

2014

# BioTechnology

*An Indian Journal*

FULL PAPER

BTAIJ, 10(19), 2014 [11177-11184]

## Study on creation and application of business administration maturity model under data vision field

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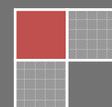
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### ABSTRACT

The data processing industry driven by economic development develops rapidly, a portion of large-scale enterprises outsource the data to special data processing enterprises for processing in order to simplify the production management. Thus, A upstream and downstream industrial chain comes into being, the business conditions of upstream and downstream enterprises interact mutually. The maturity of business administration is an important reflection of an enterprise's comprehensive strength. Client enterprises want to find out whether the maturities of data processing enterprises meet their commercial demand. Data processing enterprises under data vision field wish to know the orientation of their maturity in the competitive market and the direction to adjust the maturity if necessary. If a kind of scientific index is employed to evaluate the business administration strength and display the instance model, the evaluation mode may be objective, accurate and intuitional. The reference method, data statistics method and statistical analysis method are applied in this study to establish the model of maturity of business administration under the data vision field. data with an explanation of the method of applying the model based on instances. The achievements of this study can show the existing situation of business administration accurately, objectively and intuitionally. This model not only enables the data processing enterprises to acquaint themselves with the management level and find out the means required to be adjusted but also enables other enterprises to comprehend the management level and find out the optimal business objects to establish the industrial chain.

### KEYWORDS

Data vision field; Business administration; Maturity of business administration; Model.



## INTRODUCTION

The data processing industry driven by economic development develops rapidly, partial large-scale enterprises will outsource data processing requiring relatively professional skills to special data processing enterprises to realize the full potential of labor forces and material resources. An integrated industrial chain will be established between large-scale enterprises and data processing enterprises. To enhance the competitiveness of the industrial chain, both ends of the industrial chain are required to understand the comprehensive strength of data processing enterprises<sup>[1]</sup>. The maturity of business administration is an important reflection of an enterprise's comprehensive strength. So-called maturity refers to the degree<sup>[2]</sup> that a thing tends to perfectness. Under the data vision field, the degree of perfectness in business administration refers to the enterprise's efficient processing of various data, making full use of existing conditions and responding appropriately to emergencies. The maturity of business administration gives a bird view of an enterprise' comprehensive operating capabilities. The maturity is evaluated from external grade characteristics and the comprehensive index system. External grade characteristics can show the results from the maturity of business administration in macroscopic terms, whereas the comprehensive index system can evaluate the details of the maturity in microcosmic terms. This study will illustrate the theoretical basis and creation method of the model of maturity of business administration under data vision field and explain the method of applying the model based on instances.

### THEORETICAL BASIS OF THE MODEL OF MATURITY OF BUSINESS ADMINISTRATION UNDER DATA VISION FIELD

#### Characteristics of the maturity of business administration under data vision field

##### External grade characteristics of the maturity of business administration under data vision field

The external grades are described as follows:

Grade 1-Disorderness: An enterprise adopts a simple and basic management method, and senior leaders have no concept of business administration.

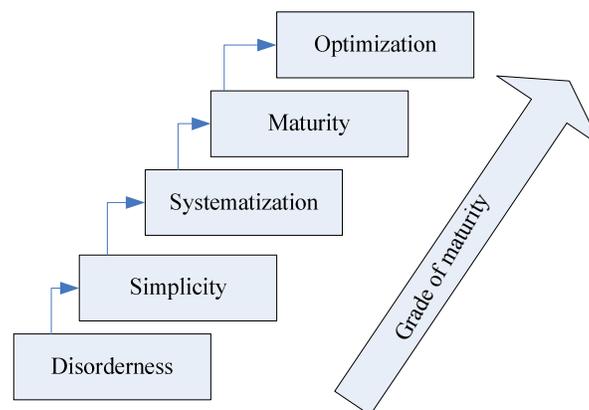
Grade 2-Simplicity: An enterprise bases its preliminary operation and management on certain simple management theories. This type of enterprises has the concept of rights and liabilities concerning management and have formed a basic business processing flow.

Grade 3-Systematization: An enterprise can carry out management in an integrated manner. The enterprise possesses a scientific division of management functions and operational modules.

