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Modelling concept for organizational goals conformance using ontology

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Abstract

We propose a modelling concept for the organizational goals as a tool to evaluate organization data conformance in relation the organization goal. We suggest that this model is important in assisting the organization to utilize the organization data and information from the vast amount of data for decision making which will be in line with the organization's goals. We develop this model based on organizational goal elements such as the main goal, sub-goals, actions and tasks. A formal ontology is developed to specific role between the organization goal elements. We develop a metric model in order to interpret organization data. We apply a case study to evaluate our model development, metric development and relationship development. Overall, the main contribution of this paper is to propose a conceptual model that seeks to support the evaluation of organization data based on organization goal elements in the achievement of the organization's goals.

Keywords: Action; Data; Data usage; Goals; Goal tree model; Organization; Ontology; Sub-goal; Task

1. Introduction

Information is the backbone of an organization. Information is an important and valuable resource that supports managerial decision making in daily business activities. This is because all decisions made by managers should be based on information within their organization. Therefore, it is crucial for management to access the valuable information within their organization to assist in decision making. However, an organizations need to look at the main organization resources in an effort to create good information within the organization. These organization resources are organization data. Professionals are trained to analyse organization data but the increase in the amount of organization data has become a major problem in applying these data to decision making. Meanwhile, the amount of organization data continues to grow and information technology also has changed beyond storage, transmission and processing (Seng

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& Chen, 2010). All of the changes mentioned add additional difficulties and complexity to the process of selecting and analysing organization data.

Organizations depend on organization data to improve their production and services as well as to remain competitive. Many research efforts have been targeted at transforming huge amount of data into succinct and meaningful information to assist decision making. Most studies which have been conducted in this area focus on data mining or knowledge discovery in databases (KDD). 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). On the other hand, the quality of organization data is important in order to improve decision making. Past studies have discussed the concept of quality metrics as an approach for data analysis (Albino, Garavelli, & Schiuma, 2001; Ebert & Morschel, 1997; Hevner, 1997; Ordonez & Garcia-Garcia, 2008; Petkova, Sander, & Brombacher, 2000). For example, Goal Question Metric (GQM) is a general methodology for the development of the quality metric approach (Ardimento, Baldassarre, Caivano, & Visaggio, 2006; Basili & Weiss, 1984). Another example is business intelligence (BI). BI is a computer based technique to analyse business data which provide past and current of business strategies and business operation for decision making. BI is been practice toward competitive intelligence where BI aims to support better decision making process based on past and current business strategies. Based on these three approaches, we conclude these approaches are between data and process. We come out with this conclusion because, first, KDD is a concept identifying new knowledge in the field of 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 organization data. Second, GQM is a metric approach for software to develop a measurement model. GQM is applied for software industry in order to integrate software measurement model. Thus, GQM is an approach toward processes and process is very dynamic where it is difficult to handle because processes constantly change based on the environment. Third, BI aims to analyse business data by providing past and current data as a strategy to assist decision making. BI analyses data for business strategies instead of evaluating the degree to which the retrieval of relevant data assist the organization to achieve its organizational goals.

In this paper, we propose a modelling concept as a tool to evaluate the quality of organization data in order to support managerial decision making and thereby assist the organization to achieve its goals. We suggest that this model is important in an effort to evaluate the quality and relevant organization data. At the mean time, this model is important in measuring the extent that organization data are consistent with the organization goal. In the present paper, we identify organizational goal elements such as the organization's goals, sub-goals, actions and tasks and we identify a relationship between these elements using a formal ontology. Finally, we develop a metric model in order to expand the interpretation of organization data.

This paper consists of five main parts. The first part introduces our model within the organization goal context. Relevant existing literature is introduced to support the model in an effort to identify the organizational goal elements. In the second part, we develop a model between the organizational goal elements using a formal ontology. The ontology model illustrates the relationships between the organizational goal elements. In the third part, we highlight the dependency relationship between the organizational goal elements. In the fourth part, we develop a metric model in order to evaluate organization data. In the last part, we apply

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a case study. In this case study, we use library data and we apply our metric model to interpret library data. The aim of this case study is to demonstrate the feasibility of our concept for applied work. The model presented in this paper will significantly improve the consistency of organization data and thereby assist the organization to achieve its goals.

The remainder of this paper is organized as following. Section 2 presents the motivation aspects toward this study whereas Section 3 discusses the related work. Section 4 concentrates on organizational goal elements and in Section 5 we discuss the modelling concept and the relationship between the organizational goal elements. We develop a metric model in Section 6. The case study is discussed in Section 7 and Section 8 presents the discussions. The final section contains our concluding remarks and suggestions for future works.

2. Motivation

In organizations, managers have certain requirements of the information they receive as they use this information to support their decision making in relation to meeting the organization's goals. However, managers often require additional data to support the information they receive, especially in relation to problem solving. For example, in a business environment, there could be several causes for a decrease in sales such as economic turndown or ineffective planning. Therefore, data are collected and analysed in relation to this problem and managers use these data to support their decision making in an effort to solve the problem. Data are presented in many forms such as documents and statistics. For example, a sales manager may require data on sales to assist his decision making. Thus, sales data are extracted from the vast amount of organizational data held by the record department. After the sales data are selected, these data are sent to the sales department. The sales department converts the data into an easy-to-understand report and sends this report to the manager to assist their decision making.

The amount of organization data is increasing every day. Thus, it is a difficult issue to manage and convert this data into valuable information to support an enterprise's decision making. Satisfying the need for information in the context of decision making is a challenge. In this paper, we develop a conceptual model as a tool to evaluate organization data in order to support managerial decision making in line with an organization's goal.

3. Related Work

In this section, we outline previous studies prior to proposing our model. The discussion includes a comparison of ontology and organizational goals with an example of an ontology approach in relation to the current issue of managing organization data. Recently, the development of a business process to integrate business strategies and knowledge management has been widely discussed topic. In contrast to past studies, we develop a model to evaluate organization data by identifying the organization's goal elements. In this section, we provide a detailed literature review to compare the previous approaches which are relevant to our topic in order to identify the gaps in the existing research in relation to organizational goals and goal setting.

