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ABSTRACT

Rapid and effective internationalization has increasingly become important for high-tech companies. Establishing a foreign subsidiary can facilitate effective internationalization for a high-tech company. This study investigates how IT can provide cross-border support to manage international subsidiary operations and makes important theoretical contributions. The research results exhibit how companies can use cross-border IT-support to effectively share and utilize information from the target country environment for international subsidiary operations. This paper also introduces the diffusion of innovations-based conceptual model which deals with various factors that should be taken into account while operating a foreign subsidiary through IT support. The findings are useful for both practice and further research.

INTRODUCTION

High-tech companies are seeking new business opportunities in foreign countries due to the liberalization of trade polices, the improvement of information technologies (ITs), and the saturation of the home markets, to name a few (Nahar, 2001). Researchers (Huda, Nahar & Tepandi, 1999; Nahar, 2001) indicate that internationalization is important for high-tech companies when they are facing increased competition and saturation in their domestic markets, or competing in the niche market segment (Bell, 1997; Crick & Spence, 2005). To take advantage of the company's chances for growth and success in a target country, it is usually important to have a strong presence of customers nearby. Through establishing a subsidiary in the target country high-tech companies can deliver their products and services, provide after-sales support, and control the market.

In the establishment phase of a foreign subsidiary, a company needs lots of information from the target country environment to evaluate its business opportunities there. Nowadays companies are increasingly using various IT-tools to evaluate business opportunities, support the internationalization process and control foreign markets. IT-tools can support companies in the establishment process of subsidiaries, in managing subsidiaries, acquiring information from target country environmental factors, and facilitating global information change (Blaine & Bowen, 2000; Nahar, 2001). This issue has been further elaborated in this study (See the conceptual model section). Researchers (Huda et al., 1999) also indicate that abusage of IT-tools can decrease a company's market potential and slow down the internationalization process.

There is a considerable amount of literature on the internationalization of companies (see e.g. Bradley, 1995; Crick & Spence, 2005; Luostarinen & Welch, 1990; Malhotra, Agarwal &

Ulgado, 2003), but very limited literature exists on how IT can be used to provide cross-border support for management of international subsidiary operations. Internationalization and operating through the subsidiary is very costly and risky. The selection of a suitable market for the establishment of a subsidiary will have a long-term effect on the success and growth of the company (Edwards & Buckley, 1998; Huda et al., 1999), whereas poorly planned internationalization and an erroneous selection of the target country will inflict a loss on the actual costs and other related costs such as missed opportunities in more suitable markets (Bradley, 1995).

Due to the aforementioned reasons, research is needed on how high-tech companies can use various IT-tools effectively to share and utilize information from the environmental factors of the target country for the subsidiary operations. This information is also needed to understand and facilitate diffusion of a company's products into the target country. The research question addressed in this study is: "How can IT provide cross-border support to management of the international subsidiary operations?"

This paper proceeds as follows: a research method and literature review on cross-border IT-support for business operations is carried out first. Based on the literature review, the conceptual model is developed. Finally, we draw conclusions on this study, and suggest future research directions.

RESEARCH METHOD

The conceptual model has been developed by following a systematic process according to the guidelines of Miles and Huberman (1994) on the basis of the:

- Objectives of this study,
- Key constructs as offered by the diffusion of innovation theory,
- Relationships among the key constructs, and
- Literature in the fields of IT-supported business operations and international business operations of high-tech companies.

In this study, we utilized the diffusion of innovation theory as, "Cross-border IT-support for the management of international subsidiary operations", which is new approach. It is thus an innovation, which is implemented and used in companies. This research evaluated a representative sample of IT-support to international subsidiary operations and IT-related diffusion of innovation research published in journals, books, and conference proceedings.