Grade 4-Maturity: An enterprise has formed a steady management system and business process which can link management with process closely. Employees from all departments work with operational projects as the core.

Grade 5-Optimization: An enterprise has a quite mature management system and business process. The enterprise's self-cure ability enables it to make corrections and adjustment by itself on management and operation to achieve the optimal management.

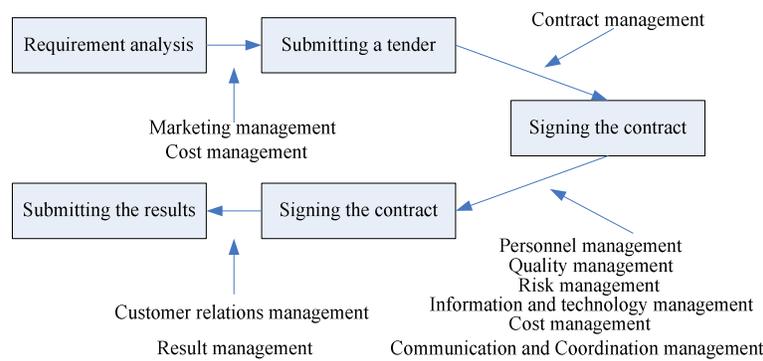
Enhanced maturity of business administration depends on higher level of external grade. An enterprise can improve the management system to increase the grade of maturity of business administration. Figure 1 shows the grade of maturity of business administration.



**Figure 1 : Schematic diagram for maturity grade of business administration under data vision field**

##### Indexes of the model of maturity of business administration under data vision field

Under data vision field, the maturity of business administration is related to business operation. The management and operation process includes determination of a project, submitting a tender, signing a contract, project management planning, data processing and accepting the result in accordance with the management guidelines in each link. Figure 2 shows the extracted indexes for the maturity of business administration.



**Figure 2 : Indexes of maturity of business administration extracted from enterprise management and operation**

**TABLE 1 : Model of maturity of business administration under data vision field**

Objective layer (U)	Criterion layer (U <sub>i</sub> )	Index layer (U <sub>j</sub> )
Level of maturity of business administration of data processing enterprises	U1 Contract management	U11 Criterion of contract texts U12 Contract compliance rate U13 Contract execution standardization U21 Frequency of skills training on employees
	U2 Personnel management	U22 Education status of employees learning instances U23 Employees' overall quality and ability
	U3 Risk management	U31 Risk identification level U32 Level of formulating risk plans U33 Risk monitoring level U41 Soundness of quality management system
	U4 Quality management	U42 Pass rate of data processing U43 Occurrence of quality problems U44 Quality monitoring level U51 Soundness of quality management system
	U5 Information and technology management	U52 Pass rate of data processing U53 Occurrence of quality problems U54 Quality monitoring level
	U6 Cost management	U61 Cost performance index U62 Cost execution rate U63 Rate of change in order processing cost U64 Rationality of distribution of financial resources
	U7 Customer relations management	U71 Customer satisfaction U72 Customer loyalty U81 Timeliness of communications U82 Coordination of progresses of process units
	U8 Communication and Coordination management	U83 Smoothness of communications between superior and subordinate U91 Publicity of enterprises in the market U92 Order acceptance rate
	U9 Marketing management	U93 Rate of using marketing fees U94 Relative market share rate U101 Perfectness of confidentiality of databases
	U10 Results management	U102 Timeliness of submission of business results U103 Soundness of the backup mechanism of databases

## MODE OF CREATING THE MODEL OF MATURITY OF BUSINESS ADMINISTRATION UNDER DATA VISION FIELD

### Preliminary creation of the model of maturity of business administration under data vision field

Provided that the indexes in Figure 2 are taken as the basis and grade 1 indexes, the factors that influence the indexes are taken as grade 2 indexes, then the preliminary creation of the model of maturity of business administration under data vision field can be described as shown in TABLE 1<sup>[7]</sup>.

### Weight calculation for maturity indexes of business administration under data vision field

#### Setting of the fuzzy set for maturity degree of business administration under data vision field

If it is assumed that the maturity of business administration of data processing enterprises is an object to be evaluated, the criterion layer (layer 1) is an evaluation set, and then, the secondary indexes under the set shall be taken as the factors that influence the set. This kind of evaluation method can be expressed by a fuzzy set.

