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STA Data Model for Effective Business Process Modelling

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Abstract

Business process management (BPM) is becoming popular in business, and the business process modelling is a way of representing an organisation to enable its analysis and improvement. A business-friendly modelling is very helpful for business people, and also can act as a communication tool between them and technical IT people. This paper focuses on a new data model, called Source-Transaction-Agent (STA) data model, as a modelling technique for business process modelling. STA data model uses business metadata to assist business and IT person to communicate and participate effectively and efficiently in business data modelling of a system development process. The STA data model uses relational database concept and semantic data modelling, developed by combining Resource-Event-Agent (REA) data model and form-based approach. Entity Relationship Diagram (ERD) is used as the benchmark for the STA effectiveness evaluation. The results show that the STA data model is an effective data model technique for business process modelling.

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Keywords: Business Process Modelling; Database Design; Entity Relationship Diagram (ERD); Source-Transaction-Agent (STA) Data Model.

1. Introduction

Business process management (BPM) is becoming popular in business, and the business process modelling is a way of representing an organisation to enable its analysis and improvement. A business-friendly modelling is very

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helpful for business people, and also can act as a communication tool between them and technical IT people. A good data modelling technique can assist BPM, thus improve the organisation operations.

The development of a database needs to go through the process of data modelling. There are a few conventional data modelling techniques, and one of the popular techniques is the entity relationship diagram (ERD). According to [1], the relational database management system (RDBMS) has become a dominant data processing software these days. ERD, on the other hand, is a popular high level conceptual data model [2]. This model and its variations are frequently used in the conceptual design of database applications. The model describes data as entities, relations and attributes. Relational database is used in most integrated accounting information system (AIS), where the relational database system is the most popular type of database used in transactional processing [3].

On the contrary of ERD's popularity, there are still some other techniques (both conventional and new) which have also caught the attention of system developers. The use of object orientation modelling is one of the options. ERD too, has gone through some development, which resulted in a few variations

This paper focuses on a new data model, called Source-Transaction-Agent (STA) data model, as a modelling technique for business process modelling. STA data model uses business metadata to assist business and IT person to communicate and participate effectively and efficiently in business data modelling of a system development process. This model introduces the 5-steps technique in its data modelling. The use of business forms (source documents) is the priority of the modelling technique. The STA data model uses relational database concept and semantic data modelling, developed by combining Resource-Event-Agent (REA) data model and form-based approach. Entity Relationship Diagram (ERD) is used as the benchmark for the STA effectiveness evaluation.

2. STA Data Model

STA data model (Source-Transaction-Agent) is the variation of ERD which has been expanded in the REA (*Resource-Event-Agent*) data model, as well as the application of the form-based approach. According to [3], REA data modelling is a data model developed for use in AIS database. The name REA is derived from three types of basic objects: resource, event, agent. Fig.1 shows the basic elements of REA data model ([4], [5], [6]).

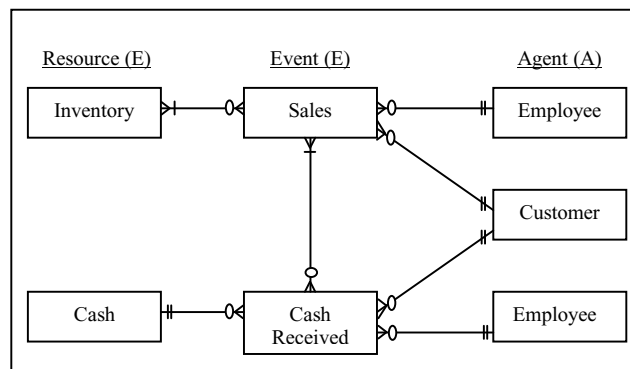


Fig. 1. Example of REA data model

STA data model combines REA data model and the form-based approach, and the emphasis on the use of business metadata ([7], [8]). STA data model introduces “5-Rules” for the development of STA data model of a normal business process:

1. Forms (such as source documents) are used as the main source for modelling.
2. Each T is connected to at least one S or A.
3. Each S, T and A has its own primary key (and their own non-keys/other attributes). But, only T has foreign key/s. S and A should not hold any foreign key.
4. All relationships are either 1:1 or 1:N, except for “bag”.

