

Risk-plus Financial Data Conceptual Modeling

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Abstract—Great value of assets has been written down for enterprise in the financial crisis. People mainly imputed the losses to the unsolicited credit, while we made out that there is a deficiency in financial forecast system, which is derived from the shortcoming of the framework of data model in today's MIS. Today's MIS employed by enterprises only shows the assets an enterprise holds and the proprietorship of its assets. Today's MIS is built on the traditional data model which does not show stockholders the risks of their enterprise's operation. We have established a new data model to reconstruct the conceptual schema of business database aimed at forecasting and disclosing the risks involved in operation. We name our model risk-plus financial conceptual data model. This paper firstly analyzes the user's requirements for business data; later presents the novel financial data model and illustrate relations among its main parts; finally gives semantic assignment of risk-plus financial data model. The advantage of our risk-plus financial conceptual data model is to provide the information about the risks of an enterprise.

Index Terms—Financial data modeling; Conceptual data modeling; Semantic modeling.

I. INTRODUCTION

According to the Global Financial Stability Report issued by the International Monetary Fund in April 2009, it is estimated that financial institutions over the world face a great losses of \$4,100bn as the global recession erodes the value of their loans and other assets due to the toxic subprime securities that triggered the crisis. Many loans on institutions' balance sheets were falling in value, total write-downs on US assets would reach \$2,700bn, the IMF estimated, almost doubling its forecast of last October.

In order to compensate these great losses, politicians and banker made efforts to merge and restructure those enterprises on the brink of collapse. But the engineers are also promising to find a solution through other channels. We could manage to provide a well performed system for those entrepreneurs so that adequate information about the financial risks could be gained prior to the advent of financial disaster. If we had provided a good MIS forecasting, many institutes would have avoided making such disastrous miscalculations about the credit markets. So a useful

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information system is desirable which can provide data fulfilling financial prediction and financial risk information.

To optimize the MIS function is a challenge. There are many reasons behind the ineffectiveness of today's MIS, but the main factor is the output of MIS does not meet the real need for information user. And what is the very information users indeed desire? If they can find a message about actual situation in a effective and efficient way, a message which really gives them important signal about those enterprises moving towards failure, or a piece of information about risk in detailed figure, from a pragmatic point of view, consequently, a huge corporation is saved from financial plight. However, MIS nowadays fails to do this.

To enhance the information utilities of modern MIS, we need to innovate and improve the information structure of today's MIS. This is the right meaning of business data system development featuring the information age. The information provided by the current MIS always deviates from the enterprise's operation reality owing to the shortage of business data structure. Sometimes, what the managers of enterprises gained in the MIS is a far from enterprises' performance reality. However, current information is always employed to make business forecast, and leads to big loss for enterprises. The reason for such a big discrepancy may include many factors, among which the most significant one is that current business data model only describe limited information for the enterprises' decision making. It seems that some new element should be added into the content or structure of current information systems.

Our research focuses on the new element of business information structure. What kind of information should be added? How this new information element should be presented to users? In what form should this new item be integrated into the traditional business data frame? To solve these problems, we will extend our study as follows.

II. TRADITIONAL BUSINESS DATA MODEL

We have analyzed the traditional business data which are popularly used as contents of general business information. From user's perspective, the current business data model is based on the traditional accounting system well known as the Double-Entry system. The method which dates from 400 years ago ensures that each individual transaction is recorded in at least two different (sections) nominal ledgers of the business bookkeeping and so implementing a double checking mechanism. In accounting it does this by first identifying values as either a Debit or a Credit value. Each transaction must be recorded on the Debit side of one nominal ledger and that same transaction and value is also recorded on the Credit side of another nominal ledger, hence the expression Double-Entry (entered in two locations) indicates one debit and one credit.

