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# The Impact of Software Product and Service Characteristics on International Distribution Arrangement for Software Solutions

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# THE IMPACT OF SOFTWARE PRODUCT AND SERVICE CHARACTERISTICS ON INTERNATIONAL DISTRIBUTION ARRANGEMENTS FOR SOFTWARE SOLUTIONS

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## Abstract

*When entering foreign markets, software firms need to make a fundamental choice on the distribution arrangements for software and related services. This choice may involve contracting with local partners or entering foreign markets through company-owned channels. This study focuses on analyzing such boundary choices of software product firms in international markets. Taking a knowledge-based perspective, a research model is developed that outlines the influence of software product and service characteristics on software firms' international entry mode choices. The research model is tested using PLS based on survey data from internationally operating software firms. In line with the knowledge-based reasoning, the results point out the need for software firms to enter foreign markets through company-owned channels if the business processes and the functionality reflected in a software product are highly specific and if a high share of complementary services is provided. In contrast, if significant country-specific adaptations of software products need to be performed, in particular language localization, the required knowledge is most effectively integrated through cooperation with local sales partners.*

**Keywords:** Software products, specificity, internationalization, distribution, entry mode, knowledge-based view

## Introduction

During the past decade, globalization of software and services has gained considerable momentum. Specifically, providing software solutions globally has become a strategic necessity for many software firms, driven both by customer demands for internationally deployable information technology (IT) solutions as well as strategic aims to explore the potential of foreign markets (Bell 1995). Since the ‘dot-com’ bust in 2001, the global software market has shown consistent growth and is expected to reach a value of \$271.8 billion by the end of 2011 (Datamonitor 2007).

In this global supply environment, software firms are facing the challenge of organizing the distribution of software products and related services in foreign markets. This implies that, when entering a foreign market, software firms need to make a basic entry mode choice of either contracting with local partners to distribute their products and services or extending the firm abroad by establishing wholly owned subsidiaries or deploying employees. To managers, entry mode choice equals a make-or-buy decision, with distribution within company-owned channels being the “make” option and distribution through contractual arrangements being the “buy” option (Anderson and Coughlan 1987).

Existing literature has tried to address this question by analyzing determinants of international entry mode choices of software firms. In line with general studies on entry mode choices of manufacturing and service firms, some studies were able to show that software firms’ entry mode choices are influenced by country-specific factors such as country risk and cultural distance (Brouthers 1995; Brouthers et al. 1996; McNaughton 1996).

Few studies with a strategic management background have made an attempt to analyze the influence of software-specific characteristics on entry mode choice. Those studies provide first insights that higher shares of *services* such as customization and implementation provided along with a software product are related to the choice of company-owned distribution channels (Bell 1995; Burgel and Murray 2000). However, existing studies attempting to analyze the influence of specific software *product* characteristics have not been able to show that product characteristics such as the specificity of knowledge assets are related to entry mode choices of software firms (McNaughton 1996; McNaughton 2002). Likewise, the majority of general entry mode studies have not been able to find significant relationships regarding the impact of transaction characteristics (i.e., asset specificity) on entry mode choice. In both cases, this shortcoming has been attributed to a lack of industry-specific theory building and conceptualization (Brouthers and Hennart 2007).

Taking a closer look at the characteristics of software, however, there are indeed indications that software product and service characteristics impose requirements on the distribution of software and hence on the choice of international entry mode. Particularly, as software is highly intangible and not fixed at the outset, implying that final product design may differ substantially from anticipated product design, software products are quite distinct from products in manufacturing (Lee 1999; Sahay 2003). Software is unique in a sense that it shows close interdependencies between product and service characteristics. During the process of development and distribution, collaboration with the customer is crucial if the software products are to be adapted to specific customer needs (Messerschmidt and Szyperski 2003) and, in case of international distribution, to specific local requirements of a foreign market (Collins 2002).

This need to adapt software products to specific customer and country demands as well as the need to provide product-related services has direct implications for organizing the distribution of software in foreign markets. Specifically, these needs imply that knowledge transfer to the foreign entity is required, regarding both the knowledge about the software product and the idiosyncrasies of foreign markets (Burgel and Murray 2000). This knowledge transfer should be facilitated by the appropriate type of organizational arrangement, that is, the appropriate entry mode channel. The knowledge transfer requirements in turn critically depend on the characteristics of the product and the associated level of services.

Given the lack of previous studies systematically analyzing software-specific determinants of entry mode choice, the main goal of this study will therefore be to identify relevant software product and service characteristics and to show how these factors influence software firms’ entry mode choices in foreign markets. This can be summarized by the following research question:

*How are software firms’ international entry mode choices influenced by software product and service characteristics?*

Our research contributes to the IS literature by being one of the first that focuses on the boundary choice of IS product firms. With standard software products making up an increasing part of organizations' IS, it becomes increasingly important to shift the focus from the downstream question of how user organizations can effectively and efficiently organize their demand of IS products and services (e.g., through outsourcing) to the upstream question of how IS product providers may optimize their organizational boundaries in an increasingly network type IS industry (Gao and Iyer 2006; Iansiti and Levien 2004). Accordingly, this study shifts the focus from understanding the impact of contingencies of IS services or functions on the IS sourcing choice to that of product characteristics on the boundary choice of software product firms. Moreover, in contrast to existing studies, software product and service characteristics are considered simultaneously.

In order to address our research question, relevant IS literature will be analyzed to identify software-specific product and service characteristics. Taking a knowledge-based perspective, a research model will be developed explaining how these characteristics are related to software firms' international entry mode choices. The research model will be tested using survey data from internationally operating software firms. Based on the analysis, implications for research and practice will be outlined and final conclusions will be drawn.

## **Theoretical Foundation**

This chapter will provide the theoretical foundation for analyzing the influence of software product and service characteristics on software firms' entry mode choices. For this purpose, the concept of entry mode will be introduced as the central dependent variable of this study. Following this conceptualization, a research model will be developed based on the knowledge-based view of the firm.

### ***The Concept of Entry Mode***

The choice of international entry mode is considered one of the central issues in international business (Rajan and Pangarkar 2000; Robinson 1978). As an important issue of international business configuration (Porter 1986), international entry mode choice is a key element of international strategy formation. In the literature, entry mode has been defined as "an institutional arrangement for organizing and conducting international business transactions" (Erramilli 1991, p. 482). Such arrangements enable the transfer of products and resources such as technology, skills, or management to foreign operations (Sharma and Erramilli 2004).

