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Exploring Antecedents of Relationship Benefits

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Abstract: This study introduces data mining technology into the framework of the antecedents of relationship benefits based self-service environment which is broadly used in relational marketing research. The findings show that the relationship benefits dimensions are confidence and special treatment benefits and their antecedents dimensions are perceived control, efficiency and convenience through the use of web self-service technology, namely web self-service attributes. The results not only provide implications for marketing practitioners but also directions for future research on relational benefits and web self-service technology.

Keywords: Data mining, factor analysis, relationship benefits, web self-service technology

INTRODUCTION

As the competition in the internet retail industry has intensified, the paradigm of relationship marketing theory is increasingly recognized by business and theory and become the focus of contemporary corporate marketing strategy (Gronroos, 1994). Relationship marketing theory believed establish a good customer relationship is an important business strategy for creating competitive advantage (Morgan and Hunt, 1994). The nature of the service industry is relationship-based and service companies always relationship-oriented. The relations between customer and business is a continuous, long-term, stable, mutually beneficial partnerships and through establishing, developing and maintaining such good relations to obtain long-term benefits (Xiao and Xiu, 2008). This study introduces generalized virtual economy theory into the framework of antecedents of relationship benefits. These benefits have been investigated and satisfied customer psychological needs, for example, perceived respects, be loved and social needs (Lin, 2010).

In recent years, with the application of technology-based self-service delivery has grown rapidly, more and more researchers have begun to focus on what kind of relationship benefits customers derive from staying in long-term relationship in the absence of employee contact(e.g., through the use of web self-service technology), an important problem is whether relationship benefits remain relevant in an online context (Barnes *et al*., 2000; Gwinner *et al*., 1998; Reynolds and Beatty, 1999; Hsiu and Gwinner, 2003; Meuter *et al*., 2000). In other words, in the absence of direct interpersonal contact, whether relationship benefits remain relevant through the use of web self-service technology.

Generally the traditional web self-service attributes are using the experience or a simply summarized the literature to summarize, so it is impossible to induce subjective ones. Therefore, it is essential to establish database or warehouse in the internet retailing management system. In this study, we carry on our study by using data mining method which is the process to extract useful information and knowledge that are implicit and unknown in advance but is potential from a lot of vague and random data of the practical application. Effective data mining and analysis in internet retail can help us to find the present and potential antecedents which can influence relational benefits in internet retail.

This study introduces data mining technology into the framework of the antecedents of relationship benefits based self-service environment which is broadly used in relational marketing research. The findings show that the relationship benefits dimensions are confidence and special treatment benefits and their antecedents dimensions are perceived control, efficiency and convenience through the use of web self-service technology, namely web self-service attributes. The results not only provide implications for marketing practitioners but also directions for future research on relational benefits and web self-service technology.

RESEARCH PROCEDURES AND MODELING

This research use data mining to explore antecedents of relationship benefits under web self-service technology environment. The research procedures and modeling were shown in Fig. 1. According to the features of ISMR, inspired by the meta-synthesis, the ways and means of achieving comprehensive and integrated are concluded as follow.

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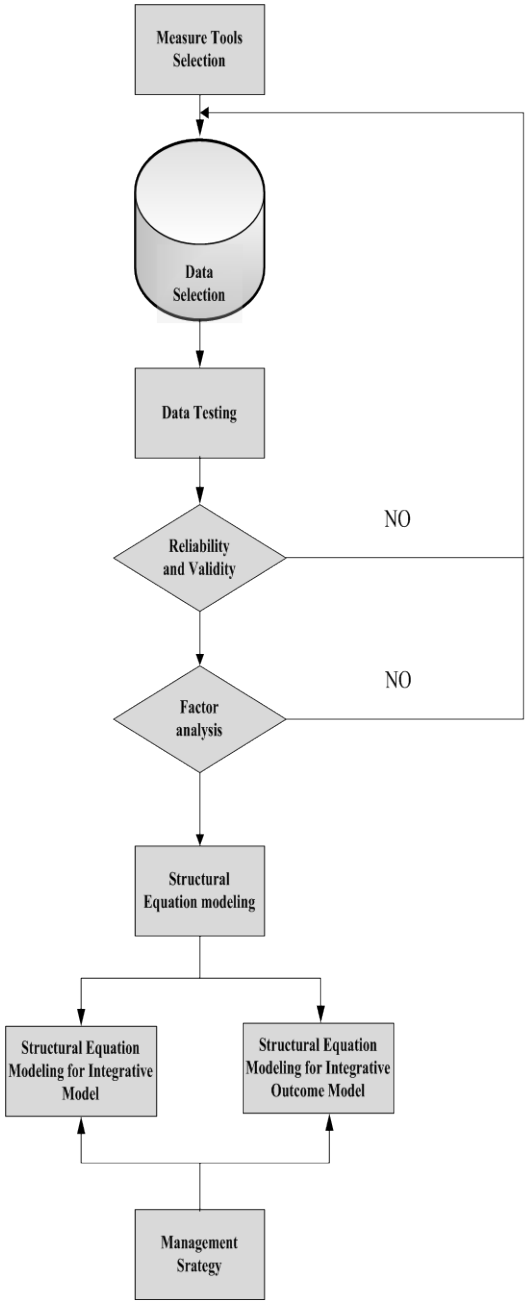

