Ontology Data Dependency Analysis for Organizational Goals Achievement

Tengku Adil Tengku Izhar

Faculty of Information Management

Universiti Teknologi MARA (UiTM)

Malaysia

Torab Torabi

Department of Computer Science and Information Technology

La Trobe University

Victoria, Australia

Abstract

Organizational data is important to assist domain experts and entrepreneurs for decision-making process in relation to the organizational goals. However, the trustworthiness of organizational data in achieving the organizational goals is questioned because of the vast amount of organizational data created in the organization. In this paper, we develop a methodology associated with the organizational goals ontology to identify the dependency relationship between organizational data and organizational goals. This would allow domain experts and entrepreneurs to evaluate relevant organizational data to assist decision-making process in respect to the organizational goals. Therefore, they can identify to what extent certain organizational goals are achieved. The results show how the methodology develops this relationship to identify the relevance of organizational data for the achievement of the organizational goals.

Keywords: data linkage, dependency relationship, organizational data, organizational goals, ontology

1. Introduction

Today, people have access to more data in a single day than most people had in the previous decade. The problem is that data is found in many different forms which makes it almost impossible to understand the existing relationships between different data elements. For example, government agencies and large, medium and small private enterprises in many domains, such as engineering, education and manufacturing, are drowning in an ever-increasing deluge of data. This is because they create and collect massive amounts of data in their daily business activities. Thus, having an ability to analyse data in a timely fashion can ensure businesses have a competitive edge to improve productivity in relation to their organizational goals. Data is the most important asset to assist the decision-making process and achieve the organizational goals. However, the trustworthiness of organizational data in relation to the organizational goals is often questionable due to the huge amount of data within the organization. Therefore, it is difficult to identify the dependency relationship between organizational data and organizational goals. As a result, some of this data are not relevant to the organizational goals. Even though professionals, such as data analysts, are trained to analyse data, the increased amount of organizational data has become a major challenge to achieve the organizational goals.

In order to ensure the quality of data, an organization needs to have a good approach to evaluating organizational data in order to support decision-making in relation to the organizational goals. Managing existing organizational data is crucial in order to avoid problems such as irrelevant organizational data. Domain experts and entrepreneurs are aware that the existing organizational data provide an opportunity to increase organizational performance in relation to the organizational goals. Therefore, they can use this organizational data to create new information and knowledge that can be used to benefit the organization.

Organizational goals are defined as the most important targets to be achieved in every organization. Even though the concept of the organizational goals has been in existence for some time, modelling the structure of the organizational goals is much more difficult. For example, one way to develop a common understanding of the organizational goals structure is to use an ontology. An ontology provides explicit and formal specifications of knowledge, especially implicit or hidden knowledge. An ontology is considered as an approach to support data sharing. Therefore, an ontology assists with part of the integration problem in relation to the organizational goals and can be used to improve the communication and collaboration between the decision makers and the users, which is, in this paper, the decision makers in relation to the organizational goals.

However, there is a shortcoming when it comes to evaluating organizational data in relation to the organizational goals during the development of organizational modelling. Modelling the organizational goals is limited to business processes and organizational processes. Most of the previous studies argue that the need for and benefits from goal modelling focus on

process modelling, workflow analysis, computer-supported cooperative work and design problem solving.

Despite this shortfall, there are a number of tools for modelling organizational processes most of which support mathematical modelling. Structuring a small organization is less complicated than a large organization. Structuring a small organization is less complicated than a large organization. Different organizational structures, processes and a vast amount of data make it more difficult to identify relevant organizational data in relation to the organizational goals.

Previous research in this area has mainly examined this issue from the data process point of view that addresses either software development or data mining, both of which are beyond the scope of this paper. While many studies have examined the process of data collection, our main contribution is to develop a framework which can incorporate organizational data and can lead to reliable decision-making in relation to meeting the organizational goals. Therefore, it is important to develop a flexible and widely applicable framework to evaluate the relevance of organizational data to evaluate the extent to which the organizational goals have been achieved.

The paper aims to present a methodology to identify relevant organizational data in relation to the organizational goals by building the dependency relationship between organizational data and organizational goals. The methodology is developed to introduce the organizational goals model based on an ontology. This paper specifies the organizational resource which is organizational data and we suggest that organizational data is the most important organizational resource in relation to the organizational goals. The main challenge during the framework development is to identify the scope of the organizational goals model.

The remainder of this paper is organized as follows. Section 2 is literature review. Section 3 is the methodology. In Section 4, we generalize the methodology for the organizational goals ontology. Case study is in Section 5. Discussion and future works are discusses in Section 6. The final section contains some concluding remarks.

2. Literature Review

The aim of this section is to observe the limitation from the previous organizational processes to build the dependency relationship of organizational data that relate to the organizational goals. Therefore, the discussion in this section is categories into two sections. Section 2.1 discusses the organizational goals based on an ontology and Section 2.2 discusses the background of the dependency relationship between organizational data and organizational goals based on data linkage. This section aims to identify the shortcoming in the previous work by examining the existing issues and gaps in order to enhance the development of the methodology. However, whether all approaches are applicable or not in proposing the methodology is beyond the scope of this paper. This is because other approaches and issues might exist and have not been identified in this paper.

2.1 Organizational Goals Ontology

Study on the organisational goals has been carried out lately and the vast majority of the studies looking at and assessing the organisational goals model concentrated on the goal structure, goal performance and goal framework. Despite the fact that studies have been completed on the organisational goals, all the studies did not concentrate on the assessment of organisational data as a primary asset for the association to accomplish its goals as we examined in this paper. Subsequently, it is imperative to distinguish the relationship between the organisational goals. In order to demonstrate the relationship for the organisational goals, an ontology is applied. An ontology can be utilized to build up the relationship for the organisational goals. There are number of study on ontology has been completed such as Enterprise Ontology, Ontological On-line Analytical Processing (OLAP) and Web Ontology Language (OWL). Be that as it may, as for these studies, there is no study has been done on the organisational goals taking into account an ontology.

Organizational goals defined as the organization main target. It is the higher and important achievement target in every organization and it consist the process of identifying the aim of the organization. Therefore, it is vital to comprehend the organisational goals structure. The structure of the organization is vital to build up the productivity and adaptability of the organization to adapt to unpredictable. For instance, organisational goals is created to accomplish the execution of the organization performance or the organisational goals is produced to accomplish the execution of goals performance. The example demonstrates some of the studies that take a look at the organizational structure toward the performance. This is because that the organizational performance relies on upon the organizational structure. Same with the goals structure and the goals performance, in which the organisational goals relies on upon the goals structure toward the goals performance. There are number of the organisational goals examines that emphasis on the performance, for example, system performance, goal performance and organizational performance. It is vital to recognize the whole organisational modelling process as a push to take a look at the organizational performance and the goals performance. Be that as it may, the procedure can be substantial and it is exceptionally hard to assess organisational data as a push to accomplish the organisational goals. As opposed to our examination, it is vital to recognize organisational data that relate to the organisational goals. In this manner, the linkage of organisational data from datasets ought to be steady to recognize the significant organisational data in connection to the organizational goals.

