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## ABSTRACT

*This paper presents a methodology based on the task-technology fit theory to identify data and output misfits in the ex-ante evaluation of an off-the shelf enterprise resources planning (ERP) package. The proposed methodology consists of two stages: output misfit analysis and data misfit analysis. The purpose of the first stage is to identify corresponding field (output misfits) and data glossary for data misfit analysis. The latter stage identifies data misfits for every corresponding activity in the business process sequence. The proposed methodology provides a systematic approach to alleviate the difficulty and complexity in identifying data and output misfits. The identification results identify where the misfits are and provide a degree of mismatch, thus providing a practical basis for ERP tool selection to reduce the risk of failure in its implementation.*

## INTRODUCTION

Enterprise Resource Planning (ERP) systems are becoming one of the most popular information systems/information technology (IS/IT) solutions in the real world of business. However, not all implementations of the ERP projects are successful. One of the major reasons of failure in implementing ERF stems from the fact that most ERP systems are commercial off-the-shelf (COTS) systems that promise a company with seamless data and information flow integration throughout the entire organization. This includes financial and accounting, human resources, supply chain and customer information (Everdingen et al., 2000).

Even though, ERP is a configurable software package that manages and integrates business processes across organizational functions and locations (Soh et al., 2000; Alshawi et al., 2004), vendors of most COTS ERP systems strongly recommend customers not to modify the system. Changing the package codes usually incur high cost and the difficulty in maintaining future upgrades (Soh et al., 2000). Although, some previous research (Glass, 1998) suggested that modifying an ERP code to satisfy a specific organizational requirement is highly impractical, in reality, the key factor of increasing the possibility of successfully implementing ERP lies on how to find a good match between ERP solution and an organization's business processes by carefully customizing both the system and the organization (Sommer, 2002, Luo, 2004)

Researches on the strategies for successful implementation of ERP solution are abundant (Botta-Genoulaz, et al., 2005). It is well known that users considering the adoption of ERP solution must determine which goals they wish to reach with the system, how to achieve this with the system, and how to customize, configure, and technically implement the package (Scheer et al., 2000). Because of the complexity of ERP systems, special emphasis has been put on the implementation stage to increase the chance of implementation success (Grossman and Walsh, 2004; Ioannou and Papadoyiannis, 2004; Nicolaou, 2004; Dowlatshahi, 2005; Ehie and Madsen 2005; Motwani et al., 2005). Since many ERP adoptions involve COTS ERP, even with those well-developed implementation strategies there still exist considerable mismatches between the business models embedded in the ERP system and the industry, company-specific business practices or culture (Soh et al., 2000; Mabert et al., 2001; Hong et al., 2002). The observed misfits were clustered into three broad categories: data, process (function), and output (Soh et al., 2000). Therefore, the most important criterion for selecting a COTS ERP package thus could be the best fit with the current business rules and processes (Everdingen et al., 2000).

Once the system is implemented, any attempt to reverse the course of actions would be very expensive and extremely difficult. In some extreme cases, the company may have to undo the changes that ERP may bring into a company. This will certainly become management's worst nightmare (Bingi et al., 1999). Therefore, any a-priori knowledge of the misfit between data and output will provide valuable insight into the ERP selection decision and thereby, reduce the risk of project failure. To date, research on methods of systematically analyzing the potential mismatches between a COTS ERP and implementation results is extremely limited.

In this paper, a methodology for identifying data and output misfits is presented. The rest of the paper is organized as follows. Approaches for evaluating information systems or information technology will first be reviewed followed by a discussion on business requirement modeling techniques. Methodology for evaluating data and output misfit will then be presented. Implications of the proposed methodology will then be reported. A brief summary of major findings in this report and discussion on directions for future study conclude this paper.

## INFORMATION SYSTEMS EVALUATION APPROACHES

Several approaches have been developed to help evaluate information system or information technology implementation. These approaches may be classified into three major areas of perspective; namely financial, interpretive, and task-technology fit as discussed below.

### Financial perspective

The IS/IT financial perspective evaluation is based on the direct cost savings and quantifiable benefits of software implementation. These approaches typically include cost-benefit analysis, net-present-value (NPV), payback time and return on investment (Bacon, 1992; Tam, 1992; Ballantine et al., 1998; Stefanou, 2001; Cilek et al., 2004; Heemstra et al., 2004). These approaches reduce all estimated cash outflows and inflows associated with a given investment as measured in present dollar terms. Cash flows in different periods and in different IT investments therefore have a common comparison basis. If the present cash inflow value exceeds the present cash outflow value, including the initial capital investment, this will produce a positive NPV and, thus, encourage investment acceptance (Bacon, 1992).

Some previous researchers have recognized that the financial approach is far too narrow to adequately evaluate IS/IT (Farbey et al., 1992; Hochstrasser, 1992; Hillam et al., 2001; Irani, 2002) and quantify many of the 'softer' benefits of IS/IT, such as the strategic higher quality benefits, faster responses to wider ranges of customer needs, and the options for future growth made available by IS/IT (Aggarwal, 1991; Irani, 2002). The financial perspective starting point is the assumptions that the cash flow is given and is known in advance. Therefore, the financial perspective provides little insight into benefit quantification and cash flow estimation (Weaver et al., 1989). The financial perspective is intrinsically subjective and based on individual value judgments (including political considerations) (Nijland, 2001). Hochstrasser asked how could one assess investments that are medium to long-term, risk intensive, and aim predominantly at qualitative improvements using short-term financial techniques (Hillam et al., 2001).

### Interpretive perspective

There is a growing belief that the financial perspective does not provide a complete picture of the potential of an ERP solution and its costs (Love et al., 2004). The ERP system is part of the organization, which is a complex social and political entity that cannot be analyzed in an absolutely objective view. Therefore, ERP cannot be viewed in isolation and must be considered as an integral part of the organization's social systems (Nijland, 2001; Hedman et al., 2004). Serafeimidis et al. (2000) argued that an IS evaluation could be improved using an interpretive perspective that included content, context and evaluation process concepts.