CROSS-BORDER IT-SUPPORT TO INTERNATIONAL BUSINESS OPERATIONS

IT supports designing, implementing, and managing business ventures in the international marketplace. It also allows the carrying out of business activities across national frontiers. Cross-border IT-support enables employees to work on the same project worldwide by using various IT-tools and assists companies in controlling their global business tasks, reducing costs, and assisting information-sharing and dissemination. The usage of cross-border IT-support has increased due to the significant improvement of telecommunications technology, the decrease of costs of hardware equipment and software applications, as well as emerging worldwide standards

(Eom, 1996; Nahar, 2001). Effective utilization of cross-border IT-support enables companies to support and coordinate their business processes on a real-time and global basis (Blaine & Bowen, 2000). This also provides a global competitive advantage in several ways, e.g. IT helps companies to acquire information regarding customers' needs, to differentiate and customize products for the market, to make a preemptive strike against competitors and enter new markets (Huda et al., 1999; Palvia, 2002). An empirical study by Nahar (2001) reveals that by using various IT tools (e.g. ValNet system, Lotus Notes, CAD, ERP, etc.) a Finnish paper machine producer identified a south Asian country as a location for establishing a subsidiary, developed appropriate plans for establishing business there, and implemented them cost efficiently. With the help of these ITs, the Finnish parent company is providing support to its south Asian subsidiary on a regular basis and controlling it effectively. The nine different capabilities of IT in providing cross-border support to business operations are described below.

Monitoring and Controlling of Subsidiaries and Foreign Markets

The utilization of various IT-tools allows companies to monitor and control business activities in distant locations. Monitoring is targeted at collecting information regarding customers' needs and changes in the environment of the target country (Palvia, 2002; Roche, 2002). By using various monitoring and controlling systems, companies can tap into new opportunities and reduce risks in the foreign markets, attain competitive advantages, as well as ensure coherent strategies between the parent company and its subsidiaries (Nahar, 2001; Simon, 1996). The monitoring and controlling of subsidiaries can be handled by utilizing, e.g. databases, website of the competitors' website, e-mail, Intranet, tele- and video- conferencing. With all these available IT-tools, companies can monitor changes in the selected markets and control progress of their own strategies, as well as monitor the actions of the competitors (Huda et al., 1999).

Global Information Sharing Between the Parent Company and Subsidiaries

Cross-border IT-support enables a real-time exchange of information between the parent company and its subsidiaries (Palvia, 2002). Improvements of the telecommunications and peer-to-peer architectures have greatly improved information sharing on an international scale (Roche, 2002; Palvia, 2002). Information-sharing about business strategies, new products, competitors, and customers' needs, etc. is essential in a global business environment. The integration of a company's information systems with Intranet, Extranet, groupware, database, teleconference and other geographically distributed systems enables managers to share information with others throughout the globally distributed business environment, overcoming the barriers of time-zone difference, distance, culture, and organizational boundaries. Through the utilization of IT-tools, employees from around the world can work together across national borders and make decisions faster concerning business operations and strategies. A parent company can both contribute and share knowledge and expertise without having to travel to the sites of its subsidiaries and vice versa. It also enables the quick implementation of a high quality project (Nahar, 2001; Roche, 2002).

Sharing and Managing Global Know-how

High-tech companies need to collect, maintain, and share information from their global operations. Through the utilization of various ITs, companies can store, organize, distribute and

share this information for the management of international subsidiary operations. IT helps companies to locate relevant knowledge quickly, expedite better and faster decision-making, easily locate employees with needed expertise in a shorter period of time, and solve problems quickly (Nahar, 2001). Global cross-border know-how sharing between a parent company and its subsidiaries can be facilitated by using Extranet, Intranet, groupware applications, tele- and video- conferencing, employees' skills databases, etc. Through the utilization of these IT-tools, stakeholders around the world can make contributions in the form of their know-how and expertise. This also decreases the employees' need to travel to the project location to share know-how and solve problems (Ives, Jarvenpaa & Mason, 1996; Nahar, 2001).

Global Training

Especially in the start-up phase of the subsidiary, the parent company needs to train their employees in the subsidiary and the distributors to sell their products and provide support to new customers (Nahar, 2001). Due to the development of the IT industry, various IT-based training tools are becoming beneficial and easier to use for global training. Interactive multimedia training utilizing Extranet, video conferencing and computer-based simulation software makes training more effective, reduces face-to-face training needs, increases training capacity and enables real-time training. Effective utilizations of these IT-tools can facilitate international training, decrease training costs and the need to travel (Nahar, 2001). Global training can be used to train the employees of the subsidiary and the distributors across national borders.