Depending on the degree of ownership of foreign ventures, three major forms of entry modes can be distinguished: (1) contractual arrangements, (2) cooperative arrangements, and (3) wholly owned subsidiaries (Aulakh and Kotabe 1997; Brouthers and Hennart 2007). While most of the international business literature focuses on these three distinct entry mode types (Kim and Hwang 1992), some studies also include (4) direct exports as a fourth form of entry into foreign markets (e.g., Brouthers 2002; Sharma and Erramilli 2004). The four basic types of entry modes are described in the following.

(1) In contractual entry arrangements (also referred to as licensing, independent channels, or distribution by foreign partners), a contract is settled between a multinational firm and a third party distributor in a foreign country that agrees upon the distributor's access to the multinational firm's products, technologies, or know-how in return for financial compensation (Rajan and Pangarkar 2000). In this market-based entry mode, the foreign distributor sells the multinational firm's products and services in a respective foreign market.

(2) In cooperative entry arrangements (also referred to as joint ventures or partnerships), a multinational firm and a local firm in a particular host country pool their assets in a common and separate organization, thereby sharing equity and control of the foreign venture (Kogut and Singh 1988; Taylor et al. 1998). In this partnership-based entry mode, the joint foreign venture sells the multinational firm's products and services to customers in that foreign market.

(3) In the case of wholly owned foreign subsidiaries (also referred to as proprietary entry mode arrangements, integrated channels, or foreign direct investment), a foreign venture is established to sell the multinational firm's products and services in a foreign market. The equity of the foreign venture is fully held by the multinational firm (Heinzl 1993; Rajan and Pangarkar 2000). Such channels are also referred to as hierarchies.

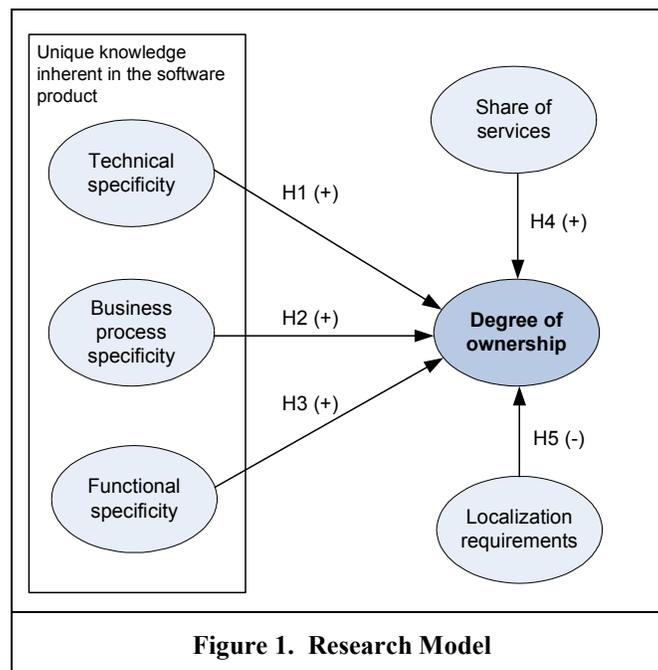
(4) Lastly, in the case of direct exporting, the multinational firm sells products and services from the firm's home country to foreign markets (Taylor et al. 1998). This may imply that employees from the multinational firm's home

country are sent to foreign markets to sell and deploy the firm’s products and services to customers in a foreign market.

For the purpose of analyzing software firms’ international entry mode choices, entry modes will be conceptualized in terms of the degree of ownership of a foreign channel. Hierarchical entry modes such as wholly owned subsidiaries are associated with the highest degree of ownership and hence the highest potential to exert influence. Company-owned channels enable the transfer of knowledge within firm boundaries. On the other side of the spectrum, market-based entry modes such as distribution via foreign partners show the lowest degree of ownership. In between those two extremes are cooperative entry modes such as joint ventures with a medium degree of ownership. It needs to be recognized that mixed entry modes chosen by software firms are common in practice, such as the establishment of a wholly owned subsidiary combined with employee deployment (i.e., full ownership), or the establishment of a wholly owned subsidiary in order to assist local distribution partners (i.e., shared ownership) (Moen et al. 2004, p. 1245).

**Hypotheses Development**

In this section, hypotheses regarding the influence of software product and service characteristics on the choice of international entry mode will be developed based on the knowledge-based view of the firm. The research model summarizing the hypotheses is presented in Figure 1.



Essentially, the model suggests that a software firm will more likely choose a wholly owned subsidiary (full ownership) if (1) the knowledge that is captured in its software product(s) is uniquely tied to the software firm (i.e., firm-specific), (2) if a high magnitude of complementary services is provided, and (3) if the requirements to localize the software product according to the idiosyncratic needs of the foreign country are low. By contrast, a software firm will prefer to contract with a local partner (no ownership) if (1) the uniqueness (i.e., specificity) of the software product, as well as (2) the level of provided services are low, and (3) if localization needs are high. Finally, if there are medium levels of (1) uniqueness, (2) share of services, and (3) location requirements, hybrid arrangements (partial ownership) will be favored.

**Knowledge-Based View of the Firm**

The Knowledge-Based View (KBV) as “the essence of the resource-based perspective” (Conner and Prahalad 1996, p. 477) explicitly considers knowledge as a critical input in production and as the primary source of value of the

firm. As each firm possesses its own unique set of human resources and, thus, a unique repository of knowledge, knowledge asymmetries exist between firms. The speed and efficiency of a firm in creating, transferring and combining knowledge creates value and potential for differentiation. According to the KBV, boundary choice is affected in two ways. First, a firm may choose to get access to superior or complementary knowledge of the external market. Second, a firm needs to consider that getting access to external knowledge requires a certain level of knowledge integration between internal and external knowledge. Thus, knowledge exchange is usually required between two distributed parties. Such knowledge transfer needs time and effort which has to be taken into account in terms of knowledge transfer costs (Demsetz 1988, p. 157). Teece (1977, p. 243) points out that knowledge transfer costs involve both the sender's cost of transmitting knowledge and the receiver's cost of absorbing knowledge. Thus, the question is raised under which circumstances the external market is too costly in terms of knowledge transfer costs. Based on the KBV, knowledge will be more efficiently transferred within firm boundaries if it is highly firm-specific (Fransman 1994), especially as external partners are likely to lack the capability to absorb such knowledge (Dibbern et al. 2008, p. 341; Kogut and Zander 1993, p. 631; Teece 1977, p. 243). Moreover, Conner (1991, p. 141) argues that "limits to integration come from a lack of specificity", implying that knowledge that is not firm-specific can be efficiently transferred through market-based channels without a loss of value.