2.2 Dependency Relationship Between Organizational Data and Organizational Goals Based on Data Linkage

The section presents brief overview on organizational data that relate to the organizational goals based on data linkage. We define data linkage as a task to identify the existing organizational data from the organizational datasets in relation to the organizational goals. In this paper, it is important to identify the relationship of the organizational data that relate to the organizational goals.

Wide research has been done on the relationship of the organization resources such as information and information system in relation to the business performance, business process, and decision making. There is no study consider the evaluation of organizational data to assist decision making process in relation to the organizational goals. Modelling the organizational goals is limited to the business process and the organization process. Therefore, it is important to identify the linkage between organizational data and organizational goals. Simultaneously, it is important to improve the relationship between the organizational data and the organizational goals in order to identify which organizational data is relevant to the organizational goals.

While numerous studies have been done on data linkage in wide areas such as data privacy, medical data, software and databases, constrained study has been seen in assessing organisational data that identify with the organisational goals. Rather than the past studies on data linkage, we adjust data linkage to address the reliance relationship of organisational data components that identify with the organizational goals. This is on the grounds that organisational data is a noteworthy asset in each association and it is vital to distinguish the importance of this data in the accomplishment of the organizational goals. We characterize data linkage as an assignment to distinguish the important organisational data in the organizational datasets in connection to the organizational goals. We propose it is essential to recognize the organisational data which is pertinent to the organizational goals.

3. Methodology

The methodology is broken into two categories. First is to assist the development of the dependency relationship between the organizational goals using an ontology. Second is to develop the dependency relationship between organizational data and organizational goals. These two categories are presented to identify which organizational data can be considered relevant in relation to the organizational goals.

3.1 Category 1: Dependency Relationship of the Organizational Goals Based on an Ontology

Organisational goals ontology aim to build up the relationship between the organisational goals components and reliance relationship between organizational data and organisational goals. An ontology is connected as a device to build up the relationship between the organisational goals components which incorporate sub-goalss and organisational data [2, 7]. It gives the way to comprehend this dependency relationship as shown in Fig. 1. In this manner, area specialists and business visionaries can characterize the organisational goals in light of their necessity.

An ontology demonstrates the dependency relationship of the organisational goals, reliance relationship of organisation data that identify with the organisational goals and to assess the weight of this relationship between organisational data and organisational goals. The assessment plans to test the adaptability of the ontology keeping in mind the end goal to build up the relationship. In the meantime, how ontology will be applied to define the organisational goals. In order to develop the organizational goals ontology, several structures

that were proposed in the previous models are combined. We adopted these models as a reference for the organizational goals ontology. However, the scope of the proposed organizational goals ontology in this methodology do not cover all the organizational processes as discussed in Sharma and Osei-Bryson, Fox et al. and Rao et al..

Fox et al. focused on structuring the linkage between organizational structure and behavior. This is critical for enterprise model development. However, the authors do not emphasize any organizational resources such as data and information but they focus on the roles and activities within the organization. Sharma and Osei-Bryson developed a framework for an organisational ontology with an end goal to expand a comprehension of the business. In any case, the authors don't particularly distinguish the relationship between organziationale assets, for example, data and the organisational goals. In this model, the authors adjusted the work of Fox et al., where the authors examined the physical resources and part of the organizational model.

Rao et al. developed an organisational ontology so as to construct a knowledge map inside the organization. The structure incorporates the stream of knowledge inside the organization with regards to knowledge sharing and knowledge storage. In this model, the authors talked about the organization assets, as in Sharma and Osei-Bryson. Another perspective that is like Sharma and Osei-Bryson's work is that both models incorporate business forms. Be that as it may, Rao et al. talked about business forms from the organisational goals perspective and Sharma and Osei-Bryson examined business forms from the organizational movement perspective. Most of these studies focused on the organizational structure and performance.

Table 1 show the results from the previous models on organizational goals using an ontology but none of these studies focus on an evaluation of the degree to which the organizational goals have been achieved. Table 1 also shows that these models do not focus on the organizational data and it also shows that there is no existing study on metrics that evaluate the dependency relationship between the organizational data and organizational goals.

Table 1. Review of the issues

Authors	Organizational goals ontology		Resources			Metrics
	Organizational goals	Sub-goals	Information	Knowledge	Organizational data	Dependency relationship
Fox el al.	/	/				
Sharma and Osei-Bryson	/	/	/	/		
Rao et al.	/	/	/	/		

We propose the extension model of the organizational goals ontology as shown in Fig. 1. In this figure, the ontology shows that an organization has organizational goals and organizational goals consist of sub-goals. In order to identify the extent to which the

organizational goals have been achieved, an organization needs organizational resources which include data to evaluate the extent to which the organizational goals have been achieved.

Different from Rao et al. Sharma and Osei-Bryson, our organizational goals ontology focuses on the use of organizational data because organizational data is a major resource in every organization and it is important to evaluate the relevance of this organizational data in relation to achieving the organizational goals. We also suggest organizational data is important as information and knowledge to assist the decision-making process. At the same time, Fig. 1 is different to other studies which either did not include metrics at all or only used the metrics to measure the knowledge within the organization.

In organization, it is extremely important for the manager to have access to the most relevant organizational data in relation to the organizational goals. Simsek et al. pointed out that sharing important data and information can provide the required knowledge to assist successful decision-making. It is crucial for organizations to create and generate new data and evaluate it to enhance decision-making. Different ways of generating new ideas, information and knowledge will help in terms of decision-making and will enable teams within the organization to use the most relevant organizational data to successfully achieve the organizational goals.
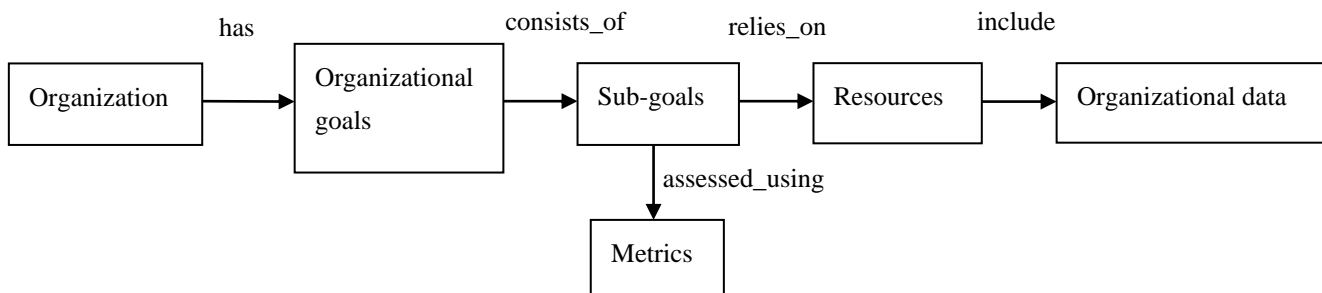
Figure 1. Organizational goals ontology