Global Coordination

Several high-tech companies produce their products in distant locations by using development resources on a global scale. These high-tech companies need to coordinate various development tasks and business activities worldwide. Global coordination is also essential when a company markets their products in a global environment, as well as works in a coherent way with customers, suppliers and alliance partners (Nahar, Käkölä, Huda & Deo, 2003). Indeed, the effective utilization of cross-border IT-support allows companies to coordinate their business, R&D and production activities in distant locations between a parent company and its subsidiaries (Palvia, 2002; Roche, 2002), as well as offer competitive advantage in the global marketplace. The utilization of Internet, Extranet and Intranet-based collaborative IT-tools (Nahar et al., 2003), integrated global planning applications, and a common language (Nahar, 2001) helps companies to conduct a timely and accurate coordination of different activities between the parent company and subsidiaries. Therefore the implications of this coordination are that they increase the manageable scale and scope of the company, as well as the output and productivity (Blaine & Bowen, 2000).

Global Project Management

Project team members and managers of the company can be located in different places around the world. A project manager can utilize various IT-tools, techniques and processes to define the goals of the project, lead and support various project teams, monitor progress and ensure that the project is done in a satisfactory manner (Nahar et al., 2003). Project managers can use various project management tools to estimate the requirements of various skills, resources and schedule the project. The utilization of project management tools and mobile computing

systems integrated with Intranet can help the project manager to monitor events, detect problems early on, initiate timely corrective actions, and control day-to-day project activities (Nahar, 2001).

Providing Technical Support and Solving Complex Problems

In some cases, the subsidiary, distributors and customers may need problem-solving support. A company's website can have special support sections for a subsidiary, distributors and customers that provide problem-solving information on a 24-hour and seven-day basis (Philips, 1998). The Internet, Extranet and Intranet, companies' databases, a centralized call centre and e-mail can also be used to ease information-sharing that can overcome distance and cultural barriers, and organizational boundaries between the parent company, subsidiaries, distributors and customers (Nahar, 2001). In order to solve complex technical problems, the experts from a parent company can connect to customers' computers over a secure online connection, diagnose and solve problems (Philips, 1998). The aforementioned methods can therefore enable rapid problem-solving between the parent company and subsidiaries, and improve customer satisfaction.

Continuous Information Supply

Multinational companies need to constantly supply appropriate information related to different global business activities to their partners, distributors and customers (Roche, 2002). IT plays a critical role when companies integrate and synchronize various tasks between the parent company, subsidiaries, suppliers, and customers (Shore, 2002). A company's websites, Extranet, Intranet and data warehouses-based information could be supplied constantly to distributors and customers. If marketing-related materials are developed separately by the parent company, a subsidiary and distributors, work can overlap and spoil efforts and resources. In fact, a possible redundancy of different information in different places can be avoided through IT-supported collaboration. The successful information supply can foster coordination of the activities of the extended supply chain in a way that decreases development time with improved quality and lower costs. A continuous and effective information supply also facilitates better communication and collaboration among all the participants involved (Nahar, Käkölä & Huda, 2002).

Access to Advice of Remote Experts

Access to the advice of remote experts enables a quicker decision-making process, as well as allowing more immediate problem-solving. Companies can utilize the advice of remote experts between the parent company and subsidiaries. If an employee in a subsidiary faces some problem, s/he can contact the parent company and get help immediately to resolve the specific problem. Thus Extranet, Intranet, tele- and video- conferencing can be utilized between the parent company and subsidiaries to solve any difficulties encountered. Utilization of these tools enables quicker and more accurate decision-making and problem-solving, as well as saving time and expenses associated with overseas traveling (Nahar, 2001).

