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PERFORMANCE EVALUATION FOR CLOUD COMPUTING APPLICATIONS: A CASE STUDY OF P COMPANY CHAIN STORE

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Abstract

The advent of cloud computing has significantly transformed the process of delivering convenience store services to organizational clients from traditional channels to a cloud-based mode. Consequently, the widely used performance measurement tool, Balanced Scorecard, may require re-examination and adaptation for use in the era of cloud computing. The Balanced Scorecard was developed and introduced by Kaplan and Norton (1990) and has been instrumental in identifying appropriate opportunities for organizations to assess their performances. The findings of this study suggest that the proposed solution is reasonable and generates a subscale structure as originally hypothesized.

Keywords - Cloud computing, Balanced Scorecard, Performance Evaluation

Introduction

Cloud computing is defined as a comprehensive suite of infrastructure components and services that enable the creation of a remote environment for various purposes. Cloud computing represents a superset of traditional infrastructure capabilities, while it may be a subset of traditional infrastructure systems. Within an organization's own network, a cloud may be utilized to establish an internal service provider model, or alternatively, it may be outsourced to an external service provider. In the fiercely competitive Taiwanese convenience store industry, companies need to be innovative to differentiate themselves from their rivals. "Cloud-computing-based (CCB)" products and services offer a clear opportunity for convenience stores to stand out from the competition and attract potential customers. Many convenience stores use cloud computing technologies to enhance customer convenience by allowing customers to shop anytime and anywhere, with transaction times and costs nearly three times faster than in a physical store. According to the Business Next report of 2010, CCB convenience stores are the preferred transaction method among online customers. The report analyzes the online convenience store experience from four perspectives: Learning and Growth, Business Processes, Customers, and Financials, focusing on the

performance of the largest convenience stores in Taiwan.

Cloud Computing As An Application And CCB Convenience Stores

A cloud is a pool of virtualized resources that can host a variety of different workloads, allow workloads to be deployed and scaled-out quickly, allocate resources when needed, and support redundancy (Greg Boss et al., 2009). In recent years, the costs associated with server management and administration have significantly increased (Islam et al., 2021). It is not uncommon to hear about lead times of 4-5 months to provision a server, especially in today's business climate where companies must launch new services, products, and solutions ahead of their competitors (FreedomOSS, 2009). Successful companies must learn how to reduce the time it takes to deliver products to market and start pilot projects with low start-up costs.

Despite the benefits of online transactions, many people still view them as a burden due to concerns about information security. To address these concerns, major online stores and sites are working hard to create a more user-friendly experience (Chen et al., 2021).

Taiwan's largest convenience store chain, P Company, has successfully employed cloud computing technology to connect small and medium-sized businesses and individual stores to regional and global supply chains, resulting in increased web traffic and daily page views (Lin et al., 2020). This success can be attributed to the "Move-to-the-Middle" hypothesis proposed by Clemons (1991) and the Electronic Market Hypothesis proposed by Malone (1989), which suggest that the development of information technology reduces coordination costs between businesses and encourages them to source products from markets rather than producing them internally. To stay ahead of the curve, P Company recognized the changing needs of its members and launched a new service called the "Virtual Convenience Store," which creates economic value by reducing buyer search costs, integrating supply chains, and providing diverse business services (Lin et al., 2020).

Balanced Scorecard and CCB Convenience Stores Performances

The Balanced Scorecard is a strategic management approach developed in the early 1990s by Drs. Robert Kaplan and David Norton (Kaplan & Norton, 1992). This approach aims to provide organizations with a clear and comprehensive measurement system that balances financial and non-financial measures, allowing them to clarify their vision and strategy and translate them into action. The Balanced Scorecard provides feedback on both internal business processes and external outcomes, enabling organizations to continuously improve their strategic performance and results (Kaplan & Norton, 1996). By fully deploying the Balanced Scorecard, organizations can transform strategic planning from an academic exercise into the nerve center of their enterprise. Kaplan and Norton (1996) explain that the Balanced Scorecard approach retains traditional financial measures but also includes measures for other critical areas. They argue that financial measures alone are inadequate for guiding and evaluating the journey that

companies in the information age must make to create future value through investment in customers, suppliers, employees, processes, technology, and innovation.