Based on the interpretive standpoint, an information system is recognized as a social system. Historical, social and political issues may be of equal or greater importance than the financial and economic dimensions. It was agreed that the user's opinion has the potential to produce deep insights into the IS evaluation and greatly assist in this area. However, the problem with this perspective involves the process articulation and documentation. This is the main barrier to undertaking the interpretive perspective (Jones et al., 2001). Cronholm et al. (2003) argued that it could also be a practical obstacle when time or resources for the evaluation are short. Therefore, in practice few organizations would attempt to follow the interpretive approach (Serafeimidis et al., 2000).

### Task-technology fit perspective

Based on the foregoing discussion, the task-technology fit (TTF) theory from Goodhue and Thompson (Goodhue et al., 1995) may provide a better foundation for evaluating the fitness of information systems. TTF can be a good supplement or alternative for the two above-mentioned approaches. Based on TTF, the correspondence between IS functionality and task requirement leads to positive user evaluations, and positive performance impacts (Goodhue, 1998). TTF posits that IT will be used if, and only if, the functions available to the user fit the activities (Dishaw et al., 1999). Palvia and Chervany further suggested the need for a fit among tasks, technologies, and users in systems implementation (Palvia et al., 1995).

As mentioned previously, a common problem confronting the users adopting ERP software has been the issue of fitness. Soh et al. (2000) clustered ERP implementation misfits into three categories: data, functional, and output types. Data misfits arise from incompatibilities between organizational requirements and ERP package in terms of data format, or the relationships among entities as represented in the underlying data model. Output misfits arise from incompatibilities between organizational requirements and the ERP package in terms of the presentation format and output information content. Functional misfits arise from incompatibilities between organizational requirements and ERP packages in terms of the processing procedures required.

Among these misfits, data and output misfits are the most critical factors due to the facts that data and output constitute the major interfaces for the system or the organization to communicate with other entities. To illustrate such said issues, some key related business requirement modeling concepts and tools for data and output misfit evaluation are introduced and discussed in the following section.

## BUSINESS REQUIREMENT MODELING

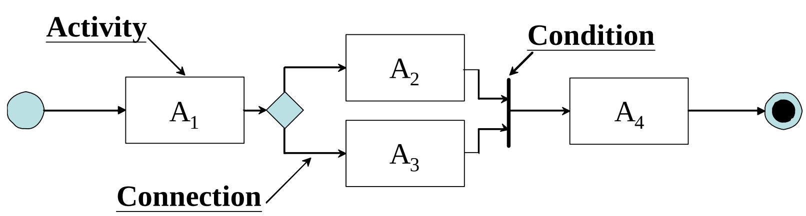
Business process is a set of one or more inter-related activities that collectively will accomplish a business objective or policy. Business requirements can be classified into business process, data and output. A business process has three basic elements: activities, conditions, and connections. An activity is a description of a piece of work that forms a logical step within a process and each activity may have data input or output. A condition is an element that determines the activity execution sequence within a process. A connection bridges two activities and indicates the flow direction within a process. One of the popular tools for modeling business processes is activity diagram as described as follows.

### Activity diagram

Activity diagram is a key component in the unified modeling language (UML) commonly used to model business processes. The activity diagram includes the following major elements: Activity, Start Activity, End Activity, Transition, Fork, Branch, Merge, and Join. The first three elements are used to represent the activity. The fourth element is used to represent the connection. The remaining four elements are used to represent conditions. A business process can be represented using an activity diagram. Figure 1 below shows an example of a business process represented by an activity diagram. Although an activity diagram can easily be constructed to represent business process flow, it cannot effectively represent the detailed input and output information for each activity.

Therefore, to support input/output representation other tools such as drawing and data glossary must be integrated into the activity diagram.

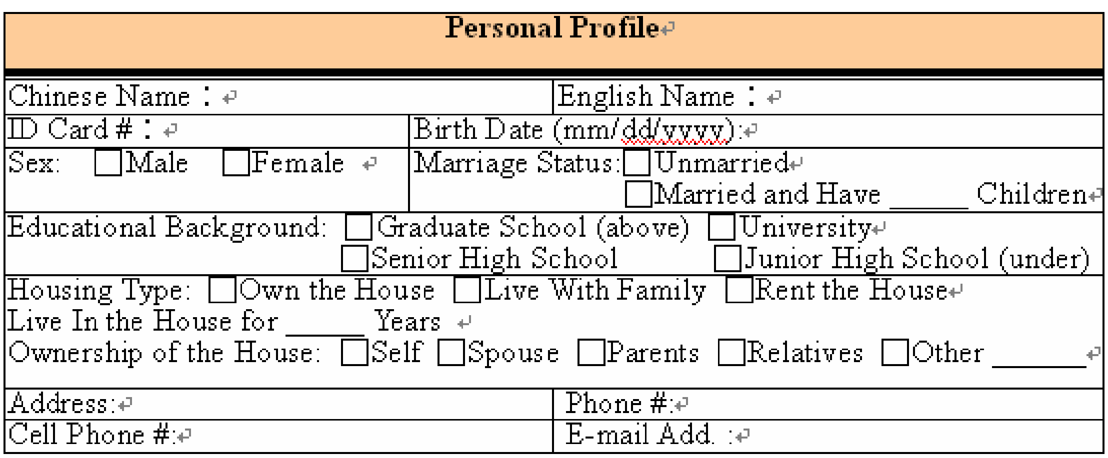
**Figure 1: An example of activity diagram.**




## Drawing and data glossary

A drawing can effectively express input and output information such as the title, presentation position, lines, figures and tables widely used in systems analysis and design. Figure 2 shows an example of a "Personal Profile" drawing. However, a drawing cannot express such detailed information as data length, type, format, formula, rule, range and limits. These unaddressed information, however, are very important for further data and output misfit identification. Hence, for each drawing, a data glossary is used to express the above detailed information that a drawing is unable to show. TableⅠ shows the data glossary record format. The data_type describes the types of items that comprise an activity. There are five major data types as summarized in Table Ⅱ (Coobineth et al., 1992).