Fig. 1: Research procedures and modeling

Measure tools selection: We use depth interview to achieve the following purposes:

- Explore what kinds of relationship benefits exists in internet retail
- Investigate what antecedents of relationship benefits can be identified
- Analyze the influence mechanism which refers to that antecedents affect relationship benefits

The interview sample included MBA students of a university who have previous experience with purchases from internet bookstores or travel agencies. Participants were asked to respond to the questions based on their previous purchasing experiences. Firstly, all participants choose a online bookstore or a travel agency which they usually invite to. Then they should describe the relationship with online bookstore or travel agency and what benefits they gain from the relationship. Each interview was limited at 20-25 min. In the interview process, we have directions to ensure the accuracy of our interview content.

We use survey methods to collect data of web-based self-service attributes (perceived control, convenience and efficiency) and relationship benefits (confidence benefits and special treatment benefits). Perceived control, convenience and efficiency were measured adapted from scale of Dabholak (1996) to depict the nature of web self-service attributes. Each attribute was measured with two items. Relationship benefits were modified from the measures used by scale of Gwinner *et al*. (1998) and Gremler and Gwinner (2000). Social benefits are not being considered in the absence of employee contact.

Table 1: Reliability and discriminant validity test

	α	CR	PC	CV	EF	CB	STB
PC	0.81	0.86	0.77	0.76	0.74	0.79	0.80
CV	0.86	0.83	0.39	0.51	0.48	0.57	0.56
EF	0.92	0.80	0.63	0.43	0.40	0.59	0.72
CB	0.80	0.87	0.56	0.39	0.47	0.63	0.45
STB	0.86	0.92	0.34	0.58	0.59	0.46	0.66

PC, CV, EF, CB, STB refers to "perceived control", "convenience", "efficiency", "confidence benefits", "special treatment benefits".

Data selection: The questionnaire survey began in 8 January 2011 and ended in 12 May 2011. A total of 368 subjects participated in this study and 312 questionnaires were returned, 84.7% recovery rate. After the invalid questionnaires removed, 297 effective questionnaires returned, effective recovery rate of 80.7%.

Data testing: To examine the reliability of the scales of perceive control, convenience and efficiency, we computed cronbach's alphas (α) and Construct Reliability (CR) for the scales (the results were shown in Table 1):

$$CR = \frac{(\sum \lambda)^2}{\left[(\sum \lambda)^2 + \sum(\theta)\right]} \quad (1)$$

where, λ means factor loadings of observed variables on latent variable θ means measurement error of observed variables. High value means a high internal consistency among the items and with their related constructs.

To test the validity of scales, we test the discriminant validity by conducting a confirmatory factor analysis and analyzing the covariance matrix using the maximum likelihood procedure of Amos 7.0

(the results were shown in Table 1). This showed that the correlation coefficient between factors were lower than the average variance extracted of the individual factors, confirming discriminant validity.

Modeling of factor analysis: Factor analysis is used to describe a few factors among many of the indicators or the relations between them and use few factors to reflect the information of the original statistical data analysis methods. The core of factor analysis is to show most information of original variables through a few independent factors (Xue, 2006). We assume that there are n samples, each n sample has p variables $X_1,\ldots X_p$, which constitute a n×p matrix as follows:

$$\begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1p} \\ x_{21} & x_{22} & \cdots & x_{2p} \\ \vdots & \vdots & \vdots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{np} \end{pmatrix} \tag{2}$$