DIFFUSION OF INNOVATIONS THEORY

The field of IT is highly dynamic and it generates new innovations continuously. At the same time, new opportunities are emerging for the development and utilization of IT for conducting different business activities. Rogers introduced the diffusion of innovations theory for

the first time in his book "Diffusion of Innovations" (Rogers, 1962). According to Rogers (1983, pp. 5-11), an innovation is "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" and diffusion is "the process by which an innovation is communicated through certain channels over time among the members of a social system". This study conceptualizes an innovation as a new practice to acquire, use, and manage information by using various IT systems to support the management of a foreign subsidiary in a target country. Due to the above mentioned reasons, the diffusion of innovations theory is suitable for this study to examine the current research problem. Several researchers have used the diffusion of innovations theory to investigate and understand the diffusion of innovations at an organizational level (Mustonen-Ollila & Lyytinen, 2003; Wolfe, 1994) or in various IT related business operations (Damsgaard & Lyytinen, 1998; Nahar 2001).

The usage of various IT systems is highly influenced by micro-, telecommunications and IT industry-, and macro level factors in a target country. The general diffusion of innovations theory by Rogers (1983) does not include these kinds of factors, thus this study utilizes an extended version of diffusion of innovations theory based on the framework developed by Nahar (2001).

Micro Level Factors

Micro level factors include the characteristics of an innovation and the characteristics of a company. The characteristics of a company have long been associated with its capacity in the successful implementation of an innovation (see e.g. Nahar, 2001; Zaltman, Robert & Jonny, 1973). An innovation is more successful and its rate of adoption is higher among users if it includes the following characteristics (Rogers, 1962, 1983; Rogers & Shoemaker, 1971):

a) **Relative advantage:** the determinant issues that are an innovation's relative advantages to consumers, and the consumers' capability of seeing the benefits of an innovation.
b) **Compatibility:** an innovation that is more compatible with cultural values and beliefs, with previous innovations or with consumers' needs, has a higher potential of being adopted.
c) **Simplicity:** if an innovation is complex, it may have negative impacts on the rate of adoption among consumers.
d) **Trialability:** an innovation that can be tried out on the installment plan has a higher potential of being adopted more rapidly than those that do not.
e) **Observability:** if an innovation is easily observed and communicated to others, it has a higher potential to be adopted by consumers.

The key characteristics of a company that are associated with the rate of innovation's adoption inside the company can be classified by the following:

a) **Need for the innovation:** high-tech companies are dependent on their capabilities to improve innovations to increase productivity and competitive edge (Nahar, 2001).
b) **Resources and experience:** successful implementation of an innovation needs adequate resources, such as material and financial resources, knowledge, etc. (Nahar et al., 2003).

c) **Management and leadership:** the successful management and leadership require the ability to plan, implement, provide support, lead, motivate, and control new innovations (Nahar, 2001).
d) **Training:** specific knowledge and skills are needed in high-tech companies. Successful training enhances the adoption of new IT-tools (Nahar et al., 2003).

Telecommunications and IT Industry Level Factors

Industry level factors include the characteristics of the telecommunications and IT industry of the target country. These factors influence companies' capabilities of implementing IT innovations in a selected country. When a high-tech company establishes a subsidiary in a target country, it needs to utilize various IT-tools. The availability of IT-support providers and their level of knowledge influence a company's capabilities to solve problems related to IT-tools (Nahar, 2001).

An advanced telecommunications infrastructure has positive influences on the implementation of IT innovations (Mata & Fuerst, 1997; Nahar, 2001; Nath & Murthy, 2003, 2004). If the telecommunications infrastructure is progressive, it enables high quality Internet services. Availability of the bandwidth in the target country is essential for the company. A bandwidth enables high quality connections and makes implementation of innovations favorable. The security of the telecommunications infrastructure in the target country is also essential for a company. Low security of the Internet in the target country may be a barrier for the successful implementation of innovations (Nahar, 2001).

Macro Level Factors

Macro level factors include the characteristics of the target country. These characteristics influence the IT-supported business operations and diffusion of innovations in the country in question. The macro level factors can be divided into the following categories: a) political and legal factors, b) cultural factors, c) economic factors, and d) marketing factors (Nahar, 2001).