Building on this perspective, a software firm's international entry mode choice can be analyzed in terms of the firm's ability and ease to transfer knowledge to a foreign entity. Basically, this involves two categories of knowledge related to the software: (1) unique knowledge inherent in the software product and related services, and (2) knowledge about requirements of a foreign market that need to be reflected in the software. The influence of both knowledge categories on a software firm's entry mode choice will be discussed in the following.

### Unique Knowledge Inherent in the Software Product

The process of software development can be characterized as "the processing of knowledge in a very focused way [...], moving from the knowledge application domain to software architectural and algorithmic design knowledge, and ending in programming language statements" (Robillard 1999, p. 92). Building on this definition, two basic types of knowledge are required in software development: (1) technical knowledge and (2) knowledge about the application problem domain. Technical knowledge refers to knowledge about the complexity and the technical design principles of a system, while knowledge about the application problem domain becomes reflected in the functional properties of a system (Bjerknes et al. 1991; Iivari et al. 2001; Tiwana 2003; Tiwana 2004). Furthermore, (3) knowledge about the interplay of computer systems and an application problem domain (i.e., knowledge about the intended or anticipated use of a system) is needed for software development. This type of knowledge is usually developed during the software development process (Bjerknes et al. 1991; Iivari et al. 2001). With software products being based on these types of knowledge, it will be necessary to transfer this knowledge to foreign entities to a certain extent, as this knowledge may be required *during the sales process* as well as *during the subsequent stages of service delivery* (e.g., consulting, implementation, maintenance, support, etc.).

*Technical knowledge* refers to the complexity and the technical design principles of a software system (Bjerknes et al. 1991, p. 32), that is, the methods and techniques that are required to build, configure, and modify a software product (Iivari et al. 2001). Technical knowledge about a software product may be required during the sales process in international markets, as complex technical products usually require explanation. This implies that a sales person should be fairly familiar with the underlying technology of a software product. Depending on how specific this technical knowledge is, hierarchical or market-based entry modes will be chosen.

On the one hand, software firms may build their software based on *proprietary technologies* specific to their organization (Harison and Cowan 2004; Messerschmidt and Szyperki 2003; West 2003). Such proprietary technical knowledge (i.e., firm-specific knowledge) is expected to be more efficiently transferred within firm boundaries. This is due to the nature of proprietary technical knowledge, as generally "only the broad outlines of technical knowledge are codified by non-personal means of intellectual communication" (Teece 1977, p. 243). To fully absorb proprietary technical knowledge, long-time involvement in the specific context and processes of socialization are required. External firms may not be able to invest in absorbing such knowledge (Kogut and Zander 1993; Luqi et al. 2004). On the other hand, software may be built upon *common technologies* that are well established in the industry or accepted as de facto standards (Harison and Cowan 2004; Messerschmidt and Szyperki 2003; West 2003). Such technical knowledge is readily available on the market (e.g., as part of education or training programs (Dibbern 2004)), implying that a software firm will be able to find sales partners in international markets that possess the technical knowledge needed to sell its software in the respective markets. Accordingly, the choice of international

entry mode is proposed to be dependent on the software's *technical specificity* (i.e., the degree to which a software product entails proprietary technologies as opposed to technologies that are established in the industry). This is put forth in the following hypothesis.

*Hypothesis 1: The higher the technical specificity of a software product, the higher the degree of ownership of the foreign channel.*

Apart from technical knowledge, software entails *knowledge about the application problem domain*, which serves as the basis for the functionalities of a system. This knowledge typically resides among users and is seldom explicated in written documents (Bjerknes et al. 1991, p. 32). Whereas early versions of business application software revolved around data-intensive and repetitive functions such as payroll or report generation, many of today's applications are developed to serve specific business functions or industries (Haigh 2002). In fact, many software applications have become deeply ingrained in business processes (Messerschmidt and Szyperski 2003). Therefore, application problem domains can be described in terms of the specificity of business processes. During the sales process in international markets, a thorough knowledge of the business processes reflected by a software is absolutely critical, as this implies an understanding of the customer's needs regarding the software. Depending on how specific (as opposed to generally available) this knowledge about the business processes is, hierarchical or market-based entry modes will be chosen.

On the one hand, software may reflect knowledge about *business processes that are highly specific to certain industries*. Knowledge about highly specific business processes is not readily available on the market. Instead, such knowledge can only be obtained by a software firm through ongoing interaction with the industry for which a software product is being developed. External firms may not be able to invest in absorbing such knowledge (Kogut and Zander 1993). Accordingly, highly business process specific knowledge is expected to be kept within the firm boundaries and thus transferred to foreign markets through company-owned channels. On the other hand, *business processes that are not industry-specific* are captured by so called cross-industry systems, such as financial or human resources applications, whose functionalities "conform to generally accepted practices, rules and regulations" (Currier 1997, p. 37). Other software firms and international distributors are likely to possess such knowledge regarding generic business processes reflected in software, enabling market-based entry modes. As stated in hypothesis 2, the choice of international entry mode is thus proposed to be dependent on the software's *business process specificity* (i.e., the extent to which business processes reflected by a software product are specific to a certain industry).

*Hypothesis 2: The higher the business process specificity of a software product, the higher the degree of ownership of the foreign channel.*

Finally, selling a software product in foreign markets to a certain extent requires knowledge about the application itself, that is, *knowledge about a software application's processing logic based on the functional and object structure of a software and its interdependency with the source code* (Bjerknes et al. 1991; Iivari et al. 2001). For foreign distribution, possessing such knowledge is absolutely crucial in order to be able to thoroughly explain an application's functionality to international customers. This knowledge concerning the interplay between a computer system and the application area is usually developed within a group of software developers during the software development process (Bjerknes et al. 1991). In this sense, obtaining knowledge concerning software functionality requires an experience-based learning process (Nelson and Winter 1982).