In the Double Entry System, business data model is simply defined and ruled by the accounting equation, which is the foundation for the double-entry bookkeeping system. It

shows that business data is constructed in the simple formula as follows:

$$\text{Assets} = \text{Liabilities} + (\text{Shareholders or Owners equity}).$$

The semantic meaning of this formula is how assets were financed: either by borrowing money from someone (liability) or by paying your own money (shareholders' equity). Obviously business information is related to three groups of objects: Assets, Liabilities, and Owner's Equity. Therefore, we can abstract the traditional business data into three classes having been listed in the formula above. In fact, each class expresses an entity. We draw an ER diagram in UML as follows to show the traditional business data model.

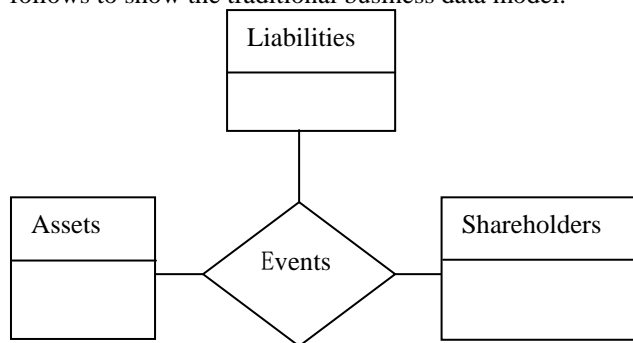


Figure 1. Traditional business data model

In the legacy business model, the relationship between the three parts of information is given by one business event. Events generally come into being in the form of trading transactions. When an event occurs, it brings on the increase or decrease in the amount of two of these three categories at the same time. These relationships make the three parts of information be created and vanish simultaneously. And there are some accounting rules having resided here, which are working as a mechanisms of changing each entity of elements associatively, we show such rules as follows:

- 1) An event that increases total assets must also increase total liabilities or owner's equity.
- 2) An event that decreases total assets must also decrease total liabilities or owner's equity.
- 3) Some events may increase one account and decrease the other on the same class of the model i.e. one asset increases and another decreases.

III. NOVEL FINANCIAL DATA MODEL

Since that the legacy business data model just shows the assets amount that an enterprise held and describes the proprietorship of those assets, the need to show the stockholders the risks is desirable for any parties interested. Notice that lack of the ability of cuing and revealing and disclosing risks in the traditional business information system arises from insufficiency of elements in information contents. We make great effects to restructure the business data model to enhance the MIS's prediction abilities. Our recent work focuses on coming up with a new financial data model to meet the need of client's risks forecast and on managing to solve MIS's problem of presenting risk information with data model. To provide risk-related information, we propose that new element be added into the old business data model. We add the risk dimension to the legacy business data system, which is a milestone in the information system development. To distinguish our novel business data model from the older, we call it as "risk-plus financial data model" for its advantage

of including risk messages in data processing. The following diagram shows the new framework of our risk-plus financial data model.

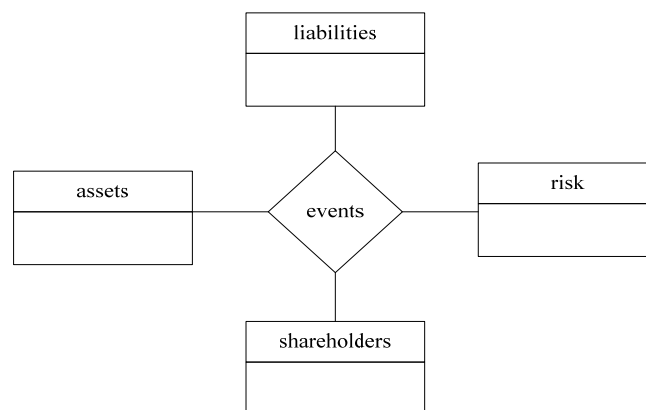


Figure 2. Risk-plus financial data model

Business events occur on a daily basis as a result of doing business, with every event bringing change to two of the four elements, assets, liabilities, and owner's equity, and risks. The most common event is purchasing or selling. Once a purchasing or selling comes up, income is made or expenses are assumed, resulting in changes of two of the four classes as elements in the Risk-plus financial data model. For instance, an enterprise achieves sale, it will change the amount of assets (cash) and income. Another instance is that the bond rating is lowered by bond rating agency. Those events will bring the change in terms of both assets and risks.