Each variable is 0.000 mean and at 1.000 standard deviation level. The original variable can be expressed as a linear combination by m (m<p) factors as follows:

$$\begin{cases} x_1 = l_{11}z_1 + l_{12}z_2 + l_{13}z_3 + \cdots + l_{1m}z_m + \varepsilon_1 \\ x_2 = l_{21}z_1 + l_{22}z_2 + l_{23}z_3 + \cdots + l_{2m}z_m + \varepsilon_2 \\ x_3 = l_{31}z_1 + l_{32}z_2 + l_{33}z_3 + \cdots + l_{3m}z_m + \varepsilon_3 \\ \vdots \\ x_p = l_{p1}z_1 + l_{p2}z_2 + l_{p3}z_3 + \cdots + l_{pm}z_m + \varepsilon_p \end{cases} \tag{3}$$

Factor analysis require original variables have a relatively strong correlation, therefore, factors analysis need to firstly carry on correlation analysis to calculate the correlation coefficient between the original variable matrix. When we conduct statistical tests on correlation matrix, most of the correlation coefficients are less than 0.3 and did not pass the test, these original variables are less suitable for factor analysis:

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1p} \\ r_{21} & r_{22} & \cdots & r_{2p} \\ \vdots & \vdots & \vdots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{np} \end{bmatrix} \tag{4}$$

$$r_{ij} = \frac{\sum_{k=1}^{n}(x_{ki} - \bar{x}_i)(x_{kj} - \bar{x}_j)}{\sqrt{\sum_{k=1}^{n}(x_{ki} - \bar{x}_i)^2 (x_{kj} - \bar{x}_j)^2}} \tag{5}$$

There are many methods of factor analysis, such as principal component analysis, maximum likelihood, least squares method and so on. Principal component analysis is the most widely used method. This method transforms the original relevant variables $X_1,\ldots,X_p$ to another set of unrelated variables $z_1,\ldots,z_p$ (principal components):

$$\begin{cases} z_1 = \mu_{11}x_1 + \mu_{12}x_2 + \mu_{13}x_3 + \cdots + \mu_{1m}x_m + \varepsilon_1 \\ z_2 = \mu_{21}x_1 + \mu_{22}x_2 + \mu_{23}x_3 + \cdots + \mu_{2m}x_m + \varepsilon_2 \\ z_3 = \mu_{31}x_1 + \mu_{32}x_2 + \mu_{33}x_3 + \cdots + \mu_{3m}x_m + \varepsilon_3 \\ \vdots \\ z_p = \mu_{p1}x_1 + \mu_{p2}x_2 + \mu_{p3}x_3 + \cdots + \mu_{pm}x_m + \varepsilon_p \end{cases} \tag{6}$$

Then we can compute correlation matrix eigenvalues and their corresponding orthonormal eigenvectors μ_i. According tothecorrelationcoefficient matrix eigenvalue, we can calculate the cumulative variance contribution rate and contribution rate of common factor z_j:

$$\frac{\lambda_i}{\sum_{k=1}^{p}\lambda_k}(i = 1, 2, \cdots p)$$

$$\frac{\sum_{k=1}^{k}\lambda_i}{\sum_{k=1}^{p}\lambda_k}(i = 1, 2, \cdots p) \tag{7}$$

After principal component analysis to get the common factors is the original variables integrated. In the actual application of the analysis, we obtain the relations between factor variables and original variables mainly through the loading matrix analysis, thus named a new factor variable. The use of factor rotation method can make factor variables more explanatory. Then we can calculate the principal component loading and build loading matrix A:

$$a_{ij} = \sqrt{\lambda_i l_{ij}}(i, j - 1, 2, \cdots p)$$

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1p} \\ a_{21} & a_{22} & \cdots & a_{2p} \\ \cdots & \cdots & \cdots & \cdots \\ a_{p1} & a_{p2} & \cdots & a_{pp} \end{bmatrix}$$

$$= \begin{bmatrix} l_{11}\sqrt{\lambda_1} & l_{12}\sqrt{\lambda_2} & \cdots & l_{1p}\sqrt{\lambda_p} \\ l_{21}\sqrt{\lambda_1} & l_{22}\sqrt{\lambda_2} & \cdots & l_{2p}\sqrt{\lambda_p} \\ \cdots & \cdots & \cdots & \cdots \\ l_{p1}\sqrt{\lambda_1} & l_{p2}\sqrt{\lambda_2} & \cdots & l_{pp}\sqrt{\lambda_p} \end{bmatrix} \tag{8}$$

