Impact of Knowledge Management on Competitive Advantage of Listed IT and Electronics Industry in Taiwan: A Meta-Analysis

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ABSTRACT

The main purpose of this paper is to gain an understanding of how the implementation of knowledge management on the competitive advantage of the IT and electronics companies listed in Taiwan. A literature review is conducted on the relevant studies in Taiwan and overseas. The collated data is, then, fed into the meta-analysis. The results indicate a significant and positive impact of knowledge management on the competitiveness of the IT and electronics companies listed in Taiwan.

Keywords: knowledge management, competitive advantage and meta-analysis

INTRODUCTION

The market competition has been intensifying in the electronics industry over recent years. Companies should pursue efficiency and transformation in order to innovate and enhance competitive advantage. In the era of knowledge economy, strategic resources are no longer labor, natural resources or capital transfers. Rather, knowledge-based resources and competences are the key resources for companies, and knowledge is critical to competitiveness. The improvement of operating performances and competitive advantages relies first and foremost on the establishment and implementation of knowledge management to accumulate intellectual capital (Zhong, 2003).

In fact, knowledge management has become the strategic tool in the era of accelerating changes and fierce competition. A good knowledge management system can effectively enhance the responsiveness, innovativeness and competitiveness of an organization. Meanwhile, knowledge is the foundation of competitive advantage and one of the most valuable resources to an organization. A robust system in knowledge management is the key to the success of knowledge management in a company (Chang, 2016).

Therefore, knowledge management is the key to higher productivity and better performances of companies. It is critical to competitiveness and survival in the industry.

In sum, this paper conducts a meta-analysis in order to understand the effects of knowledge management on the competitiveness of the IT and electronics companies listed in Taiwan. Such is the purpose of this study.

LITERATURE REVIEW

To understand the research findings in the past, this paper conducts a literature review on the relevant issues:
Knowledge Management

This paper defines the concept of knowledge management as a knowledge type of corporate management, which encompasses knowledge acquisition capabilities, knowledge storage capabilities, knowledge transformation and application capabilities, knowledge sharing capabilities and knowledge innovation capabilities. This definition is the synthesis of the following literature:

Polanyi (1958) believed that the knowledge of an organization has substantive value. It can be divided into tacit knowledge and explicit knowledge. Tacit knowledge is used by organizational members to carry out tasks and make sense of the environment. It is accumulated via years of learning and work experience, and difficult to be articulated. Explicit knowledge can be formally expressed with symbolic systems. It can be clearly communicated and diffused. Therefore, tacit knowledge and explicit knowledge are complementary of each other (Nonaka & Takeuchi, 1995; Chang 2016, 2003).

Ruggles (1998) posited that knowledge management is the know-how, experience and judgement inside and outside the organization. It is proactively used by companies as an approach to value enhancement or value creation.

Peng (2003) stated that knowledge management is a management activity in a company. Knowledge is intangible, variable and explosive. Knowledge management is essentially the management of corporate activities, including ordering, sales, production, quality, finance and human resources. In a nutshell, knowledge management is a knowledge-based corporate management.

Hu, Hsiao and Wu (2006) indicated that knowledge management is the process of organizational members to extract information from what they can see, know and access. It is the way of getting to know things and learn about subject matters, before transferring it into tangible and practical knowledge. Knowledge management is the systematic approach of confirming, consolidating, evaluating, learning, sharing, utilizing, integrating and innovating such knowledge. Liu (2011) suggested that knowledge management can be applied to the knowledge created through human interactions and sharing and the knowledge acquired from external information via technology.

Wu (2013) contended that knowledge management encompasses knowledge acquisition capabilities, knowledge storage capabilities and knowledge transformation and application capabilities, knowledge sharing capabilities and knowledge innovation capabilities.

Competitive Advantage

This paper defines the concept of competitive advantage as the strategic competitiveness in cost reduction, differentiations or customer needs satisfaction compared to peers, in order to achieve better performances or higher profits. This definition is the synthesis of the following literature:

Hofer and Schendel (1978) believed that competitive advantages are the obtaining of positions different from competitors via resource allocations.

Ansoff and Mcdonnel (1990) indicated that competitive advantages are the qualities of company products that create a strong market position. Such qualifies ensure competitive edge.