3.1. Ontology approach

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The existing literature on ontology approaches addresses either software development or organizational process, both of which are beyond the scope of this paper. However, the most important work on ontology development is briefly discussed in this section to identify the existing gaps in the current research.

In organizations, it is important to use data and information to predict future performance. Information needs to be readily retrievable. Jimeno-Yepes et al. (2010) studied on ontology refinement to improve information retrieval. In this study, the authors used an ontology query model to analyse the usefulness of the ontology in effectively performing document searches. In our work, we use an ontology to identify the relationships between organizational goal elements in an effort to evaluate organization data.

In order to survive in today's competitive environment, most enterprises recognize the importance of their knowledge assets in achieving performance goals. However, when knowledge is separated from the context of the business process, it cannot contribute to performance goals (Han & Park, 2009). In this study, the authors proposed a knowledge model framework and an enterprise ontology for a process-centered enterprise structure by classifying the model into two types: process knowledge and task support knowledge. Our work is similar to the work of Han & Park (2009) in term of enterprise ontology development to gain new knowledge, but we focus on organization data evaluation instead of the process of knowledge creation.

Table 1
Ontology approach and concept

Authors	Approach	Conceptual
Kang et al. (2010)	• Ontology enterprise architecture • Zachman's enterprise architecture framework	Development of a business process to enhance the business environment.
Kang, Lee & Kim (2010)	• Fact based enterprise ontology • Enterprise meta model • Enterprise architecture	Measuring organization resource for enterprise process and strategy.
Han & Park (2009)	• Enterprise ontology • KMS	Knowledge on enterprise performance.
(Jimeno-Yepes et al.(2010)	• Ontology refinement	Data usage and information retrieval to enhance enterprise performance.
Huang & Diao (2008)	• Ontology • Semantic Web Rule language	Managing enterprise knowledge during the business process.

Table 1 lists various approaches in previous studies and shows that most focus on the development of an enterprise ontology which is similar to our goal. For example, Kang et al.(2010) examined the relationship between business systems and the staff within an organization in order to better understand the communication problems which hinder collaborations with other organizations. The authors developed an ontology based on enterprise architecture. Another example of enterprise architecture was proposed by Kang et al. (2010) who developed an enterprise ontology to support enterprise strategies. In this study, they looked at the organization's resources that support enterprise processes based on the organization's strategies. Han & Park (2009) studied business processes in relation to a knowledge management system as knowledge is a critical driving force in relation to the organization achieving its performance

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goals. In this study, they investigated if knowledge was separated from the business process hence hindering the target performance. Jimeno-Yepes et al. (2010) studied ontologies in information retrieval (IR). In this study, the authors examined whether ontology resources appeared in IR either to perform semantic indexing of documents or to produce a better organization of retrieved documents. Lastly, Huang & Diao (2008) studied knowledge integration using ontologies. In this study, an ontology becomes an important concept for knowledge integration where enterprises are getting more knowledge intensive with the development of various types of knowledge within organizations. Our work is similar to that of Kang et al.(2010), Han & Park (2009) and Jimeno-Yepes et al. (2010) in terms of ontology development within an enterprise. However, our work can be seen to be a quality model by focusing on organization data evaluation within the context of the organization's goals.

3.2. Organizational goals

Barlas & Yasarcan (2006) provided a model for goal setting in order to support an organization's performance. In this study, the organization's performance level is evaluated in relation to the organization's goals, and, in return, the effectiveness of the goal should be evaluated also. Studies on organization's goals have been conducted since the 1970s. In addition, the identification of variables was first studied in 1973 by England & Lee (1973). They studied the influence on perceiving organizational goal. In this study, the authors identified several variables in order to represent a relatively diverse group for organization's goal. This study was supported by Lusk and Oliver (Lusk & Oliver, 1974), who focused on the social goals involved in the achievement of the overall organizational goal. On the other hand, Hall & Hall (1976) identified several variables in order to study the relationship between various organization goal. In this study, the authors investigated the relationship between goals, performance, success, self-image, involvement and future goals. A recent study by Ceresia (2011) proposed a model for the development of dynamic goals within the organization. The authors focused on the systematic dynamic for goal rather than analysing the usage of data in the achievement of organizational goal. This paper is less focussed on the goal process as discussed in Lusk & Oliver (1974), Hall & Hall (1976) and Ceresia (2011), rather, our work evaluates organization data which is in line with organization goals. Our work evaluates the degree to which the validity of quality organization data in the achievement of the organization's goals.

3.3. Importance of data and information in decision making: Related issues

Entrepreneurship is an important aspect in economic development and wealth creation (Christensen & Bower, 1996; Song et al., 2010). However, many new entrepreneurs are failed to identify the quality of organization data which can lead to poor decisions in relation to the organization's finance. A previous empirical study on new U.S technology ventures found that after four years, only 36% of companies survived and after one more year, the survival rate decreased to 21.9% (Song et al., 2008). Bad management in terms of the collection of information and subsequent poor planning based on this information is one explanation for this failure (Gruber, 2007). In the real business world, collecting high quality information and formulating a suitable business plan based on this information is crucial as entrepreneurs rely on organization data to assist in decision making. Thus, it is important for entrepreneurs to collect data that can improve their decision making.

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This section discussed past studies which focused on enterprise's ontologies, in similar way to this paper, but none of the previous studies focus on ontology development in relation to the organizational goals. In this paper, we identify organizational goal elements to develop an organizational goal ontology. Many studies on data evaluation have been conducted but little research has been directed to the evaluation of organization data in the achievement of the organization's goals. Past studies discussed organizational goals but none evaluated the quality of the organization data in relation to meeting the organization goal. The studies are more on process toward data instead of measuring directly on organization data. These are the gaps in the existing literature have been identified and our aim in this paper is to develop a model in an effort to evaluate the degree to which the retrieval of relevant and quality organization data assists the organization to achieve its organizational goals.