The more *specific knowledge about a software's functionality* is (as a result of having evolved from complex social interactions during the development process), the more interaction between the developers and the sales people of the foreign entity will be required to transfer the knowledge. Such knowledge transfer across firm boundaries may be more costly than through company-owned channels, since internal personnel may possess higher levels of absorptive capacity based on longer-term experiences with the respective software products (cf. Dibbern et al. 2008; Kogut and Zander 1993). In contrast, some applications may largely involve standard or commoditized functionality that is well-established in the market and often available open source (West 2003). Knowledge regarding such rather unspecific functionality can be efficiently transferred through market-based channels. Following this reasoning, a software firm's international entry mode choice is proposed to be dependent upon the software product's *functional specificity* (i.e., the extent to which a software product's structure, functionality, underlying operational procedure, and use are unique to this software product (Dibbern 2004, p. 160)). This is put forth in hypothesis 3.

*Hypothesis 3: The higher the functional specificity of a software product, the higher the degree of ownership of the foreign channel.*

## Share of Complementary Services

When analyzing the influence of product characteristics on software firms' entry mode choices, one also has to consider the *complementary services* provided with a software product. The line between software and services becomes increasingly blurred, as many software providers offer hybrid solutions, that is, they provide base functionalities as captured in the software product along with add-on services such as consulting, implementation (including customization), training, maintenance, and support (Boehm 2006; Cusumano 2004).

The choice of international entry mode has implications for the *provision of services*. If hierarchical entry modes are chosen, services are provided by company-owned staff, whereas foreign distributors provide the services in case of market-based entry modes. In a previous study on international market entries of technology-based start-ups, Burgel and Murray (2000) were able to show that intermediaries are excluded from the sales process if a high degree of customization services is provided. Likewise, in the case of software firms, Bell (1995) found that the provision of services generally requires close interaction between the services provider and the customer in a foreign market. From the software developer's perspective, this proximity to the customer becomes especially important, as software innovation usually comes from both the technology supply side and the customer demand side (Hirschheim et al. 1991; Hirschheim et al. 1996; Newman and Robey 1992). Close interaction with a customer during the rollout of a software solution enables feedback to the developers not only about problems, but also about new customer requirements that emerge during the provision of services. This feedback can be considered in the development of later versions of a software product.

Based on this reasoning, it follows that the more services a software firm provides along with a software product, the more likely it will do so through company-owned foreign channels in order to ensure that customer feedback is effectively captured and regenerated to the development units. Accordingly, international entry mode choice of software firms is proposed to be dependent on the share of complementary services (i.e., the extent to which services are offered along with a software product as part of a software solution). This is put forth in the following hypothesis:

*Hypothesis 4: The higher the share of complementary services offered with a software product, the higher the degree of ownership of the foreign channel.*

## Localization Requirements

Beyond the strategy of addressing the needs of foreign markets ex post through add-on services and through customization, however, software firms usually seek to anticipate typical requirements of potential customers and localize the software products accordingly prior to selling it. Any foreign feature that is already installed in the software product increases its attractiveness to the customer. This process is referred to as localization (Collins 2002, p. 74). Although the internationalization of a software product is increasingly a concern in the early phases of software development, implying that software "is designed from the beginning to support international conventions, languages, formats, and processing" (Collins 2002, p. 74), the actual execution of localization becomes an issue with each international market entry. Localization concerns the following three areas: (1) language, (2) legal requirements, and (3) standards (Collins 2002; Pauleen et al. 2006; Wang et al. 2006).

*Language:* The user interfaces need to be translated to the foreign market's native language or at least to a language that is understood by users in the foreign market. Ideally, this translation involves native speakers from the respective country. Translation may involve the usage of different character sets required by certain alphabets (Hogan et al. 2004; Yeo 1996). Attention should also be paid to differences in the use of punctuation in various languages (Collins 2002; Yeo 1996).

*Legal requirements:* Moreover, localization of software for the use in international markets involves the adaptation of the software according to the respective legal requirements of a foreign market. For example, tax rates and the specific calculations of these rates may differ between countries. Moreover, attention should be paid to the proper display of legal messages and disclaimers according to a country's laws and regulations (Chan and Suwanda 2000).

*Standards:* During the process of localization, a software product must also be adapted to a foreign country's customary standards. This pertains to, for example, numbers, dates, and time formats, as these formats differ significantly between countries concerning their inner order, the separators used or their overall scope. Moreover, currency symbols and the corresponding currencies must be implemented correctly. Another example for country-

specific standards includes units of measurement that need to be calculated and displayed correctly (Belge 1995; Chan and Suwanda 2000; Collins 2002; Russo and Boor 1993; Yeo 1996).

In order to be able to perform localization tasks, a local software firm therefore needs to adopt specific knowledge about foreign market requirements (Kersten et al. 2002; Marble and Lu 2006). Partnering with firms in the respective foreign markets is a viable strategy for software firms to close such knowledge gaps (McNaughton 1996), as external knowledge about country-specific requirements will be more efficiently and effectively integrated through partnership arrangements. Thus, in case of higher localization requirements (i.e., the extent to which the firm entering an international market needs to adapt its software in terms of country-specific elements that need to be reflected in a software product) lower degrees of ownership such as cooperative or market-based entry modes will be favored. This is proposed in hypothesis 5.

*Hypothesis 5: The higher the localization requirements of a software product when entering a particular foreign market, the lower the degree of ownership of the foreign channel.*

## Methodology

In order to test the proposed relationships between software product-specific determinants and entry mode choice of software firms, a confirmatory empirical approach was followed. Given the goal of this study to explain variations in the degree of ownership in software firms' entry mode choices, thereby aiming at theory building by analyzing the influence of product-specific determinants, a component-based structural equation modeling (SEM) approach was considered appropriate (Gefen et al. 2000). For this purpose, data was collected in a survey among German medium-sized software firms in 2008. The survey data was analyzed using Partial Least Squares (PLS). The operationalization of the model constructs will be outlined next, followed by a description of the pretest and the data collection procedure.

### *Operationalization of Constructs*

For the purpose of empirical data collection and analysis, SEM requires an operationalization of the theoretical constructs of the research model. The operationalization (i.e., the development of measurement items) will be based on the construct definitions that were outlined during the development of hypotheses in the previous section. Whenever possible, existing measures from previous empirical studies will be adopted, or, if necessary, changed (i.e., adapted) for the purpose of this study. For those constructs that have not previously been measured in other studies, measurement items will be developed based on the construct definitions.