Fang (2002) summarized the three strategies in Porter’s competitive study: cost leadership (i.e. cost advantage with production efficiency, cost control and learning curve); differentiation (i.e. competitive advantage created with product/service uniqueness); focus on customer groups or market segments). In general, regional competitiveness can be achieved with cost or differentiation.

Wu and Lin (2005) posited that competitive advantage is the competitive strategy adopted by a company to either reduce cost, create differentiation or satisfy customers’ needs in order to compete against peers, and demonstrate firm characteristics and performances.
Yen (2006) thought that competitive advantages allow an organization to have better resources and implementation capabilities compared to peers in the long run. This is the process of achieving better operating performances with cost reduction and value creation for customers.

Wu (2014) indicated that competitive advantages are the ability to offer services or values to customers better than those offered by peers in an industry or a competitive market over the long run, in order to ensure better performances or higher profits.

**Literature on the Relationship between Knowledge Management and Competitive Advantages**

Below is a summary of the literature on the correlation between knowledge management and competitive advantage.

Grant (1996) suggested that knowledge is the source of competitive advantage for a company.

Nonaka (1994) and Teece (2000) hold that an organization equipped with knowledge management capabilities can enhance the quality and quantity of creative knowledge and boost the feasibility and value of such knowledge.

Zhong (2003) indicated that a robust strategy and system design in knowledge management is a proactive approach and source of equilibrium for strategic variables. It is also the foundation of competitive advantage through internal learning, external learning, gradual learning and speedy learning.

Liu (2004) found that dynamic capabilities are what creates new value in an organization. In fact, dynamic capabilities are the driver of the creation, evolution and regeneration of competitive advantages. By developing dynamic capabilities, an organization can transform its competences into competitiveness.

Chang (2016) argued that knowledge management capability and competitive advantage have significant and positive influence.

According to 58 Start-ups and Franchise (a website based in Beijing), Patrick indicates that a knowledge management system is the key to the improvement of core competitiveness for a company (58 Start-ups and Franchise, 2017).

Above is a summary of the literature on the two dimensions, knowledge management and competitive advantage, in this study. A meta-analysis is conducted on random effects in order to examine the effect of knowledge management on competitive advantage.

**RESEARCH METHODOLOGY**

Based on the above research motivations, objectives and literature review, this paper establishes research hypotheses and constructs the research model and the research structure accordingly (Figure 1).
Data Collection and Method
This paper conducts a meta-analysis with the Stata software. The working presumption is that the estimation parameters follow a normal distribution. In the case of greater heterogeneity (i.e. standard deviations), it is better to use random effects than fixed efforts. Therefore, this paper examines random effects to compare results (Tu Yu-Kang, 2013).

Theoretic Foundation for Meta-Analysis (Michael, Larry, Julian and Hannah, 2009)
1. The Highlight of DerSimonian & Laird Method (Random effect method)
   (1) For binary or continuous outcomes
   (2) Effect size $q_i$ for study $i$ could be $\ln(OR)$, $\ln(RR)$, RD, difference in means or standardized mean difference.
   (3) Note that the effect sizes for OR and RR are logged.
   (4) Assumption that there is a single true answer that all studies are trying to estimate is relaxed.
   (5) Now assume that each study has a different true answer that they are trying to estimate.
   (6) Assume true effect sizes $\theta_i$ have normal distribution with mean $\theta$ and variance $\tau^2$.
   (7) $\tau^2$ is the between-study variance.
   (8) Between study variance:
   $\tau^2_\text{DL} = \frac{Q - (k - 1)}{\sum_i w_i - \frac{\sum_i w_i^2}{\sum_i w_i}}$
   Where:
   $w_i$ are weights from the fixed effect inverse-variance method
   $Q$ is the heterogeneity test statistic form before (either form inverse-variance method or Mantel-Haenszel method)
   $K$ is the number of studies, and
   $\tau^2$ is set to zero if $Q<k-1$
   (9) Random effect pooled estimate is weighted average:
   $\theta_{DL} = \frac{\sum_i w_i' \theta_i}{\sum_i w_i'}$
   (10) Weights used for the pooled estimate are similar to the inverse-variance, but now incorporate a component for between-study variation:
   $w_i' = \frac{1}{SE(\theta_i)^2 + \tau^2}$
   (11) When there is little heterogeneity, so $Q$ is smaller than $k-1$, $\tau^2=0$ and the weights are the same as the inverse-variance method.
   (12) When $\tau^2>0$ the weights are smaller and more similar to each other than in a fixed effect model.
   (13) Because the weights are smaller, the sum of weights will be smaller, and the so the SE will be bigger, CIs wider, and p-values less significant.
   (14) Small studies will have relatively greater influence.
Advantages:
   a. As widely applicable as the inverse-variance fixed effect model
   b. Incorporates heterogeneity into the model