4. Organizational goal elements

In this section, we briefly describe organizational goal elements in an effort to develop our model. To make the explanation as clear as possible, the discussion takes place in the context of the organization. The process is as follows. First, we identify organizational goal elements. The elements are the organization's goals, sub-goals, actions and tasks. Then, we discuss the relationship between these elements. In the rest of this paper, we denote organization goal as Org_{goal}, sub-goal as Sub_{goal}, action as A_{ction} and task as T_{ask}. After this, we identify the roles between Org_{goal} elements based on ontology. In the rest of this paper, we expand the ontology for Org_{goal}.

4.1. Role

In this section, we introduce the basic relationship of Org_{goal} based on the organization's ontology. The relationships involve the elements of Org_{goal}, Sub_{goal}, A_{ction} and T_{ask}. In particular, every organization has Org_{goal} that specifies the target that the members of organization try to achieve. This Org_{goal} consists of a single Sub_{goal} or several Sub_{goals} to be achieved. However, A_{ction} is necessary required to achieve Sub_{goal}. This A_{ction} comprises T_{ask} in order to achieve Sub_{goal}. T_{ask} is defined as a number of activities that are involve in A_{ction}. These activities rely on organization data in order to perform Org_{goal} elements. In order to support our discussion, we developed an organization ontology model based on Org_{goal} elements. The concept, based on the use of an ontology, has been studied previously in order to identify the relationships within the organization (Fox, Barbuceanu, & Gruninger, 1996) but we improve this ontology model based on Org_{goal} elements. Fig. 1 illustrates our Org_{goal} elements using an ontology.

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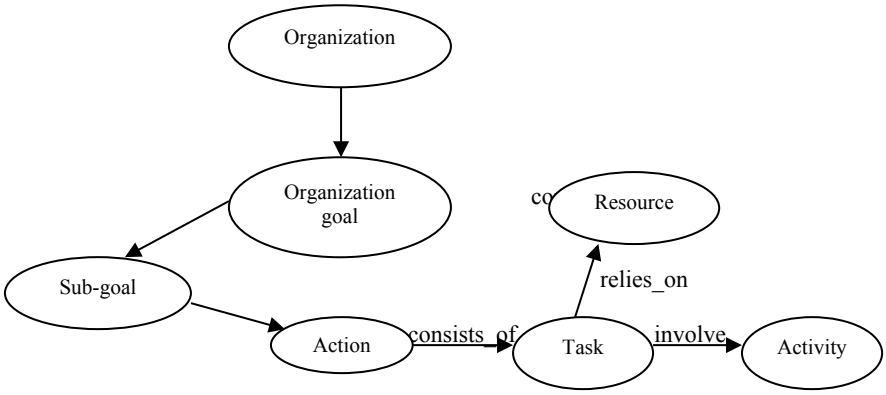

Fig. 1. Org_{goal} elements.

Based on Fig. 1, role is defined as a function of Org_{goal} elements in an organization. Each role can be indicate as

- *Has:* Organization *has* Org_{goal}.
- *Consist:* Org_{goal} *consist* Sub_{goal} to support Org_{goal}.
- *Requires:* Sub_{goal} *requires* A_{ction} with a number of activity that have been defined to achieve the goal.
- *Consist:* A_{ction} *consist* T_{ask}.
- *Rely:* T_{ask} *relies* on resource as organization data.

4.2. Organization

An organization is defined as a social group of people working in one scope of activity to achieve Org_{goal}. An organization involves several elements which make up Org_{goal}, as shown in Fig. 1. Here we denote organization as

$$has(Org, Org_{goal})$$

signifying that an organization has Org_{goal}.

4.3. Organization goal

An organizational goal is the most important target in any organization. It consists of the process of identifying the aim of the organization. In order to achieve Org_{goal}, an organization develops Sub_{goal}. Here we denote Org_{goal} as

$$consist(Org_{goal}, Sub_{goal})$$

signifying that Org_{goal} consists of Sub_{goal}.

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4.4. Sub-goal

A Sub_{goal} is defined as an out-come which is necessary to achieve Org_{goal}. Setting Sub_{goals} is important in order for the organization to develop a plan part of the process of identifying the activities which need to be performed in the achievement of the Org_{goal}. Sub_{goal} is used as a platform by which to examine the organization's progress toward achieving its main goal. However, A_{ction} is required to perform Sub_{goal}. We denote Sub_{goal} as

$$requires(Sub_{goal}, A_{ction})$$

signifying that Sub_{goal} requires A_{ction}.

4.5. Action

A_{ction} is a set of activities performed by T_{ask} in order to achieve Org_{goal}. Here, A_{ction} depends on T_{ask} and T_{ask} is an activity in the achievement of Org_{goal}. We denote A_{ction} as

$$consist(A_{ction}, T_{ask})$$

signifying that A_{ction} consists of T_{ask} in the progress toward Org_{goal}.

4.6. Task

T_{ask} is an activity performed in A_{ction}. However, as shown in Fig. 1, T_{ask} relies on resources, that is, organization data. Organization data is the most important asset of the organization in performing its daily activities. We denote T_{ask} as

$$rely(T_{ask}, D_{ata})$$

signifying that T_{ask} relies on data.

5. Relationship modelling concept

In this section, we specify the model concept. To explain this concept as clearly as possible, we define Org_{goal} elements in the context of the university library. First, we expand the definition of Org_{goal} elements from the previous section. Then, we develop the relationships for the Org_{goal} elements in order to support our model.

5.1. Organization goal

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In organizations, an Org_{goal} is very important because it is an achievement target. Sub_{goals} are developed in order to support Org_{goal}. Sub_{goal} becomes a guideline for organizational performance and progress toward Org_{goal}. For example, let's look at Org_{goal}, Sub_{goal} and A_{ction}. As discussed in Section 4, Org_{goal} consists of Sub_{goal} and Sub_{goal} requires A_{ction}. If we define Org_{goal}, then we conclude Org_{goal} as

$$Org_{goal} = Sub_{goal} + A_{ction}$$

where Org_{goal} depends on Sub_{goal} and A_{ction} to achieve its goal. Taking an example in the context of the university library, if the main objective or goal is to *Transform Student Lives Through Learning*, then the Sub_{goal} is to *Create Pathways for Underrepresented Students* AND *Substantially increase student enrolments.* In order to achieve the Sub_{goal}, Sub_{goal} requires A_{ction}. For example, the Sub_{goal} *Create Pathways for Underrepresented Students* is decomposed into *Contribute to the School Partnership Program* OR *Work with relevant University staff*. The ontology model for our organization can be decomposed into an AND/OR goal tree. We demonstrate this process in Fig. 2.