The expression mode is as follows:  $U$  indicates the objective level,  $U_i$  indicates the criterion layer and  $U_{ij}$  indicates the index level. The fuzzy set of the maturity of business administration of data processing enterprises is expressed as follows:

$$U = \{U_1, U_2, \dots, U_{10}\}, U_1 = \{U_{11}, U_{12}, \dots, U_{13}\}, \dots, U_{10} = \{U_{101}, U_{102}, \dots, U_{103}\} \quad (1)$$

The comment set of the maturity of business administration of data processing enterprises is expressed by  $V$  shown as follows:

$$V = \{V_1, V_2, \dots, V_p\} \quad (2)$$

Take  $V_p$  as an example. The comment set of  $V_p$  is expressed as  $V_p (p = 1, 2, \dots, q)$ , which indicates the  $P$  comment result. Based on the five grades of the maturity of business administration under data vision field, comment grades can be described as

$$V = \{V_1, V_2, V_3, V_4, V_5, \dots\} \quad (3)$$

The comment grades correspond to those in Figure 1.

#### Calculation on weight value for maturity indexes of business administration under data vision field

A great number of methods are available to determine the weight values of a fuzzy set. This study adopts the analytic hierarchy process (AHP) that is definitely objective. The AHP is described as follows:

Hierarchy 1 weight value set:

$$A = \{a_1, a_2, \dots, a_{10}, \dots\} \quad (4)$$

And

$$\sum_{i=1}^{10} a_i = 1 (i = 1, 2, 3, \dots, 10) \quad (5)$$

Hierarchy 2 weight value set:

$$A_i = \{a_{i1}, a_{i2}, \dots, a_{ij}, \dots\} \quad (6)$$

and

$$(i = 1, 2, \dots, 10, j = 1, 2, \dots, n) \quad (7)$$

$n$  indicates the number of factors at the criterion layer and expressed as

$$\sum a_{ij} = 1 \quad (8)$$

A matrix can calculate the set of weight values of a fuzzy set of the maturity of business administration under data vision field. The calculation is as follows:

For the fuzzy judgment of the maturity grade of indexes described in a matrix, the maturity grade can be taken as

$$r_{ijp} \quad (i = 1, 2, \dots, m, j = 1, 2, \dots, n, p = 1, 2, \dots, q) \tag{9}$$

The fuzzy judgment can describe the grade of membership of the index  $U_{ij}$  in the  $p$  maturity grade  $V_p$ , that is,

$$r_{ijp} = \frac{V_p}{\sum_{p=1}^q V_p} \tag{10}$$

The fuzzy judgment of the matrix of the fuzzy set of maturity of business administration under data vision field is shown as follows:

$$R_i = \begin{bmatrix} r_{i11} & r_{i12} & \dots & r_{i15} \\ r_{i21} & r_{i22} & \dots & r_{i25} \\ r_{i31} & r_{i32} & \dots & r_{i35} \end{bmatrix} \tag{11}$$

In the matrix,  $i = (1, 2, 3, \dots, 10)$ ,

Fuzzy vector judgment using one factor is as follows:

$$B_i = A_i * R_i = (b_{i1}, b_{i2}, \dots, b_{i5}), i = (1, 2, 3, \dots, 10) \tag{12}$$

Fuzzy vector judgment using more factors is as follows:

$B = A * R = (b_1, b_2, \dots, b_{10})$ , while the value of R is

$$R = \begin{bmatrix} B_1 \\ B_2 \\ M \\ B_{10} \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & \dots & b_{15} \\ b_{21} & b_{22} & \dots & b_{25} \\ b_{101} & b_{102} & \dots & b_{105} \end{bmatrix} \tag{13}$$

**Determination on comment value for maturity indexes of business administration under data vision field**

For fuzzy vector evaluation using one factor, comment values are calculated as follows:  $U_i = B_i * C^T$ , while  $i = 1, 2, 3, 4$ ;

$C$  is the row vector of scores for the maturity grade, and  $C^T$  is the transformation of  $C$ ;  $C = 1, 2, 3, 4, 5$ .

