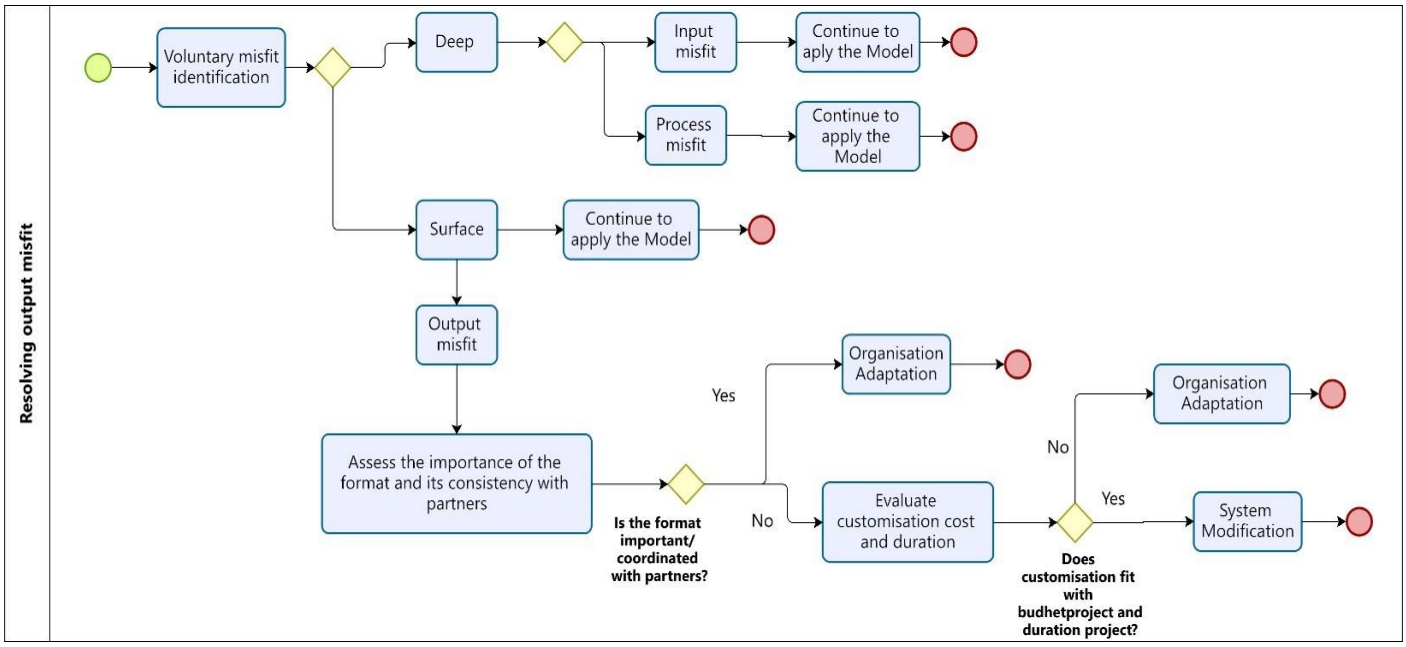

Fig. 11. Resolving Voluntary Misfit (Process Misfit).

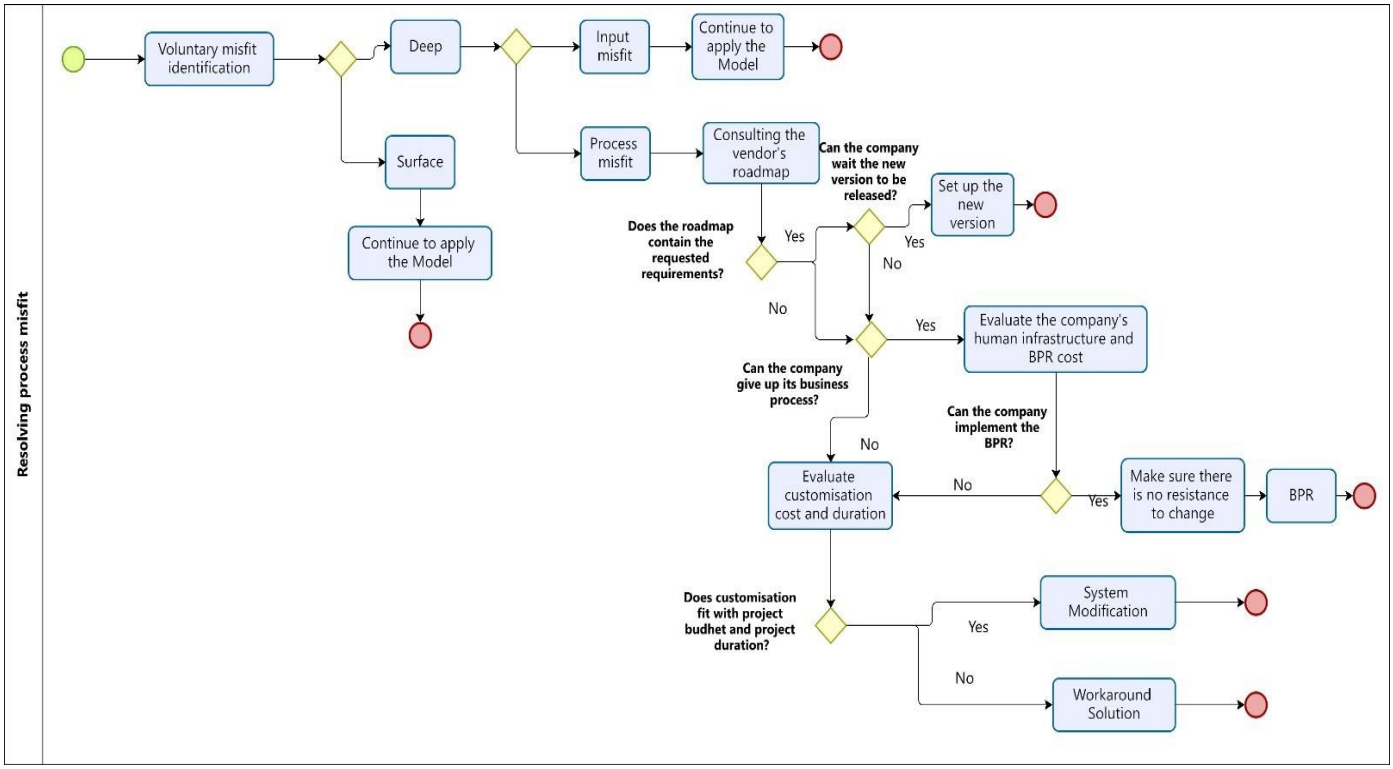

Fig. 12. Resolving Voluntary Misfit (Output Misfit).