3.2 Category 2: Dependency Relationship Between Organizational Data and Organizational Goals

In this methodology, data linkage is adapted to identify the dependency relationship between organizational data and organizational goals. In the literature, data linkage is highly used to identify data that being linked, so all datasets under consideration should ideally undergo a matching process prior to the record linkage. Even though there are studies have been carried out in various issues such as software, data privacy and security, it is important to develop a standard set of the methodology to show the relationship between organizational data and organizational goals.

A large body of existing work uses the term record linkage, data linkage, record matching, data matching, we use the term data dependency in an effort to identify the dependency relationship between organizational data and organizational goals because we attempt to identify dependency for every organizational data that relate to the organizational goals.

We suggest data and goals dependency based on the organizational goals ontology to define the dependency relationship between the organizational data elements and organizational goal as shown in Fig. 2. Data and goals dependency is a process to identify which organizational data from the organizational datasets is relevant to the organizational goals.
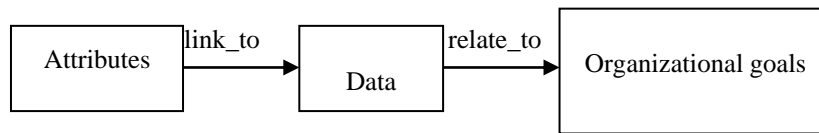

Figure 2. An example of data and goals dependency

Fig. 2 shows that data and goals dependency involves the organizational data, attributes, relationships and organizational goals. However, the example in this figure does not include any organizational goal elements because we just want to show the relationship between the organizational data and organizational goals.

3.2.1 Data and Goals Dependency Elements

This section discusses on the elements of data goals dependency, based on the work in Christen [1] to clarify the elements of data dependency in the context of the organizational goals ontology.
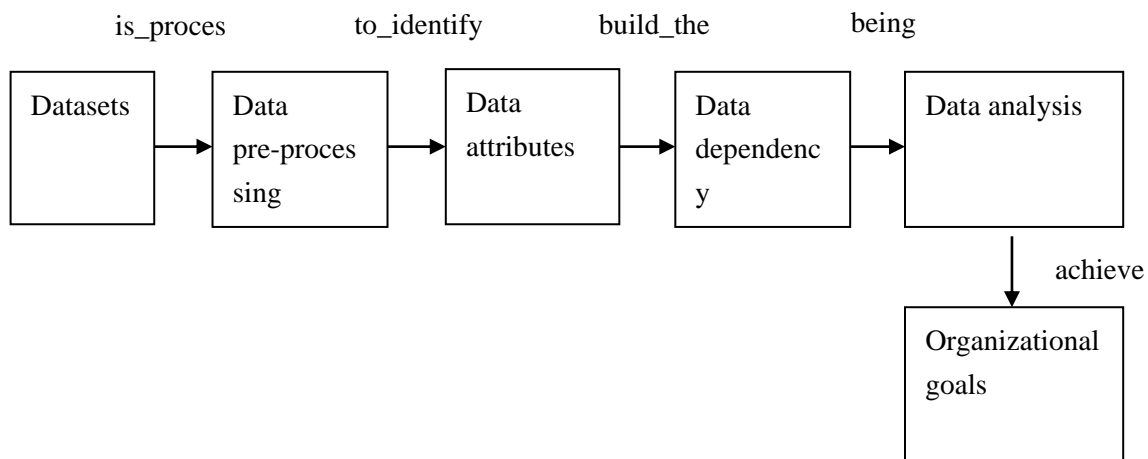

Figure 3. Data dependency process to the organizational goals (adapted from Christen)

In contrast to Christen, we show the process of data dependency in the context of the organizational goals as shown in Fig. 3. The process of data goals dependency is extended from Fig. 2. In Fig. 3, we show the elements of data linkage. Previous research investigated data linkage using terms such as datasets, data pre-processing, data linkage, data matching from the perspective of information systems and databases. However, this paper investigates data linkage from the perspective of organizational data and organizational goals.

In contrast to previous studies, we included the dependency relationship between the organizational data elements and organizational goals. However, in Fig. 3, we added data

dependency instead of data linkage and data matching. This is because we want to look at the dependency relationship between the organizational data elements that relate to organizational goals. At the same time, there is no discussion in the existing research on organizational data elements and attributes in relation to the organizational goals. Past studies noted data linkage as a task to identify data corresponding to the same entity from one or more data sources. In response to this gap in the existing research, we investigated the existing organizational data and attributes from organizational datasets in order to evaluate the value of the dependency organizational data elements that relate to the organizational goals. Thus, we consider these organizational data are relevant to the organizational goals.

- *Datasets*

Datasets are a collection of data that have been stored in different datasets to represent the different types of data. These datasets are important as a reference for any decision-making evaluation. However, this data can be very large and it is a challenge as to how to identify relevant data from the huge number of datasets. Therefore, it is important to discuss the creation of datasets in order to perform an evaluation of data from the databases.

In this paper, we attempt to perform the evaluation of organizational data from organizational datasets in relation to the organizational goals. Therefore, we can identify which organizational data is relevant to the organizational goals.

- *Data pre-processing*

Organizations create vast amount of data every day but some of these data are not relevant for decision-making. Christen defined data pre-processing as a process to identify quality data.

In contrast to Christen, we suggest data pre-processing is important to eliminate any redundant organizational data in an effort to identify relevant organizational data in relation to the organizational goals. At the same time, it is important to identify matching data from various datasets that relate to the organizational goals.

- *Data and attributes*

In this paper, the process of identifying data and attributes from datasets is important in an effort to identify relevant organizational data. In contrast to previous studies, several studies [46, 47], discussed the linkage of domain data such as databases but no observation has been carried out in the context of organizational data in relation to organizational goals. In this paper, the identification of data and attributes is important in order to develop the dependency relationship between organizational data and attributes that relate to the organizational goals

- *Data dependency*

Data linkage is the task of quickly and accurately identifying records corresponding to the same entity from one or more data sources. As discussed previously, most studies on data linkage cover the linkage of domain data such as databases. Data matching is an important

step in identifying data from datasets. The approach suggests data matching is the process of bringing together data from different sources and comparing it.