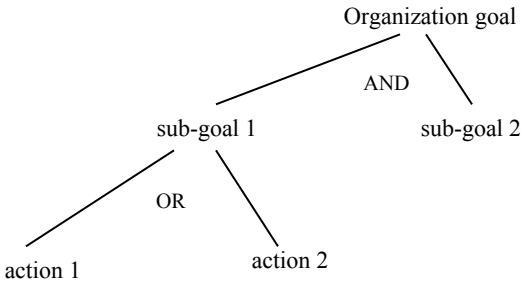

Fig. 2. Goal tree model.

If the relationship is 'AND' then we can present Org_{goal} as

$$Org_{goal} = consist(Org_{goal}, Sub_{goal}\ 1) \wedge consist(Org_{goal}, Sub_{goal}\ 2).$$

This relationship is described as Org_{goal} consisting of $Sub_{goal}\ 1$ and $Sub_{goal}\ 2$ where "$\wedge$" represents AND. If the relationship is 'OR' then

$$Sub_{goal}\ 1 = requires(Sub_{goal}, A_{ction}\ 1) \vee requires(Sub_{goal}, A_{ction}\ 2).$$

The relationship is described as $Sub_{goal}\ 1$ requires $A_{ction}\ 1$ or $A_{ction}\ 2$ and "$\vee$" represent OR. As shown in Fig. 2, $A_{ction}\ 2$ depends on $A_{ction}\ 1$ if $A_{ction}\ 1$ cannot be achieved then $A_{ction}\ 2$ is required, where "$\supset$" is denoted as dependence.

$$A_{ction} = Sub_{goal}\ 1(A_{ction}\ 1) \supset Sub_{goal}\ 1(A_{ction}\ 2)$$

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5.2. Organization sub-goal

In this paper, we define Sub_{goal} as sub-components in order to achieve Org_{goal}. It forms a part of a main goal. It is very important for organizations to identify the Sub_{goal} which are necessary to achieve in order to meet the Org_{goal}. For example, if the main objective or goal is to *Transform Student Lives Through Learning*, then the Sub_{goal} is to *Create Pathways for Underrepresented Students*. Based on this Sub_{goal}, A_{ction} is developed in order to achieve this Sub_{goal}.

5.3. Organization action

Sub_{goal} requires A_{ction} in order to realize Org_{goal}. Here, A_{ction} comprises T_{ask}. This T_{ask} is a set of activities to perform A_{ction} to achieve Org_{goal}. The relationship between A_{ction} and Sub_{goal} also provides extra alternatives in order to achieve Org_{goal}. In addition, A_{ction} provides a systematic organizational plan which must be followed to achieve its objectives. Using the same example, if the main objective or goal is to *Transform Student Lives Through Learning*, then the Sub_{goal} is to *Create Pathways for Underrepresented Students*. Here A_{ction} to achieve this goal is '*to work with relevant university staff to develop programs to support under-prepared students*' or '*review and further develop the library website in order to create more effective gateways for diverse client groups*'.

5.4. Organization task

T_{ask} is defined as a group of activities that is required in order to perform A_{ction} so as to achieve the Org_{goal}. In this paper, an organization task is a T_{ask} that an organization performs in the context of the organizational environment in order to achieve Org_{goal}. T_{ask} and activities rely on organization data to assist A_{ction} in the achievement of the Org_{goal}. For example, if A_{ction} is '*to work with relevant university staff to develop programs to support under-prepared students*' then the possible T_{ask} is to '*identify the student background in order to identify the most suitable program*'.

6. Metric

As discussed in the previous sections and taking into account the discussion on Org_{goal} elements, we define a set of metrics for our model. In this paper, a metric is important in order to support our model in an effort to evaluate organization data in the achievement of the Org_{goal}. We develop a metric model based on the relationship between Org_{goal} elements. In order to develop our metric, we propose five main steps. First we discuss our metric proposal. Second, we set a scale of metrics to evaluate organization data. This scale is important to identify the value of organization data based on Org_{goal} elements. Third, we identify organization environment E between Org_{goal} elements. Environment is denoted as E in this paper. Fourth, we define the rules for our metric. We identify the variable relationship based on the value of organization data. Lastly, we discuss the metric requirement and metric analysis.

6.1. Metric proposal

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We describe the definition stages of the metric model as illustrated in Fig. 3 below. Fig. 3 illustrates the process regarding the metric model. This process has been discussed in (Soligen & Berghout, 1999) but the authors discussed the process in relation to software improvement such as GQM but we improve this process as an effort to develop a metric to evaluate organization data in the achievement of the Org_{goal}.

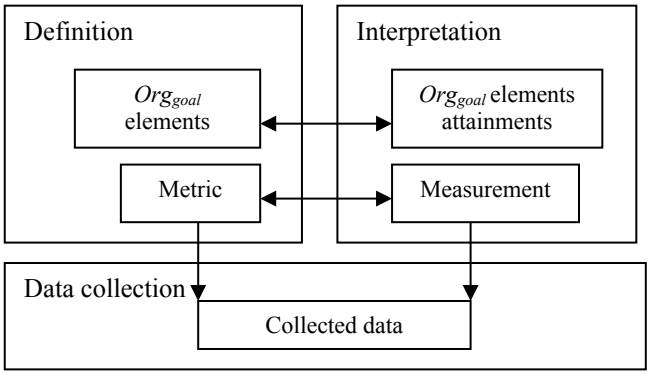

Fig. 3. Stages of the metric model.

In the definition stage, we define Org_{goal} elements and develop a metric based on this definition. In the interpretation stage, this is the measurement which is based on data collection. This is a model we develop in this paper in an effort to evaluate organization data which will be in line with Org_{goal}.