5. “Bag” (the grid in the form) will create many-to-many (M:N) relationship. 3NF should not have M:N relationship, so need to add a new associative entity to break the M:N into two 1:N relationships. So “WHEN there is a bag, THEN create an associative entity”. This new entity does not have primary key, but will hold foreign keys (the primary keys of those M:N entities) and other related keys in the grid. Thus, those M:N entities will not take the foreign keys taken by the associative entity.

By using this method, normality and cardinality could be bypassed, and achieving 3NF. Fig. 2 shows an example of STA data model.

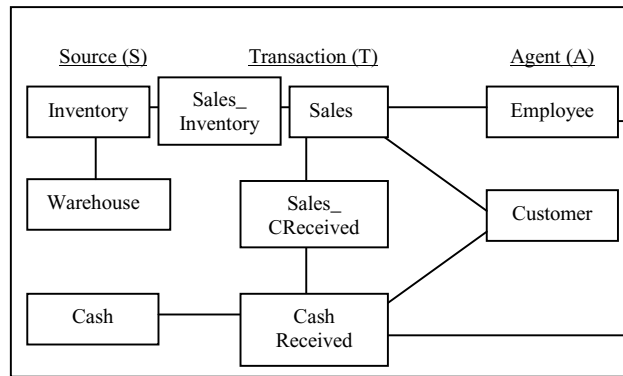


Fig. 2. Example of STA data model

3. Discussion

The goal of this data collection primarily to fulfil the need of REEAM (a model to evaluate the readiness, effectiveness, efficiency, and accuracy). A total of 56 people are involved in the pilot test. The participants of the case study and questionnaires are 263 people, which consists of 57 participants from the case study and another 206 participated in the questionnaires. This paper only focuses on the effectiveness of the data model, compared to ERD.

From the 206 participants of the questionnaires, 61 participants are IT people, while 145 are non-IT people. It is reasonable to have more non-IT people than IT people as this is common in the real organisation that using computers. Group A and B have quite similar number of participants (30 and 31 participants respectively). Group 1, 2 and 3, somehow, have uneven number of participants, due to rearrangement of the groups because difficulty on conducting the workshop. The overcrowded of participants in the workshop for Group 1, although all of them got individual computer during the session, led to the decision to split the next group into two groups, namely Group 2 and 3. About 17 contact hours was spent for each of the group, where the contents consist of introduction to database, STA data model theory and practice, creating database, and discussion. The workshop was done in computer laboratory, to ensure each of the participant have computer to work on developing database (sharing computer is not allowed). Each session consist of one lecturer (or instructor) and teaching assistants to help participants during the session. Microsoft Access was used as database software because it is easy and got internal interface design (VBA).

Table 1. shows the results of the reliability test on effectiveness, using Cronbach's Alpha. The value of Cronbach's Alpha reliability is between 0 and 1[9]. A value bigger than 0.9 is very good [10]. The results in Table 1 show a very high reliability for effectiveness (0.935).

Table 1. Reliability Tests

Construct	Cronbach's Alpha
Effectiveness	0.935

The STA data model has been tested on the accuracy compared to ERD, based on the precision (p), recall (r) and F-score. Participants are expert IT people, and they are given a case study. Each participant (some of them in group, others being done individually, depend on the availability of the experts), after they finish and understand the case study, they can answer the ERD question. Next, a short lecture to introduce STA data model, followed by experts answer the case study using the STA data model.

Table 2 shows the STA got highest scores for all categories (precision (p), recall (r) and F-score), showing better accuracy than ERD. All of the results for STA got higher than 0.8, while ERD only got 0.7 to 0.73. The highest difference between ERD and STA is for precision, then F-score, lastly recall, indicate the accuracy of STA is better than ERD in terms of exactness (precision) and completeness (recall).