In contrast to the previous studies, we refer to data linkage and data matching as data dependency to search for organizational data in the datasets that refer to the same organizational goals from different data sources. However, the term data dependency is usually defined in the context of computer science to analyse data to discover new information and knowledge.

In this paper, we use the term data dependency to show which organizational data relate to the organizational goals. We suggest data dependency is important to identify similar data from large datasets in order to avoid any irrelevant organizational data during the decision-making process in relation to the organizational goals. It involves analysing the dependency organizational data elements that relate to the organizational goals.

- *Analysis*

The main objective of data analysis is to evaluate organizational data from the vast amount of organizational datasets in relation to the organizational goals. We suggest that data analysis is important to identify the value of the organizational data that are relevant to the organizational goals.

The increased amount of other organizational resources, such as information, knowledge and tools, also makes it difficult for the decision maker to identify the most relevant organizational data, as data might not be relevant to the organizational goals. Therefore, it is important to apply an analysis approach that can identify the organizational data that is relevant to the organizational goals.

In Fig. 1, we illustrated metrics as a measurement tool to analyse the dependencies of organizational data. In the literature, metrics is proposed to evaluate organization resources such as information and knowledge for business process. In the methodology, metrics is defined based on the dependency relationship of the organizational goals ontology.

4. Generalizing the Organization Goals Ontology

In this section, we generalize the organizational goals ontology. The process is important to show how data is selected and develop the dependency relationship between organizational data and organizational goals. There are two stages to generalize the organizational goals ontology. First is to generalize the organizational goals and second is to generalize the data goals dependency

4.1 Generalizing the Organizational Goals

The first stage is to generalize the entire relationship of the organizational goals. At this stage, we suggest there are four categories to generalize the organizational goals: *type of goals*, *data and attributes*, *relationship* and *description* as shown in Table 2. *Type of goals* is the process to identify the existing goals in the organization. *Attributes* can be defined as a process to

identify the attribute that relate to the goals. *Relationship* is the process to identify dependency relationship of attributes that relate to the goals and lastly, *description* of the goals.

Table 2. Generalizing the organizational goals

Type of goals	Attributes	Relationships	Descriptions
(Identify the possible goals)	(Identify the possible attribute based on existing attributes)	(Identify the possible relationship in relation to the goals)	(Descriptions of the goals)

4.2 Generalizing Data and Goals Linkage

The second stage is to generalize data and goal linkage. There are three categories for in this stage: *concept*, *types of entity* and *description* as shown in Table 3. *Concept* is the relationship of attributes that relate to the goal. *Types of entity* are the entity for the goals and *description* of the goals.

Table 3. Generalizing the data and goals linkage

Concept	Types of entity	Descriptions
(Relationships for the goals based on attributes)	(Type of entity for the goals)	(Description for the goals)

5. Case Study

The aim of this case study is to test the flexibility and applicability of the methodology based on La Trobe University Library. In this case study, we refer data from the Insync Survey (see www.lib.latrobe.edu.au/about/surveys.php). Insync Survey is aim to ensure libraries can measure performance against each other that help libraries to develop the highest possible standards of service for library users. Library use this data to assist any decision-making process in relation to the library goals. In this example, library wants to look at "how students think the library is performing?" and "how students think the library is important?" Therefore, datasets in this case study are based on the library's performance and importance as shown in Table 4 and Table 5.

5.1 Evaluation of the Methodology

Two steps of evaluation are applied to test the methodology. First is to test the dependency relationship of library data that relate to the library's performance and importance based on an ontology. Second is to generalize the organizational goals ontology for library data to the library's performance and importance.

5.1.1 Dependency Relationship
In order to identify the dependency relationship of library data that relate to the library's performance and importance, it is important to identify the existing attributes from the datasets as shown in Table 4 and Table 5.

Table 4 shows the dataset for library's importance. We identified the goal is the library's importance and we identified the attributes for this goal. In order to identify the dependency relationship between the attributes that relate to the library's importance, we developed an ontology for library's importance as shown in Fig. 4. However, some of the attribute might be related to the library's performance as shown in Fig. 5. This ontology shows the dependency relationship for the library's importance.

Fig. 4 shows the dependency relationship of library data that relate to the library's importance. The relationship shows the attributes of *library staffs*, *library website*, *library* and *campus* are relate to the library's importance.

Table 4. Dataset for the library's importance

| No	How students think library is important?	Attributes
1	Library staffs are approachable and helpful	*Library staffs, approachable, helpful.*
2	I can get wireless access in the library when I need to	*Library, wireless access.*
3	When I am away from campus I can access the library resources and services I need	*Campus, library resources, library services.*
4	Library staffs are readily available to assist me	*Library staffs, available, assist.*
5	The library web site is easy to use	*Library web site, easy to use.*
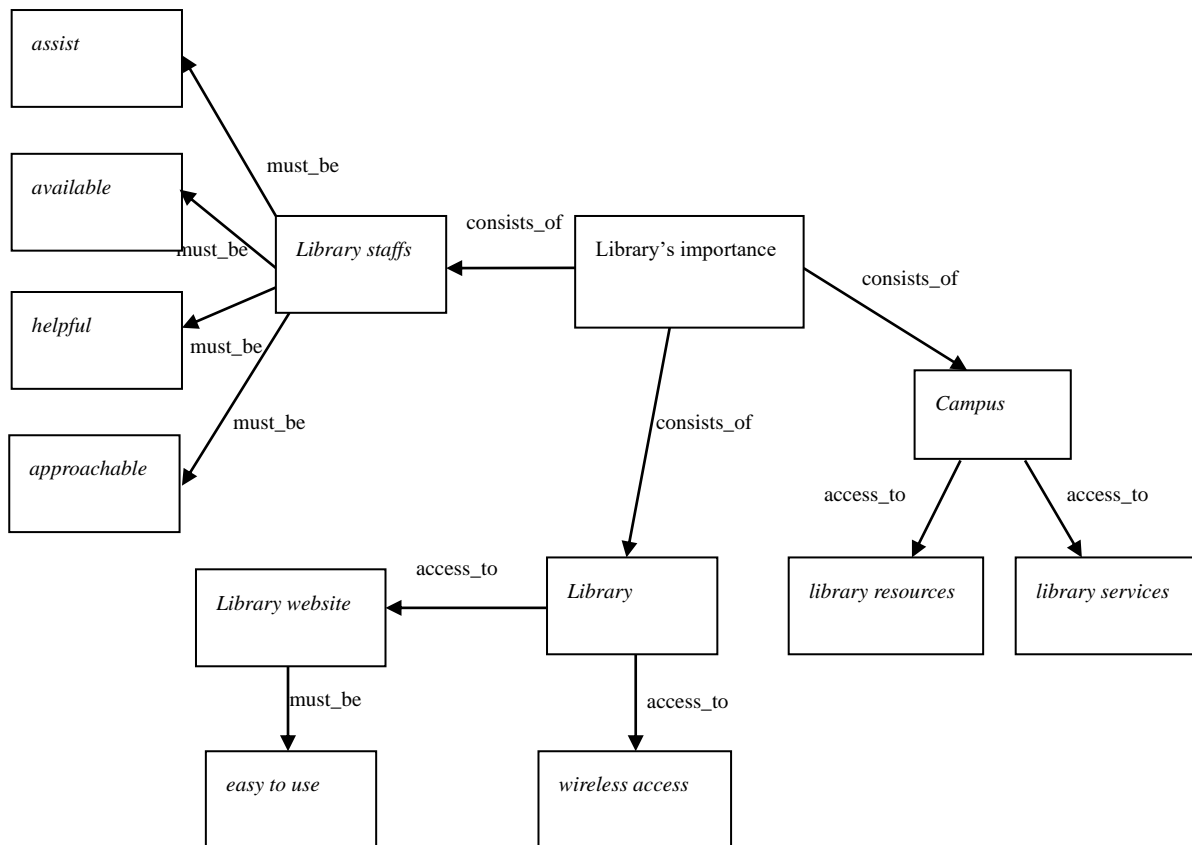
Figure 4. Dependency relationship for the library's importance based on an ontology