6.2. Metric definition

We specify the process as follows. Organization data is collected and the mean percentage is identified in the collection of organization data. A metric is used to identify the value for the mean percentage. A metric is important in measuring the value of the organization goal. For this metric, the mean is defined in the context of Org_{goal}.

We define our metric based on a scale (1→ 7): low (0-2), fair (3-5) and important (6-7). This scale is important in identifying the value of organization data between Org_{goal} elements. For this metric, the relationship between Org_{goal} elements is represented as E. Three main E within Org_{goal} elements are

Environment 1: E between Org_{goal} and $Sub_{goal.}$
Environment 2: E between Sub_{goal} and $A_{ction.}$
Environment 3: E between A_{ction} and $T_{ask.}$

In order to propose the metrics in this paper, we must take into account the different levels of E. First, E between A_{ction} and T_{ask} refers to the value of organization data in the completion T_{ask}. This is because A_{ction} depends on T_{ask}. Second, E between Sub_{goal} and A_{ction} refers

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to the value of organization data that supports E between A_{ction} and T_{ask}. Lastly, E between Org_{goal} and Sub_{goal} refers to the value of the overall Org_{goal} from A_{ction} and T_{ask}, and Sub_{goal} and A_{ction}.

In this metric, we outline a rule to evaluate the value of organization data in relation to E. The rules are as follows. If the value of $E \leq 2$, then organization data is not important, but if the value of $E \geq 3$, then the organization data is important and needs to be considered during the decision making process.

6.2.1. Variable identification

The next step is to identify the variables in the organization data. Justifying the variables is very important in order to identify the dependent variables and independent variables between the Org_{goal} elements. It is important to identify the set of components known as latent vectors which perform an immediate decomposition between the variables. In this metric, the variables are based on E. Thus, we define rules for variables as follows:

- Variable rule 1: E between Org_{goal} and Sub_{goal} then Org_{goal} is a dependent variable and Sub_{goal} is an independent variable because Org_{goal} depends on Sub_{goal}.

- Variable rule 2: E between Sub_{goal} and A_{ction} then Sub_{goal} is a dependent variable and A_{ction} is an independent variable because Sub_{goal} depends on A_{ction}.

- Variable rule 3: E between A_{ction} and T_{ask} then A_{ction} is a dependent variable and T_{ask} is an independent variable because A_{ction} depends on T_{ask}.

We specify the metric as organization data is collected and the mean percentage is identified among organization data. A metric is used to identify the mean's value. This value is based on the rule of the value on E. The next step to propose a metric, a metric is clarified based on metric requirements and metric analysis. This clarification is very important in an effort to identify the main criteria to achieve the metric development.

6.3. Metric clarification

It is important that the metric verifies both the quantitative and qualitative measures of organization data, because as the volume of organizational data increase, the metric is able to refine the data. The clarification process is very important to make a statement in metric development more clear.

6.3.1. Metric requirements

We define metric requirements as a metric design of what needs to be accomplished during the metric process. We identify two variables in metric requirements which are verifiable and measure. In this metric, verifiable is defined as a set of data that been agreed for converting process into measure. Thus, metric must have the capability of being verified and meets the regulatory concept. Meanwhile, measure is defined as characteristics in a numerical or nominal

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form. In this case, metric must have the ability to integrate over all possible processes, algorithms or functions.

6.3.2. Metric analysis

Metric analysis is defined as a requirement that must be fulfilled in metric development. We identify three variables in metric analysis: control, communication and improvement. In this metric, control is the ability of metrics to evaluate and control the source they are measuring. Communication is the ability of metrics to communicate externally and internally for the purpose of control. Improvement is the ability to identify the gaps for improvement.

Based on the discussion of metric requirements and metric analysis, the metric can be written as

$$Metric: (MetReq)(MetAna)$$

and

$$Metric: (V_{erifiable}, M_{easure})\ (C_{ontrol}, C_{ommunication}, I_{mprovement})$$

where metric requirement and metric analysis are the variables of the metric model. Finally, we concluded that the metric model in this paper allows the evaluation of organization data in relation to gaps, setting and change.

7. Case study

7.1. University and Library goal and action

In this section, we present a case study to test our model. First, we develop an ontology model based on a case study. We apply data from the university's library in this case study. Then, we improve the library's interpretation of the library data based on the metric. Finally, we identify the variables and the relationship between the variables.

In order to deeply understand the concept, let's use a simple scenario. The scenario discusses A_{ction} performed by La Trobe University Library in relation to La Trobe University's mission or goal (see www.latrobe.edu.au/library). The university's goal is to 'Transform the lives of students and communities through learning and knowledge'. This goal consists of a Sub_{goal} which is to 'create new and useful knowledge'. Next, the university requires several A_{ction} to achieve this Sub_{goal}. This scenario necessitates looking at the library's A_{ction} that supports the university's A_{ction}, the university's Sub_{goal} and the university's goal.

The first university A_{ction} to support the university Sub_{goal} is to 'increase the quantity and quality of research activity'. This university A_{ction} is supported by the library's A_{ction} such as 'establish research data management services', 'investigate the provision of a bibliographic citation reporting service, promote the new postgraduate study room in library Melbourne campus' and 'extend and promote digital object management services'. The second university A_{ction} to support the university Sub_{goal} is to 'develop knowledge exchange programs'. In order to achieve this university A_{ction}, the library has developed A_{ction} to 'develop strategies for increasing

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the number of full text open access research output in the repository'; hence, this Library A_{ction} is important in increasing the impact and reputation of La Trobe University's research. Another library A_{ction} is to 'enhance the profile and maximise the use of library special collection'. This has been done through the promotion, digitisation and collection acquisition. The last university A_{ction} to support the university Sub_{goal} is to 'produce more excellently trained research graduates'. The university's library has developed an A_{ction} to assist this university A_{ction}, this being to 'develop a research gateway on the library website for academic staff and postgraduate students' and to 'provide targeted outreach services for academic staff and postgraduate students' that is tailored to research skills training.