For fuzzy vector evaluation using more factors, comment values are calculated as follows:  $U = B * C^T$ .

**APPLICATION CASES FOR MATURITY MODEL OF BUSINESS ADMINISTRATION UNDER DATA VISION FIELD**

**Description on application cases for maturity model of business administration under data vision field**

A data processing enterprise was established in 2007 and evaluates the maturity of its own business administration by using the maturity model of business administration in this study. Before evaluation, the enterprise sent the administrative staff and important technical personnel questionnaires to calculate the weight values of the model. 15 copies of questionnaires were sent totally, 13 copies are returned and 3 copies are invalid. Qualified questionnaires account for 10 totally. The enterprise's weight values and grades of membership of the indexes are obtained through a one-off check as shown in TABLE 2.

**Method of calculating items of the model of maturity of business administration under data vision field**

**Calculation and application of evaluation vectors**

The judgment vectors at the criterion layer can be calculated using the formula  $B_i = A_i * R_i = (b_{i1}, b_{i2}, \dots, b_{i5})$  and values in TABLE 2. For example, the judgment vectors of contract management can be calculated as follows:

TABLE 2 : An enterprise's weight values and grades of membership of indexes of maturity of business administration

Weight values at the criterion layer ( $U_i$ )	Weight values at the index layer ( $U_j$ )	Maturity grades and grades of membership				
		Disorder ness	Simplic ity	Systemat ization	Maturity	Optimiza tion
		1	2	3	4	5
U <sub>1</sub> Contract management (0.043)	U <sub>11</sub> Criterion of contract texts (0.184)	0	0	0.2	0.5	0.3
	U <sub>12</sub> Contract compliance rate (0.382)	0	0.2	0.5	0.2	0.1
	U <sub>13</sub> Contract execution standardization (0.434)	0	0.1	0.3	9.6	0
U <sub>2</sub> Personnel management(0.131)	U <sub>21</sub> Frequency of skills training on employees (0.227)	0	0.1	0.2	0.6	0.1
	U <sub>22</sub> Education status of employees learning instances (0.314)	0	0	0.2	0.6	0.2
	U <sub>23</sub> Employees' overall quality and ability (0.459)	0	0.1	0.3	0.5	0.1
U <sub>3</sub> Risk management (0.061)	U <sub>31</sub> Risk identification level (0.254)	0.1	0.2	0.4	0.3	0
	U <sub>32</sub> Level of formulating risk plans (0.340)	0	0.1	0.6	0.3	0
	U <sub>33</sub> Risk monitoring level (0.406)	0	0	0.3	0.6	0.1
U <sub>4</sub> Quality management (0.122)	U <sub>41</sub> Soundness of quality management system (0.186)	0	0.3	0.3	0.5	0
	U <sub>42</sub> Pass rate of data processing (0.285)	0	0.2	0.2	0.6	0.2
	U <sub>43</sub> Occurrence of quality problems (0.090)	0.1	0.1	0.3	0.3	0.1
U <sub>5</sub> Information and technology management (0.103)	U <sub>44</sub> Quality monitoring level (0.439)	0.1	0.1	0.3	0.2	0
	U <sub>51</sub> Soundness of quality management system (0.256)	0.2	0.3	0.4	0.1	0
	U <sub>52</sub> Pass rate of data processing (0.274)	0	0.2	0.6	0.2	0
U <sub>6</sub> Cost management (0.132)	U <sub>53</sub> Occurrence of quality problems (0.328)	0	0.2	0.4	0.2	0.2
	U <sub>54</sub> Quality monitoring level (0.142)	0	0	0.1	0.6	0.3
	U <sub>61</sub> Cost performance index (0.233)	0	0.1	0.6	0.2	0.1
U <sub>7</sub> Customer relations management (0.063)	U <sub>62</sub> Cost execution rate (0.225)	0	0.1	0.6	0.2	0.1
	U <sub>63</sub> Rate of change in order processing cost (0.106)	0	0.2	0.4	0.3	0.1
	U <sub>64</sub> Rationality of distribution of financial resources (0.436)	0.1	0.6	0.2	0.1	0
U <sub>8</sub> Communication and coordination management (0.201)	U <sub>71</sub> Customer satisfaction (0.500)	0.2	0.2	0.5	0.1	0
	U <sub>72</sub> Customer loyalty (0.500)	0	0	0.3	0.7	0.2
	U <sub>81</sub> Timeliness of communications (0.328)	0	0	0.3	0.5	0.2
U <sub>9</sub> Marketing management (0.060)	U <sub>82</sub> Coordination of progresses of process units (0.340)	0	0.2	0.4	0.4	0
	U <sub>83</sub> Smoothness of communications between superior and subordinate (0.332)	0	0.1	0.6	0.2	0.1
	U <sub>91</sub> Publicity of enterprises in the market (0.418)	0.3	0.2	0.4	0.1	0
U <sub>10</sub> Result management (0.084)	U <sub>92</sub> Order acceptance rate (0.159)	0.4	0.4	0.2	0	0
	U <sub>93</sub> Rate of using marketing fees (0.065)	0	0.1	0.5	0.4	0
	U <sub>94</sub> Relative market share rate (0.358)	0.2	0.4	0.3	0.1	0
U <sub>10</sub> Result management (0.084)	U <sub>101</sub> Perfectness of confidentiality of databases (0.462)	0.1	0.3	0.4	0.2	0
	U <sub>102</sub> Timeliness of submission of business results (0.435)	0	0	0.6	0.3	0.1
	U <sub>103</sub> Soundness of the backup mechanism of databases (0.103)	0	0.1	0.2	0.5	0.2