On the other hand, Table 5 shows the dataset for library's performance. We identified the goal is the library's performance and we identified the attributes for this goal. In order to identify the dependency relationship between attributes that relate to the library's importance, we developed an ontology for library's performance as shown in Fig. 5.

Table 5. Dataset for the library's performance

No	How student think library is performing?	Attributes
1	Library staffs are approachable and helpful	*Library staffs, approachable, helpful.*
2	Self Service (e.g. self check loans, requests, renewals, holds) meets student needs	*Student need, self service, check loans, requests, renewals, holds.*
3	When I am away from campus I can access the library resources and services I need	*Campus, library resources, library services.*
4	The library web site is easy to use	*Library web site, easy to use.*
5	I can get wireless access in the library when I need to	*Library, wireless access.*

Fig. 5 shows the dependency relationship of library data that relate to the library's performance. The relationship shows the attributes of *library staffs*, *student need*, *library* and *campus* are relate to the library's performance.
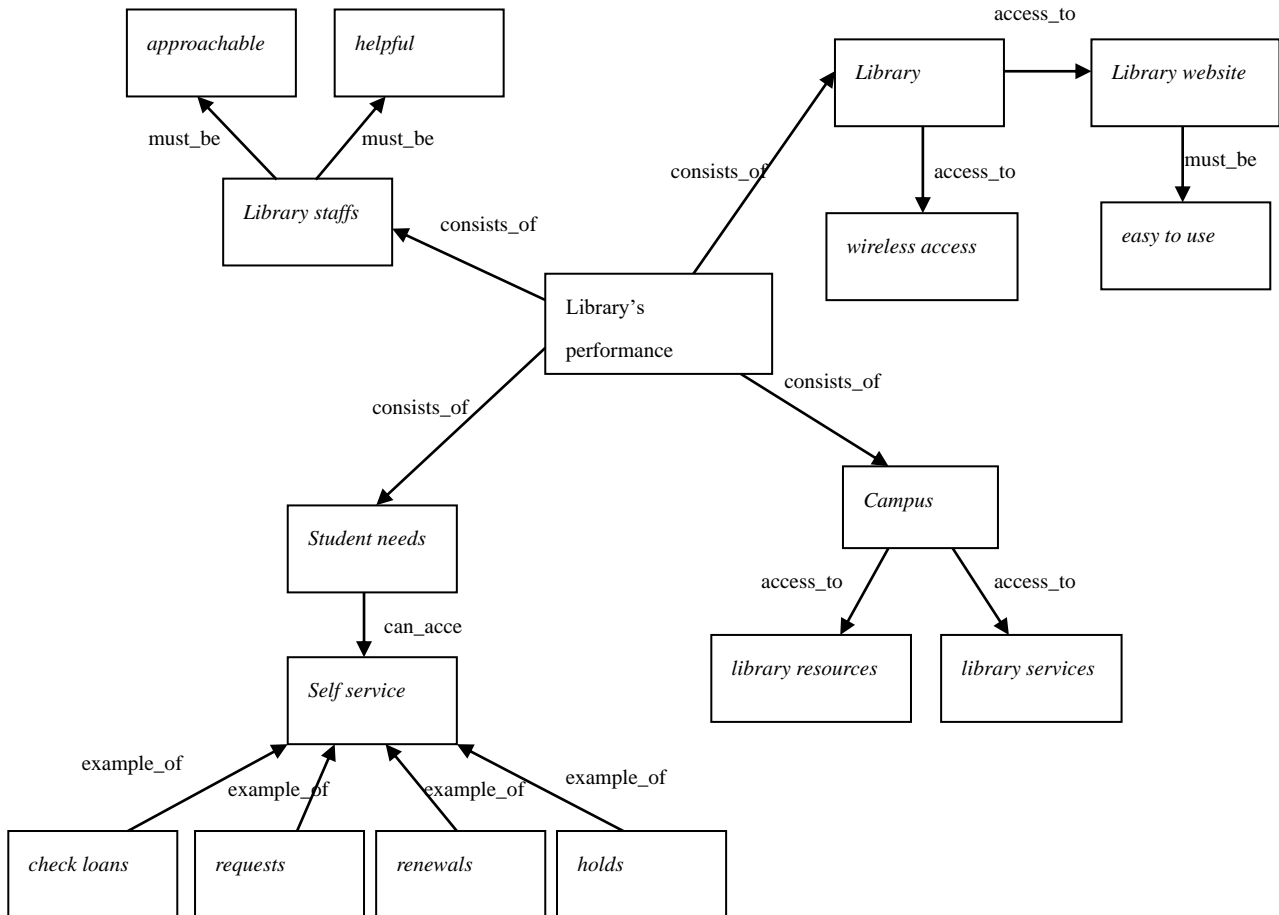

Figure 5. Dependency relationship for the library's performance based on an ontology

In this case study, Table 4 and Table 5 show the relationship of attributes that relate to the library's performance and importance. It is suggested that it is important to identify attributes from datasets that relate to the goals in order to avoid any irrelevant of data and attribute that relate to the library's performance and importance. The process is important to identify which attributes have been used more for the achievement of the library's performance and importance.