The above example gives a complete picture of Org_{goal}, Sub_{goal} and A_{ction} within the university and library environment. Fig. 4 shows the entire relationship based on the ontology. In this concept, A_{ction} consists of T_{ask} and T_{ask} relies on data to perform Org_{goal}. Taking one university and library A_{ction} as an example, the university A_{ction} is to 'produce more excellently trained research graduates' and the library A_{ction} that consists of the T_{ask} is to 'develop a research gateway on the library website for academic staff and postgraduate student'. The data that the library required in the achievement of these T_{ask} and A_{ction} is 'data on previous research year', 'data on research area' and 'data on research publication'. These data help the library to develop a research gateway within the website. Hence, users can rely on this data to perform their research. Fig. 4 illustrates the ontology relationship in this case study.

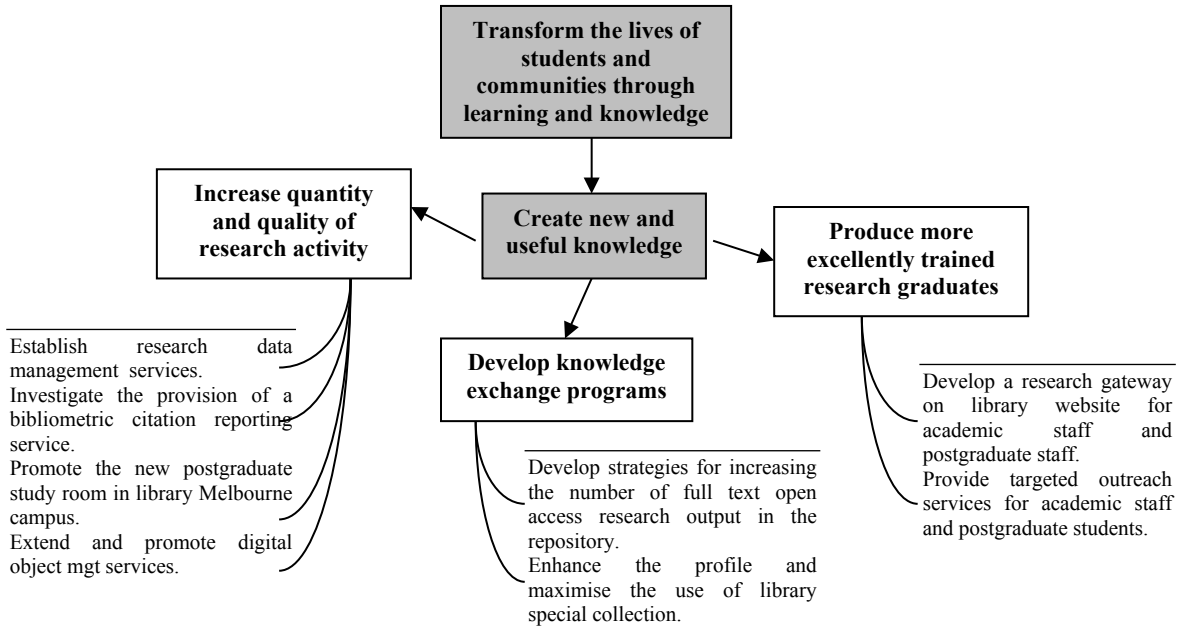

Fig. 4. Ontology relationship between goal (university goal), sub-goal (university sub-goal) and action (university action and library action).

7.2. Evaluation steps

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In this case study, data were obtained from the La Trobe University Library (see http://www.lib.latrobe.edu.au/about/surveys.php). In this survey, library performance has been evaluated based on two aspects, that is, the importance of the library and the performance of the library (see Table 2 and Table 3). Thus, we choose these aspects as a main focus in examining if the library data assist the achievement of the library and university A_{ction}. Based on the library's interpretation of data, the library data were ranked and we used this ranking to identify the important aspects in order to achieve the library A_{ction} in relation to the the university's goal. In this section, we improve the library's interpretation of data using a metric. In this paper, a metric is important in order to evaluate the library's data in an effort to identify the value of the library's data. In this case study, we do not apply any data analysis but we used real survey data from the library, as we described as being important for the library A_{ction} in the achievement of the university's goal. Finally, we improve the interpretation of the library's data and we conclude the result of the library data.

7.2.1. Data selection

In this paper, we obtained data from the library's website but the library data were too vast. In order to implement our concept, we select data that are suitable to support the library's importance and performance. At this stage, the library data were selected randomly because the library had already interpreted these data based on the Insync Survey[1]. Thus, we used these library data in an effort to implement our concept. Selected Library data are shown in Table 2 and Table 3.

7.2.2. Metric measurement and results

In this paper, we measured the extent of the metric model that is vital to identify the value of the library data that are important in the achievement of the library A_{ction} and the university goal (as discussed in Section 5.5). Using real library data, the library has already interpreted these data by as 1 being low and 7 being high. However, we improved this interpretation by using our definition based on metric (1→7): low (0-2), fair (3-5) and important (6-7). Let's denote the organization's environment as E and the rule to consider E is based on this metric. Using this interpretation, we summarized a simple rule to interpret library data. If $E \leq 2$ then the data in T_{ask} and A_{ction} is not important and if $E \geq 3$ then the data in T_{ask} and A_{ction} are important and need to be considered during the decision making process.

Table 2. What users believe to be important for the library

Important	Mean	Important	Mean
Online resource (eg e-journals, database, e-books) meet my learning and research needs	6.54	Library staff treat me fairly and without discrimination*	6.44
Library staff provide accurate answers to my enquiries*	6.51	Library staff are readily available to assist me*	6.43
Library staff are approachable and helpful*	6.49	The library web site is easy to use	6.42
I can get wireless access in the	6.46	The items I'm looking for on the	6.41

[1] Insync Surveys ensures libraries can measure performance against each other that help libraries to develop the highest possible standards of service for library users.

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library when I need to*		library shelves are usually there	
When I am away from campus I can access the library resources and services I need*	6.44	The library catalogue is easy to use	6.40

*The same variables as Table 3

In Table 2, we present the result based on what users believe to be important for the library. The results concluded that users believe that all the aspects in Table 2 are important. The results show that these library data are important for the library to achieve library A_{ction} in relation to achieve university's goal.