**Figure 2: Drawing of personal profile.**



**Personal Profile**

| | |
|---|---|
| Chinese Name： | English Name： |
| ID Card #： | Birth Date (mm/dd/yyyy): |
| Sex: ☐Male ☐Female | Marriage Status: ☐Unmarried<br>☐Married and Have ______ Children |
| Educational Background: ☐Graduate School (above) ☐University<br>☐Senior High School ☐Junior High School (under) | |
| Housing Type: ☐Own the House ☐Live With Family ☐Rent the House<br>Live In the House for ______ Years<br>Ownership of the House: ☐Self ☐Spouse ☐Parents ☐Relatives ☐Other ______ | |
| Address: | Phone #: |
| Cell Phone #: | E-mail Add. : |

**Table1: Record format of data glossary.**

| Field_ name | Data_ type | Origin_ type | Source_ field | Computing_ rule |
|---|---|---|---|---|
| | | | | |

**Table 2: Five major Data_types.**

| **Data_type** | **Meaning** |
|---|---|
| CH(n) | Character string of length n |
| CHV(n) | Character string of variable length, where n is the maximum length of the string. |
| NUM(n) | An integer, where n is the number of digits. |
| NUM(m).NUM(n) | A number with a decimal point, where m and n denote the number of digits before and after the decimal point, respectively. |
| DATE(mm/dd/yyyy) | Date type records the particular date, where mm, dd and yyyy represent the month, day and year of the date, respectively. |

The Origin_type summarized in Table Ⅲ indicates the types of source values for a field, such as Value-Triggered, which means that the value is displayed because a given value in a field is a currently used activity. Computation-triggered means the data field is computed from one or more activity fields. If the Origin_type of field is 'A', ‘V’ or ‘AV’, the value coming from will be recorded in Source_field. If the Origin_type is ‘C’, computing expression is stored in Computing_rule.

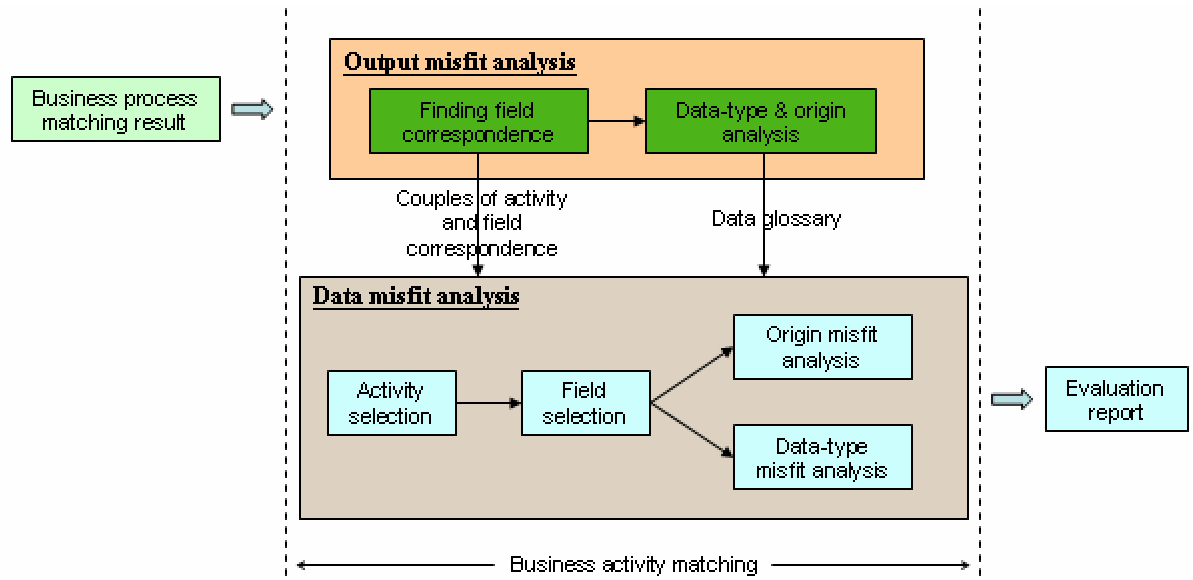
**Table 3: Six major Origin_types.**

| **Origin_type** | **Symbol** | **Meaning** |
|---|---|---|
| User-Triggered | U | User enters value |
| System-Triggered | S | System enters values without referencing any value in current activity |
| Computation-Triggered | C | Value is computed from one or more fields in current activity |
| Activity-Triggered | A | Value is identically transferred from another activity |
| Value-Triggered | V | Value is displayed because of a value in a current activity field |
| Activity-Value-Triggered | AV | Value is displayed because of a value in a another activity field |

## METHODOLOGY FOR EVALUATING DATA AND OUTPUT MISFIT

The methodology, shown in Figure 3, consists of two stages: output misfit analysis and data misfit analysis. Assuming that the input is the output of the functional misfit identification, this means the corresponding activity in the candidate ERP for every firm activity can be identified. This would enable the analyses of output misfit as well as data misfit.

**Figure 3: The framework of output and data misfit analysis.**




### Output misfit analysis

The purpose of this stage is to identify corresponding field (output misfits) and data glossary for further data misfit analysis. This stage involves two major tasks, namely: finding field correspondence and data-type and origin analysis as described below.

### Finding field correspondence

This step is used to check whether each field in enterprise's activity has a corresponding field in package's activity for each pairs of corresponding activity. If it does not exist, then it will be marked as field misfit (output misfit). Any marked message would suggest that the IS package does not provide all the data the fields that the enterprise needs.

### Data-type and origin analysis

This step is used to analyze the Data_type and Origin_type of fields for each corresponding activity and record this information in data glossary as depicted in Table**l**. This provides a good basis for identifying the Data_type and Origin_type misfits (data misfit) for the next stage.

The algorithm that performs the field analysis automatically is described as follows:

### <u>Output misfit analysis</u>

**Input:** Result of business process matching
**Output:** 1. Data glossary of each required and target activity
2. Couples of field correspondence
3. Field misfits (output misfit)

**Begin**

For each required activity in the sequence of business process
(1) For each field in the required activity
(1.1) Finding the target field that carries the same information with that of the required field
(1.1.1) If there is such target field, mark the required field and target field as corresponding fields
(1.1.2) Else if there is no such target field, mark this gap as a field misfit (output misfit)
For each required activity and its corresponding one.
(2) Analyzing the Data_type of each field in the activity
(3) Filling Data_type of each field into data glossary
(4) Analyzing the Origin_type of each field in the activity
(4.1) Determining what the Origin_type is
(4.2) If the Origin type is 'A', 'V' or 'AV', determine what the Source_field of the data field is
(4.3) If the Origin_type is 'C', analyze the Computing_rule of the data field
(5) Filling Origin_type, Source_field, and Computing_rule into the data glossary

**End of output misfit analysis**

## Data misfit analysis

The purpose of this stage activities is to identify data misfit for every corresponding activity including Data_type and Origin_type misfits in the sequence of business process. It consists of four major steps: activity selection, field selection, Data_type misfit analysis and Origin_type misfit analysis (data misfit). Because of the activity correspondences have been determined by business process matching, the activity selection could be done in the sequence of business process. The other three steps are described below.