Political stability and safety in the target country has a significant role in IT-supported business operations (Blaine & Bowen, 2000). Legal and/or political restrictions on the IT-sector by the local government negatively influence the implementation of IT-supported operations (Mata & Fuerst, 1997; Nahar, 2001). Several researchers (see e.g. Blaine & Bowen, 2000; Hall & Hall, 1987) indicated that cultural differences influence the company's capabilities of doing business in the target country. Mutual cultural understanding among the managers, employees and customers enables effective communication and successful management of the company, as well as enabling better services for the customers. Moreover, good knowledge of the local culture enables the successful implementation of innovations.

Having a stable economic situation also positively influences the implementation of IT innovations, e.g. stable exchange rates of the currency influence a company's availability to implement IT-supported business operations. The availability and quality of IT-trained employees in the target country is also essential for the company (Galup, Dattero & Quan, 2004; Nahar et al., 2002). The large size of the market and/or demand for a specific product makes a country attractive to foreign companies (Ojala & Nahar, 2004). Laws and regulations regarding

marketing the product (e.g. quality standards) vary in different countries. If these differ substantially, it may hinder the implementation of innovations in the target country (Nahar, 2001), for example if the intellectual property protection system is poorly developed, it may hinder the market entry and implementation of innovations. Several other factors may also influence the implementation of innovations, technological innovations, and IT innovations; therefore, the aforementioned factors may not be comprehensive. The internal factors of the company are more controllable than external factors (Nahar, 2001).

THE DIFFUSION OF INNOVATIONS-BASED CONCEPTUAL MODEL FOR THE MANAGEMENT OF IT-SUPPORTED INTERNATIONAL SUBSIDIARY OPERATIONS

The diffusion of innovations-based conceptual model for the management of IT-supported international subsidiary operations (see Figure 1) is developed on the basis of the diffusion of innovations theory (Nahar, 2001; Rogers, 1962, 1983) and an in-depth literature review. The conceptual model deals with the IT-supported international subsidiary operations in the context of the environment of the target country.

In the conceptual model, the key actors are the parent company and the foreign subsidiary. Between the parent company and the foreign subsidiary, the IT-supported international subsidiary establishment process has been demonstrated. The process consists of the following phases: a) need for establishing a subsidiary, b) international market research for the selection of the attractive markets, c) internal promotion for establishing a subsidiary, d) decision to establish a subsidiary, e) international promotion targeting to selected markets, f) planning for the subsidiary implementation, g) implementation of the subsidiary, h) evaluation, and i) managing and developing the subsidiary. This process has been introduced in more detail in the study of Ojala & Nahar (2004).

The arrow from the parent company, through the IT-supported international subsidiary establishment process to the foreign subsidiary is a two-way flow, because the parent company supports the subsidiary establishment process and information flows both ways. In the establishment process of the subsidiary, cross-border IT-support is needed, because in the different phases of the subsidiary establishment process, information from the target country's macro- and industry- level factors is necessary. The various activities that are performed by the parent company and its foreign subsidiary, both individually and collaboratively are described by using three arrows. The upper arrow describes resources, support and new innovations that flow from the parent company to the foreign subsidiary. The middle arrow presents the continuous information flow and feedback between the parent company and the foreign subsidiary. The lower arrow exhibits profits and reports that the foreign subsidiary returns to the parent company. The industry level factors are interconnected to the telecommunications and IT industry level factors and the macro level factors are interconnected to political/legal, cultural, economic, and marketing environment of the target country. The arrows from the parent company through cross-border IT-support to the foreign subsidiary is a two-way flow, because both of them can collect information from industrial and macro level factors and share information by utilizing various IT systems. Based on the in-depth literature review, the capacities of ITs to provide cross-border support to international business operations have been categorized (see Table 1.).