5.1.2 Generalizing the Organizational Goals Ontology for Library Data That Relate to the Library'S Performance and Importance

There are two stages involve as discussed in Section 4 in order to generalize the methodology. First is to generalize the organizational goals ontology for the library's performance and importance. Second is to generalize data goals dependency for library data that relate to the library's performance and importance.

In Table 6, we identify the library's performance and importance as the *types of goals* and we identified the relationship of attributes for the library's performance and importance as shown in Fig. 4 and Fig. 5. Table 6 summarized the dependency relationship for the library's performance and importance. The process improves the understanding of the goal process for the library's performance and importance. In the meantime, the process shows the dependency relationship of data and attributes that relate to the library's performance and importance.

Table 6. Generalizing the goals model for the library's performance and importance

Type of goals	Attributes	Relationships	Descriptions
Library's importance. Library's performance.	Library staffs. Assist. Approachable. Library website. Wireless access. Easy to use. Library resource. Self-service. Library service. Campus. Available. Request. Holds. Renewals. Check loans. Student needs. Library. Helpful.	consists_of must_be access_to can_access example_of	Library staffs are approachable and helpful. I can get wireless access in the library when I need to. When I am away from campus I can access the library resources and services I need. Library staffs are readily available to assist me. The library web site is easy to use. Self Service (e.g. self-check loans, requests, renewals, holds) meets student needs.

The results in Table 7 and Table 8 show the dependency relationship of the attributes that relate to the library's performance and importance. The process is important to identify which attribute relate to the library's performance and importance.

Table 7. Generalizing the data and goals dependency for the library's importance

Concepts	Types of entity	Descriptions
Library's importance	Goal	What student believes to be important for the library?
consists_of	Relationship	Goal consists of sub-goal 1, sub-goal 2 and sub-goal 3.
Library staffs	Sub-goal 1	Library staffs are approachable and helpful; and library staffs are readily available to assist student.
must_be	Relationship	Relationship of attribute.
Approachable	Attribute	Library staffs must be approachable.
Helpful	Attribute	Library staffs must be helpful.
Available	Attribute	Library staffs must be available.
Assist	Attribute	Library staffs must be available for assistant.
Library	Sub-goal 2	Student can access to wireless in library when they need to.
access_to	Relationship	Relationship of attribute
Wireless access	Attribute	Library has access to wireless.
access_to	Relationship	Relationship of attribute.
Library website	Sub-goal to sub-goal 2	Student can access to the library website.
must_be	Relationship	Relationship of attribute.
Easy to use	Attribute	Library website must be easy to use.
Campus	Sub-goal 3	Students can access to library resources and services when they are away from campus.
access_to	Relationship	Relationship of attribute.
Library resource	Attribute	Students can access to the library resources.
Library service	Attribute	Students can access to the library services.

Table 8. Generalizing the data and goals dependency for the library's performance

Concepts	Types of entity	Descriptions
Library's performance	Goal	How student think library is performing?
consists_of	Relationship	Goal consists of sub-goal 1, sub-goal 2, sub-goal 3 and sub-goal 4.
Library staffs	Sub-goal 1	Library staffs are approachable and helpful; and library staffs are readily available to assist student.
must_be	Relationship	Relationship of attribute.
Approachable	Attribute	Library staffs must be approachable.
Helpful	Attribute	Library staffs must be helpful.

Available	Attribute	Library staffs must be available.
Assist	Attribute	Library staffs must be available for assistant.
Library	Sub-goal 2	Student can access to wireless in library when they need to.
access_to	Relationship	Relationship of attribute
Wireless access	Attribute	Library has access to wireless.
access_to	Relationship	Relationship of attribute.
Library website	Sub-goal to sub-goal 2	Student can access to the library website.
must_be	Relationship	Relationship of attribute.
Easy to use	Attribute	Library website must be easy to use.
Campus	Sub-goal 3	Students can access to library resources and services when they are away from campus.
access_to	Relationship	Relationship of attribute.
Library resource	Attribute	Students can access to the library resources.
Library service	Attribute	Students can access to the library services.
Student	Sub-goal 4	Student can access library self service.
can_access	Relationship	Relationship of attribute.
Self service	Sub-goal to sub-goal 4	Self service meets student needs.
example_of	Relationship	Relationship of attribute.
Check loans	Attribute	Check loan is an example of self service.
Requests	Attribute	Request is an example of self service.
Renewals	Attribute	Renewal is an example of self service.
Holds	Attribute	Hold is an example of self service.

6. Discussion

The case study is presented to apply the methodology in order to identify the dependency relationship between organizational data and organizational goal. The dependency relationship of data goals linkage shows the relationship of data that relate to the library's performance and importance. Data and goals dependency improve the understanding of the dependency relationship between data, attributes and the goals as discussed in the case study. The results in the case study achieved the number of process in the ways:

• The proposed methodology can be applied in real situation. The implementation of the proposed methodology developed the dependency relationship of the organizational goals based on an ontology.

• Since the proposed methodology is developed to identify organizational data that relates to the organizational goals so that this data can be considered relevant, it shows the flexibility

of the methodology in evaluating the organizational data for the achievement of the organizational goals.

• Unlike other approach of the organizational modelling, the proposed methodology provide reliable approach that is flexible and applicable for domain experts and entrepreneurs for decision-making in relation to the organizational goals. The methodology presents the flexibility of the organizational goals ontology to identify the dependency relationship of organizational data that relates to the organizational goals.

6.1 Future Works

This paper is presented as a first step in evaluating organizational data for the achievement of the organizational goals. There are several areas that can be investigated in the future. Further research could be done to improve the entire methodology that covers:

• Extending the ontology in the scope of the organizational goals. Organizational goals ontology is developed to identify the dependency relationship between the organizational goal elements. In this organizational goals ontology, we only identify the elements of the sub-goals and resources as shown in Fig. 1. Therefore, future work can be done to add new elements, such as human resources, organizational behaviors, roles and activities in order identify the dependency relationship between these new elements in relation to the organizational goals.

• Extending the dependency relationship between organizational data and organizational goals. Data linkage was adapted from Christen to drive the understanding of the dependency relationship between the organizational data elements that relate to the organizational goals. However, future research could be conducted to investigate the dependency relationship for external data, such as social data in order to assist the decision-making process.

• Applying the methodology to evaluate organizational data that relate to the organizational goals using a metrics as shown in Fig. 1. This research is about gathering the measurement data and making an effectiveness results to assist decision-making process in relation to the organizational goals. In the future, we will extend the methodology with systematic steps for domain experts and entrepreneurs to identify relevant organizational data to assist decision-making process in relation to the organizational goals. Therefore, domain experts can identify to what extend this organizational goals are achieved.

