

## AN ONTOLOGY-BASED GOAL FRAMEWORK TO EVALUATE THE LEVEL OF THE ORGANIZATIONAL GOALS ACHIEVEMENT

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**ABSTRACT.** This paper is about gathering the measurement data and making an effectiveness results to assist decision-making process to evaluate the level of the organizational goals achievement. In order to achieve this aim, we designed GOAL framework as a platform represents five steps for domain experts and entrepreneurs to identify the relevant organizational data to assist decision-making process in relation to the organizational goals. The aim of this paper concentrates on the design of this framework. GOAL framework associated with the organizational goals ontology aim to identify the dependency relationship between organizational goals and dependency relationship between organizational data and organizational goals. Metrics is defined for this dependency to identify which organizational data is relevant to the organizational goals. The framework is flexible to change without affecting things around because the framework is applicable in any organizational data with different organizational goals.

### INTRODUCTION

CEOs of organizations have certain requirements of the data they receive as they use this data to support the decision-making process.

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In today's technological age, organizations accumulate a huge amount of data, and information technology has developed beyond the storage, transmission and processing of data (Seng & Chen, 2010). Organizations rely on resources such as data, information and knowledge to assist the development of the business plan, the design of business strategies and decision-making. Organizational resources such as organizational data must be relevant to assist the decision-making process to evaluate the achievement level of the organizational goals (Izhar, Torabi, Bhatti, & Liu, 2013). Relevant data for decision-making is extracted from the organizational data sources (Romero & Abello, 2010). Therefore, organizations should have the ability to manage their resources (Omerzel & Antoncic, 2008; Schalenkamp & Smith, 2008; Smith, Schalenkamp, & Eicholz, 2007). However, the growth in the amount of the organizational resources available nowadays poses major difficulties as well as challenges to decision-making (Mikroyannidis & Theodoulidis, 2010).

Professional such as data analysts are trained to analyse the organizational data but the dramatic increase in the amount of available organizational resources has become a major problem in applying the organizational data. This is because they do not have enough relevant data to enhance the reliability of decision-making. Even though organizations have a vast amount of the organizational data, they may not have the data that they really need. Therefore, the relevance of organizational data in relation to meeting the organizational goals is often in doubt which raises the question as to how to optimize the selected organizational data to improve decision-making to evaluate the achievement level of the organizational goals (Izhar et al., 2013).

### **Problem Definition**

Organizational goals are defined as the most important targets to be achieved in every organization (Izhar et al., 2013). Even though the concept of the organizational goals has been in the existence for some time, modeling the structure of the organizational goals is much more difficult (Izhar et al., 2012; Izhar et al., 2013). For example, one way to develop a common understanding of the organizational goals structure is based on an ontology (Izhar et al., 2013). An ontology provides explicit and formal specifications of knowledge, especially implicit or hidden knowledge (Cho, Han, & Kim, 2006). An ontology is considered as an approach to support data sharing (Pundt & Bisher,

2002). 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 (Selma et al., 2012), which is, in this paper, the decision makers in relation to the organizational goals.

Today people have access to more data in single day than most people that have access to data in the previous decade. The problem is the data found in many different forms. All this information captures in different formats and makes it almost impossible to understand the existing relationship between different data. An ontology captures data in the way that allow the relationship to become visible. It captures knowledge within the organization as a model. This model can be created by a user to answer complex questions and display relationship across the enterprise.

There is a shortcoming when it comes to evaluate the organizational data in relation to the organizational goals during the development of the organizational modeling. Modeling the organizational goals is limited to business processes and organizational processes (Fox, Barbuceanu, & Gruninger, 1996; Fox Barbuceanu, Gruninger, & Lin, 1998; Mansingh, Osei-Bryson, & Reichgelt, 2009; Rao, Mansingh, & Osei-Bryson, 2012; Sharma & Osei-Bryson, 2008). Most of the previous studies argued that the need for and benefits from goal modeling focus on process modeling, workflow analysis, computer-supported cooperative work and design problem solving (Popova & Sharpanskykh, 2011).

Despite this shortfall, there are a number of tools for the modeling organizational processes where most of these tools support mathematical modeling (Vergidis, Turner, & Tiwari, 2008). 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. Therefore, it is also important to define a metrics that can measure the relevance of organizational data in relation to the organizational goals.

However, in many ontology studies, there is lack of tools reporting on such metrics (Rao, Mansingh, & Osei-Bryson, 2012; Valiente, Garcia-Barriocanal, & Sicilia, 2012). We suggest that metrics is important to enable both domain experts and entrepreneurs to evaluate the relevance of organizational data in relation to the

organizational goals. Domain experts can identify the relevance of organizational data in achieving the organizational goals and measure the value of the analysed organizational data. Furthermore, the organizational goals ontology is important for assisting domain experts to apply such knowledge in relation to the organizational goals (Izhar et al., 2013).

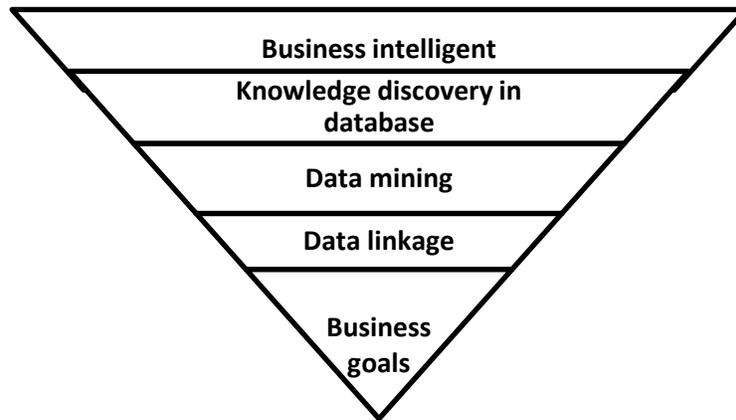
### **Problem Scope**

Previous research in this area has mainly examined the 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 (Lee, Hong, & Wang, 2008). 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 meeting the organizational goals. Therefore, it is important to develop a flexible and applicable framework to evaluate the relevance of organizational data to evaluate the level of the organizational goals achievement.

Most studies which have been conducted in this issue focus on business intelligent (BI) (Azma & Mostafapour, 2012; Nofal & Yusof, 2013; Popovic, Hackney, Coelho, & Jaklic, 2012), data mining (Aghdaie, Zolfani, & Zavadskas, 2014; Weerdt, Schupp, Vanderloock, & Baesens, 2013; Zandi, 2014), data linkage (Christen, 2008; Durham, Xue, Kantarcioglu, & Malin, 2012; Ferrante & Boyd, 2012) and knowledge discovery in databases (KDD) (Cheng, Wang, & Sun, 2012; Lin, Lin, Li, & Kuo, 2008). Even though these studies focused on the decision-making but they do not focus on the interaction between organizational data and organizational goals as shown in Figure 1. Therefore, it is difficult to identify the relevance of organizational data that relate to the organizational goals.

For example, KDD is an interdisciplinary field that searches for valuable information in large volumes of data and has played an important role in identifying effective patterns from a vast amount of data (Lee, Hong, & Wang, 2008). KDD is a concept of identifying new knowledge in the field of the computer science that describes the process of searching a vast amount of data in order to produce knowledge. However, KDD applies the concept within the system instead of searching and evaluating the organization data.

**FIGURE 1**  
**Problem Scope**



Another example is the business intelligence (BI). BI is a computer based technique to analyse the business data which provide past and current of the business strategies and business operation for the decision-making. BI has been practice toward the competitive intelligence where BI aims to support better decision-making process based on the past and current business strategies. BI aims to analyse the business data by providing the past and current data as a strategy to assist the decision-making. Meanwhile, data linkage is a process to identify data from different datasets. Christen (2012) defined data linkage as a process of data pre-processing to identify quality of data.

We tackle the problem to evaluate the organizational goals by proposing a framework to advance the understanding of the organizational model based on an ontology to assist the decision-making process in relation to the organizational goals. We propose this framework as a tool to evaluate the organizational data in order to support decision-making and thereby assist the organization to achieve its goals. We suggest that this framework is important in an effort to evaluate the relevance of organizational data. This framework is also important in measuring the extent to which organizational data are consistent with organizational goals.

In this paper, the proposed framework observed the limitations of the previous organizational processes in relation to the organizational

goals. As a result, this framework is proposed as an extension approach to introduce the organizational goals process as an effort to measure organizational data that relate to the organizational goals. This paper specified the organizational resource which is organizational data as it is suggested that organizational data is the most important organizational resource in relation to the organizational goals (Izhar et al., 2012; Izhar et al., 2013). The outcome of this paper will improve the process of evaluating the level of the organizational goals achievement.