## Field selection

In this step, which field in the selected activity should be analyzed first must be identified. To accomplish this goal, the most "independent" field, i.e. the field that has no relations with other fields must first be selected. This information will lay the foundation for analyzing these fields without referring the misfit analysis results of other fields. To illustrate such procedures, the 'U' and 'S' fields are first selected because these fields are independent to other fields.

Once all independent fields have been analyzed, the secondary "independent" fields that have relations with fields in prior activity can then be selected and the previous analysis results for data misfit analyzing can be used. That is, after analyzing all the 'U' and 'S' fields, the 'A' and 'AV' fields can be analyzed. The 'A' and 'AV' fields reference the analysis result of prior activities and have no relation with fields in the current activity. Finally, the 'V' and 'C' fields in this activity can now be analyzed because the analyses must refer to the analysis results from other fields that were analyzed in the previous step.

## Data_type misfit analysis

So far, the format misfit (data misfit) in Data_type has been identified by comparing the data glossaries of corresponding activity. The five data types reported in Table Ⅱ can now be clustered into three categories: Character, Number and Date. Character group contains CH(n) and CHV(n) types; Number group contains NUM(N), NUM(m).NUM(n) types; Date group contains DATE(mm/dd/yyyy) type. Different data type group is not compatible with other data types. Therefore, when the corresponding fields' category is mismatched, it is marked as a format misfit (data misfit). When the fields' category is matched, the types' characteristics in detail will be further analyzed and decided whether there is a format misfit.

## Origin_type misfit analysis

The Origin_type misfit is identified by comparing the data glossaries of the corresponding activities. Let R denotes the required field and T denote the target field and Rs and Ts denote the source fields of R and T, respectively. There are three kind of situation: (1) If R's Origin type is 'U' or 'S', then there will not have any misfit in the source field since the values of R and T do not depend on other fields. (2) If R's Origin_type is 'A', 'V' or 'AV', then an analysis must be conducted to check whether Rs and Ts are a couple of corresponding fields. If Rs and Ts are not the corresponding fields, then there is a format misfit in Origin_type between R and T. If Rs and Ts are the corresponding fields and there is a format misfit in Origin_type between Rs and Ts, it will result in the format misfit in Origin_type between R and T. (3) If R's Origin_type is 'C', an examination will be done to see if the computing rules of R and T are the same. If the rules are not the same, then obviously there is a format misfit.

The algorithm that performs the data misfit analysis automatically is described as below:

**<u>Data misfit analysis</u>**

**Input:** 1. Data glossary of each corresponding activity for enterprise and package
2. Pairs of corresponding activities and data fields

**Output:** Format misfits in Data_type and Origin_type

**Begin**

For each enterprise's activity that has corresponding target activity in the sequence of business process

For each required fields

(1) Field selection:

From the unanalyzed required data fields that have corresponding target fields in the selected activity

(1.1) IF there are fields with Origin_types of 'U' or 'S', select one of them arbitrarily.

(1.2) ELSE IF there are fields with Origin_types of 'A' or 'AV', select one of them arbitrarily.

(1.3) ELSE select one of the fields with Origin_types of 'V' or 'C' arbitrarily.

(2) Analysis of Data_type misfit:

IF there is misfit between selected field and corresponding target fields, mark it as a Format Misfit (Data_type).

(3) Analysis of Origin misfit:

IF there is misfit between selected field and corresponding target fields, mark it as a Format Misfit (Origin_type).

**End of Data misfit analysis**

## THE EXAMPLE

To illustrate the feasibility of the proposed methodology, the case of AEIC Corp., is used to demonstrate all the scenarios. AEIC is a medium-sized enterprise that has about 600 employees in 3 countries, an annual turnover of US 28 million, about 95 parts suppliers, 35 customers, and 4 production plants in Taiwan and China. The main products include baseball bats, bicycle frames, golf balls and golf clubs. Ninety percent of the operation focuses on OEM/ODM for a famous Japanese company.

To show how a manager applies the proposed methodology to determine data and output misfit, AEIC's procurement requirements are used as an example to illustrate the process as follows. Figure 4 shows AEIC procurement requirement construction process (i.e., $P_F$) and a candidate ERP's procurement process (i.e., $P_E$). In this case, the resulting $P_F$ has 10 activities and $P_E$ has 9 activities. The business processes from the above two sources are constructed using the activity diagram. Figures 5, 6, 7, and 8 represent the drawings from AEIC purchase request activity and that of the ERP package.