Figure 1: The diffusion of innovations-based conceptual model for the management of IT-supported international subsidiary operations
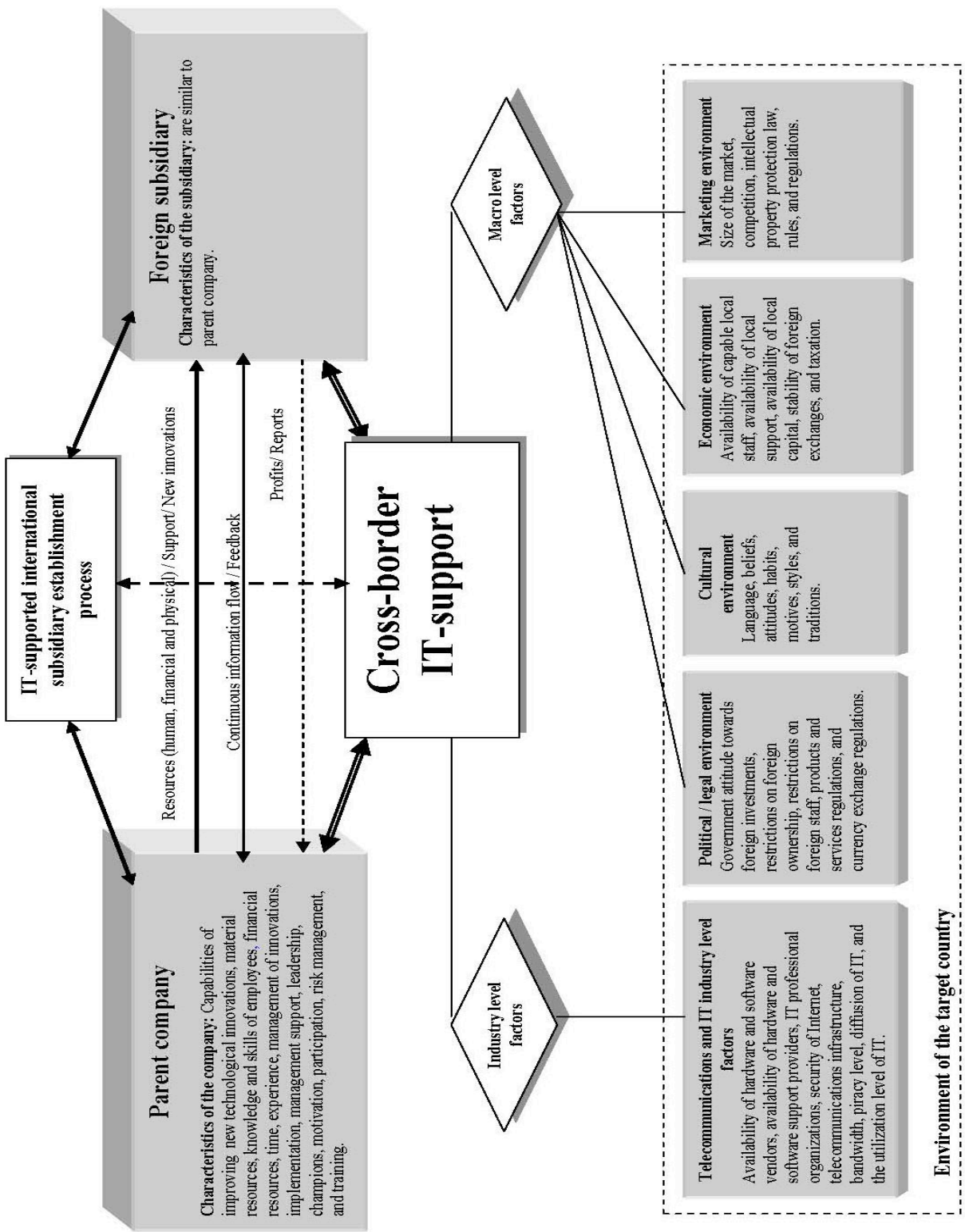
Table 1: Capacities of ITs and their potential to support the management of international subsidiary operations