*Degree of ownership.* In order to determine the degree of ownership, survey participants were asked to choose one particular market entry and refer to this one entry mode decision in their answers. Respondents were given a list of possible entry modes to select the distribution channel chosen for the selected market entry. This list included (1) distribution via foreign market distributors without equity stake (i.e., no ownership), (2) distribution via foreign market distributors with equity stake (i.e., partial ownership), (3) the establishment of a wholly owned subsidiary (i.e., full ownership), (4) the acquisition of a wholly owned sales subsidiary (i.e., full ownership), (5) employee deployment (i.e., full ownership), (6) the Internet, and (7) other channels (Aulakh and Kotabe 1997, p. 169; Bell 1995, p. 68; Fryges 2007, pp. 148 ff.). The choice of multiple channels was considered a feasible option, as mixed entry modes chosen by software firms are common in practice, such as the establishment of a wholly owned subsidiary combined with employee deployment (i.e., full ownership), or the establishment of a wholly owned subsidiary in order to assist local distribution partners (i.e., shared ownership) (Moen et al. 2004, p. 1245).

*Unique knowledge inherent in the software product.* During the theory building part, three distinct constructs were identified regarding unique knowledge inherent in the software product: technical specificity, business process specificity, and functional specificity. As no adequate operationalization of those constructs was available from previous literature, measures for these constructs were developed based on the construct definitions. Table 1 provides the items developed for the measurement of technical, business process, and functional specificity and indicates the relevant source. All three items were measured on a seven-point Likert scale, ranging from "strongly agree" to "strongly disagree". It should be noted that items TechSpec1, TechSpec3, BPSpec1 and BPSpec4 have been inversely coded.

*Share of complementary services.* Based on the operationalization by Burgel and Murray (2000), the share of complementary services was measured by asking respondents to determine the shares of licenses and the different types of services in an average customer deal by assigning percentages (0-100%) to (1) software licenses, (2) implementation/consulting/training, (3) maintenance/support, and (4) others. Moreover, an additional reflective item was developed, asking if the respective provider offers software solutions rather than a software product only, which is measured on a seven-point Likert scale (“strongly agree” - “strongly disagree”).

<b>Table 1. Operationalization of Technical, Business Process, and Functional Specificity</b>	
Construct	Item
<b>Technical specificity</b> (based on Messerschmidt and Szyperski 2003)	Predominantly, our software comprises technology that is commonly used by other software providers. (TechSpec1)
	Predominantly, our software comprises a high amount of proprietary technology. (TechSpec2)
	Predominantly, our software comprises technology that is considered 'standard' on the market. (TechSpec3)
<b>Business process specificity</b> (based on Currier 1997)	The core functionality reflected by our software conforms to practices, rules and regulations that are generally accepted across industries. (BPSpec1)
	Our software's core functionality reflects business processes that are unique to a specific industry. (BPSpec2)
	Our software's core functionality addresses the needs of a specific industry. (BPSpec3)
	Our software is uniformly used across different industries. (BPSpec4)
<b>Functional specificity</b> (based on Dibbern 2004 and Dibbern et al. 2008)	The underlying structure and functionality of our software are hard to understand for outside software developers. (FuncSpec1)
	The inherent logic of our software product is hard to comprehend for outside software developers. (FuncSpec2)
	For outside software developers, it is very hard to modify the source code of our software. (FuncSpec3)
	The relations between the single functionalities and the source code are hard to identify for outside software developers. (FuncSpec4)

*Localization requirements.* As the concept of localization entails three distinct facets, namely, adjustments regarding (1) language, (2) legal requirements, and (3) standards, the localization requirements construct was operationalized in the formative mode. Therefore, respondents were asked to assess whether the introduction of a software product in a particular foreign country requires localization to meet country-specific customer requirements with regard to (1) language, (2) legal requirements, and (3) standards, using a seven-point Likert scale ranging from “strongly agree” to “strongly disagree”.

### **Pretest**

All items were assembled into a questionnaire. Prior to the actual survey, a pretest was conducted in order to reveal whether the questions were easy to read and whether respondents were able to understand the questions consistently and provided accurate answers (Fowler 2002). During the pretest, three steps suggested by Dillman (2000) were followed. In a first step, the questionnaire items were discussed with a researcher who was both familiar with the topic and experienced in the design and testing of questionnaires. In a second step, the questionnaire was tested by the first author in a round of individual interviews involving three executives with long-time experience in the software business. During the interviews, each question was discussed with the test persons in terms of wording, understandability, and practical applicability. Overall, the questionnaire was well understood by all of the test persons. Few comments and suggestions to reword some of the questions were made. It was also suggested to change the order of some questions. The final draft was presented independently to one researcher with considerable experience in the design of questionnaires and one executive manager with long-term experience in the software

business who had not participated in designing the questionnaire. The final questionnaire was well understood by both test persons.

### Data Collection

For the purpose of data collection, a survey was conducted among German, medium-sized software firms from May to July of 2008. Specifically, 1426 providers of pre-packaged software with 20 to 500 employees in Germany or 5 million Euros to 50 million Euros sales in Germany were asked to complete the questionnaire. High-level executives were chosen as key informants who were expected to possess substantial knowledge about their firm's international market entries (McKendall and Wagner 1997). Participants were given the choice of either completing a paper-based or an online version of the questionnaire. In total, 175 completed (172 usable) questionnaires were returned, equaling a response rate of 12.3%.

## Data Analysis and Results

### Descriptive Findings

*Respondents' backgrounds.* The returned questionnaires had been completed by directors and CEOs as well as executives from the marketing and sales departments. Among the respondents, 134 (78%) were directors or CEOs, while 8 respondents (5%) were sales directors. The remaining 30 (17%) indicated that they held other positions, such as positions of marketing directors and managers, international business development managers, or partner managers. On average, the executives had worked for their respective company for a period of 12 years. Moreover, 34 (20%) of the responding executives had working experience abroad.

*Demographics.* Among the responding companies, two thirds (116 companies) operate internationally, while one third (56 companies) serves the domestic market only. 20 responding companies (12%) belong to an international holding company, whereas the remaining companies are independent German-based entities. As shown in Table 2, the responding firms that operate internationally have an average of 83 employees in Germany and 310 employees worldwide. Their sales in 2007 value an average of ten million Euros in Germany and 43 million Euros worldwide. The responding firms with domestic operations employ an average of 75 employees in Germany, achieving annual sales of eight million Euros in 2007. At the time the survey was conducted, the internationally operating software firms had entered an average of nine international markets. On average, the companies have ten years of international business involvement. International sales make up about 22% of total sales on average.