Table 3. How users believe the library is performing

Performance	Mean	Performance	Mean
Library staff treat me fairly and without discrimination*	6.19	The library web site is easy to use	5.64
Library staff provide accurate answers to my enquiries*	5.85	I can get wireless access in the library when I need to*	5.63
Library staff are approachable and helpful*	5.84	Library staff are readily available to assist me*	5.63
Self Service (e.g. self check loans, requests, renewals, holds) meets my needs	5.81	Books and articles I have requested from other libraries and campuses are delivered promptly	5.62
When I am away from campus I can access the library resources and services I need*	5.69	Opening hours meet my needs	5.60

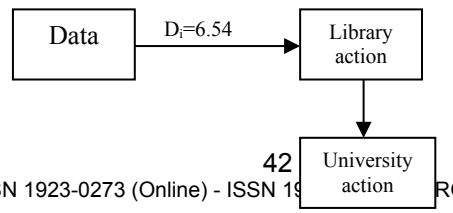
*The same variables as Table 2

In Table 3, we present the results based on how users view the library's performance. Based from the results in Table 3, we can conclude that the library is performed in order to fulfil user's satisfaction. The results show that these library data are important for library to evaluate its performance in relation to achieve library A_{ction}.

The results in Tables 2 and 3 show that library data are important. These library data are important for library to achieve its A_{ction} in relation to meeting the university's goal. In the next step, we discussed the connection of these library data in the context of Org_{goal} elements.

7.3. Data connection with organizational goal

In this subsection, we demonstrate the concept that we developed in this paper in an effort to evaluate organization data to realise the Org_{goal}. In this subsection, we discussed the connection of library data in relation to achieve library A_{ction} and university A_{ction}. For example, if the library wants to utilise one A_{ction} from Fig. 4 in order to achieve university A_{ction}, then, library data must be evaluated in relation to Library A_{ction}. We referred to library data from Table 2 and developed our explanation as shown in Fig. 5.



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D_{ii}=6.44

Fig. 5. Data flow in relation to the goal: An example.

We describe the information in Fig. 5 as,

1. D_i= Online resource meets my learning and research needs.
2. D_{ii}=When I am away from campus I can access the library resources and services I need.
3. Library A_{ction} = Enhances the profile and maximise the use of the library's special collection.
4. University A_{ction} = Develops knowledge exchange programs.

Thus, we explain Fig. 5 as,

1. Estimate D_i toward library A_{ction}. This D_i is important to support library A_{ction}.
2. D_{ii} is estimate to support university A_{ction}. D_{ii} toward university A_{ction} is important. This shows that library A_{ction} is performed toward university A_{ction}.
3. Based on these two Library data (D_i and D_{ii}), we conclude that these data are important toward library A_{ction} and university A_{ction}.

We used two library data sets as an example to shows the connection between library data and library A_{ction} and university A_{ction} in relation to the university goal. In this example, university A_{ction} is performed based on library A_{ction}, which means that university A_{ction} depends on library A_{ction}. Therefore, based on Fig. 5, we conclude that university A_{ction} is a dependent variable and library A_{ction} is an independent variable.

In this section, we demonstrated the connection between library data based on Org_{goal} elements as shown in Fig. 5. However, in this paper, we do not apply any data analysis but rather used metrics to improve the library interpretation of data. As demonstrated in Fig. 5, we conclude that library data are important to support library A_{ction} and university A_{ction} in relation to achieve university goal because the library data shows a high mean percentage.

In the context of data evaluation between organization data, data analysis is very important in order to measure dependent and independent variable. This process is important to identify the set of components which is known as latent vectors and these vectors perform an immediate decomposition between dependent variables and independent variables. It explains the covariance between dependent variable and independent variable so the focus is the step to estimate organization data within variables. Partial least squares (PLS) regression is one example of this effort. PLS regression can be also used to predict the dependent variables from a large amount of independent variables (organization data).

7.4. Variable relationship

We predict the relationship between what users believe to be important for the library (see Table 2) and how users assess the library's performance (see Table 3). However, we want to

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predict if the library data supports the relationship between library A_{ction} and university A_{ction} in relation to the university's goal. The predictors are variables y_1 to y_6 (see Table 4).

Table 4. Variables

Variables (y)	Important (x_1)	Perform (x_2)	Mean
Library staff provide accurate answers to my enquiries	6.54	5.86	6.2
Library staff are approachable and helpful	6.49	5.84	6.2
I can get wireless access in the Library when I need to	6.46	5.63	6.0
When I am away from campus I can access the Library resources and services I need	6.44	5.69	6.1
Library staff treat me fairly and without discrimination	6.44	6.19	6.3
Library staff are readily available to assist me	6.43	5.63	6.0
Median values	6.45	5.76	6.15

In Table 2 and Table 3, we identified six similar variables in relation to the library's importance and performance. Then, we used library data from these six variables to predict the relationship between the library's importance and performance as shown in Table 4. The reasons we selected these similar variables is because: 1) we want to show the relationship of these variables and 2) we want to identify the value of these variables in relation Library's importance and performance.

In this example, we identified the value of the library data as shown in Table 4 where we conclude library data are important in achieving the university's goal. Then, the relationship is developed between independent variables and dependent variables based on the consistency of library data. Fig. 6 presents the path diagram of these variables.

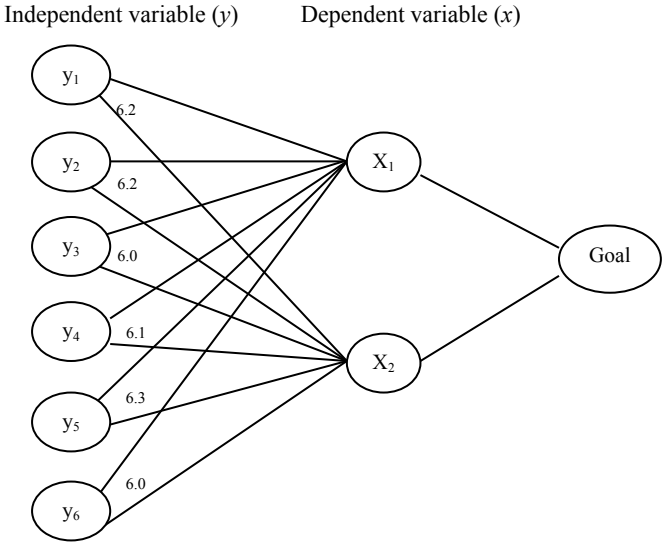

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Fig. 6. Variables diagram.