$$\begin{cases} x_1 = a_{11}z_1 + a_{12}z_2 + \cdots + a_{1p}z_p \\ x_2 = a_{21}z_1 + a_{22}z_2 + \cdots + a_{2p}z_p \\ \vdots \\ x_m = a_{m1}z_1 + a_{m2}z_2 + \cdots + a_{mp}z_p \end{cases}$$

$$\begin{cases} z_1 = l_{11}x_1 + l_{12}x_2 + \cdots + l_{1p}x_p \\ z_2 = l_{21}x_1 + l_{22}x_2 + \cdots + l_{2p}x_p \\ \vdots \\ z_m = l_{m1}x_1 + l_{m2}x_2 + \cdots + l_{mp}x_p \end{cases} \tag{9}$$

Following factor variables determined, we hope to get factor scores of each sample data and firstly calculate the factor in the form of linear combination of original variables. Here we can find the factor loading as follows:

$$A=\begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & a_{22} & \cdots & a_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ a_{p1} & a_{p2} & \cdots & a_{pm} \end{bmatrix}$$

$$=\begin{bmatrix} l_{11}\sqrt{\lambda_1} & l_{12}\sqrt{\lambda_2} & \cdots & l_{1m}\sqrt{\lambda_m} \\ l_{21}\sqrt{\lambda_1} & l_{22}\sqrt{\lambda_2} & \cdots & l_{2m}\sqrt{\lambda_m} \\ \cdots & \cdots & \cdots & \cdots \\ l_{p1}\sqrt{\lambda_1} & l_{p2}\sqrt{\lambda_2} & \cdots & l_{pm}\sqrt{\lambda_m} \end{bmatrix} \quad (10)$$

Modeling of structural equation modeling: Measure model can be used to measure the relations between endogenous latent variables and exogenous latent variables:

$$\begin{aligned} x &= \hat{x}\xi + \delta \\ y &= \hat{y}\eta + \varepsilon \end{aligned} \quad (11)$$

where, ξ means endogenous variables, η means exogenous variables, x means endogenous indicator, y means exogenous indicator, δ means endogenous variables error, ε means exogenous variables error, $\hat{x}$ means relations between endogenous indexes and endogenous variables, $\hat{y}$ means relations between exogenous indexes and exogenous variables.

Structural model can be used to measure the relations among latent variables:

$$\eta = B\eta + \Gamma\xi + \zeta \quad (12)$$

where η means endogenous variables, ξ means exogenous variables, B means relations among endogenous latent variables, means the effects of exogenous variables on endogenous variables, ζ means structural equation residuals. We use a series of indexes to estimate the fit statistics as follows:

$$\begin{aligned} \chi^2 &= (n-1)F \\ df &= \frac{1}{2}(p+q)(p+q+1)-t \end{aligned} \quad (13)$$

where, n represents the number of samples, F means the least value of fit function, p represents the number of independent variables, q represents the number of dependent variables, t means the number of free variables. The value of χ^2 smaller means the difference between the actual matrix and input matrix is smaller and the proposed model and sample data has high degree fit:

Table 2: SEM fit indexes

Fit index	Recommended value	Actual value
χ^2/df	<5	2.18
GFI	>0.9	0.949
AGFI	>0.9	0.918
NFI	>0.9	0.932
IFI	>0.9	0.945
CFI	>0.9	0.956
RMR	<0.05	0.032
RMSEA	<0.08	0.061
P	>0.05	0.073

All correlations are significant at the 0.001 level

$$GFI = 1 - \frac{F\left\lfloor s, \sum(\hat{\theta})\right\rfloor}{F\left\lfloor s, \sum(0)\right\rfloor} \quad (14)$$

$$AGFI = 1 - \frac{(p+q)(p+q+1)/2}{df}(1-GFI) \quad (15)$$

$$RMSEA = \sqrt{\hat{F}_0 / df} \quad (16)$$

$$NFI = \frac{x_0^2 - x_t^2}{x_0^2} \quad (17)$$

$$IFI = \frac{x_0^2 - x_t^2}{x_0^2 - df_t} \quad (18)$$

$$CFI = 1 - \frac{\tau_t}{\tau_0} \quad (19)$$

where x^2_0 derives from the independent model and x^2_t derives from the target model. All the structural equation model fit indexes recommended values are show in Table 2.

RESULTS OF DATA MINING

Results of factor analysis: The factors loading are shown in Table 3. All the factor loadings were greater than recommended value, which means there are three antecedents of relationship benefits which are perceived control, convenience and efficiency. Similarly, there are two dimensions of relationship benefits which are confidence benefits and special treatment benefits.