	International only		Domestic only	
	N	Mean	N	Mean
Employees in Germany	115	83	56	75
Employees worldwide	113	310	N/A	N/A
Sales in Germany (mio. €)	101	10	52	8
Sales worldwide (mio. €)	98	43	N/A	N/A

*Software solutions.* 40 of the responding companies are providers of Enterprise Resource Planning (ERP) solutions, partly for specific industries. The software solutions offered by the remaining companies can be assigned to the following categories, with the number of responding companies for each category indicated in brackets: document management (15), banking (12), logistics (10), controlling (8), process management (8), programming tools (7), Quality Management Systems (QMS) (7), Customer Relationship Management (CRM) (6), e-commerce (6), public sector solutions (6), communication (5), project management (5), Computer-Aided Design (CAD) (4), health sector solutions (4), production (4), security (4), device programming (3), marketing (3), multi media (3), Business Intelligence (BI) (2), finance solutions (2), mobile solutions (1), and portal solutions (1).

*Selected international market entry.* In order to be able to analyze the influence of product-specific, country-specific, and firm-specific determinants on software firms' entry mode choices, the responding companies were asked to provide information about one particular market entry. The selected market entries took mostly place in Western Europe (60 market entries, i.e., 52%), followed by North America (17 market entries, i.e., 15%), Eastern Europe and Russia (13 market entries, i.e., 11%), leaving 12 market entries (10%) in Asian countries, eleven multinational (10%), one in South America (1%) and one in Australia (1%). On average, the selected market entries took place in 2002, with an average share of 11% of total sales.

Moreover, the responding companies provided information about the channels chosen for the selected market entries. Specifically, the companies indicated whether the selected market entries took place via distribution partners, wholly owned subsidiaries, employee deployment, the Internet, or other sales channels. 56% of the responding (internationally operating) companies chose to enter the selected foreign markets via distribution partners, while 49% chose employee deployment, and 38% the establishment of wholly owned subsidiaries. 20% used the Internet as a sales channel in the selected international markets, while 7% indicated the use of other channels (including software communities, trade shows, and personal relationships).

The selected entry modes were then assigned to three categories representing different degrees of ownership: market-based channels (sales via distribution partners), hierarchies (sales through wholly owned subsidiaries and/or employee deployment), and mixed (i.e., hybrid) channels (sales via both distribution partners and wholly owned subsidiaries and/or employee deployment). This was possible for 114 entry mode decisions. Based on this categorization, the "degree of ownership" variable was composed. As shown in Table 3, market-based entry modes were assigned a value of zero (indicating 0% ownership), while mixed modes were assigned a value of 0.5 (indicating shared ownership), and hierarchical entry modes were assigned a value of one (indicating 100% ownership). In line with previous studies (Brouthers et al. 1996; Brouthers et al. 1999), sales via distribution partners with equity stake was classified as a market-based entry mode for equity stakes of less than 5%, as a hierarchical entry mode for equity stakes of more than 95%, and as a mixed entry mode for equity stakes in between these values.

Entry mode characteristics	N	Degree of ownership
Market-based	31	0
Mixed	29	0.5
Hierarchical	54	1

### ***Results from Model Testing***

As outlined above, the component-based approach (PLS) was used for model testing. Particularly, the software package PLS Graph version 3.0 (Chin 1999-2003) was used to perform the analysis of the model, estimating both the measurement model and the structural model simultaneously. In the following sections, the measurement model results as well as the structural model results will be presented.

### **Measurement Model Results**

For the purpose of measurement model evaluation, different validity checks were performed. In terms of *convergent validity*, both indicator reliability and construct reliability were assessed. Significance tests were conducted using the bootstrap routine with 500 samples. For the reflective indicators, all loadings are significant at the 0.01 level and above the recommended 0.6 parameter value. The weights are distributed about equally across the indicators of the respective constructs. Only in one case (functional specificity), the deletion of an indicator was necessary (FuncSpec1) due to a very low loading.

The formative measurement model for the localization requirements construct showed highly different weights for the three indicators, one indicator even showing a strong negative weight. A possible interpretation of these weights is that software adjustment in terms of (1) language, (2) legal requirements, and (3) standards are three different and separate facets of localization. Software adjustments regarding each of the three categories are therefore likely to require different skill sets and effort, leading to different implications for entry mode choice. For this reason, it was

decided to use the indicators as measures for three separate constructs, that is, language localization requirements (Lo1), legal localization requirements (Lo2), and standards localization requirements (Lo3) and later perform tests for three separate hypotheses (H5a, H5b, H5c).

For an assessment of *construct reliability*, scores for composite reliability and average variance extracted were calculated for each variable. For all variables, the scores for composite reliability (CR) and average variance extracted (AVE) range comfortably above the recommended thresholds of 0.6 and 0.5, respectively.

Moreover, the measurement model was evaluated in terms of *discriminant validity*. For this purpose, the squared correlations of the latent variable scores obtained from the PLS deck were compared with the AVE scores. All AVE scores are greater than the squared correlations of all latent variables in the model, thereby ensuring discriminant validity.

### Structural Model Results

*Overall model evaluation.* Based on the model estimation, an  $R^2$  of 0.223 was achieved, indicating that well over 20% of the variance in the degree of ownership of a foreign distribution channel was explained by the underlying independent variables.

*Hypotheses testing.* In order to test the hypotheses of the research model, the path coefficients resulting from the model estimation are analyzed. In the component-based (PLS) approach, path coefficients can be interpreted as standardized  $\beta$ -coefficients resulting from the least squares estimation. Based on these coefficients, the strength and signs of the relationships between the independent variables and the dependent variable can be analyzed. Furthermore, the significance of the path coefficients can be assessed based on the t-values obtained from the bootstrapping routine (Krafft et al. 2005, p. 83). For this purpose, significance tests were conducted using the bootstrap routine with 500 samples.

In Table 4, the model results regarding the impacts of software product-specific determinants on entry mode choice are presented. For each structural path, path coefficients, t-values, and levels of significance are indicated. Moreover, the table summarizes whether a hypothesis is supported or not based on the model results.