The Learning and Growth Perspective: according to Kaplan and Norton (2001) this perspective includes employee training and corporate cultural attitudes related to both individual and corporate self-improvement. In knowledge-oriented sectors, people, the only repository of knowledge, are the main resource. In the current climate of rapid cloud computing technological change, it is becoming necessary for convenience store service providers to be in a continuous learning mode. In any case, learning and growth constitute the essential foundation for success of any knowledge-oriented industry.

High customer satisfaction: with growing threats of security fraud, identity theft and phishing, where fraudulent online website and e-mail communication appears to legitimately come from an online store, executives and marketing professionals must carefully develop online strategy and deployment. Off-the-shelf solutions can be near fatal and must be replaced by highly customized secure experiences that win consumer confidence and integrate effectively into a growing digital culture (Snyder, 2006).

The Business Process Perspective: this perspective refers to internal business processes. Metrics based on this perspective allow the managers to know how well their business is running, and whether its products and services conform to customer requirements. These metrics have to be carefully designed by those who know these processes most intimately; with our unique missions these are not something that can be developed by outside consultants. In addition to the strategic management process, two kinds of business processes may be identified: a) mission-oriented processes, and b) support processes. Mission-oriented processes are the special functions of government offices, and many unique problems are encountered in these processes. The support processes are more repetitive in nature, and hence easier to measure and benchmark using generic metrics (Graham, 2001).

The Customer Perspective: Ellingson and Wambsganss (2001) states that recent management philosophy has shown an increasing realization of the importance of customer focus and customer satisfaction in any business. These are leading indicators: if customers are not satisfied, they will eventually find other suppliers that will meet their needs. Poor performance from this perspective is thus a leading indicator of future decline, even though the current financial picture may look good. In developing metrics for satisfaction, customers should be analyzed in terms of kinds of customers and the kinds of processes for which we are providing a product or service to those customer groups.

The Financial Perspective: Kaplan and Norton (2001) do not disregard the traditional need for financial data. Timely and accurate funding data will always be a priority, and managers will do whatever necessary to provide it. In fact, often there is more than enough handling and processing of financial data. With the implementation of a

corporate database, it is hoped that more of the processing can be centralized and automated. But the point is that the current emphasis on financials leads to the "unbalanced" situation with regard to other perspectives. There is perhaps a need to include additional financial-related data, such as risk assessment and cost-benefit data, in this category (Ginovsky, 2006).

Research Methods, Results and Findings

This empirical study is a combination of qualitative and quantitative research techniques that aim to analyze the online convenience store performance of Uni-mall, a P company. Data were collected from the organization's records, 600 subjects through questionnaires, and face-to-face interviews with 30 of the respondents between July and December 2018. The questionnaire, which was used in the survey, had 20 items and demographic questions based on the Balanced Scorecard, a tool developed by Kaplan and Norton (1990). The reliability of the measures was calculated using the Cronbach (1951) test and demonstrated adequate internal consistency with values ranging from 0.61 to 0.83 (Nunnally and Bernstein, 1994). IBM SPSS 22.0 and LISREL 12 were used to analyze the questionnaire responses. A probability sample procedure (Bernard, 1994) was used to distribute the packets to highly involved Uni-mall service users and technician personnel. A total of 370 questionnaires were returned from four regions of Taiwan - north, central, east, and south - with a 62% response rate. The sample size of 368 usable surveys represented the recommended sample size for a 95 percent level of confidence (Krejcie and Morgan, 1970). The questionnaire was stratified by region and color-coded to minimize administration order effects.

The scales used in the questionnaire were derived from the literature review and 20 semi-structured interviews with highly involved online convenience store service users. The study concluded that the developed instrument for measuring online convenience store performance was reliable, and the scales of the Balanced Scorecard questionnaire used in the survey instrument had demonstrated adequate levels of internal consistency (Cronbach's alpha ranged from 0.61 to 0.83).

Principal Components And Confirmatory Factor Analysis

The initial statistics and scree plot from the principal components analysis are presented in this study. The suitability of the correlational matrix for factor analysis was evaluated using the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) (Kaiser, 1974). A KMO value close to 1.0 indicates that the sum of the squared partial correlation coefficients between all pairs is small compared to the sum of the squared correlation coefficients, indicating that the data set is appropriate for factor analysis (Zillmer and Vuz, 1995). In this study, the KMO measure is 0.911, which is meritorious and almost marvelous, indicating that the data set is approximately multivariate normal and acceptable for factor analysis (Byrne, 1998).