Capacities of ITs to provide cross-border support to international business operations	Potential tasks of cross-border IT-support	Expected benefits in the context of international business operations
Monitoring and controlling of subsidiaries and foreign markets	• Monitor information on the customers' needs and changes in the market. • Control different business activities in the global market.	• Enables appropriate adaptations to be made to plans. • Implements suitable strategies. • Standardizes planning and budgeting systems. • Develops multicultural collaboration. • Enables real-time reporting.
Global information sharing between the parent company and subsidiaries	• Share information about corporate and subsidiary strategies, new products, competitors, product development strategies and customers' needs.	• Enables employees to work together over national borders. • Facilitates faster decisions concerning business operations and strategies.
Sharing and managing global know-how	• Collect, maintain, store, and share information in international subsidiary operations.	• Locates relevant knowledge. • Enables faster decision-making and problem-solving. • Reduces need to travel.
Global training	• Interactive multimedia training through utilizing various IT training tools.	• Reduces face-to-face training needs. • Enables remote real-time training. • Decreases cost of training.
Global coordination	• Develop distributed products and market them in global environment. • Coordinate customers, suppliers, and alliance partners.	• Decreases risks of global software production. • Increases the manageable scale and scope of the company. • Provides better customer services and coordination of activities.
Global project management	• Estimate and define requirements of various skills, resources, and project scheduling. • Control the progress of the project.	• Detects problems early on. • Controls day-to-day project activities.
Providing technical support and solving complex problems	• Solve technical problems by overcoming distance, cultural barriers, and organizational boundaries.	• Facilitates faster problem-solving support on a 24-hour and seven-day basis. • Improves customer satisfaction.
Continuous information supply	• Constantly supplying appropriate information to partners, distributors and customers.	• Reduces work overlap. • Decreases product development time, as well as spoiling of efforts and resources.
Access to advice of remote experts	• Share information and get help immediately to resolve specific problems.	• Enables quicker decision-making and problem-solving. • Reduces need to travel.

CONCLUSIONS AND FUTURE RESEARCH

In many cases, the domestic market for various high-tech products is small and saturated. High-tech companies worldwide are seeking new business opportunities in countries where they can market their products, recover R&D costs, and make a profit. New IT-tools are creating opportunities for companies to acquire information from attractive countries, share information over the borders, and facilitate international subsidiary operations. Unfortunately, most companies are failing to avail themselves of these opportunities, as very limited literature exists on how IT can be used to provide cross-border support for foreign subsidiaries. This research examined and analyzed how high-tech companies can use various IT-tools for cross-border IT-support. Cross-border IT-support allows companies to collect, store, organize, share and utilize information from the macro- and industry- level factors of the target country. A company can use this information when they evaluate the diffusion of a company's products in the target country.

This study makes theoretical contributions and extends both traditional diffusion theory (Roger, 1983) and the extended version of diffusion of innovations framework (Nahar, 2001). The research result is unique, as no prior scholarly inquiry has examined and introduced a diffusion of innovations-based conceptual model for the management of international subsidiary operations. This study suggests that the utilization of a variety of IT-tools for cross-border support assists companies in acquiring and delivering information from the target country environment. This cross-border IT-support facilitates their internationalization process, enhances cross-border assistance for international operations, and assists effective management of information.

The conceptual model developed in this study, can be used to identify, analyze, and understand the characteristics of an innovation and a company, as well as the industrial and environmental factors of the target country. Companies can use this model when they evaluate their capabilities of entering foreign markets and identify the most attractive markets for their products. The knowledge obtained from this research will also assist companies in managing and developing their business in foreign countries. The field of IT is developing rapidly and new IT-tools create opportunities for companies to make their internationalization operations more effective, and enhance the management of data globally between distant units. Companies need to take into consideration these new tools as well.

This research develops a generic model for the management of IT-supported international subsidiary operations. Further research in this area is needed to validate the developed conceptual model empirically. Further empirical research is also necessary regarding how much the IT environment of some specific country influences cross-border IT-support, such as in the context of developing or developed countries. Research is also necessary on the barriers that companies encounter while using cross-border IT-support in real-life settings.

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