The analysis proceeds to examine the structural model. A procedure was used to estimate the model. The overall model fit (χ2/df = 2.18, CFI = 0.949, AGFI = 0.918, NFI = 0.932, IFI = 0.945, CFI = 0.956, RMR = 0.032, RMSEA = 0.061, P = 0.073) provides an acceptable fit of the data. The details are shown in Table 2.

Results of structural equation modeling: Table 4 and Fig. 2 show the structural model results. The results show that perceived control is significantly related to confidence benefits (β = 0.256, t = 7.532), H1a is

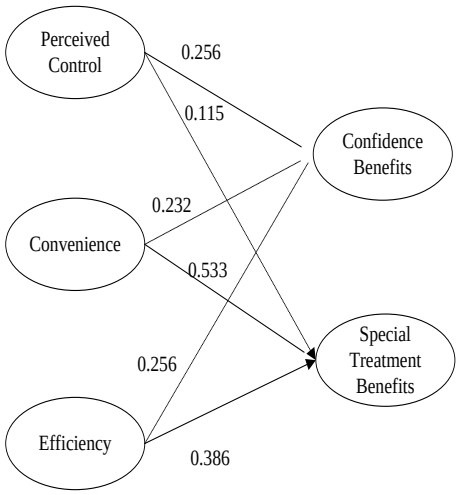

Fig. 2: Structural model results

Table 3: Results of factor analysis

	PC	CV	EF	CB	STB	t-value
PC1	0.79					8.795
PC2	0.86					9.962
CV1		0.78				5.104
CV2		0.83				4.672
EF1			0.68			10.013
EF2			0.71			8.720
CB1				0.80		24.413
CB2				0.82		23.059
STB1					0.81	17.532
STB2					0.69	16.996
STB3					0.74	8.396

Table 4: Standard path coefficient

Path	Coefficient	t-value	Estimate result
PC→CB	0.256	7.532	Supported
PC→STB	0.115	0.961	Not supported
CV→CB	0.232	0.826	Not supported
CV→STB	0.533	9.187	Supported
EF→CB	0.256	0.784	Not supported
EF→STB	0.386	8.993	Supported

supported. In contrast, the positive relationship between perceived control and special treatment benefits (β = 0.115, t = 0.961) is not significant, which does not support H1b. Contrary to that of perceived control, convenience is significantly associated with special treatment benefits (β = 0.533, t = 9.187) but not the case for confidence benefits (β = 0.232, t = 0.826), thus H2b is supported whereas H2a is not supported. Efficiency is not significantly associated with confidence benefits (β = 0.256, t = 0.784) which does not support H3a, while the positive impact it has on special treatment benefits is significant (β = 0.386, t = 8.933), which supports H3b.

CONCLUSION

Implication of research: This study proposed and investigated relationship benefits and antecedents in web self-service. In internet retail context, we find two types of relationship benefits and three types of antecedents based on data mining. Our findings have the following contributions to theories.

Firstly, this study extends for prior research that has been investigated in more traditional face-to-face contexts. The findings suggest that relationship benefits constructs remain relevant in web-based environment. This supports the previous opinions that there is a weaker relationship with service providers when internet-based transactions. That is, relationship with a web interface is significantly different from relationships with people. However, despite these differences exits, we can still derive benefits from their mutual relations.

Finally, this study explored three types of web self-service attributes as relationship benefits antecedents. That is, perceived control, convenience and efficiency. Perceived control has positive influence on confidence benefits, whereas convenience and efficiency have positive influence on special treatment benefits.

Managerial implications: With the understanding that confidence and special treatment benefits play an important role in marketing strategy, these could be used in comparisons to competitors, in that a firm's services could be positioned at creating greater confidence in the service or delivering greater levels of special treatment benefits than can be provided by competing offers.

Furthermore, firms can consider factors of either the technological aspects of their delivery system or the specific services offered that might also instill greater confidence or add to the receipt of special treatment benefits. For instance, up-to-date features on a website may serve to increase confidence benefits and time-save pay could increase special treatment benefits. The database capability of web commerce represents a potential powerful way of enhancing the relations between firms and customers. Database not only used to record customer preferences and give suggestions based on previous preference, but also used to keep track of information and products purchased in prior visits. These capabilities can be used to enhance the virtual relationship customers have with the internet retail.

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