IV. THE RELATIONSHIP AMONG FOUR CLASSES

The relationship among the four classes in risk-plus financial data model is expanded on the basis of relationship among the three in the current business data model. The relationship in the new model do not impair the one in legacy model, however, Moreover, new relationship inherits the structure of the legacy relationship and integrated a new element, namely, the risks into the old model. After the absorption the new model has four elements, functionally greatly improved.

What is the relationship among the four elements? Let's start with the analysis of the legacy one with three elements. There is no composition or containment here. Some may think that liabilities and owner's equity compose assets. In fact, this is not true. In appearance, assets contain liabilities and owner's equity. In essence liabilities and owner's equity are determined by the assets. If assets increases or decreases, the corresponding liabilities (or the owner's equity) increases or decreases. After we analyze the three elements of assets, liabilities and owner's equity, we found the dependency among the three is just the *equality* as narrated in section II above.

Analyzing shows that there is no composition among the three elements. At the same time the relationship among the three classes is not aggregation either. We can not identify which is the whole or which is the part. Of course, we can not find a generalization among the three classes either. The relationship of three elements in the current data model is not strong but obviously weak.

Switch to the risk-plus financial data model, The relationship in the new model is compatible with those in legacy model. And the same principle and structure apply

with the old model. The relationship between the four elements in the model is a weak association. In fact, there is dependency relationship between assets and any one of the other three. As shown in Figure 3, any one of liabilities, owner's equity and risks depends on the assets. To calculate the amount of risks to which an enterprise is exposed, firstly we need to identify amount on assets, this is the beginning of our model calculation; secondly the liabilities will make collaboration with their assets, thus gaining the liabilities' information relative to the assets. So liabilities come up as the clients of the service of assets; thirdly the owner's equity need to request services from assets quality and quantity, then we get the information about owner's equity; the 4th step, by evaluating the assets at risks, we acquire data on how much is needed for an enterprise to make compensation for its risks, what amount of discount should be taken. So liabilities, or owner's equity or risks that an enterprise has have an relationship with assets, with the former's value dependent on the latter's.

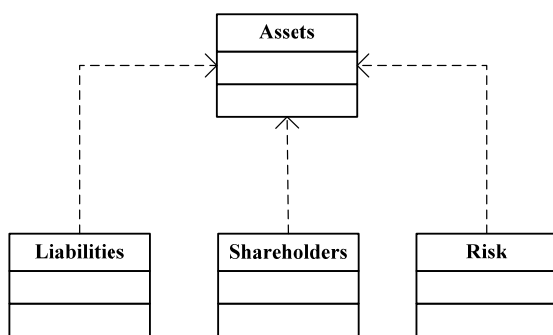


Figure 3. dependence between the classes

V. MAPPING ON ACCOUNTING TIME SPANS

To analyze the relationships among the four classes, we manage to make association between the business information and the time line. Our study has found that there is a kind of timeliness utilizable for information. Information can be attributed to a time span in which it has its meaning and can be used with its timing value. Since information is generated from the events, the events must have relationship with time spans. Our study shows that events can be assigned information in time span respectively [3].

Financial information is a commerce language of communication in the business fields. It presents enterprises' financial situation and operating conditions. Since accounting information can reflect business events from the perspective of time span, and can be attributed into three time periods. We can divide all financial information into three categories; one is financial information about the "past" of enterprise, one about "present" and one about "future". In other word, business information includes the results of measurement in three time categories. Hence, we can give information from the three time spans in our MIS computing, that is, all accounting information can be mapped on three time spans, the "past", the "present", and the "future" of enterprises respectively. This is to say some information is about the past of an enterprise, some about present, and still some about future. Add up all the business data of all single business events of an enterprise, and we will get the full-side business information of an enterprise.