### AIM

This paper aim to propose a framework as a platform to evaluates the level of the organizational goals. The proposed framework aims to provide a solution in evaluating the organizational data in achieving the organizational goals. It is important to evaluate the organizational data as an effort to identify which organizational data is relevant in relation to the organizational goals. At the same time, the framework aim to provide systematic steps as a tool to follows by domain experts and entrepreneurs in assisting their decision-making process to evaluate the level of the organizational goals achievement. The framework categorized into:

1. To build the relationship between the organizational goals based on an ontology.
2. To develop the dependency relationship of the organizational data that relate to the organizational goals based on an ontology.
3. To provide the measurement approach in evaluating the organizational data to identify which organizational data can be considered relevant in relation to the organizational goals.
4. To assist decision-making process to evaluate the level of the organizational goals achievement.

These proposed categories are important for the scope of the framework. In order to assist the decision-making process, these categories will to improve the efficiency and effectiveness of decision-making in relation to the organizational goals. Even though the process of the organizational goals models have been developed, we aim to extend the previous organizational goals models in Fox et al. (1998),

Sharma & Osei-Bryson (2008) and Rao, Mansingh, and Osei-Bryson (2012).

### **MODEL FOR THE ORGANIZATIONAL GOALS**

Model is simplified to represent the scientific method of a conceptual idea, which expected to understand. Model can be a concept, theory or data model and proliferate in organization as a mean of representing the process of the organization by information system (Almeida & Barbosa, 2009). Information has a relevant role to consolidate the creation of model to represent an activity in the organization.

In this paper, the contribution of ontology represent the information system is to improve the creation of model ultimately takes place through the organizational goals and it works as a type of relationship to represent the dependencies of the organizational goals elements and dependency relationship between organizational data and organizational goals.

In this paper, the problems covered the limitation in analysing organizational data that relate to the organizational goals. Therefore, it prevents the solution to analyse this organizational data from being practical and implement. This paper describes in detail the proposed framework to address the issues with the aim to measure organizational data that relate to the organizational goals so this organizational data can be considered relevant to assist decision-making process in relation to the organizational goals.

The framework is designed and developed specifically to address the issues in order to propose a framework associated with the organizational goals ontology. The framework is designed to:

- Successfully develop the dependency relationship between the organizational goals elements based on an ontology.
- Capable to be applicable in wide range of domains.
- Successfully develop the dependency relationship between organizational data that relate to the organizational goals.
- Capable of defining a metrics to evaluate the level of the organizational goals achievement by evaluating organizational data that relate to the organizational goals.

- Develop a framework as a tool represents systematic steps to assist decision-making process to the organizational goals.

### **The Requirement of Ontology**

The development of the ontology for the organizational goals model is comprised of the following stages: i) determining the scope, ii) conceptualization and iii) application of the ontology. The ontology is planned to be built to address the following dependency relationship: to address the relationship of the organizational goals elements and to address the relationship of organizational data that relate to the organizational goals. The framework adopted for building the organizational goals ontology is based on the work of Rao, Mansingh, and Osei-Bryson (2012), Sharma & Osei-Bryson (2008) and Fox et al. (1998). Despite many research efforts and established model for the organizational goals using an ontology, they have not yet been systematically applied for decision-making to support the evaluation of the organizational goals achievement. This is important because decision-support is one of the main objectives of an ontology (Bastinos & Krisper, 2013).

### ***Determining the Scope of the Ontology for the Organizational Goals***

In order to determine the scope of the organizational goals, an ontology is developed to address the relationship of the organizational goals elements (Izhar et al., 2012; Izhar et al., 2013). The purpose of the ontology is determined as being the definition of the dependency relationship representing the organizational goals process and how the process extracts organizational data from organizational datasets in achieving the organizational goals.

### ***Conceptualization***

Once the scope is determined, the conceptualization phase developed as an intellectual activity in the construction of the proposed organizational goals ontology. This is aim to structure the knowledge obtained through the process of collecting organizational data and analysing this organizational data for decision-making process (Izhar et al., 2013).

### ***Application of the Ontology***

The implementation of the ontology for the achievement of the organizational goals consist the role constrained the interpretation framework of the dependency relationship of organizational data that relate to the organizational goals. Despite huge volume of organizational data created, to the best of our knowledge, it is difficult to identify relevance of organizational data that relate to the organizational goals. Therefore, the implementation of an ontology reduced irrelevant organizational data because an ontology represents the dependency relationship of organizational data that only relate to the organizational goals.

Despite the various initiatives methodology for the evaluation of organizational process based on an ontology (Fox et al., 1996; Fox, Barbuceanu, & Gruninger, 1998; Mansingh, Osei-Bryson, & Reichgelt, 2009; Rao, Mansingh, & Osei-Bryson, 2012; Rao, Reichgelt, & Osei-Bryson, 2009; Sharma & Osei-Bryson, 2008), this paper focus on the evaluation of organizational data that relate to the organizational goals. It consists of the process to identify which organizational data is relevant correspond in achieving the organizational goals. This identification focus on domain experts and entrepreneurs who contribute in the decision-making process and responsible to identify to what extend the organizational goals are achieved.

An ontology shows the dependency relationship of the organizational goals, dependency relationship of organizational data that relate to the organizational goals and to evaluate the weight of this dependency between organizational data and organizational goals. The evaluation aims to test the flexibility of this ontology to develop these dependencies and how ontology is applied to define the organizational goals.

### **GOAL FRAMEWORK**

The framework is developed as a problem solution to the issues addressed in this paper. We develop this framework as an extension approach from the previous studies on the organizational modeling to introduce the model for the organizational goals based on an ontology (Izhar et al., 2013). In this framework, organizational goals ontology aim to identify the dependency relationship between the organizational goals elements and dependency relationship between organizational

data and organizational goals. We named this framework as the GOAL framework as defined in Table 1.

GOAL framework is defined as a framework to represent the organizational goals ontology. The framework discovers a systematic pattern in defining the organizational goal, use an ontology to develop the relationship of the organizational goals, analyse the organizational data that relate to the organizational goals and come out with decision-making in evaluating the level of the organizational goals achievement.

In this framework, it is important to develop this dependency relationship in order to identify the main goals for the organization and to identify which organizational data is relevant for the achievement of the organizational goals. In order to identify the relevance of organizational data from organizational datasets, metrics is defined as a measurement tool to analyse organizational data in order to evaluate the level of the organizational goals achievement.

**TABLE 1**  
**Definition of the GOAL Framework**

GOAL Framework		
Mnemonic	Description	Questions
<b>G</b> <b>Goals</b> (Fox et al., 1996; Rao et al., 2012; Sharma & Osei-Bryson, 2008).	Using the framework we define the goals in the organization.	What goals we want to define and evaluate?
<b>O</b> <b>Ontology</b> (Fox et al., 1996; Rao et al., 2012; Sharma & Osei-Bryson, 2008), <b>Organization</b> (Beydoun et al., 2011; Fox et al., 1996; Park et al., 2011; Rao et al., 2012; Sharma & Osei-Bryson, 2008; Sharp et al., 2011), <b>Organizational data</b> (Izhar et al., 2012; Izhar et al., 2013).	We use ontology to identify the relationship between the organizational goals elements, and between organizational data and organizational goals.	What sub-goals relate to the goal? Which data relate to the goal? Can we develop the dependency relationship between these two?

**TABLE 1** (Continued)

GOAL Framework
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	Mnemonic	Description	Questions
<b>A</b>	<b>Analysis</b> (Barnes & Vidgen, 2006; Goel & Chengalur-Smith, 2010; Petkova et al., 2000; Rao et al., 2012), <b>Achievement</b> (Izhar et al., 2012; Izhar et al., 2013).	We analyse organizational data for the goals achievement.	How we want to evaluate the data that relate to the goals? How to define the metrics that relate to the goals?
<b>L</b>	<b>Level of the organizational goals achievement</b> (Izhar et al., 2012; Izhar et al., 2013).	Final results from data analysis will assist decision-making to evaluate the level of the organizational goals achievement.	Are the final results relevant for decision-making to evaluate the level of the goals achievement?