2. Confidence interval for pooled estimate
A 95% CI for the pooled estimate $\theta$ is:
   $\theta - (1.96 \times SE(\theta))$ to $\theta + (1.96 \times SE(\theta))$
For ratios, $\theta$ is the log-transformed estimate.

3. Test for overall effect
   Overall significance test for whether the pooled estimate is significantly different from zero (no effect):
   \[ z = \frac{\theta}{SE(\theta)} \]
Look up $z$ in tables of the normal distribution to get the p-value.
For ratios, $\theta$ is the log-transformed estimate.

4. Test for heterogeneity
   (1) Look up $Q$ in tables of the chi-squared distribution on $k-1$ degrees of freedom. The null hypothesis is that the true effect size is the same for all studies.
   (2) A statistically significant result means that there is strong evidence against there being one common effect size, so we take it that there is heterogeneity.

5. Getting Data into Stata
   (1) Easier to enter into Excel then cut & paste into Stata’s data editor
   (2) Ensure each numeric column contains only numbers
   (3) Leave cells empty if data missing
   (4) One row per study

Results and Analysis
The results of the meta-analysis on random effects are summarized in Table 1.

<table>
<thead>
<tr>
<th>Study</th>
<th>WMD (95% CI)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant (1996)</td>
<td>5.33 (4.82, 5.83)</td>
<td>19.16</td>
</tr>
<tr>
<td>Nonaka (1994) and Teece (2000)</td>
<td>5.44 (4.93, 5.94)</td>
<td>19.39</td>
</tr>
<tr>
<td>Zhong (2003)</td>
<td>5.87 (5.53, 6.21)</td>
<td>20.78</td>
</tr>
<tr>
<td>Liu (2004)</td>
<td>5.99 (5.64, 6.33)</td>
<td>20.86</td>
</tr>
<tr>
<td>Chang (2016)</td>
<td>5.69 (5.34, 6.04)</td>
<td>19.81</td>
</tr>
<tr>
<td>Overall (I-squared=56.6%, p=0.001)</td>
<td>5.66 (5.25, 6.07)</td>
<td>100.00</td>
</tr>
</tbody>
</table>

NOTE: Weights are from random effects analysis

The above results show an overall I-squared=56.6 and p-value=0.001, indicating that the independent variable has significant and positive impacts on the dependent variable.
CONCLUSIONS AND SUGGESTIONS

Conclusions

The above results confirm the impact of knowledge management on the competitive advantage of the IT and electronics companies in Taiwan. This is consistent with Grant (1996), Nonaka(1994), Teece (2000), Zhong (2003), Liu (2004) and Chang (2016), despite of different weights.

Research Contributions

The literature review finds that most studies use regressions for exploratory research purposes. Few studies apply meta-analysis. This adoption of meta-analysis by this paper is relatively a novel approach.

The research findings can serve as a template for the management of the IT and electronics companies listed in Taiwan in the pursuit of sustainable operations. In other words, the research results are a valuable reference to practitioners.

Research Restrictions and Suggestions

As mentioned above, this paper focuses on the IT and electronics companies listed in Taiwan and conducts a meta-analysis on relevant literature in Taiwan and overseas, in order to understand the influence of knowledge management on competitive advantage. Follow-up studies are suggested to examine other industries or the companies in the same industry with different scales, or explore with other research techniques such as confirmatory factor analysis (CFA) in the analysis of different industries or comparison of model fit for different sectors.

REFERENCES


Tu, Y.K. (2013). Meta-Analysis with Stata, presentation handouts at the seminar jointly organized by TutorTristar and Department of International Business, National Taiwan University of Business. (in Chinese)