**Figure 4: Procurement processes from AEIC requirement and ERP Package.**

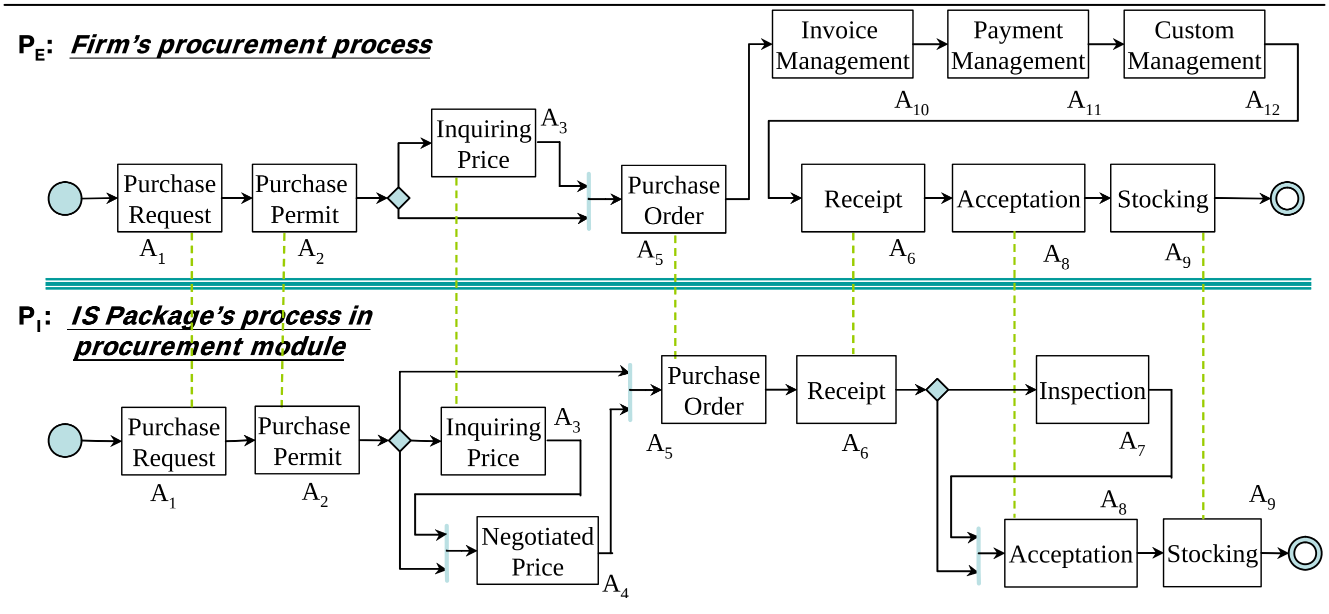



**Figure 5: The AEIC purchase request activity (E_PR).**

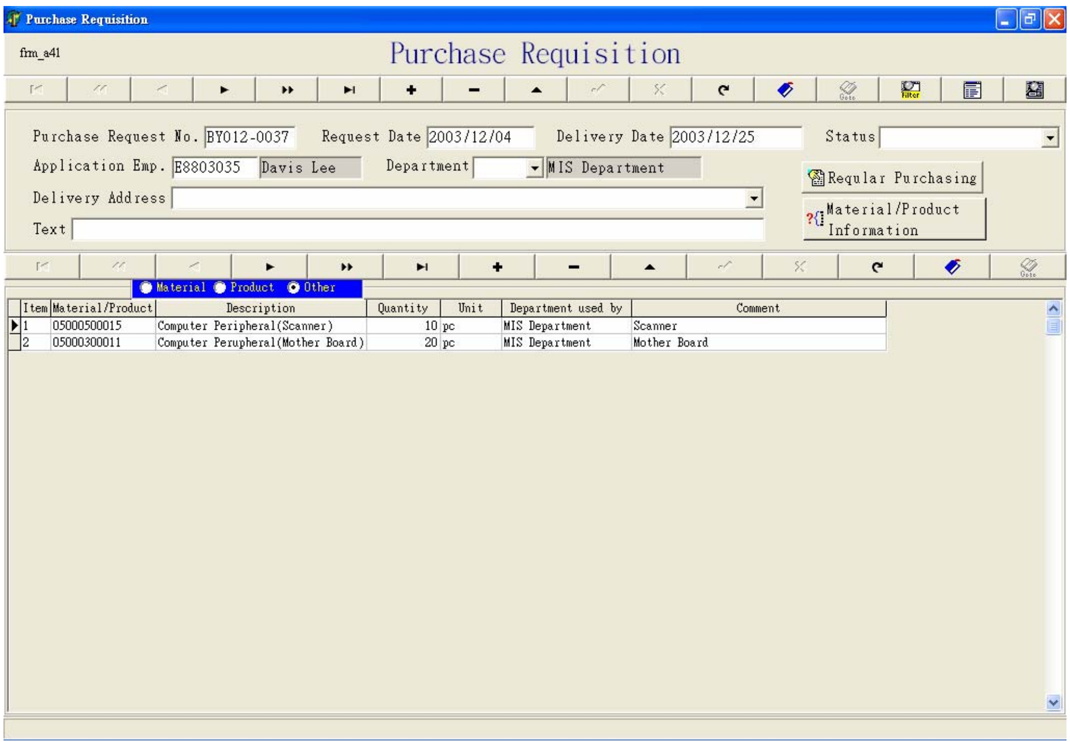


**Figure 6: The package purchase request activity (I_PR).**

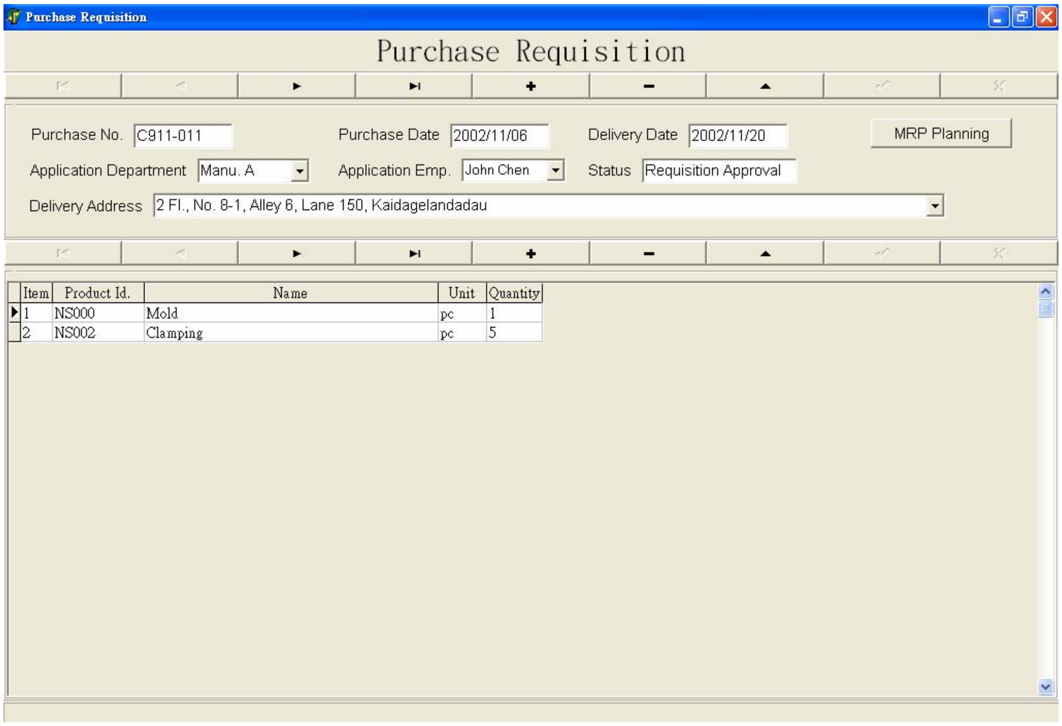



**Figure 7: The AEIC purchase order activity (E_PO).**

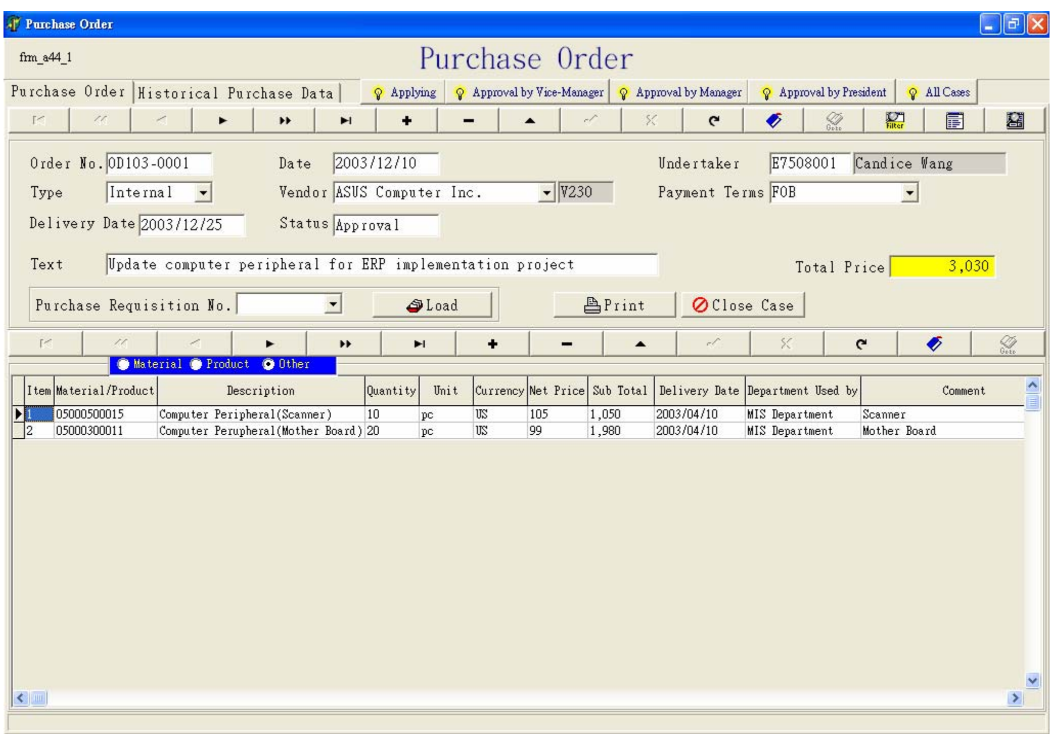
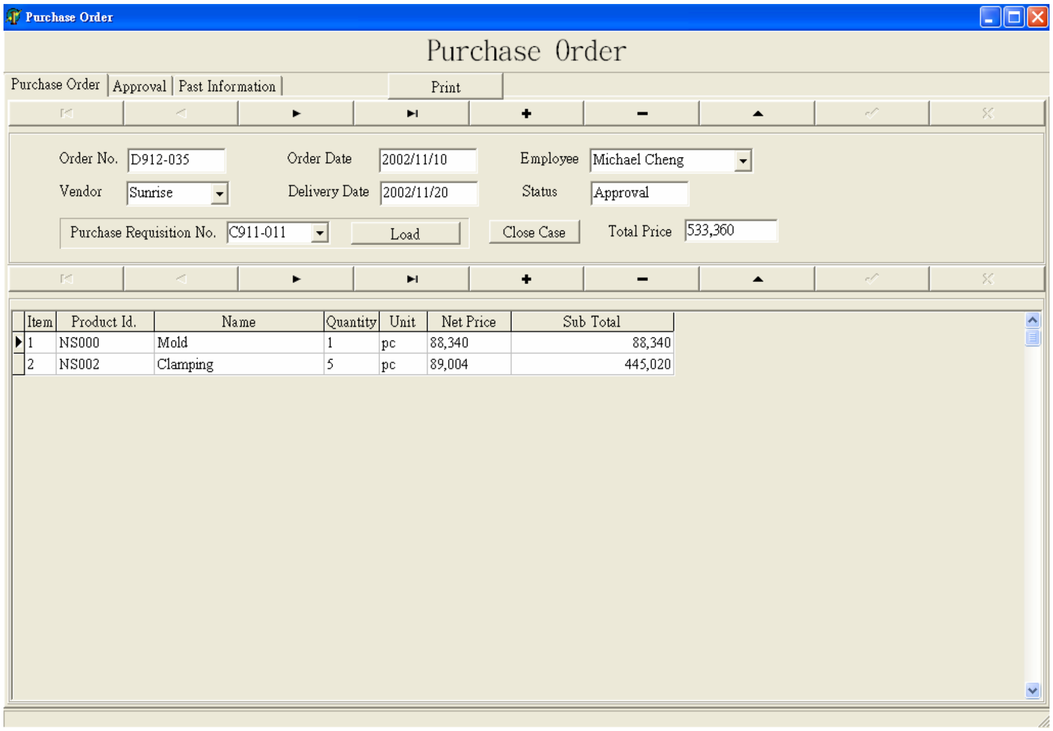


**Figure 8: The package purchase order activity (I_PO).**




## Output misfit analysis

First, the field correspondence is analyzed. In this case, there are 35 required fields and 27 target fields in this case. The purchase request and purchase order data glossaries are summarized in Tables Ⅳ, Ⅴ, Ⅵ, and Ⅶ. Eight required fields that have no corresponding fields have been identified and are marked by gray background color in Tables Ⅳ and Ⅵ. These are what referred to as field misfits (output misfit) as discussed in previous sections. To simplify this case, it is assumed that the origin type of all fields in purchase request activity is U, and focus on the misfit degree of purchase order activity between AEIC and package.