**Organizational Goals Ontology**

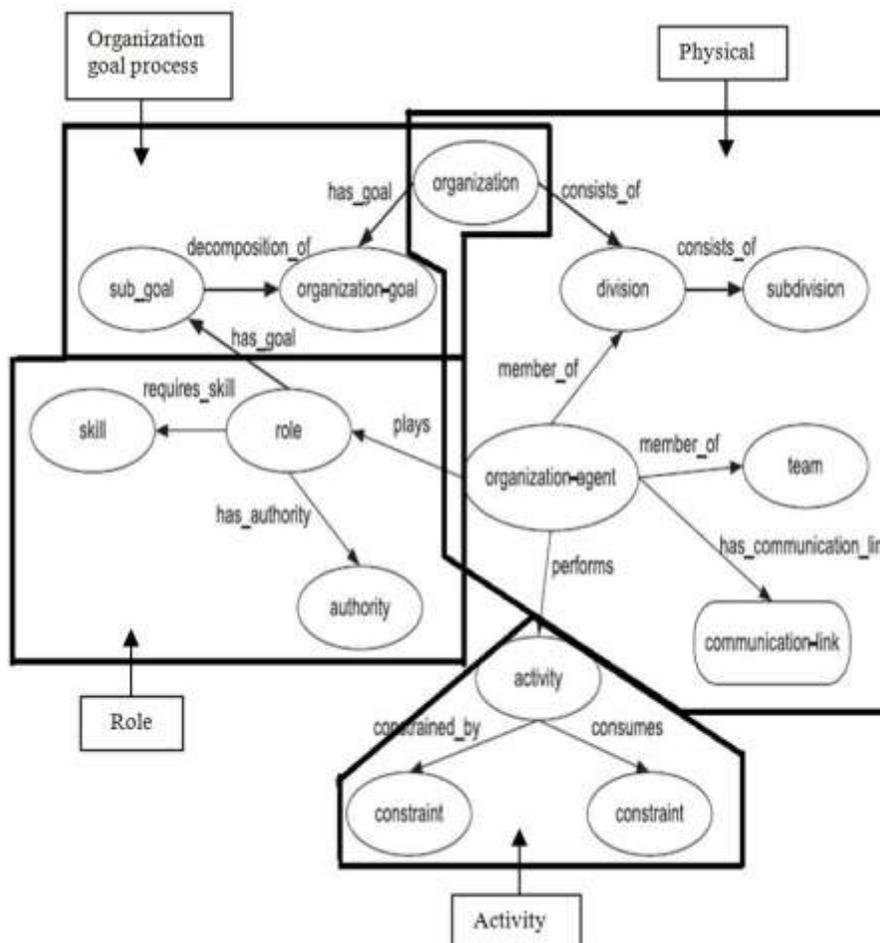
In this framework, an ontology is applied as a tool to identify the dependency relationship between the organizational goals elements in the organization, which include sub-goals and organizational data (Izhar et al., 2012; Izhar et al., 2013). It provides the means to understand this dependency relationship as shown in Figure 5. Therefore, domain experts and entrepreneurs can define the organizational goals based on their requirement.

In this section, we discuss the background of the organizational goals ontology in order to identify the dependency relationship between the organizational goals. The background shows how we clarify our organizational goals ontology in order to assist the process to identify the relationship for the organizational goals, the possible sub-goals and its variables.

In order to develop the organizational goals ontology, several structures that were proposed in the previous models are combined (Fox et al., 1998; Rao, Mansingh, & Osei-Bryson, 2012; Sharma & Osei-Bryson, 2008). We adopted these models as a reference for our organizational goals ontology. However, the scope of the proposed organizational goals ontology in this paper do not cover all the organizational processes in Sharma and Osei-Bryson (2008), Fox et al. (1998) and Rao, Mansingh, and Osei-Bryson (2012).

Fox et al. (1998) focused on structuring the linkage between organizational structure and behavior as shown in Figure 2. This is critical for enterprise model development. However, the authors do not emphasize any organizational resources such as data and information but focus on the roles and activities within the organization.

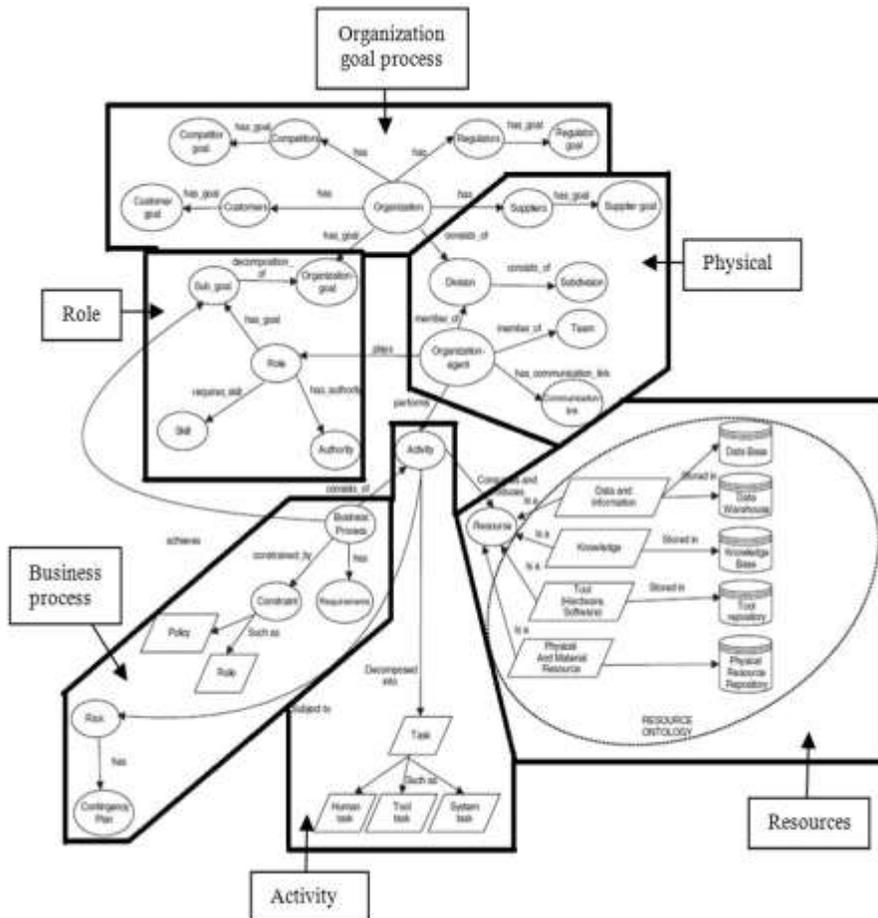
**FIGURE 2**  
**Organizational Ontology**



Source: Fox et al. (1998).

Meanwhile, Sharma and Osei-Bryson (2008) developed a framework for an organizational ontology in an effort to increase an understanding of the business as shown in Figure 3. However, the authors do not specifically identify the relationship between organizational resources, such as data, and the organizational goals. In this model, the authors adapted the work of Fox et al. (1998), where the authors discussed the physical resources and role of the organizational model.

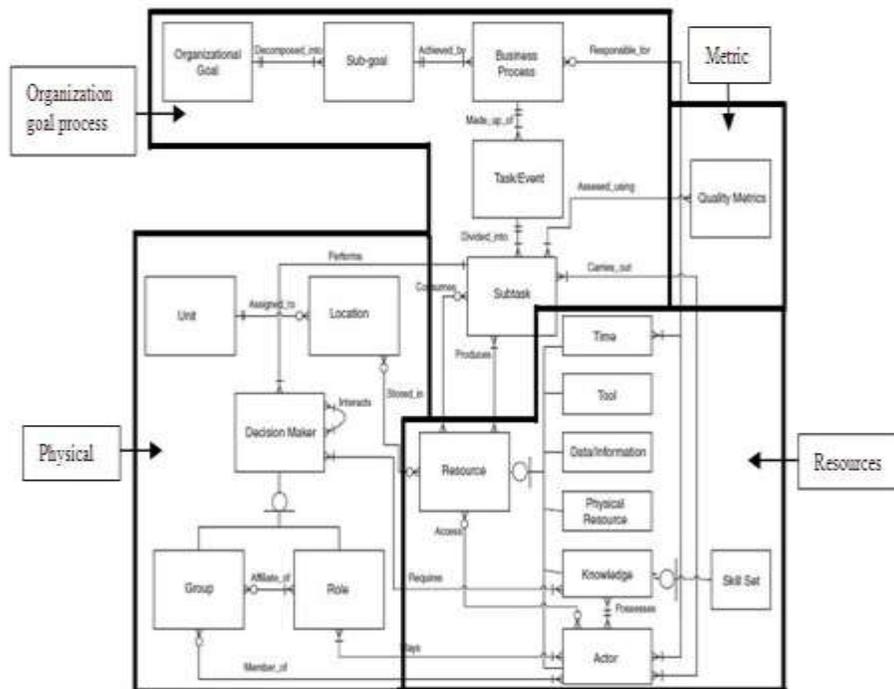
**FIGURE 3**  
**Organizational Ontology**



Source: Sharma & Osei-Bryson (2008).

Recently, Rao, Mansingh, and Osei-Bryson (2012) developed an organizational ontology to build a knowledge map within the organization as shown in Figure 4. The structure includes the flow of knowledge within the organization in the context of knowledge sharing and knowledge storage. In this model, the authors discussed the organizational resources, as in Sharma & Osei-Bryson (2008). Another aspect that is similar to Sharma & Osei-Bryson's work is that both models include business processes. However, Rao, Mansingh, and Osei-Bryson (2012) discussed business processes from the organizational goals point of view and Sharma & Osei-Bryson (2008) discussed business processes from the organizational activity point of view. Most of these studies focused on the organizational structure and performance.

**FIGURE. 4**  
**Organizational Ontology**



Source: Rao, Mansingh, and Osei-Bryson (2012).

Based on the above discussion, we proposed the organizational goals ontology as shown in Figure 5. In this figure, we show that each organization has many organizational goals and each organizational goal consists of sub-goals. In order to evaluate the level of the organizational goals achievement, organization relies on organizational resource include data to evaluate this level of the organizational goals achievement.

Compare to Sharma and Osei-Bryson (2008), our organizational goals ontology focus on the usage of organizational data instead of knowledge, information or tools because organizational data is a major resource in every organization and it is important to evaluate the relevance of this organizational data in achieving the organizational goals. We also suggest organizational data is important as information and knowledge to assist the decision-making process (Izhar et al., 2013).