The relationships in Fig. 6 are summarized based on the variable rules of Org_{goal} elements. The relationships show the connection of library data in order to achieve the university's goal. As presented in Fig. 6, library data are represented by dependent variables and independent variables in an effort to achieve the university's goal. It can be concluded that the relationship between variables are important in order to verify the library data that are important in the achievement of the university's goal.

8. Discussion

Organizations are accumulating vast amounts of data due to the implementation of information system that make it easier to collect and store organization data. Entrepreneurs require organization data to assist them to make decisions and they need to identify valid and current organization data within vast amounts of organization data to support their decision making. The discussion for this paper is justified based on three main processes: model development, metric development and relationship development.

First, model development in this paper is based on Org_{goal} elements. In the model, the relationship among Org_{goal} elements is very important in an effort to evaluate organization data in relation to meeting the Org_{goal}. In order to achieve this, an ontology is applied to create the relationship among Org_{goal} elements. The relationship shows that Org_{goal} consists of Sub_{goal} and Sub_{goal} require A_{ction}. Then A_{ction} consists of T_{ask} to perform Sub_{goal}. These are the Org_{goal} elements that we have identified in our model.

Second, metric development in this paper is proposed to evaluate the value of organization data in relation to the Org_{goal}. The metric is developed based on Org_{goal} elements. In this metric we set a scale and this scale is used to evaluate organization data and to identify the value of organization data. On the other hand, we described Org_{goal} elements as environment E in this metric. It is important to describe E because metrics evaluate organization in the achievement of the Org_{goal} elements based on E. At the end of the metric development, we identified rules in E in an effort to identify the dependent variables and independent variables among Org_{goal} elements. It is important to develop a fit metric concept in order to evaluate the quality of the organization data in relation to achieve Org_{goal}

Third, the relationship of the Org_{goal} elements is developed as discussed in our model. In this paper, relationships are developed among Org_{goal} elements based on a formal ontology. We expanded the relationship where Org_{goal} consists of Sub_{goal} and Sub_{goal} requires A_{ction} and A_{ction} consists of T_{ask}. The relationship is very important in order to identify the variables aspect among these Org_{goal} elements.

In the case study, we used data from La Trobe University Library in an effort to support the university's goal. However, the library data in this case study has already been interpreted but we expanded this interpretation using our metric model.

Results from the case study examined the discussion between Org_{goal} elements in the context of the library goals and the university's goal. In the case study, a relationship is developed between library A_{ction} and university A_{ction} in relation to achieve the university's goal. At the same time, library data from the case study identified the connection between Org_{goal}

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elements in the context of the library. In other words, the model identified the connection between dependent variables and independent variables between the library A_{ction} and university A_{ction} in relation to meeting the university's goal. In light of Fig. 5 in Section 7.3, library A_{ction} is performed in line with university A_{ction}, which means that university A_{ction} depends on library A_{ction} to achieve university's goal. Therefore, we concluded university A_{ction} is a dependent variable and library A_{ction} is an independent variable. Using Fig. 5 as a guideline, it can be concluded that library data are measure between library A_{ction} and university A_{ction} in relation to the achievement of the university's goal. These variables are very important in order to identify dependency in a huge amount of library data in an effort to implement the measurement for library data.

Since data were interpreted by the library, we used a metric to improve the library's interpretation on data. As a result, we concluded that the library data from Table 2 and Table 3 are important to support the library A_{ction} in relation to the university's goal. Finally, we concluded that library data from this case study support our model because library data are positively connected to the model as shown in the ontology. In this paper, Org_{goal} model is developed and organization data is evaluated based on the metric, thus, providing evidence that organization data are important to support Org_{goal}. Finally, the results from the case study concluded that Org_{goal} elements are correlated with each other in relation to meeting the Org_{goal}.

9. Conclusion and future work

The aim of this paper was to develop a model based on Org_{goal} elements and ontology as a tool to evaluate the quality of the organization data in relation to achieve Org_{goal}. This model is important in measuring the extent to which organization data are consistent with the organization goal. Data from the internal and external organization environment is analysed to assist the process of decision making in an effort to achieve Org_{goal}. In Section 1 and Section 2 of this paper, we developed our model based on Org_{goal}. In Section 3, we discussed past studies in order to support our model. In Section 4, we justified our model concept by identifying Org_{goal} elements. In this section, we identified the roles between Org_{goal} elements using a formal ontology model. In Section 5, we developed a relationship between Org_{goal} elements (Fox et al., 1996). In Section 6, we developed a metric model based on Org_{goal} elements. In Section 7, we applied a case study in the context of the library's and university's goal. In this section, we evaluated library data using our metric model. In the case study, we identified independent variables and dependent variables. We concluded that these variables are important in order to identify the dependency within the huge amount of library data.

The main limitations in this paper include the metric model in organization data interpretation, the ontology model based on Org_{goal} elements and the small amount of library data in our case study. In order to eliminate these limitations, further works are necessary. Thus, one future work is to extend our Org_{goal} model by expanding our ontology model. Ontology is important to improve the relationship between Org_{goal} elements. Other future work is to expand the metric model that we have developed in order to interpret future organization data to support Org_{goal}. In this paper, we used library data and we improved the interpretation of library data using our metric. However, in the future, we will apply large organization data in an effort to implement our metric. Therefore, it is important to develop a metric that can fit to any organization data.

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In the nutshell, the main contribution of this paper is to propose a model that seeks to support the evaluation of organization data based on Org_{goal} elements. As a result, the model development needs to deal with organization data inconsistencies, changes and gaps.

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