Confirmatory factor analysis was conducted to evaluate the convergent and discriminant validity of the Balanced Scorecard scale proposed in this

study (Gerbing and Anderson, 1988). A congeneric measurement model was estimated for the 20 items included in the analysis, as two items were removed due to poor item-to-total correlations and high cross-loadings. The final model fit statistics indicate an adequate level of fit considering the number of parameters estimated in the measurement model.

Eigenvalues were evaluated for components 1 through 20 to determine the number of factors to extract. Factors with eigenvalues greater than or equal to zero and less than or equal to the total variance were retained. Based on the scree plot analysis, four factors were extracted, which is consistent with established criteria (Darren and Mallery, 2001). Reliability coefficients ranged from 0.78 to 0.92, indicating that some scales were more reliable than others. The developed instrument for measuring online convenience store performance was judged to be reliable according to established criteria (Nunnally, 1978; DeVellis, 1991; Darren and Mallery, 2001).

Confirmatory factor analysis was used to assess the convergent and discriminant validity of the Balanced Scorecard scale proposed in this study. A congeneric measurement model was estimated for the items, where 22 items were initially included but two were dropped due to poor item-to-total correlations and high cross-loadings. The final model fit statistics with 20 items corresponding to the four dimensions indicate an adequate level of fit considering the number of parameters estimated in the measurement model (Gerbing and Anderson, 1988). The eigenvalues were evaluated for components 1 through 20, as they account for the variance among the variables. An eigenvalue for a factor should be greater than or equal to zero and cannot exceed the total variance. The percent of variance of the variables accounted for by the factor is equal to the eigenvalue divided by the total amount of variance of the variables times 100. Eigenvalues are helpful in deciding how many factors should be used in the analysis. One criterion is to retain all factors that have eigenvalues greater than 1. This criterion is the default option in SPSS 14.0. Another criterion is to examine the plot of the eigenvalues, also known as the scree test, and to retain all factors with eigenvalues in the sharp descent part of the plot before the eigenvalues start to level off.

Based on the scree plot analysis, we concluded that four-dimensional factors should be extracted (Darren and Mallery, 2001). The output showed initial statistics, and the scree plot from the principal component analysis was presented. A procedure for determining the suitability of the correlational matrix for factor analysis was conducted. This involved computing the Kaiser-Meyer-Olkin measure of sampling adequacy (Kaiser, 1974), which determines the sum of the squared partial correlation coefficients between all pairs compared to the sum of the squared correlation coefficients. A KMO index of less than 0.50 indicates that the correlational matrix (i.e., data set) is not suitable for factor analysis. In this study, the KMO measure was 0.911, indicating that the correlation matrix is an identity matrix and appropriate for further factor analysis (Byrne, 1998). Finally, the reliability coefficients ranged from 0.78 to 0.92, indicating that some scales were more

reliable than others. According to the guidelines provided by Naunally (1978), DeVellis (1991), and Darren and Mallery (2001), the instrument developed for measuring online convenience store performance was judged to be reliable.

Model Testing

Structural equation modeling was employed in testing the theoretical model hypothesized in this research. There are two ways of estimating a LISREL model. First, all paths of the measurement model and structural model are estimated simultaneously. Second, the paths of both models can be estimated separately, which is two-stage analysis. Many researchers are now proposing a two-stage process of structural equation modeling (Jöreskog and Sörbom, 1999; Hair et al., 1992). In this research, the total observations were 391, which was sufficient for estimating the measurement and structural models simultaneously. In this section, only the structural model is estimated. Jöreskog and Sörbom (1999) stated that the path analysis technique can be used to test the plausibility of putative causal relationships between one variable and another in non-experimental conditions. Path analysis is the basis for the empirical estimation of the strength of each causal relationship depicted in the path model, and is based on calculating the strength of the causal relationships from the correlation among the constructs. The procedure can be formulated as one of estimating the coefficients of a set of linear structural equations representing the cause and effect relationships hypothesized by researcher.