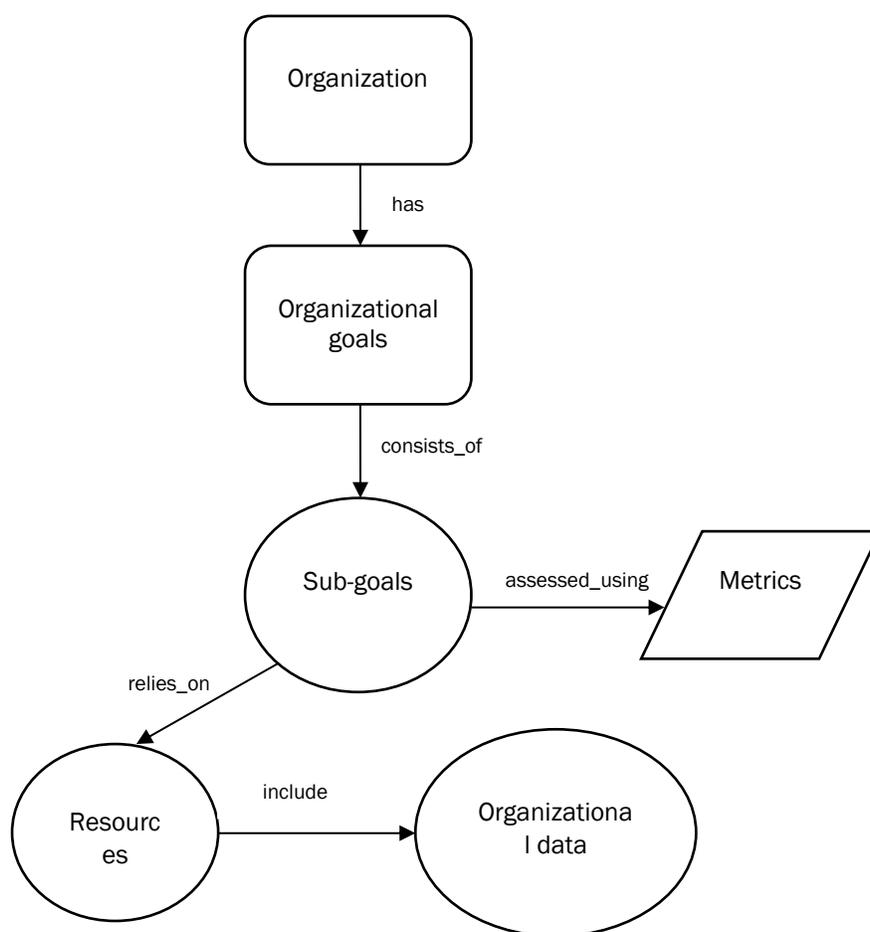
Table 2 shows the results from the previous models on the organizational goals using an ontology but none of these studies focus on the evaluation level of the organizational goals achievement. Table 2 also shows that these models do not focus on organizational data. At the same time, there is no study on metrics to evaluate the dependency relationship of organizational data that relate to the organizational goals. The gaps of these issues are important during the development of the framework.

**TABLE 2**  
**Review of the Issues**

Authors	Organizational goals ontology		Resources			Metrics
	Organizational goals	Sub-goals	Information	Knowledge	Organizational data	Dependency relationship
Fox et al. (1998)	✓	✓	✓	✓	✓	✓
Sharma & Osei-Bryson (2008)	✓	✓	✓	✓	✓	✓
Rao et al. (2012)	✓	✓	✓	✓	✓	✓

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, Lubatkin, Veiga, and Dino (2009) 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 domain experts and entrepreneurs to use the most relevant organizational data to successfully achieve the organizational goals.

**FIGURE 5**  
Elements of the Organizational Goals Ontology



Data is presented in many forms such as documents and statistics. These data are the most important resources in relation to the organizational goals. In this paper, we defined this data as organizational data.

At the same time, Figure 5 is different to other studies which either did not include metrics at all (Fox et al., 1998; Sharma & Osei-Bryson, 2008) or only used the metrics to measure the knowledge within the organization (Rao, Mansingh, & Osei-Bryson, 2012). In this research we introduce metrics as a measurement tool to analyse organizational data that relate to the organizational goals.

### **Five Steps of the GOAL Framework**

In this framework, we develop a tool associated from the organizational goals ontology to assist domain experts and entrepreneurs to be able to analyse and evaluate the level of the organizational goals. The tool assist the flexibility of the framework to identify the dependency relationship between the organizational goals element and the dependency relationship between organizational data and organizational goals (Izhar et al., 2012; Izhar et al., 2013). This dependency relationship is important to identify which organizational data is relevant. In order to achieve this, we set a measurement tool based on the metrics in order to evaluate organizational data that relate to the organizational goals.

The application process of the GOAL framework is based on two stages: planning and operational. These stages will allow the flexibility of the framework. Based on these two stages, we develop five-steps during the application process. The steps will provide a systematic approach on how the organizational goals will be identified, the dependency relationship between organizational data and organizational goals, and how the metrics will be defined to evaluate the organizational data to assist the decision-making process in relation to the organizational goals.

Planning stage is to test the flexibility and applicability of the framework. At this stage, domain experts and entrepreneurs can customize the framework to identify the organizational goals together with it sub-goals and variables. At the same time, it is a stage to develop the dependency relationship between organizational data and organizational goals in order to identify which organizational data are

related to the organizational goals. Therefore, we can define the metrics to evaluate this organizational data.

Operational stage is a stage to execute the application of the framework. This stage is about identifying the measurement data and making effectiveness results to assist decision-making process in relation to the organizational goals. We need to identify the weight of analysed data based on the actual implementation. Operational stage is the process covering the evaluation of the framework in order to identify the value from the populated data. Using this value, domain experts and entrepreneurs can identify to what extent the organizational goals might be achieved. Based on the planning and operational stages, we describe the five-steps of the application process as shown in Table 3.

**TABLE 3**  
**Five Steps of the Application Process**

Planning stage	Step 1: Identify the organizational goals
	Step 2: Identify the sub-goals and variables
	Step 3: Identify the dependency relationship
	Step 4: Identify the metrics
Operational stage	Step 5: Analysis and feedback

This tool is presented as an instruction for domain experts to follow from Step 1 to Step 5. The steps include how to identify the goals, the organizational dataset and how domain experts evaluate the goals. After we identified the goals, we populate the data to the dataset and evaluate this data to assist the decision-making process. The implementation of the tool is based on the application process of the GOAL framework, in which from the planning stage to the operational stage.

### ***Planning Stage***

The steps involve the process to identify the main goals and the metrics without populating any data to the main goals.

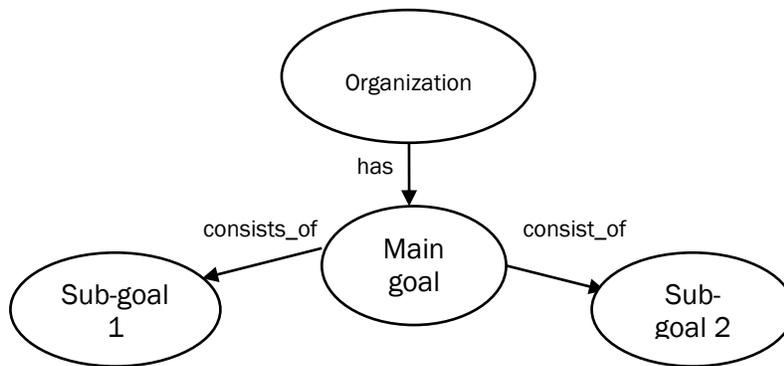
#### ***Step 1: Identify the organizational goals***

Using framework to facilitate the identification set of the organizational goals based on an ontology. The first step proposed

from the framework is to identify the main goal and the possible sub-goals that relate to the main goal. In this research, organizational goals can be defined in many ways. For example, goals might be defined in relation to different requirements, such as what sub-goals relate to the goals? what is the weight of these sub-goals that relate to the goals? and if we examine each sub-goal, can it be considered as a goal itself. This section aims to give a brief idea on how the goal can be defined based on different situations.

The example shows how the goals could be defined based on an ontology from Figure 6. However, this example only gives general idea of this concept. The first situation show if main goal has two sub-goals and this goal can be defined in other way as shown in the second situation. The process is discussed in the next section to show how main goal could be defined based on the dependency relationship of the organizational goals ontology.