$$B_1 = A_1 * R_1 = (0.184, 0.382, 0.434) * \begin{bmatrix} 0 & 0 & 0.2 & 0.5 & 0.3 \\ 0 & 0.2 & 0.5 & 0.2 & 0.1 \\ 0 & 0.1 & 0.3 & 0.6 & 0 \end{bmatrix} = (0.0000, 0.1198, 0.3580, 0.4288, 0.0934) \tag{14}$$

All judgment vectors at the criterion layer can be calculated in the same manner as shown in TABLE 3.

**TABLE 3 : Calculation of judgment vectors for maturity of business administration**

Judgment vector calculation	Calculation formula	Calculation result
Judgment vector of contract management B <sub>1</sub>	A <sub>1</sub> * R <sub>1</sub>	(0.0000, 0.1198, 0.3580, 0.4288, 0.0934)
Judgment vector of personnel management B <sub>2</sub>	A <sub>2</sub> * R <sub>2</sub>	(0.0000, 0.0680, 0.2459, 0.5541, 0.1314)
Judgment vector of risk management B <sub>3</sub>	A <sub>3</sub> * R <sub>3</sub>	(0.0254, 0.0848, 0.4274, 0.4218, 0.0406)
Judgment vector of quality management B <sub>4</sub>	A <sub>4</sub> * R <sub>4</sub>	(0.0439, 0.2218, 0.2895, 0.3788, 0.0660)
Judgment vector of information and technology management B <sub>5</sub>	A <sub>5</sub> * R <sub>5</sub>	(0.0512, 0.1972, 0.4122, 0.2312, 0.1082)
Judgment vector of cost management B <sub>6</sub>	A <sub>6</sub> * R <sub>6</sub>	(0.0978, 0.2191, 0.4690, 0.1683, 0.0458)
Judgment vector of customer relations management B <sub>7</sub>	A <sub>7</sub> * R <sub>7</sub>	(0.0000, 0.0000, 0.2000, 0.6000, 0.2000)
Judgment vector of communication and coordination management B <sub>8</sub>	A <sub>8</sub> * R <sub>8</sub>	(0.0996, 0.1660, 0.4680, 0.2324, 0.0340)
Judgment vector of marketing management B <sub>9</sub>	A <sub>9</sub> * R <sub>9</sub>	(0.2160, 0.3165, 0.3258, 0.1417, 0.0000)
Judgment vector of result management B <sub>10</sub>	A <sub>10</sub> * R <sub>10</sub>	(0.0000, 0.0744, 0.4260, 0.3664, 0.1332)

**Calculation and application of calculating weight**

According to the formula  $U_i = B_i * C^T$ , the following weight value can be obtained:

$$U_1 = B_1 * C^T = (0.0000, 0.1198, 0.3580, 0.4288, 0.0934) * (1, 2, 3, 4, 5)^T = 3.4958 \tag{15}$$

All weight values at the criterion layer can be obtained in the same manner as shown in TABLE 4.