7. Conclusion

We have presented the design, implementation and evaluation of the data goals dependency for the achievement of the organizational goals. We developed data goals dependency based on the organizational goals ontology. The purpose of the data goals dependency is to identify the dependency relationship between organizational data and organizational goals. In this paper, we discussed the background of the organizational goals based on an ontology. Then we discussed the concept of the data goals linkage. We generalized the organizational goals ontology to improve the understanding of the data goals dependency. In the case study, we

evaluated library data in order to test the methodology. The outcome of this evaluation shows the dependency relationship of library data that relate to the library's performance and importance. The results from the case study are considered as a future steps for domain experts and entrepreneurs to follow in order to identify the dependency relationship between organizational data and the organizational goals.

In conclusion, data is the most important organizational resource and the organization can embrace the fact that it is important to have relevant organizational data to evaluate the level of the organizational goals achievement or facing the problem in identifying the relevance of organizational data from the vast amount of it.

References

Abril, D., Navarro-Arribas, G., & Torra, V. (2012). Improving record linkage with supervised learning for disclosure risk assessment. *Information Fusion, 13,* 274-284, 2012. https://doi.org/10.1016/j.inffus.2011.05.001

Barjis, J. (2008). The importance of business process modeling in software systems design. *Science of Computer Programming, 71,* 73-87, 2008. https://doi.org/10.1016/j.scico.2008.01.002

Barlas, Y., & Yasarcan, H. (2006). Goal setting, evaluation, learning and revision: A dynamic modeling approach. *Evaluation and Program Planning, 29,* 79-87, 2006. https://doi.org/10.1016/j.evalprogplan.2005.08.003

Bouskila-Yam, O., & Kluger, A. N. (2011). Strength-based performance appraisal and goal setting. *Human Resource Management Review, 21,* 137-147, 2011. https://doi.org/10.1016/j.hrmr.2010.09.001

Ceresia, F. (2011). A model of goal dynamic in technology-based organizations. *Journal of Engineering and Technology Management, 28,* 49-76, 2011. https://doi.org/10.1016/j.jengtecman.2010.12.004

Cho, J., Han, S., & Kim, H. (2006). Meta-ontology for automated information integration of parts libraries. *Computer-Aided Design, 38,* 713-725, 2006. https://doi.org/10.1016/j.cad.2006.03.002

Christen, P. (2012). A survey of indexing techniques for scalable record linkage and deduplication. *IEEE Transaction on Knowledge and Data Engineering, 24,* 1537-1555, 2012. https://doi.org/10.1109/TKDE.2011.127

Dillard, J. F. (1981). A longitudinal evaluation of an occupational goal-expectancy model in professional accounting organizations. *Accounting, Organizations and Society, 6,* 17-26, 1981. https://doi.org/10.1016/0361-3682(81)90019-2

Durham, E., Xue, Y., Kantarcioglu, M., & Malin, B. (2012). Quantifying the correctness, computational complexity, and security of privacy-preserving string comparators for record linkage. *Information Fusion, 13,* 245-259, 2012. https://doi.org/10.1016/j.inffus.2011.04.004

Earley, P. C., & Kanfer, R. (1985). The influence of component participation and role models on goal acceptance, goal satisfaction and performance. *Organizational Behavior and Human Decision Processes, 36,* 378-390, 1985. https://doi.org/10.1016/0749-5978(85)90006-8

Elbashir, M. Z., Collier, P. A., & Davern, M. J. (2008). Measuring the effects of business intelligence systems: The relationship between business process and organizational performance. *International Journal of Accounting Information Systems, 9,* 135-153, 2008. https://doi.org/10.1016/j.accinf.2008.03.001

England, G. W., & Lee, R. (1973). Organization size as an influence on perceived organizational goals: A comparative study among American, Japanese, and Korean managers. *Organizational Behavior and Human Performance, 9,* 48-58. https://doi.org/10.1016/0030-5073(73)90036-6

Ferrante, A., & Boyd, K. (2012). A transparent and transportable methodology for evaluating Data Linkage software. *Journal of Biomedical Informatics, 45,* 165-172, 2012. https://doi.org/10.1016/j.jbi.2011.10.006

Fox, M. S., Barbuceanu, M., & Gruninger, M. (1996). An organisation ontology for enterprise modeling: Preliminary concepts for linking structure and behaviour. *Computers in Industry, 29,* 123-134, 1996. https://doi.org/10.1016/0166-3615(95)00079-8

Fox, M. S., Barbuceanu, M., Gruninger, M., & Lin, J. (1998). An organization ontology for enterprise modelling. In *Simulation organizations: Computational models of institutions and groupsAAAI/MIT Press*, ed, 131-152.

Freeland, J. R., & Baker, N. R. (1975). Goal partitioning in a hierarchical organization. *Omega, 3,* 673-688. https://doi.org/10.1016/0305-0483(75)90070-5

Freire, S. M., Almeida, R. T. D., Cabral, M. D. B., Bastos, E. D. A., Souza, R. C., & Silva, M. G. P. D. (2012). A record linkage process of a cervical cancer screening database. *Computer Method and Program in Biomedecine, 108,* 90-101, 2012. https://doi.org/10.1016/j.cmpb.2012.01.007

Harmancioglu, N., Grinstein, A., & Goldman, A. (2010). Innovation and performance outcomes of market information collection efforts: The role of top management team involvement. *International Journal of Research in Marketing, 27,* 33-43, 2010. https://doi.org/10.1016/j.ijresmar.2009.09.005

Izhar, T. A. T., Torabi, T., Bhatti, I., & Liu, F. (2012). Analytical dependency between organisational goals and actions: Modelling concept. in *International Conference on Innovation and Information Management (ICIIM 2012)* Chengdu, China, 2012.