LISREL provides different methods for estimating structural models. Among them are the maximum likelihood (ML), the generalized least squares (GLS), and the generally weighted least squares (WLS). In this research, the Pearson correlation matrix was selected as the input matrix. LISREL provides estimated coefficients, standard errors and calculated t-values for each coefficient. A hypothesis is confirmed if the estimated path coefficient is significant and has the hypothesized sign. In this study, one-tailed significance levels are used since the hypotheses formulate explicit predictions of the direction of the effect of one variable on another. A t-value larger than 1.282 corresponds to $p<0.10$ (weakly significant), a t-value larger than 1.645 to $p<0.05$ (moderately significant), and a t-value greater than 2.326 to $p<0.01$ (strongly significant) (Jöreskog and Sörbom, 1999; Harnett and Murphy, 1985). In theoretical model testing, a major issue is whether the theoretical model is in conflict with reality as observed in the sample; namely, how well the theoretical model fits the data (De Jong, 1999). Many indicators are calculated by LISREL 12, which can be used to evaluate the global model-fit. Five common measures for judging goodness-of-fit are the Chi-square (c2), the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the root mean square error of approximation (RMSEA), and the root mean square residual (RMR) (Byrne, 1998; Hair et al., 1992; Jöreskog and Sörbom, 1996).

In this hypothesized theoretical model, Balanced Scorecard items treated as independent variables, the value of which can be calculated by summing the scores of all of the 20

items. PRELIS 12 was used in calculating the Pearson correlation matrix and checking normality of inputting data (Litwin, 1995). The correlation matrix calculated served as the input matrix for LISREL in estimating the hypothesized theoretical model. Results show that the variables have a relatively normal distribution since the skewness and kurtosis do not exceed the absolute value of 1. Therefore, LISREL can be used to estimate the theoretical model.

The theoretical model of Balanced Scorecard dimensions will be tested simultaneously. A hypothesis is confirmed if the estimated path coefficient is significant. The path coefficients test result indicates the theoretical hypothesis was moderately confirmed by the empirical data since the Chi-Square p-value is great than 0.05, RMSEA is 0.017, RMR is 0.028, GFI is 0.61 and AGFI is 0.53. According to Joreskog and Sorbom (1999), when Chi-Square value is not significant, RMSEA below 0.05, RMR below 0.05, GFI above 0.9, and AGFI above 0.8, the model is a good fit. Further, all t-values associated with the standardized loadings are significant ($p < 0.001$), suggesting reasonable levels of convergence among items for these constructs.

Conclusions

In this fast-paced era, convenience stores have become an integral part of our everyday lives. The emergence of e-commerce has made it possible for customers to buy their favorite products from the comfort of their own homes, and online convenience stores have become a popular option. Nonetheless, as with any business, the key to success lies in comprehending and fulfilling the needs of your customers. That's where the Balanced Scorecard tool comes into play. The Balanced Scorecard is a strategic management instrument that aids organizations in aligning their goals with their vision and strategy. The tool, developed by Kaplan and Norton in 1992, has gained widespread popularity because of its effectiveness in evaluating organizational performance across four key perspectives - financial, customer, internal processes, and learning and growth.

Our research aimed to investigate the efficacy of the Balanced Scorecard tool in predicting employees' reactions important to online convenience store efforts. We assessed the tool using standard psychometric practices, specifically with respect to content validity, internal validity, and reliability. During the development of the instrument, factor analysis was used, and empirical evidence from our studies suggests that the dimensions identified qualitatively by Kaplan and Norton (1990) are distinct constructs. Our findings indicate that the Balanced Scorecard instrument is highly reliable and reveals a consistent scale.

Moreover, the structural model, which decomposes overall satisfaction into four dimensions, is a good fit for the data. We observed that business processes have the greatest impact on a customer's overall satisfaction with their online convenience store. Our study also revealed that in-person branch convenience stores are conducted most frequently and are the next highest in terms of satisfaction. However, the online convenience store industry faces a significant challenge

in the highly competitive e-market, as customers demand both the convenience of shopping online and a personal touch. To ensure success in this field, it's crucial for the industry to analyze business processes and gain a better understanding of a customer's revenue potential to the online convenience store, which is a major aspect influencing customer commitment to the e-store, in addition to brand image and a customer's propensity toward loyalty.

In conclusion, our research provides valuable insights into the online convenience store industry and establishes a foundation for further exploration in this area. The Balanced Scorecard tool is an effective way to measure organizational performance and gain a better understanding of customer needs. By utilizing this tool, online convenience stores can ensure that they are satisfying the needs of their customers and delivering the best possible service.

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