## Data misfit analysis

This step further measures the data misfit degree based on the data glossary associated with the activity. Here, results from Section 5.1 are followed to measure the misfit degree of purchase order directly. Those fields whose Data_type are ‘U’ or ‘S’ are analyzed first. The results are shown in Table VIII.

After analyzing ‘U’ and ‘S’ type fields, 'A' and ‘AV’ type fields in enterprise’s purchase order activity are then analyzed. In this case, there are two pairs of 'A' or ‘AV’ fields, i.e. E_PO-Product_ID/I_PO-Product_ID and E_PO-Request_No/I_PO-Request_No, and the results are shown as in Table Ⅸ.

**Table IV: The AEIC purchase request activity data glossary.**

| Field name | Data_type | Origin type | Source filed | Computing rule |
|---|---|---|---|---|
| E_PR-No | VarChar(12) | U | - | - |
| E_PR-Date | DATE | U | - | - |
| E_PR-Deed_Date | DATE | U | - | - |
| E_PR-Emp | VarChar(6) | U | - | - |
| E_PR-Apply_Department | VarChar(6) | U | - | - |
| E_PR-Status | VarChar(6) | U | - | - |
| E_PR-Delivery_Address | VarChar(255) | U | - | - |
| E_PR-Use | VarChar(255) | U | - | - |
| E_PR-Item_No | Number(2) | U | - | - |
| E_PR-Product_ID | VarChar(20) | U | - | - |
| E_PR-Product_Name | VarChar(30) | U | - | - |
| E_PR-Request_Qty | Number(4) | U | - | - |
| E_PR-Unit | VarChar(6) | U | - | - |
| E_PR-Department_Use | VarChar(6) | U | - | - |
| E_PR-Comment | VarChar(255) | U | - | - |

**Table V: The package purchase request activity data glossary.**

| Field name | Data_type | Origin type | Source filed | Computing rule |
|---|---|---|---|---|
| I_PR-No | VarChar(20) | U | - | - |
| I_PR-Date | DATE | U | - | - |
| I_PR-Deed_Date | DATE | U | - | - |
| I_PR-Emp | VarChar(10) | U | - | - |
| I_PR-Apply_Department | VarChar(10) | U | - | - |
| I_PR-Status | VarChar(10) | U | - | - |
| I_PR-Delivery_Address | VarChar(255) | U | - | - |
| I_PR-Item_No | Number(2) | U | - | - |
| I_PR-Product_ID | VarChar(12) | U | - | - |
| I_PR-Product_Name | VarChar(30) | U | - | - |
| I_PR-Request_Qty | Number(4) | U | - | - |
| I_PR-Unit | VarChar(10) | U | - | - |
| I_PR-Comment | VarChar(255) | U | - | - |

**Table VI: The AEIC purchase order activity data glossary.**

| Field name | Data type | Origin type | Source filed | Computing rule |
|---|---|---|---|---|
| E_PO-No | VarChar(25) | S | - | - |
| E_PO-Date | DATE | U | - | - |
| E_PO-Emp | VarChar(6) | U | - | - |
| E_PO-Type | VarChar(10) | U | - | - |
| E_PO-Vender | VarChar(6) | U | - | - |
| E_PO-Total_Price | Number(4) | C | E_PO-Unit_Price<br>E_PO-Odr_Qty | Sum(E_PO-Unit_Price<br>*E_PO-Odr_Qty) |
| E_PO-Pay_type | VarChar(12) | U | - | - |
| E_PO-Delivery_Date | Date | U | - | - |
| E_PO-Status | VarChar(6) | S | - | - |
| E_PO-Use | VarChar(255) | U | - | - |
| E_PO-Item_No | Number(2) | S | - | - |
| E_PO-Product_ID | VarChar(12) | A | E_PR-Product_ID | - |
| E_PO-Product_Name | VarChar(30) | V | E_PO-Product_ID | - |
| E_PO-Odr_Qty | Number(4) | U | - | - |
| E_PO-Unit | VarChar(6) | V | E_PO-Product_ID | - |
| E_PO-Currency | VarChar(10) | U | - | - |
| E_PO-Unit_Price | Number(4) | U | - | - |
| E_PO-Sub_Total | Number(4) | C | E_PO-Unit_Price<br>E_PO-Odr_Qty | E_PO-Unit_Price<br>*E_PO-Odr_Qty |
| E_PO-Item_Delivery_Date | Date | U | - | - |
| E_PO-Department_Use | VarChar(12) | U | - | - |
| E_PO-Request_No | VarChar(12) | A | E_PR-No | - |

**Table VII: The package purchase order activity data glossary.**

| Field name | Data type | Origin type | Source filed | Computing rule |
|---|---|---|---|---|
| I_PO-No | VarChar(20) | S | - | - |
| I_PO-Date | DATE | U | - | - |
| I_PO-Emp | VarChar(10) | U | - | - |
| I_PO-Vender | VarChar(12) | U | - | - |
| I_PO-Total_Price | Number(4) | C | I_PO-Unit_Price<br>I_PO-Odr_Qty | Sum(I_PO-Unit_Price<br>*I_PO-Odr_Qty) |
| I_PO-Delivery_Date | Date | U | - | - |
| I_PO-Status | VarChar(12) | S | - | - |
| I_PO-Item_No | Number(2) | S | - | - |
| I_PO-Product_ID | VarChar(20) | U | - | - |
| I_PO-Product_Name | VarChar(30) | V | I_PO-Product_ID | - |
| I_PO-Odr_Qty | Number(4) | U | - | - |
| I_PO-Unit | VarChar(10) | V | I_PO-Product_ID | - |
| I_PO-Unit_Price | Number(4) | U | - | - |
| I_PO-Sub_Total | Number(4) | C | I_PO-Unit_Price<br>I_PO-Odr_Qty | I_PO-Unit_Price<br>*I_PO-Odr_Qty |
| I_PO-Request_No | VarChar(20) | U | - | - |