Izhar, T. A. T., Torabi, T., Bhatti, M. I., & Liu, F. (2013). Recent developments in the organization goals conformance using ontology. *Expert Systems with Applications, 40,* 4252-4267. https://doi.org/10.1016/j.eswa.2013.01.025

Jonsson, S., & Lindbergh, J. (2010). The impact of institutional impediments and information and knowledge exchange on SMEs' investments in international business relationships. *International Business Review, 19,* 548-561, 2010. https://doi.org/10.1016/j.ibusrev.2010.04.002

Jutte, D. P., Roos, L. L., & Brownell, M. D. (2011). Administrative record linkage as a tool for public health research. *Annual Review Public Health, 32,* 91-108, 2011. https://doi.org/10.1146/annurev-publhealth-031210-100700

Kang, S., & Norton, H. E. (2004). Nonprofit organizations' use of the World Wide Web: are they sufficiently fulfilling organizational goals. *Public Relations Review, 30,* 279-284, 2004. https://doi.org/10.1016/j.pubrev.2004.04.002

Karakasidis, A., & Verykios, V. S. (2011). Secure blocking+secure matching= secure record linkage. *Journal of Computing Science and Engineering, 5,* 223-235, 2011. https://doi.org/10.5626/JCSE.2011.5.3.223

Lee, Y.-C., Hong, T.-P., & Wang, T.-C. (2008). Multi-level fuzzy mining with multiple minimum supports. *Expert Systems with Applications, 34,* 459-468, 2008. https://doi.org/10.1016/j.eswa.2006.09.011

Lepmets, M., McBride, T., & Ras, E. (2012). Goal alignment in process improvement. *The Journal of System and Software, 85,* 1440-1452. https://doi.org/10.1016/j.jss.2012.01.038

Mansingh, G., Osei-Bryson, K.-M., & Reichgelt, H. (2009). Building ontology-based knowledge maps to assist knowledge process outsourcing decisions. *Knowledge Management Research and Practice, 7,* 37-51, 2009. https://doi.org/10.1057/kmrp.2008.37

Meray, N., Reitsma, J. B., Ravelli, A. C. J., & Bonsel, G. J. (2007). Probabilistic record linkage is a valid and transparent tool to combine databased without a patient identification number. *Journal of Clinical Epideminology, 60,* 883-891, 2007. https://doi.org/10.1016/j.jclinepi.2006.11.021

Park, J.-H., Kim, K.-H., & Bae, J.-H. J. (2011). Analysis of shipbuilding fabrication process with enterprise ontology. *Computers in Human Behavior, 27,* 1519-1526, 2011. https://doi.org/10.1016/j.chb.2010.10.021

Popova, V., & Sharpanskykh, A. (2011). Formal modelling of organisational goals based on performance indicators. *Data & Knowledge Engineering, 70,* 335-364, 2011. https://doi.org/10.1016/j.datak.2011.01.001

Pundt, H., & Bishr, Y. (2002). Domain ontologies for data sharing-an example from environmental monitoring using field GIS. *Computer & Geosciences, 28,* 95-102, 2002. https://doi.org/10.1016/S0098-3004(01)00018-8

Rao, L., Mansingh, G., & Osei-Bryson, K.-M. (2012). Building ontology based knowledge maps to assist business process re-engineering. *Decision Support Systems, 52,* 577-589, 2012. https://doi.org/10.1016/j.dss.2011.10.014

Romero, O., & Abello, A. (2010). A framework for multidimensional design of data warehouses from ontologies. *Data & Knowledge Engineering, 69,* 1138-1157, 2010. https://doi.org/10.1016/j.datak.2010.07.007

Salerno, M. S. (2009). Reconfigurable organisation to cope with unpredictable goals,. *International Journal Economics, 122,* 419-428, 2009. https://doi.org/10.1016/j.ijpe.2009.06.015

Scannapieco, M., Figotin, I., Bertino, E., & Elmagarmid, A. (2007). Privacy preserving schema and data matching. In *ACM SIGMOD Conference*, Beijing, China, 2007, pp. 653-664. https://doi.org/10.1145/1247480.1247553

Selma, K., Ilyes, B., Ladjel, B., Eric, S., Stephane, J., & Michael, B. (2012). Ontology-based structured web data warehouses for sustainable interoperability: requirement modeling, design methodology and tool. *Computer in Industry, 63,* 799-812, 2012. https://doi.org/10.1016/j.compind.2012.08.001

Sharma, S., & Osei-Bryson, K.-M. (2008). Organization-ontology based framework for implementing the business understanding phase of data mining projects. In *International Conference on System Sciences*, Hawaii, 2008, pp. 27. https://doi.org/10.1109/HICSS.2008.339

Sholihin, M., Pike, R., Mangena, M., & Li, J. (2011). Goal-setting participation and goal commitment: Examining the mediating roles of procedural fairness and interpersonal trust in a UK financial services organisation. *The British Accounting Review, 43,* 135-146, 2011. https://doi.org/10.1016/j.bar.2011.02.003

Simsek, Z., Lubatkin, M. H., Veiga, J. F., & Dino R. N. (2009). The role of an entrepreneurially alert information system in promoting corporate entrepreneurship. *Journal of Business Research., 62,* 810-817, 2009. https://doi.org/10.1016/j.jbusres.2008.03.002

Su, W., Wang, J., & Lochovsky, F. H. (2010). Record matching over query results from multiple web databases. *IEEE Transaction on Knowledge and Data Engineering, 22,* 578-589, 2010. https://doi.org/10.1109/TKDE.2009.90

Trepetin, S. (2008). Privacy-preserving string comparisons in record linkage systems: A review. *Information Security Journal: A Global Perspective, 17,* 253-266, 2008. https://doi.org/10.1080/19393550802492503

Trkman, P. (2010). The critical success factors of business process management. *International Journal of Information Management, 30,* 125-134, 2010. https://doi.org/10.1016/j.ijinfomgt.2009.07.003

Unsworth, K., Adriasola, E., Johnston-Billings, A., Dmitrieva, M., & Hodkiewicz, A. (2011). Goal hierarchy: Improving asset data quality by improving motivation. *Reliability Engineering and System Safety, 96,* 1474-1481, 2011. https://doi.org/10.1016/j.ress.2011.06.003

Valiente, M.-C., Garcia-Barriocanal, E., & Sicilia, M.-A. (2012). Applying an ontology approach to IT service management for business-IT integration. *Knowledge-Based Systems, 28,* 76-87, 2012. https://doi.org/10.1016/j.knosys.2011.12.003

Vergidis, K., Turner, C. J., & Tiwari, A. (2008). Business process perspectives: Theoretical developments vs real world practice. *International Journal of Production Economics, 114,* 91-104, 2008. https://doi.org/10.1016/j.ijpe.2007.12.009

Xiaoying, D., Qianqian, L., & Dezhi, Y. (2008). Business performance, business strategy, and information system strategic alignment: An empirical study on Chinese firms. *Tsinghua Science and Technology, 13,* 348-354, 2008. https://doi.org/10.1016/S1007-0214(08)70056-7

Yakout, M., Elmagarmid, A. K., Elmeleegy, H., & Ouzzanil, M. (2010). Behavior based record linkage. In *The 36th International Conference on Very Large Data Bases*, Singapore, 2010, pp. 439-448. https://doi.org/10.14778/1920841.1920899

Copyright