Table 4. Model Results						
Hypothesis	Independent Variable	Dependent Variable	Path		t-Value	Supported
H1a (+)	Technical specificity	Degree of ownership	-0.052	n.s.	0.360	NO
H2a (+)	Business process specificity	Degree of ownership	0.254	***	2.807	YES
H3a (+)	Functional specificity	Degree of ownership	0.140	*	1.288	YES
H4 (+)	Share of services	Degree of ownership	0.274	***	2.869	YES
H5a (-)	Localization (language)	Degree of ownership	-0.203	***	2.447	YES
H5b (-)	Localization (legal)	Degree of ownership	0.045	n.s.	0.428	NO
H5c (-)	Localization (norms)	Degree of ownership	0.057	n.s.	0.580	NO
*** / ** / *: significant at the 1% / 5% / 10% level; n.s.: not significant						
p<0.01: t = 2.334; p<0.05: t = 1.648; p<0.10: t = 1.283; df = 499 (500 bootstrap samples)						

In terms of unique knowledge inherent in the software product, the results provide support for hypotheses H2 and H3, implying that higher degrees of ownership of a foreign channel are chosen if the business processes reflected in a software product and the software product's functionality are highly specific. Both business process specificity and functional specificity have a significant positive impact on the degree of ownership. The path coefficients are significant at the 1% and 10% level, respectively. In contrast, no support could be provided for hypothesis H1. For technical specificity, only a very weak negative and not significant impact on the degree of ownership was found.

The share of complementary services was found to be positively related to the degree of ownership, providing support for hypothesis 4. Software firms providing higher shares of complementary services such as implementation, consulting, training, maintenance, and support along with their software products were found to

enter foreign markets via company-owned channels (i.e., hierarchical modes) rather than through foreign distributors. This finding is significant at the 1% level. The share of complementary services has the strongest impact on the degree of ownership in the overall model.

Regarding the influence of localization requirements when introducing a software product in a foreign market, three separate paths were tested, one analyzing the impact of localization requirements in terms of language (H5a), one in terms of legal requirements (H5b), and one in terms of standards (H5c). For localization requirements in terms of language, a negative impact on the degree of ownership was found, significant at the 1% level and thus supporting H5a. This implies that, if the introduction of a software product in a foreign market necessitates a lot of changes to the software product to reflect the language of this market, software firms prefer entering international markets through market-based channels (e.g., distribution partners). In contrast, no support was provided for hypotheses H5b and H5c, with both localization in terms of legal requirements and localization in terms of standards having a weak positive impact on the degree of ownership. Both paths are not significant.

## Discussion

This study was motivated by the need to improve our understanding of how international entry mode choices of software firms are influenced by software product-specific determinants. The study results provide strong support for the influence of software product-specific determinants on entry mode choice. Particularly, the results show that the more specific the required knowledge during the sales process regarding the underlying business processes and functionality of a software product is, the more likely software firms will choose company-owned channels (i.e., higher degrees of ownership) to enter foreign markets. Moreover, the findings indicate that the need to provide complementary services along with the introduction of a software product in a foreign market is associated with higher degrees of ownership in international entry mode choice. In contrast, if software products require a lot of changes to reflect the language of a foreign market, software firms are more likely to cooperate with local distribution partners (i.e., choose lower degrees of ownership). The study results lead to a number of theoretical contributions and practical implications that will be outlined and discussed next. However, in order to provide a well-defined context for interpreting the findings, the major limitations of this study will be pointed out first.

### Limitations

When interpreting the study findings, several limitations of this study should be taken into account. First, this study is *cross-sectional* in nature, implying that the empirical data only allows for an analysis of entry modes at one point in time. For this reason, no insight can be gained from the findings on how changes, knowledge accumulation, and learning may influence entry mode choice over time, thereby limiting the ability to draw causal inferences. Second, as the data about market entries was collected *retrospectively*, that is, after the market entries had occurred, the answers provided by the survey participants may be subject to recall bias (Huber and Power 1985). Third, while the *survey-based methodology* allows for an analysis of a larger sample of entry mode decisions, detailed information about peculiarities of individual cases is not available for analysis as it would be the case if data had been collected on an interview basis. Fourth, the limits of this study's *sample size* need to be recognized as well. While based on 114 international market entries, consistent patterns regarding international entry mode choice of German software firms could be observed, the findings may still not be representative for a larger population. Moreover, statistical power may be affected by small sample sizes (Baroudi and Orlikowski 1989; Cohen 1988). Fifth, the findings are drawn from international market entries by mostly *German-based software firms*. For this reason, the findings reflect international entry mode behavior of this specific national group of firms, implying that attention should be paid to this fact when transferring the findings to other national settings.

### Theoretical Contribution

Keeping these limitations in mind, this study offers a number of theoretical contributions. Particularly, this study has contributed to the study of boundary choices in IS development by being one of the first that took the perspective of IS product firms rather than user organizations or IT service firms. Taking the perspective of IS product firms becomes increasingly important since the majority of IS requirements are now anticipated within standard software products. The IS products industry has developed inter-organizational networks to ensure that IS products are compatible with each other and able to meet customer requirements (Gao and Iyer 2006; Iansiti and Levien 2004).

Accordingly, software firms must carefully analyze to what extent they should make use of the external market. One important question that software firms are faced with in this realm is how to reach foreign markets efficiently and effectively. This study is one of the first that has addressed this question by introducing idiosyncratic IS factors as determinants of the entry mode choice. By drawing on the KBV as a theoretical base, three sets of product characteristics have been elaborated that affect the way in which foreign markets may be entered by software firms.

The empirical results are highly encouraging. The study findings provide strong support for the relation between unique knowledge inherent in a software product and entry mode choice. Both knowledge regarding industry-specific *business processes* and highly specific *functionality* reflected in a software product were found to be related to higher degrees of ownership of foreign channels (i.e., hierarchical entry modes). The two types of knowledge are required during the *process of selling software in international markets*, as the ability of understanding customer requirements regarding business processes and explaining software functionality to foreign customers largely depends on this knowledge.