**FIGURE 6**  
**Dependency Relationship of the Organizational Goals Based on an Ontology**



For example,

- Main goal
    - Sub-goal 1
    - Sub-goal 2
  
  - Main goal
    - Sub-goal 1 (become main goal)
    - Sub-goal 2 (become sub-goal 1)
- } First situation
- } Second situation

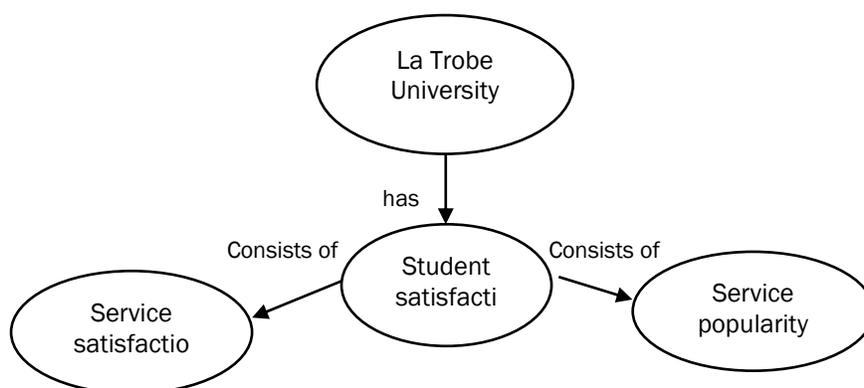
In order to test how the goal is identify, let's come out with one example as shown in Figure 7. We use example from the La Trobe University in order to look at the level of student satisfaction of university services based on study level (undergraduate and postgraduate). This example represent different variable that can be defined as the goals based on the requirement of domain experts and entrepreneurs. In this example, let's put ourselves as domain experts and this is the dataset we received as shown in Figure 7. We can see that the aim is to look at the level of student satisfaction. Therefore, the main goal is level of student satisfaction. We show how the goals are defined based on an ontology in Figure 8.

**FIGURE 7**  
Example of Goal Identification from Dataset

	A	B	C	D	E	F	G
46							
47		Services/ Study level	Undergraduate	Rank	Postgraduate	Rank	
48		Career events	534	3	117	3	
49		Career information and resources	605	2	125	2	
50		Career planning and advice	359	6	94	5	
51		Chaplaincy and religious services	148	7	39	8	
52		Childcare	33	11	18	10	
53		Clubs, collectives & societies	494	4	84	6	
54		Counseling	379	5	104	4	
55		Disability support	118	9	23	9	
56		Discrimination and harassment support services	38	10	11	11	
57		English language support	133	8	78	7	
58		Faculty office	1944	1	445	1	
59		STUDENT SATISFACTION					
60		TOTAL NUMBER	4785		1138		
61		TOTAL RANK	14686		3802		
62		Service satisfaction	33		30		
63		Service popularity	67		70		
64							

Source: La Trobe University Library

**FIGURE 8**  
**Example of goal identification based on an ontology**



For example,

- Student satisfaction
    - Service satisfaction
    - Service popularity
- } First situation
- Student satisfaction
    - Service satisfaction (become main goal)
    - Service popularity (become sub-goal)
- } Second situation

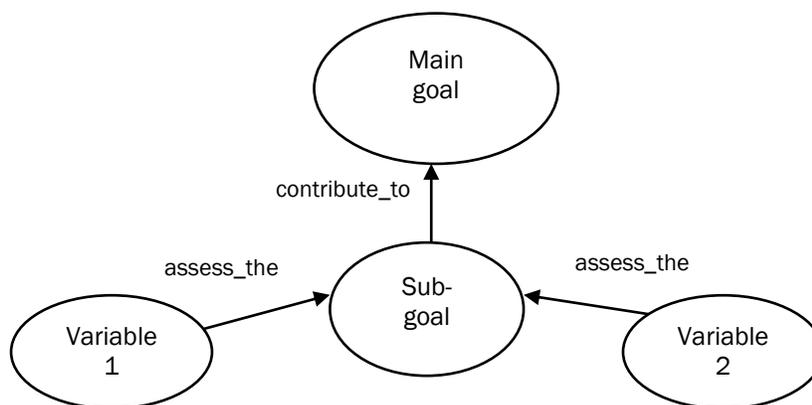
*Step 2: Identify the Sub-Goals and Variables.*

Generate the framework to identify the sub-goals and variables that relate to the organizational goals. The second step is to identify the sub-goals and variables that relate to the organizational goals. The step aims to identify the dependency relationship between sub-goals, variables and organizational goals. It includes on how sub-goals and variables are defined and how the process of measuring organizational data depend on this dependency relationship.

In order to define the goal as discussed in Step 1, the same process is applied between the sub-goals, variables and organizational goals as shown in Figure 9. In this example, we show three different situations between the main goal, sub-goals and variables. These situations represent different ways to customize the process to identify

the main goal based on how domain experts and entrepreneurs want to define the main goals. Even though we show three different situations but in real organization, they could only relies based on one situation or more than three situations. Step 2 only discusses on how sub-goals and variables could be identified based on these three situations.

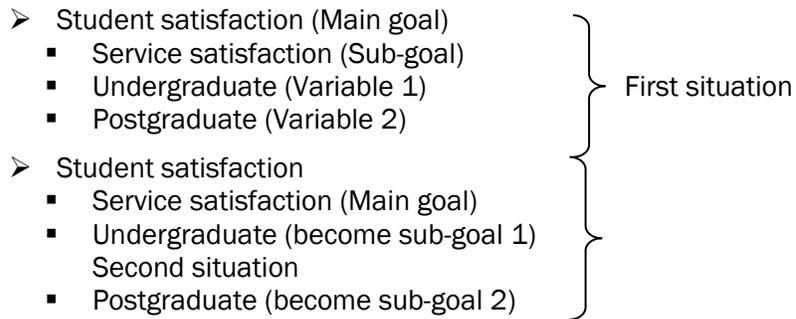
**FIGURE. 9**  
**Dependency Relationship Based on an Ontology**



For example, if domain experts want to focus on sub-goal 1 from situation 1 then this sub-goal 1 becomes the main goal as shown in situation 2. The same process applied to variable 1 and variable 2. For example,

- Main goal
    - Sub-goal 1
      - Variable 1
      - Variable 2
  - Main goal
    - Sub-goal 1 Main goal
      - Variable 1 Sub-goal 1
      - Variable 2 Variable 1
  - Main goal
    - Sub-goal 1
      - Variable 1 Main goal
      - Variable 2 Sub-goal 1
- } First situation  
 } Second situation  
 } Third situation

Using the same example as shown in Figure 7 in Step 1, the figure shows different variables that can be defined as goal. The goal in this figure can be defined based on the situation as discussed in the example above. In this example, we defined *student satisfaction* as main goal, then *service satisfaction* and *service popularity* become sub-goals and *undergraduate*, *postgraduate* and *services* become variables which based on how the goal in this figure is defined. Figure 9 show an example on how the possible sub-goals and variables relate to the organizational goals based on an ontology. However, the example only shows two variables but in real practical case they might be more than two variables or they could only have one variable. For example,



**Step 3: Identify the Dependency Relationship**

Develop the dependency relationship between organizational data and organizational goals from the framework. Step 3 is to identify organizational data from organizational datasets that relate to the organizational goals. The step involved the process to develop the dependency relationship between organizational data and organizational goals.

This step discussed the dependency relationship of this organizational data that relate to the organizational goals. The step aim to assist the evaluation of organizational data to the organizational goals to consider this organizational data is relevant. The process is discussed with the definition of the metrics as a measurement tool to evaluate this organizational data as discussed in Step 4.

In order to assist domain experts and entrepreneurs with decision-making, it is important to identify organizational data that relate to the organizational goals. At the same time, it is important to understand

the requirement of domain experts and entrepreneurs to assist their decision-making in relation to the organizational goals. For example, based on this organizational data, domain experts and entrepreneurs will decide the value of the organizational data and whether this value will help them in evaluating the level of the organizational goals achievement.

Dependency relationship between organizational data and organizational goals will show how many times the organizational data is related to the organizational goals. Therefore, the weight of this organizational data will be analysed so decision-making can be made based on the value of this organizational data to identify to what extent the organizational goals are achieved.

Figure 7 in Step 1 shows an example how data relate to the goal from the dataset. This example shows few variables that could be defined as a main goal and sub-goals (as discussed in Step 1 and Step 2). In this example we defined the main goal is the *level of student satisfaction* based on *service satisfaction* and *service popularity* as sub-goals.

In this figure, we can see 11 services represent as data related to the sub-goals. However, in other cases some of these services might not relate to the sub-goals and consider not very important to the goals. The framework using an ontology assist the process to select and define which data might be considered important to the goals by defining the dependency relationship between data and goals.

Data can be analysed based on future requirement of domain experts and entrepreneurs to assist their decision-making. The value in this example can be evaluated based on each service or based on overall services that relate to the sub-goals.

#### *Step 4: Identify the Metrics*

Metrics is defined to measure the level of the organizational goals achievement. Metrics advance the understanding on how data could be analysed to assist decision-making process in relation to the organizational goals. The metrics is defined based on how organizational goals is defined from datasets.

Metrics could be defined in many ways based on how domain experts and entrepreneurs defined the main goals. Metrics is defined based on the dependency relationship of the organizational goals and

dependency relationship between organizational data and organizational goals (Izhar et al., 2013). At the same time, metrics can be defined to evaluate different value such as weight, frequency, percentage and rank.

