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Abstract

Multinational Corporations (MNCs) compete in a dynamic environment that calls for process integration and leverage of resources. MNCs require maximizing flexibility and local responsiveness, while maintaining control and integration. The appropriate global management of Information Technologies (IT) may aid in this endeavor by fostering the transfer of valuable IT, resulting in the reduction of development efforts duplication. Few research works have focused on the IT transfer process across national borders. Even fewer do so within the boundaries of organizations, rather than between firms. This research explores the factors that determine the extent to which subsidiaries of MNCs adopt usable IT that was developed at headquarters, thus fostering integration and leveraging the development resources.

Drivers of Technology Transfer

Drivers of transfer of technology face many barriers and have many promoters. Such barriers and enhancers are comprised of various factors that have been identified by many researchers: (1) Local governments' actions play a crucial role in establishing credibility for potential investors, being strong determinants of the choice of entry mode (Kogut & Zander, 1993) and the extent to which IT is transferred. Another major concern is the status of local conditions like the existing infrastructure (Haq, 1985; Lau & Wan, 1993). (2) The structural characteristics of the multinational corporations need to be adapted for the stage of the process of innovation and diffusion (Duncan, 1976; Galbraith, 1982). The levels of Formalization and Centralization have been of particular interest in past research (Duncan, 1976; Zmud, 1982; Damanpour, 1991). (3) Individual characteristics that determine a positive perception and ease of assimilation of new technologies, are greatly determined by the cultural characteristics of the foreign nation (Zmud, 1982; Perkins, 1993; Hofstede 1980). (4) Global competition will require different strategies for the use of IT in foreign operations units (FOUs) (Porter, 1990). Thus, the strategic relevance of IT in the firm seems to play a major role in the extent of IT transfer overseas.

From the constructs identified above, those that have not received enough attention in the research efforts on international IT transfer are the basis for the two main research questions of this study:

1. How do the levels of Environmental Uncertainty, Internalization, and Strategic Relevance of IT affect the extent of transfer to a foreign operations unit?

2. Does the IT transfer process differ to countries with different levels of development?

The following model, shown in figure 1, is proposed to provide a comprehensive perspective. Other constructs that may provide confounding effects are included in the model.

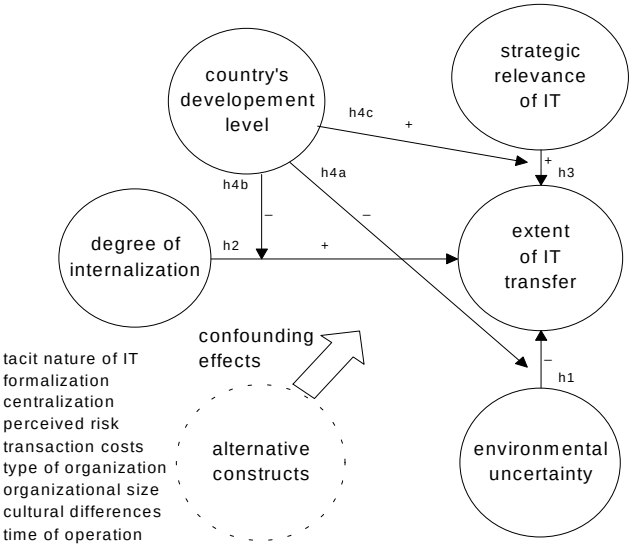

Figure 1. Proposed Model for the Determinants of the Extent of Adoption.

Based on the model in figure 1, the following hypotheses are derived for this study: (h1) The more Environmental Uncertainty, the less IT transfer to FOUs; (h2) The more Internalization of foreign operations, the more IT transfer to FOUs; (h3) The more Strategic Relevance of IT for the firm, the more IT transfer to FOUs; (h4) The Level of Development of the foreign country moderates the relationships described above.

Research Methodology

This study was conducted using a mail survey questionnaire. Instruments were selected from published research or developed. Face validity was evaluated by five Ph.D. students, five professors, and three Chief Information Officers (CIOs). A pilot study was undertaken to evaluate the instrument validity, including 30 global companies that provided data for 62 FOUs. A stratified random sample was drawn to select companies that operate in countries with different levels of development. The validated questionnaire was mailed to CIOs and International Operations Managers, or officers with equivalent positions. Data was gathered for 219 FOUs, belonging to 88 multinational corporations. The validity of the instruments was evaluated again using limited-information factor analysis and a multi-trait/multi-method matrix, as well as by calculation of Cronbach's alpha reliability coefficients. Linear models were used to test the hypotheses in the model. Alternative constructs were accounted for by direct measurement, or their effects were equally distributed by randomization.

Empirical Findings

The regression results for the one-tail test of the model are shown on table 1.