The fact that knowledge about industry-specific business processes and specific functionality reflected in a software product was found to be associated with international market entry through company-owned channels is in line with the *knowledge-based reasoning*. As knowledge about industry-specific business processes is developed over time through ongoing interaction with the industry, transferring such knowledge through market-based channels cannot be achieved without a loss in value (Madhok 1997), implying that external partner firms are facing limits in absorbing such knowledge (Kogut and Zander 1993). The same applies to specific functional knowledge reflected in a software product, as such knowledge is usually developed in an experience-based learning process as part of the collaboration between software developers during the software development process (Bjerknes et al. 1991).

In contrast, proprietary *technical knowledge* on which software is based was not found to be significantly related to international entry mode choice of software firms. From a *knowledge-based perspective*, this finding may imply that even in presence of high technical specificity, knowledge transfer to foreign entities is not necessarily required, as the explanation of complex software products may not require a sales person to possess a large amount of knowledge about the software's underlying technology or since technical knowledge is explicit and, thus, perfectly mobile (Mata et al. 1995).

Regarding the three types of knowledge inherent in software products, the study findings thus show that the specificity of a software product's underlying technology itself does not have implications on the ease of knowledge transfer to foreign units and hence on the choice of firm boundaries. Rather, it is the way in which technology is instantiated to reflect more or less specific functional or business process needs that determines which organizational arrangements should be chosen to enable effective and efficient knowledge transfer to the foreign entity.

Knowledge-based explanations of entry mode choice receive further support from the findings regarding the *provision of complementary services* along with selling software products in foreign markets. Software solutions with a high share of complementary services such as implementation, consulting, training, maintenance, and support were found to be associated with higher degrees of ownership of foreign channels (i.e., hierarchical entry modes). From a knowledge-based perspective, this may be explained by the fact that company-owned channels enable close interaction with customers in international markets and hence enable to give feedback about customer requirements to the software developers that can be considered in later product versions. Thereby, software innovation largely depends on collaboration with customers (Hirschheim et al. 1991; Hirschheim et al. 1996; Newman and Robey 1992).

Finally, the knowledge-based perspective yields insights about how requirements to *localize* a software product to the needs of foreign markets influence the degree of ownership of foreign channels. The findings show that partnering with local distribution partners in foreign markets (i.e., choosing lower degrees of ownership) is a viable strategy to close knowledge gaps regarding country-specific requirements to be reflected in a software product (cf. McNaughton 1996). Particularly, partnering strategies were chosen if the software had to be adapted to reflect the *language* of a foreign market. In contrast, no significant relationship between localization regarding *legal requirements* and *standards* was found. These findings suggest that adjusting a software product to a foreign country's language requires more country-specific skills than assessing and understanding country-specific legal requirements and standards. Language skills are best available from native-speakers that should also be able to understand the usage context and its specific vocabulary. Such skills are more likely available with external partners.

Overall, the elaboration of product-specific determinants of entry mode choices based on the KBV not only enhances our theoretical understanding of boundary choices in IS development and distribution, but also serves as a

blueprint for a contingency-theoretic perspective in studying international entry mode choices in general. Notably, current entry mode research has largely neglected product-related characteristics as determinants of entry mode choice or could not find statistically significant impacts (Brouthers and Hennart 2007). This study has shown that it is necessary to acknowledge the idiosyncratic features of particular industries as well as the complementary nature of products and services in building product-related determinants of entry mode choices.

### ***Implications for Practice***

From a practical perspective, this study provides a *basic orientation* how a software firm's situation should be reflected in the choice of international entry modes. The findings indicate that particularly the characteristics of a software product and associated services determine entry mode choice. If a software product entails highly specific knowledge regarding business processes and functionality, software firms decide to enter markets through company-owned channels (i.e., wholly owned subsidiaries or employee deployment). When such specific knowledge is needed to sell the software in foreign markets, knowledge transfer to the foreign entity can more easily occur inside the company's boundaries. Moreover, software firms offering high shares of complementary services such as implementation, consulting, training, maintenance, and support have also been found to enter foreign markets through own subsidiaries or employee deployment. The provision of services by company-owned personnel enables valuable feedback about international customer requirements back to the development units in the home country.

In contrast, cooperating with local sales partners in international markets proves particularly beneficial when there are high language differences between a software firm's home country and the host country. Such cooperations facilitate localization of the software product in terms of language. The study findings point out the need for software firms to actively *invest in knowledge transfer activities* to foreign entities. Software firms should acknowledge the potential of cooperating with local distribution partners to bring knowledge about foreign markets and capabilities of dealing with international customers into the foreign units. This requires an *active management of partner network relationships* to be able to benefit from complementarities (Dyer and Singh 1998; Gao and Iyer 2008). Nevertheless, this entry mode strategy bears the risk of leaking strategic knowledge caused by opportunistic partner behavior. Thus, every software firm has to carefully assess and balance the related market opportunities and resulting risks before entering a foreign market in a cooperative mode.

### **Conclusion and Outlook**

The goal of this study was to provide a systematic analysis of how software firms' international entry mode choices are influenced by product-specific determinants. Analyzing software firms' international entry mode choices from a knowledge-based perspective, this study particularly recognizes the need to transfer knowledge about both the software product and the requirements of a foreign market to the foreign entity. For the purpose of theory building, a research model was developed based on an analysis of distinctive software characteristics, explaining their influence on international entry mode choice from a knowledge-based perspective. The model was tested using a survey-based methodology, drawing on data from 114 international market entries made by German medium-sized software firms.

The study findings support the knowledge-based reasoning that unique knowledge inherent in a software product that may be required during the sales process and subsequent processes of service delivery can be more easily transferred through company-owned channels. By extending the existing theory base with product-specific determinants and by explaining software firms' entry mode choices from a knowledge-based perspective, this study has made a unique contribution to existing literature, both to IS research and to reference disciplines including strategic management and marketing. The study has shown how industry-specific conceptualization and measurement approaches can yield rich insight regarding the foreign entry mode determinants as in the case of software firms, thereby addressing a major shortcoming of existing studies analyzing the influence of knowledge-based assets on entry mode choice (Brouthers and Hennart 2007).

As in the face of globalization the global supply and distribution of software is likely to gain importance, international entry mode decisions will become even more critical during software firms' internationalization processes. Based on this study's findings, future research is encouraged to further examine software firms' entry mode choices from a knowledge-based perspective. Particularly, studies analyzing how knowledge about software products and foreign markets is transferred to foreign entities without excessive know-how leakage should yield valuable insights about software firms' internationalization processes and their management of foreign channels.

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