**TABLE 4 : Calculation of judgment values of maturity of business administration**

Comprehensive judgment value calculation	Calculation formula	Calculation result
Judgment vector of contract management U <sub>1</sub>	B <sub>1</sub> * C <sup>T</sup>	3.4958
Judgment vector of personnel management U <sub>2</sub>	B <sub>2</sub> * C <sup>T</sup>	3.7483
Judgment vector of risk management U <sub>3</sub>	B <sub>3</sub> * C <sup>T</sup>	3.3674
Judgment vector of quality management U <sub>4</sub>	B <sub>4</sub> * C <sup>T</sup>	3.3212
Judgment vector of information and technology management U <sub>5</sub>	B <sub>5</sub> * C <sup>T</sup>	3.1480
Judgment vector of cost management U <sub>6</sub>	B <sub>6</sub> * C <sup>T</sup>	2.8452
Judgment vector of customer relations management U <sub>7</sub>	B <sub>7</sub> * C <sup>T</sup>	4.0
Judgment vector of communication and coordination management U <sub>8</sub>	B <sub>8</sub> * C <sup>T</sup>	2.9352
Judgment vector of marketing management U <sub>9</sub>	B <sub>9</sub> * C <sup>T</sup>	2.3932
Judgment vector of result management U <sub>10</sub>	B <sub>10</sub> * C <sup>T</sup>	3.5584

**Calculation and application of comprehensive evaluation**

According to the formula  $B = A * R(b_1, b_2, \dots, b_{10})$ , the fuzzy and comprehensive judgment vector formula of maturity of business administration can be obtained as follows:

$$B = A * R(0.043, 0.131, 0.061, 0.122, 0.103, 0.132, 0.063, 0.201, 0.060, 0.084) *$$

$$\begin{bmatrix} 0.0000 & 0.1198 & 0.3580 & 0.4288 & 0.0934 \\ 0.0000 & 0.0686 & 0.2459 & 0.5541 & 0.1314 \\ 0.0254 & 0.0848 & 0.4274 & 0.4218 & 0.0406 \\ 0.0439 & 0.2218 & 0.2859 & 0.3788 & 0.0660 \\ 0.0512 & 0.1972 & 0.4122 & 0.2312 & 0.1082 \\ 0.0978 & 0.2191 & 0.4690 & 0.1683 & 0.0458 \\ 0.0000 & 0.0000 & 0.2000 & 0.6000 & 0.2000 \\ 0.0996 & 0.1660 & 0.4680 & 0.2324 & 0.0340 \\ 0.2160 & 0.3165 & 0.3258 & 0.1417 & 0.0000 \\ 0.0000 & 0.0744 & 0.4260 & 0.3664 & 0.1332 \end{bmatrix} \quad (16)$$

The value is (0.0709, 0.1542, 0.3754, 0.3328, 0.0796) .

According to the formula, the comprehensive comment value is

$$U = B * C^T = (0.0709, 0.1542, 0.3754, 0.3328, 0.0796) * (1, 2, 3, 4, 5)^T = 3.1638 \quad (17)$$

### Analysis on application cases for model maturity of business administration under data vision field

According to the above calculation result, the comprehensive maturity of the enterprise is 3.1638, indicating that the maturity of its business administration reaches the third grade, namely systematization. The enterprise is relatively competitive in the market, for a majority of management links are in the third grade, though very few remain in the second grade.

## CONCLUSION

To accurately summarize the conditions of business administration under data vision field, this study establishes the model of maturity of business administration in accordance with the theory of maturity of business administration. The model and the method of calculating comment values deduced from the model will guarantee an accurate calculation of the judgment values of maturity of business administration. The model reflects the management conditions of data processing enterprises by evaluating not only the comprehensive management grades under data vision field but also the evaluation model of each management link. The application case testifies that the model of maturity of business administration put forward in this study is of extremely high use value. Readers will be facilitated by this model to understand the comprehensive business administration from the macroscopic and microscopic point of view.

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