**Table VIII: Result of misfit analysis of 'U' or 'S' fields.**

| Corresponding field | Data_type characteristics |
|---|---|
| I_PO_No | Varchar(25) |
| E_PO_No | Varchar(20) |
| Misfit type | **Format misfit** |

**Table IX: Result of misfit analysis of 'A' and 'AV' fields.**

| Field name | Data type | Origin type | Source fields | Computing rules |
|---|---|---|---|---|
| E_PO-Product_ID | Varchar(12) | A | E_PR-Product_ID | - |
| I_PO-Product_ID | Varchar(20) | U | | - |
| Misfit type | **No DATA_TYPE misfit** **ORIGIN misfit** | | | |
| E_PO-Request_No | Varchar(12) | A | E_PR-No | - |
| I_PO-Request_No | Varchar(20) | U | | - |
| Misfit type | **No DATA_TYPE misfit** **ORIGIN misfit** | | | |

An investigation on the misfit of ‘V’ and ‘C’ type fields can now be conducted. There are four pairs of corresponding fields with ‘V’ or ‘C’ type. The results are listed as in Table Ⅹ. Once the above steps are done, the overall results of data and output misfit are summarized as in Table Ⅺ. For instance, it indicates that the purchase order activity contains 6 field misfits (output misfit), one data type misfit and two origin type misfits (data misfit) based on the above analysis.

**Table X: Origin misfit analysis result for the ‘V’ and ‘C’ fields.**

| Field name | Data_type | Origin_type | Source fields | Computing rules |
|---|---|---|---|---|
| E_PO-Total_Price | Number(4) | C | E_PO-Unit_Price | Sum(E_PO-Unit_Price |
| | | | E_PO-Odr_Qty | *E_PO-Odr_Qty)- |
| I_PO-Total_Price | Number(4) | C | I_PO-Unit_Price | Sum(I_PO-Unit_Price |
| | | | I_PO-Odr_Qty | *I_PO-Odr_Qty)- |
| Misfit type | **No DATA_TYPE misfit;** | | **No ORIGIN misfit** | |
| E_PO-Product_Name | Varchar(30) | V | E_PO-Product_ID | |
| I_PO-Product_Name | Varchar(30) | V | I_PO-Product_ID | |
| Misfit type | **No DATA_TYPE misfit;** | | **No ORIGIN misfit** | |
| E_PO-Unit | Varchar(6) | V | E_PO-Product_ID | |
| I_PO-Unit | Varchar(10) | V | I_PO-Product_ID | |
| Misfit type | **No DATA_TYPE misfit;** | | **No ORIGIN misfit** | |
| E_PO-Sub_Total | Number(4) | C | E_PO-Unit_Price | E_PO-Unit_Price |
| | | | E_PO-Odr_Qty | *E_PO-Odr_Qty |
| I_PO-Sub_Total | Number(4) | C | I_PO-Unit_Price | I_PO-Unit_Price |
| | | | I_PO-Odr_Qty | *I_PO-Odr_Qty |
| Misfit type | **No DATA_TYPE misfit;** | | **No ORIGIN misfit** | |

The above information provides a good starting point for a manager to determine whether the candidate ERP package is suitable for his/her firm or not. If it is suitable, he or she can then judge whether the data and output misfits are critical to the firm by considering factors such as firm’s core business process, budget, human resource, project schedule, and so forth to further decide whether to perform business process reengineering (BPR) or customization.

**Table XI: Misfit result of purchase order activity.**

| **Misfit degree of activity (Enterprise’s purchase order)** | |
|---|---|
| Number of fields: | 21 |
| Number of field-level information content misfits: | 6 |
| Number of format misfits in DATA_TYPE: | 1 |
| Number of format misfits in ORIGIN: | 2 |

## MANAGEMENT IMPLICATIONS

For years, managerial users at companies of all sizes have treated the ERP as one of the final solutions to integrate companywide information resources. There are many successful cases of ERP implementation. But a lot of ERP proposals failed. For the managerial users who are considering ERP solutions, the proposed methodology could offer a cushion to minimize the chance of costly failure. There are a few important lessons implied with the results of this study.

1) Even though ERP solution could offer company an efficient approach to integrating company's information systems resources, there is no one-size-fit-all ERP solution available.
2) All ERP solutions require some degree of customizations to make it work, even if all users corporate and are willing to be re-engineered to fit the business process flow requirements as embedded in the ERP packages.
3) Although, ex-ante evaluation of the off-the-shelf ERP tools to identify the potential data and output misfits in these tools could be a time-consuming, and in some cases a technically challenging task to managerial users, it still beats the enormous costs of trying to fix the problems after an ERP solution implementation.
4) The proposed methodology could provide an effective and systematically approach to helping managerial users identify potential problems associated with an ERP solution being considered before making a sizable capital investment commitment to the tool.

## CONCLUSION

This paper presented a methodology for identifying the data and output misfits in the ERP package implementation context. The contribution of this paper is two-fold. First, the proposed methodology provides a systematic approach to alleviate the difficulty and complexity in identifying data and output misfits. Second, the identified misfit information provides the degree of mismatch and the possible areas where the misfits might lie. These results provide greater insight for understanding the data and output misfits between the business requirements and that provided by the ERP package. They also help to evaluate the efforts needed for ERP package customization and BPR for each misfit and thereby help promote decisions for customization or BPR. This knowledge is specifically valuable for the ex-ante ERP evaluation.

The proposed methodology provides a systematical approach to facilitate the data and output misfit identification process. With this methodology, the ERP adopting organizations can more easily and systematically determine where the data and output misfits are and thus provide a practical basis for ERP selection and thereby reduce the risk of ERP implementation failure. Although, this methodology focuses on ERP misfit evaluation, it can also be applied to other COTS system evaluation such as customer relationship management or knowledge management systems.

This report presents the results of the beginning of a series of IS evaluation researches focusing on data and output misfit identification in the COST system implementation context. Future research directions are abundant. For instance, to provide complete misfit identification, the proposed methodology must be extended to include functional misfit identification. Other issues include strategies for customization or BPR decisions for each functional, data, and output misfit.

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