In this example, the process of defining the metrics as a measurement tool is based on what situation of goal that domain experts and entrepreneurs want to define as we discussed in Step 1 and Step 2. Figure 7 shows an example of dataset to identify the level of student satisfaction of the La Trobe University Services. Based on these services, *faculty office*, *career event* and *career information and resources* have the higher value for undergraduate and postgraduate. Therefore, as domain experts and entrepreneurs we can consider data that represent these services are important. We can identify the value for these services or for the entire services shown in Figure 7.

In this paper, the framework attempts to give a brief idea how domain experts and entrepreneurs can identify the possible goals, sub-goals and analyse the organizational data that relate to the organizational goals. How domain experts and entrepreneurs analyse the organizational data is not the main objective of the framework but the framework represent systematic steps on how organizational data could be analysed.

### **Operational Stage**

This stage is about how data is populated from the datasets and how this data will be analysed based on the metrics in order to assist decision-making process in relation to the goal.

#### *Step 5: Analysis and feedback*

In the framework, the main objective of data analysis is to evaluate organizational data from the vast amount of the organizational datasets. At the same time, we suggest that data analysis is important to identify the value of organizational data that relevant to the organizational goals to support decision-making process in achieving the organizational goals.

The value of organizational data will be presented in the dashboard to evaluate the level of the organizational goals achievement. For example, if student satisfaction of the services among undergraduate and postgraduate student is evaluated as discussed in Step 4, the

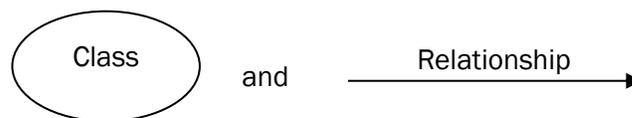
value can be presented in the dashboard in order to show the level of student satisfaction between undergraduate or postgraduate student. Therefore, based on this dashboard we can analyse, evaluate, and compare the value of the goal that we defined.

### PROTÉGÉ 4.3

In this section, we develop the organizational goals ontology using Protégé 4.3 in order to test the ontology and the relationships. The aim of this section is to support the organizational goals ontology in order to define and develop the relationship for the organizational goals. We use Protégé to test the organizational goals ontology. Protégé is an open source ontology editor and a knowledge acquisition system

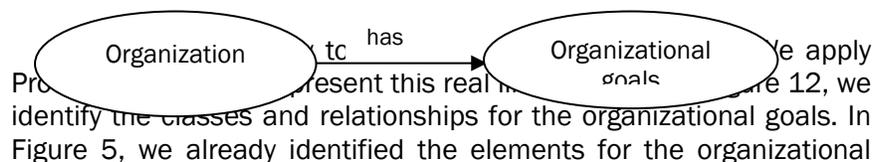
This section explains how we identify the main goal, sub-goals, develop the dependency for these goal and sub-goals using Protégé. An ontology is made up based on two main components: classes and relationships as show in Figure 10.

**FIGURE 10**  
**Classes and Relationships**



For example, if we have two different classes, *organization* and *organizational goals* which each representing real world concept. There is also a relationship which is *has*. Together these classes and relationship can be combined. The example shows that the *organization has organizational goals* as shown in Figure 11.

**FIGURE 11**  
**Example of Classes and Relationship**





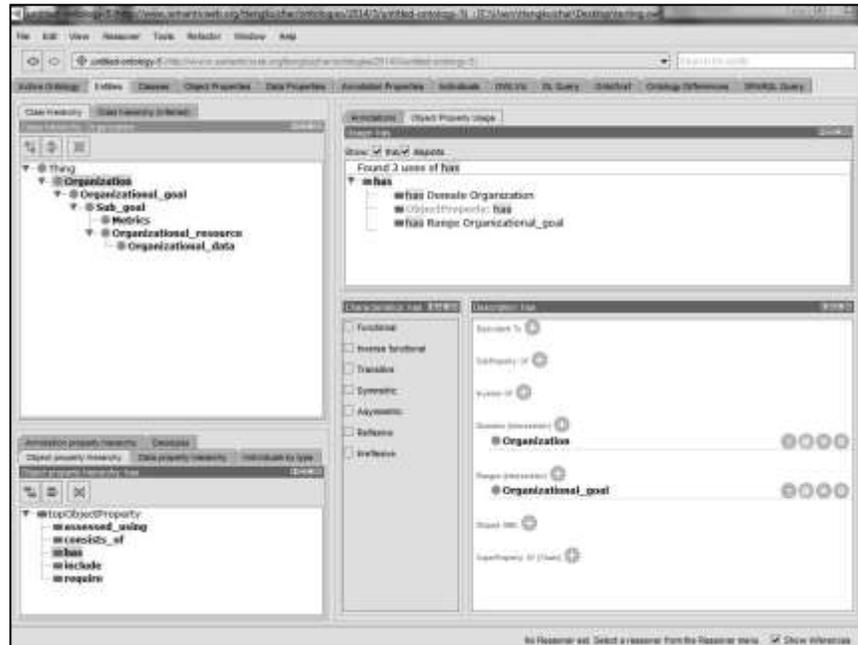


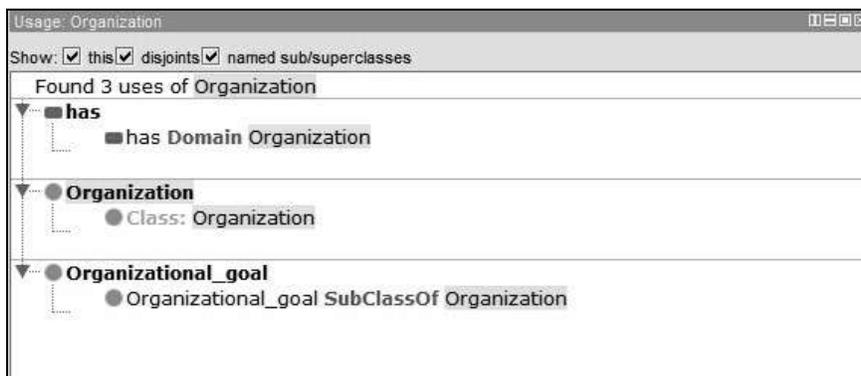
FIGURE 14  
Object Property to Represent the Relationships



Figure 15 shows an example of the relationship between class and sub-class. In this example it shows that organizational goal is a sub-

class for organization. It shows the linkage between organization and organizational goals.

**FIGURE 15**  
**Class and Sub-Class**



We take one example from Figure 13 in order to show the relationship between the classes. In Figure 16, it shows the relationship between class and sub-class. In this example, it shows that organization has organizational goal.

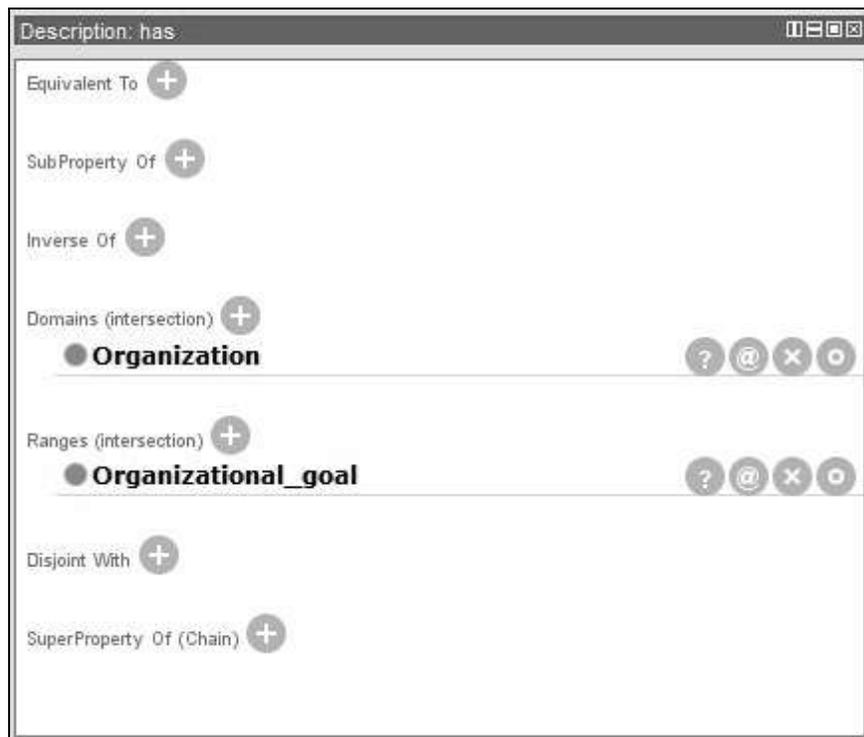
**FIGURE 16**  
**The Relationship between Class and Sub-Class**



For example, Figure 17 shows the description for the relationship in which class for organization is a domain for sub-class for