Table 2. Accuracy for STA Data Model Compared to ERD

Technique	p	r	F-score
ERD	0.73	0.71	0.70
STA	0.95	0.84	0.88
Difference	0.22	0.13	0.18

Table 3. shows positive correlations among effectiveness variables, indicating that all variables are positively correlated to each other. Most of the correlations are highly correlated (high positive values). It shows the variables are highly correlated.

Table 3. Correlations for Effectiveness of STA Data Model.

Correlation (Pearson) 0.01 level, 1-tailed	STA fulfils system develop- ment tasks	STA is easy to use	STA is reliable	STA reduces workload	STA is easy-to- learn	STA enables data classifica- tion tasks	Overall, STA assists my task effectively
STA fulfils system. development tasks.	1.000	0.680	0.716	0.682	0.409	0.720	0.630
STA is easy to use.	0.680	1.000	0.799	0.755	0.597	0.773	0.683
STA is reliable.	0.716	0.799	1.000	0.729	0.521	0.747	0.693
STA reduces workload.	0.682	0.755	0.729	1.000	0.508	0.714	0.713
STA is easy-to-learn.	0.409	0.597	0.521	0.508	1.000	0.515	0.571
STA enables data classification tasks.	0.720	0.773	0.747	0.714	0.515	1.000	0.778
Overall, STA assists my task effectively.	0.630	0.683	0.693	0.713	0.571	0.778	1.000

Fig. 3 shows very high scores for effectiveness, and the median for all groups are six, except for easy-to-learn.

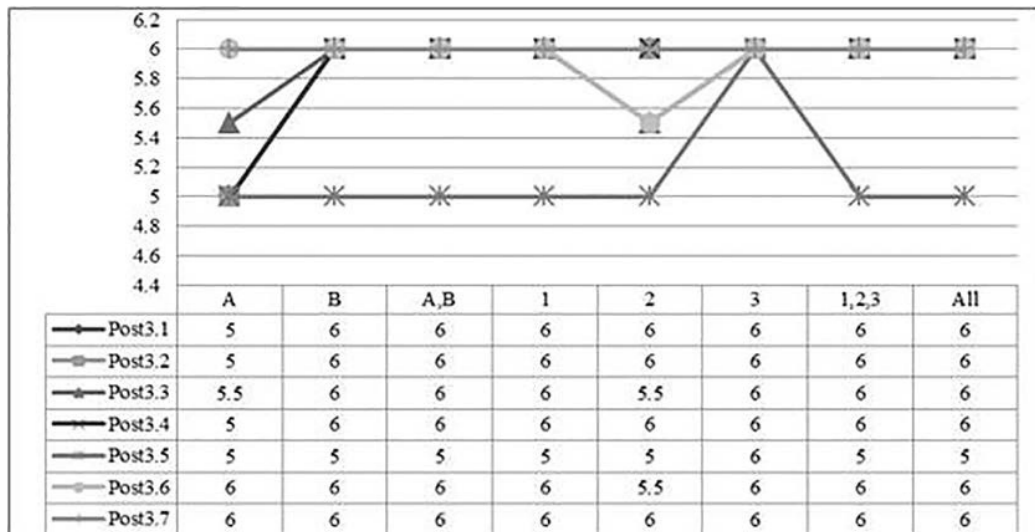


Fig. 3. Medians for Effectiveness of STA Data Model

4. Conclusion

The results show that the STA data model is an effective data model technique for business process modelling. The participants can participate in the process as terms used are familiar and business-friendly. The output of this research should ease the system development process and data modelling technique, and increase user participation. As the STA proven as a better technique, so businesses can start adopting this new technique

In summary, this paper is a research-based study. More research and collaboration of new technique (such as SOA, cloud computing and other data modelling techniques) is needed. It is hope that the STA data model will be of interest to the IT community, especially in Malaysia and can be used as a guideline for data modelling technique.

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