Table 1. Regression Results for the Main Model

R-square:	0.4089	Adjusted R-square: 0.3912
Overall p-value:	0.0001	
Variable	*Parameter*	*p-value*
Intercept	-416.1456	0.0001***
Internationalization	1.042632	0.0001***
Strategic Relevance	5.590230	0.0001***
Heterogeneity	-3.732091	0.0552*
Dynamism	7.873981	0.9999***
Level of Development	-31.445019	0.0330**

Environmental Uncertainty

The components of Environmental Uncertainty were treated as separate variables. However, the Hostility component was dropped because of the low reliability coefficient obtained for its instrument. It was originally hypothesized (i.e., hypothesis h1) that the greater the Environmental Uncertainty, the less the IT transfer. Heterogeneity is only significant at the 0.1 level of confidence. The strength of the relationship seems to be relatively weak, given that the sample size (i.e., 173 observations after deletion of those with missing values) provides enough power for the test (Stevens, 1990). The direction of the relationship is consistent with that hypothesized in h1, as indicated by the negative association shown by the negative sign of the beta coefficient. Surprisingly, Dynamism shows a positive association with the extent of IT transfer, which contradicts what was originally hypothesized. A p-value of 0.9999 supports a large significance, but in the opposite direction from what was hypothesized. Overall, the inconclusiveness of the results provides only partial support for h1.

Internalization

The sign of the beta coefficient for Internalization and the significance of the relationship (i.e., significant at alpha = 0.01) provide full support for h2.

Strategic Relevance

Full support was also attained for h3. The relationship between Strategic Relevance and the extent of IT transfer shows to have a positive direction and a strong and significant level of association (i.e., at alpha = 0.01).

Moderating Effect of Level of Development

The observations in the data set were categorized into one of the four economic groups previously identified by Summers and Heston (1991). Despite the efforts made in the sampling process to obtain similar numbers for each category, that was unfortunately not the case. It was decided to regroup into two categories, adequate in size to make valid statistical inferences. As a result, 83 FOUs are classified as developed, and 136 as developing. A dummy variable was used to identify observations for which the FOUs are located in a developing country. Developed countries, therefore, were used as the base. The beta coefficient has a negative sign, indicating that FOUs in less-developed countries will be transferred less IT than those located in developed countries. The direction of the association is consistent with hypothesis h4. The level of association is less significant, however, than those of the main effects, given that it is supported at alpha = 0.05, indicating a mild moderation role.

To test the moderation caused by development in the individual relationships of the main constructs with IT Transfer, interactions were included in the regression model. The proportion of variance explained (i.e., R-square), for the new regression model, had a small, but significant, improvement in R-square. It was surprising that none of the interactions were significant. It can be interpreted that a pooled moderating effect by the Level

of Development exists, but no individual effects are present. Pooled moderation was also supported by conducting an F-drop test, where a significant increase in the F statistics was obtained. Furthermore, a regression analysis sorted by group of development was computed. The results obtained suggest that the roles of the constructs change depending, on the group. It becomes apparent that the role played by Strategic Relevance is more significant for developed than for developing ones. This is shown by the decrease in the size of the beta coefficient for the construct, as it moves from the developed nations to the less-developed ones. The opposite trend is observed for the role of Dynamism.

Potential Confounding Effects and Controls

Nested regression models were used to control for the effects of Formalization, Centralization, Industry Type, Time of Operations, Organizational Size, and National Culture. Even though these constructs have been strongly supported by many authors as main determinants of IT transfer, their effects were of little or no significance once the effects of the constructs in the main model had been accounted for.

Conclusions

This research shows the importance that the strategic role of information technology for the firm and the Dynamism of the environment play in the ability and willingness to transfer all available and appropriate IT to foreign operations units. Such factors prevail over formal structure and existing procedures that may, in turn, be shaped by the existing organizational culture. The levels of technological leverage attained by firms are different between developing and developed nations, regardless of the Strategic Relevance and the Dynamism of the environment. The difference in levels, therefore, is probably not the result of a planned strategy, but rather the inability to overcome existing conditions and barriers in the local foreign markets. Companies tend to decide on the choice of entry mode to a foreign market based on a series of factors that involve the risks associated. Higher levels of Internalization are generally found in developing economies that are characterized by greater instability of the environment. Use of IT may be limited to support operations in these contexts, limiting the ability of the firm to use IT as a core factor for success.

The study of IT transfer increases in importance as firms are reshaping the way they conduct business. Globalization trends and stiff overseas competition make it crucial to consider the factors that foster or dampen the transfer process for firms in the international arena. Obtaining a greater understanding of the process and its implications to business competitiveness is a major research stream that should be undertaken seriously by many researchers in the academic and practitioner fields. Industry-university collaboration has never been so important, given the need for understanding and dealing with rapid changes in the competitive environment. Successful firms in the future will be those whose structure and planning process foster a rapid dissemination of technologies and knowledge, which in turn enable flexibility and adaptation.

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