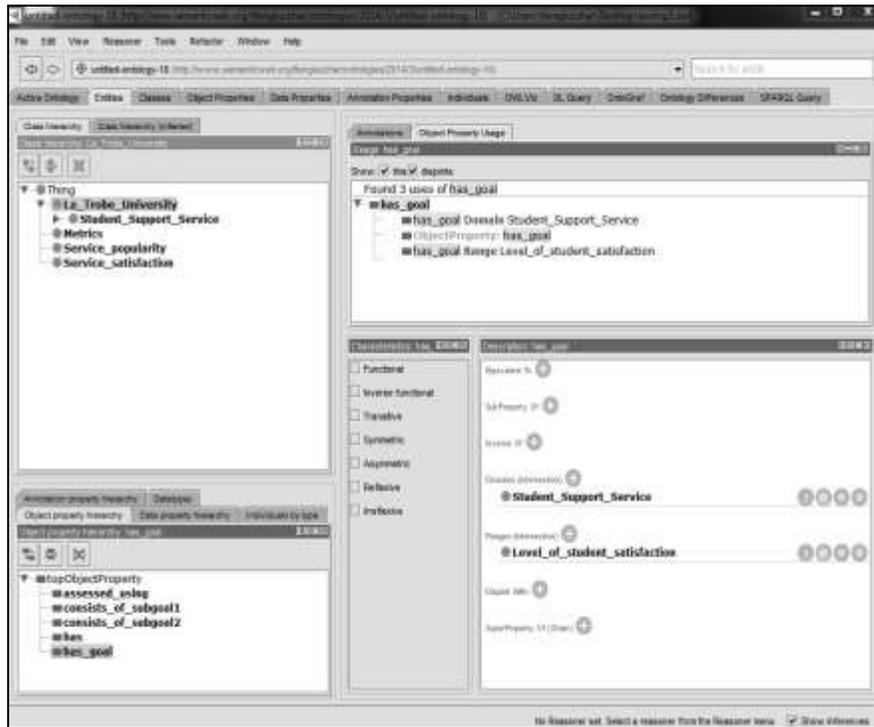
organizational goal. It shows the domain and range for the relationship *has*.

**FIGURE 17**  
Description for Class and Sub-Class



In order to test the applicability of the organizational goals ontology, we test the identification between classes and relationships for the La Trobe University as shown in Figure 18. In this figure, we identified the goal and sub-goals for the La Trobe University with its relationships. For example, the figure shows that Student Support Service has goal, which is the level of student satisfaction.

**FIGURE 18**  
Classes and Relationships for La Trobe University



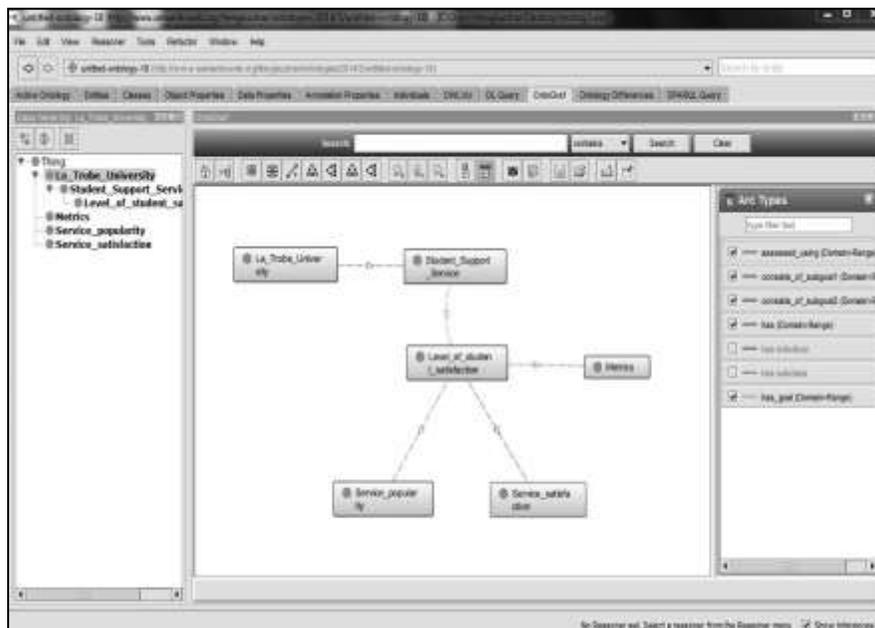
We developed the ontology for the La Trobe University as shown in Figure 19. This figure shows the applicability of the organizational goals ontology by showing the relationship between the classes which defined as the goal and sub-goals. Figure 19 assists the understanding on the dependency relationship between the goals and how metrics relate in this organizational goals ontology.

The example in this section shows the process to identify the main goals and sub-goals together with the dependency relationship between the organizational goal elements. The application of the Protégé concludes the application of the organizational goals ontology as:

- Flexible to identify the organizational goals,
- Flexible to identify the sub-goals that relate to the main goals, and
- Flexible to identify the dependency relationship between sub-goals and main goals.

This section shows how we developed the organizational goals ontology using Protégé. It a suitable tool constructs domain model and knowledge based on the organizational goals. We can create and edit the ontology using Protégé as a tool to complete relationship between the organizational goal elements.

**FIGURE 19**  
**Example of Ontology for La Trobe University Using Protégé OntoGraf**



#### TOOL TO IMPLEMENT THE FIVE STEPS OF THE GOAL FRAMEWORK

GOAL framework aims to assist the decision-making process in evaluating the achievement level of the organizational goals. The implementation of the GOAL framework consists of five main steps. We present a tool embedded in the framework to assist the implementation process of these five steps. In this section, we discuss how this tool will be applied manually to support these steps. We present this tool as an instruction for domain experts to follow from Step 1 to Step 5.

This section discuss that by using any analysis tools (such as SPSS or Microsoft Excel), the GOAL framework can be flexible and applicable in different domains. In this section, we designed and implemented the tool using a Microsoft Excel as an example to discuss the application of the GOAL framework. The steps include how to identify the goals, the organizational dataset and how domain experts can set the goals. After we identified the goals, we populate the data from the dataset and evaluate this data to assist the decision-making process. The implementation of the tool is based on the application process of the GOAL framework, in which from the planning stage to the operational stage.

**Planning Stage**

In the planning stage, we explain the process from Step 1 to Step 4. The discussion refers to Figure 20 and Figure 21. The steps involve the process to identify the main goals and the metrics without populating any data to the main goals.

***Step 1: Identify the Organizational Goals***

No 1:

- Domain experts identify set of goals in the organization.
- They identify the goal they want to evaluate as shown in Figure 20.
- By using the framework, domain experts can keep changing on how they want to identify and select the main goal.

***Step 2: Identify the Sub-Goals and Variables***

No 2:

- From the set of the organizational goals, domain experts identify the possible sub-goals and variables that relate to the main goal.

No 3:

- Possible variables identified.
- Using the framework, they have the flexibility to re-define and identify these sub-goals and variables.

**FIGURE 20**  
**Identification Process for Step 1 to Step 3**

		Variables identified ③			
Services/ Study level		Undergraduate	Rank	Postgraduate	Rank
④ Set of data and attributes that relate to the goal and sub-goals	Career events	534	3	117	3
	Career information and resources	605	2	125	2
	Career planning and advice	359	6	94	5
	Chaplaincy and religious services	148	7	39	8
	Childcare	33	11	18	10
	Clubs, collectives & societies	494	4	84	6
	Counseling	379	5	104	4
	Disability support	118	9	23	9
	Discrimination and harassment support services	38	10	11	11
	English language support	133	8	78	7
	Faculty office	1944	1	445	1
STUDENT SATISFACTION					
TOTAL NUMBER		4785		1138	
TOTAL RANK		14686		3802	
① Main goal identified	Service satisfaction	33		30	
② Sub-goals identified	Service popularity	67		70	

Source: La Trobe University Library.

### Step 3: Identify the Dependency Relationship

No 4:

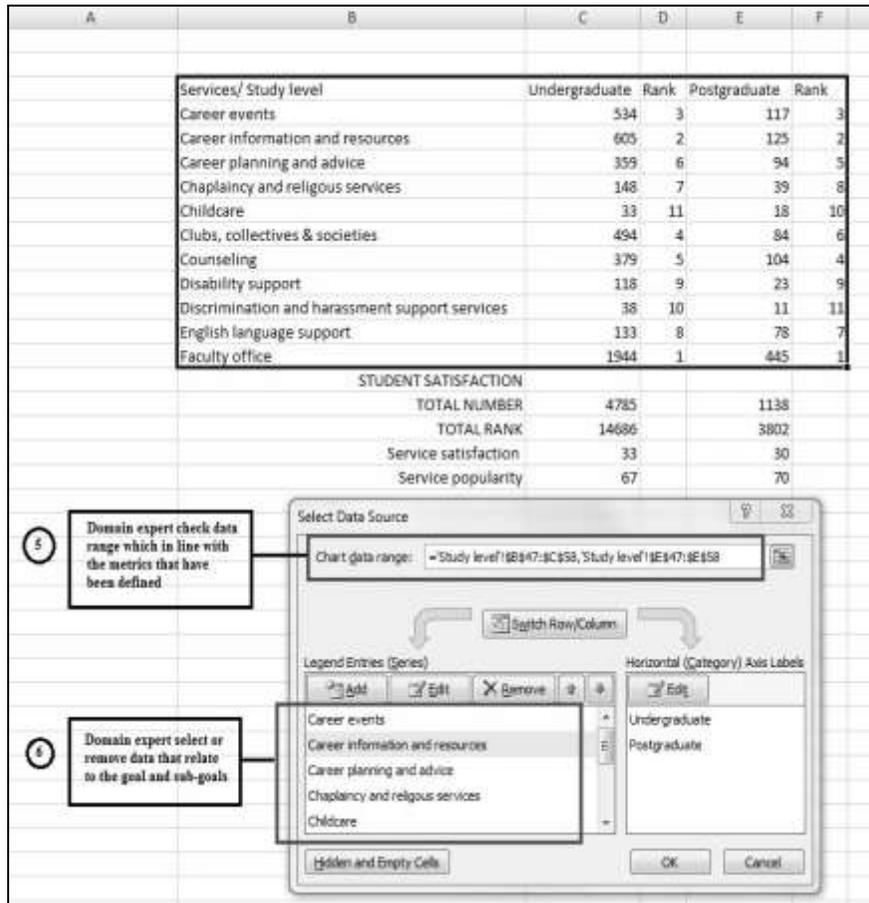
- By using the framework, domain experts identify the dependency relationship between the goals and sub-goals.
- Domain experts identify the dependency relationship of data and attributes that relate to the goals.