In the risk-plus financial data model, to implement providing data from the perspective of enterprise's past, present and future, we map the information on three time spans. We map the assets information on the past span, liabilities on the present span, owner's equity on the present span, and risks on the future span. The three time periods involved in the risk-plus financial model are called "the former span", "the current span" and "the later span" describing information in the concept of time span. Corresponding business information on the three time spans are called "the former-span information", "current-span information", "later-span information", which is three-span information in one word.

The data source for the three-span information can be got in way of accounting measurement, which is common accounting method to gain information of four entities. Based on the accounting system, and with the mapping from accounting elements to the time spans, our system can attain a structure of tuple with three fields in which we could fill amount of these four elements as attribute values of object in novel financial model.

A good financial model should provide the three-span information so as to give a historical, complete and integrated delineation of an enterprise. Therefore, it is really a pity that information provided by the current financial data model is no more than information in the former span and the current span, while the future information is not presented at all. It is worse that sometimes even the present information is not so reliable, or such messages are simply neglected. The sudden collapse of some multinational companies can, to some extent, be traced to the lack of information about the future, or to the absence of an information data model which can provide information in the later span, namely, the risk information.

VI. THE SEMANTIC ASSIGNMENT TO TIME SPAN

What should we fill in the contents of former-span information, current-span information and later-span information of an enterprise? Or directly, what are the past, the present and the future of an enterprise in the risk-plus financial data model?

A. The current span information of an enterprise

Since the day of its foundation, a firm gets its identity from finance of investors, with the help of laws and statutes. It is a legal entity established by other economic entities or persons, and thus the substance of a firm is the owner's equity and liability. In the case of liquidity, the firm should repay its liability and return the capital right away. So we conclude that the "present" of a firm is its owner's equity and liability.

B. The former span information of an enterprise

The current responsibility results from the financial activities in the past, and assets accumulated through these activities can be an indication of the past of a firm. Just as the fortune of one person made through years of persistent hard work can be a symbol of his past life, the assets of a firm accumulated through its operation activities can be an illustration of its history. To conclude, the assets to a firm are its past tense.

C. The later span information of an enterprise

The future of a firm may be described from aspects of the expected income or reserve funds (for the expected losses),

the usage of funds and the uncertainty in its operation. A firm, during its business activities, has no way to judge or predict the environment or circumstance in the next period, so any knowledge about its future is confined to assumed predictions, such as the pre-allocation of funds, the evaluation of the future profitability, or the estimate of the uncertainty of investment risks and premiums related to it.

VII. CONCLUSIONS

From the analysis above, and comparing Figure 1 with Figure 2, we can come to conclusion that risk-plus financial data model has a function of predicting risks for user. The risk-plus financial data model differs from the traditional business data model. Correspondingly the elements of risk-plus financial data model are more complex than those of the legacy business model. The advantage of the new financial data model is its ability to provide financial information about future to make accurate prediction while old data model does not. Information got from old model gives unreliable business situation message so that enterprises go on operation blindly till the collapse comes. No evasion measures can be taken to recover the losses owing to the lack of risks information in advance. Enterprises will be entangled in various menace like bankruptcy etc.

With our new financial data model and its data provided, enterprise can avoid many crises. By virtue of revealing uncertain factors in operation, risk-plus financial data model gives a full reflection to those enterprises and provide in-depth parsing of future operating of enterprises, so it is a useful model. However, how to implement this model is under the study. Efforts are under way to design a feasible application to apply our innovation. With application of the new data model, enterprise will reveal and forecast the uncertainty about the future, and help itself to predictably avoid market risks and financial risks and shun the crisis in the ever-changing market place.

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