### Step 4: Identify the Metrics

No 5:

- Domain experts define the metrics based on the dependency relationship that have been identified in Step 3.
- They check the data range which in line with the metrics that have been defined.

**FIGURE 21**  
**Metrics Identification Process**



Source: La Trobe University Library

No 6:

- They select or remove data and attributes from dataset that they want to analyse in relation to the main goals.
- Using the framework, domain experts also have the flexibility to change how they want to define the metrics based on how they defined the goals.

**Operational Stage**

In this stage, we discuss how data is populated from the datasets and how this data is analysed to assist decision-making process in relation to the goal.

***Step 5: Analysis and Feedback***

No 7:

- Domain experts will assign the value to the dataset.

No 8 and No 9:

- The tool will show the summary of the evaluated and analysed value.
- Based on this summary, domain experts can keep changing the value and assign another value to the dataset before this value will be evaluated in the dashboard.

No 10:

- Final results will be shown in the dashboard to evaluate the level of the goals achievement.
- Using the framework, the evaluation process for the final results is flexible with the change of the value in the dataset.

The process discuss in this section explain how we identify the main goals and sub-goals from the dataset and how we can define the metrics to evaluate the data that relate to the goals from Step 1 to Step 5.

The implementation of GOAL framework will allow these five steps to be systematically applied with any organizational goals and organizational data. In this section, we included examples to illustrate how the steps are implemented. This section discusses how domain experts implement the framework based on the steps in order to evaluate the level of the organizational goals achievement.

**THE OUTCOMES BY USING THE GOAL FRAMEWORK**

GOAL framework drives an approach for the achievement of the organizational goals. There are several positive outcomes associated with the proposed framework that attempt to drive a decision-making process in relation to the organizational goals. The outcomes provide

significant contribution to the organization in managing large datasets into useful information.

The GOAL framework represents systematic steps to assist decision-making. This framework will assist domain experts and entrepreneurs in evaluating the achievement level of the organizational goals. Instead of evaluating the resources such as knowledge, tool and physical and material resource for organization data mining project (Sharma & Osei-Bryson, 2008) or time, knowledge, tool for business process (Rao, Mansingh, & Osei-Bryson, 2012), our framework focus on organizational data. The framework evaluates organizational data to identify which organizational data is relevant for the achievement of the organizational goals.

The GOAL framework is flexible with the change of the organizational environment. Every organization has different organizational goals and organizational data. This framework aim to be flexible and applicable with different organizational goals. At the same time, organization might change the organizational goal so this framework aims to be flexible with this change. An ontology applied in the framework assists the process to define the organizational goals.

The flexibility of the framework does not impact the overall organizational process because the main focus of this framework is the organizational goals. Previous models in Sharma & Osei-Bryson (2008), Fox et al. (1998) and Rao, Mansingh, and Osei-Bryson (2012) focused to evaluate the performance of business and organizational process. For example, Rao, Mansingh, and Osei-Bryson (2012) applied ontology based knowledge maps to assist business process re-engineering and Fox et al. (1998) applied an ontology focus on the linkage structure and behavior for enterprise modeling. GOAL-Framework looks at the organizational goals without affecting the organizational process. This is because we aim to evaluate the achievement level of the organizational goals.

The GOAL framework drives the process to identify the dependency relationship between organizational data and organizational goals. In Sharma & Osei-Bryson (2008), Fox et al. (1998) and Rao, Mansingh, and Osei-Bryson (2012), the authors developed the model for the entire organization and business process to see the relationship between organization and business process. However, we attempt to define the dependency relationship between the organizational goals based on an ontology (Izhar et al., 2013). We suggest the process is

important as an effort to identify to what extent the organizational goals have been achieved. At the same time, this dependency relationship makes the process to identify organizational data that relate to the organizational goals becomes easier and reduce the irrelevant organizational data.

It enables the process to identify the relevance of organizational data from huge set of organizational datasets. We adapted study on record linkage in an effort to identify organizational data that relate to the organizational goals. However, most of record linkage studies focus on database but we applied this approach to identify organizational data from organizational datasets that relate to the organizational goals.

It enables the flexibility of the metrics as a measurement tool to measure organizational data in order to identify the level of the organizational goals achievement. In order to identify the relevance of organizational data that relate to the organizational goals, metrics is defined based on the dependency relationship between the organizational goals and dependency relationship between organizational data and organizational goals. In Rao, Mansingh, and Osei-Bryson (2012), the authors applied the metrics to evaluate organizational resource to the organizational. They used metrics to access the possible sub-goals that relate to the organizational goals. We evaluate organizational data using a metrics in an effort to identify which organizational data from organizational datasets are relevant to the organizational goals.

#### **LIMITATION AND FUTURE RESEARCH**

The main limitation of the GOAL framework is due to the lack of past definition of the organizational goals in order to identify the dependency relationship between organizational data and organizational goals based on an ontology. Although we applied an ontology to drive the common understanding of this dependency relationship, the ability to identify this relationship is limited among organizational data only. It unable to interact with external data such as social data in order to see how social data can play it parts in assisting the decision-making process 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 framework, which includes:

- Extending the ontology for the organizational goals. Organizational goals ontology is developed to identify the dependency relationship between the organizational goals elements. In this organizational goals ontology, we only identify the elements of the sub-goals and resources. Therefore, future work can be done to add new elements such as human resources, organizational behaviors, role and activity in order identify the dependency relationship between these new elements in relation to the organizational goals.
- Guiding the domain experts and entrepreneurs to define the dependency relationship between organizational data and organizational goals. Data linkage will be adapted from Christen (2012) to drive the understanding of the dependency relationship of organizational data that relate to the organizational goals. However, future research can be conducted to investigate the dependency relationship for external data such as social data in order to investigate how we can implement this framework using social data to assist the decision-making process.
- Guiding the domain experts and entrepreneurs to define the metrics to measure organizational data. GOAL framework provides flexibility for domain experts and entrepreneurs to define the metrics as a measurement tool to evaluate organizational data that relate to the organizational goals. They have this flexibility to define the metrics based on how they want to evaluate the organizational data after they defined the organizational goals. However, in the future, this metrics need to be tested in order to identify relevant organizational data that relate to the organizational goals.
- There were limitations in applying our framework. In the example, we identified few sub-goals relate to the La Trobe Student Support Service. Even though we identified few sub-goals, the process to implement this framework to the main goals will be the same. Therefore, it is important to apply this framework with main goals. Future work will allow us to apply this framework in the case study with the main organizational goals.
- In future research, we will apply the framework incorporate with social data in order to identify how social data could be applied to

evaluate the level of the organizational goals. Social data defined as the increase of personal information sharing through the social networks. As a result, it accumulates the unprecedented amounts of public data. Social data enable new business models that provide large opportunities to improve decision-making. We aim to see how social data can be incorporated in relation to the organizational goals. It is important to analyse social data in which to evaluate how people work in social and collaborative context to make sense of this data. Therefore, our framework could capture this data and develop the dependency relationship between this data and the goals. However, the implementation of social data highlights the recent development of the big data. The challenge includes how the framework search, transfer, captures and analyse the data from the vast collection of datasets. This is due to the flexibility of the framework to capture large set of related data to the organizational goals that allow this data to be analysed and present the value of the analysed data in relation to the organizational goals.

### CONCLUSION

This paper covered the overall process on how the GOAL framework is defined, designed and implemented with five main steps to assist domain experts and entrepreneurs with decision-making process in relation to the organizational goals. The paper discussed on how the steps are implemented and applied with examples. The discussion include how the organizational goals are identified, the possible sub-goals and variables that relate to the organizational goals, how to identify data that has been presented to the organizational goals, how to analyse organizational data and use this analysis results as a feedback to evaluate the level of the organizational goals achievement. The paper discussed on how the framework is applicable, repeatable, flexible and configurable in many domains.

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