

## Quality, Impact and Success of ERP Systems: A Study Involving Some Firms in the Nordic-Baltic Region

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### Abstract

*Enterprise Resource Planning (ERP) systems are among the largest information technology (IT) investments made by firms. Such systems are diffusing rapidly in the Nordic-Baltic region of Europe. While studies discuss the diffusion of ERP in the region, few studies discuss their success in adopting firms. In this study, we explored the issue of ERP success by sampling the views of private firms in two countries in the region. We employed a three-phase research approach to enhance the validity of our findings. We found that the views of ERP success in an emerging economy (Estonia) and a developed economy (Finland) were similar, and the perception of the qualities and impacts of ERP were not unique to the region, rather they are comparable to those reported in the literature. In that regard, the informational quality of ERP was the highest rated (order of importance) dimension of success for firms in our sample, and organizational impact rated the lowest. Another notable observation in the study was that ERP success in adopting firms in the region might be related to the nature of ERP being acquired, namely, less complex systems may be providing higher success levels. The implications of the findings for both practice and research are highlighted and we outlined areas for future research.*

**Keywords:** Private sector, firms, Estonia, Finland.

### Introduction

Enterprise Resource Planning (ERP) systems are complex comprehensive software designed to integrate business processes and functions. They present a holistic view of a business by permitting the sharing of common data and practices in a real-time environment (Davenport, 1998; 2000; Markus and Tanis, 2000; Somers et al., 2000). Several businesses worldwide are adopting ERP for a variety of reasons, including legacy systems replacement, cost reductions, customer service improvement, and faster information transactions (Davenport, 1998; van Everdingen et al., 2000; Nahar and Savolainen, 2000; Nahar 2001). A recent press release by AMR Research reported the global ERP market increased 14% in 2004 to US \$25 billion for the vendors of such software following a downturn in sales, and the top ERP vendors include SAP and Oracle (Reilly, 2005). ERP adoption continues to grow globally, despite the difficulties and risks encountered by organizations when adopting and implementing these systems (Martin,

1998; Markus et al., 2000). Such systems have been adopted in the Baltic-Nordic region of Europe as well (van Everdingen et al., 2000; Clouter, 2004; Laukkanen, et al., 2005; Ifinedo, 2005). Van Everdingen et al. (2000) noted that the penetration rates of ERP systems among mid-sized companies in the Nordic region were higher in comparison to those of other regions in Europe. They attributed this to the cultural factors of countries in the region and stated, "This cluster [of countries] is recognized as the most innovative cluster with relatively weak resistance to new products and a strong desire for novelty and variety" (p. 29). However, these researchers added a note of caution that there was no proof of a casual relationship between the higher levels of ERP adoption and cultural factors for the Nordic countries.

The objective of this study is to add insight to the discourse of ERP adoption in the region by focusing attention on the perceptions of the derived benefits from such systems to adopting firms. Particularly, we concentrate on private firms in the region because we believe the adoption of ERP systems might be higher there than in public firms. Also, our scan of the literature revealed that other researchers (e.g., Sedera et al., 2002; 2004) have studied the impacts of ERP systems in public sector organizations. The operational environments of public and private sector organization differ considerably (see Ifinedo, 2006b), and we believe that insights that could emerge from a study involving private firms would add to the body of knowledge on ERP success assessment. Specifically, our primary objective is to answer the following questions: What qualities and impacts do adopting firms in the region associate with their ERP software? Using these impacts and qualities to define ERP system success, how do such measures rate in ERP adopting firms? Our secondary objective is to determine whether there are differences in the evaluation of ERP systems success dimensions and measures in the two chosen countries in the region.

## **Research Context**

We conducted our research in Finland and Estonia; both are small Northern European countries with a combined population of approximately seven (7) million people (CIA World Factbook, 2005). Finland is a technologically developed Nordic country, and Estonia is one of three Baltic countries. Estonia is an emerging economy and leads Eastern European countries on the use of information technology (IT) products for socio-economic development (WEF, 2004; Ifinedo and Davidrajuh, 2005). In general, emerging economies have a more liberalized environment and a higher per capita GDP compared to developing countries; however, these indicators are generally lower when compared to developed nations (Ifinedo, 2006b). Due to the limited financial resources available to this research, we are unable to sample the views from all the countries in the region; nevertheless, the two countries chosen for illustration purposes might be sufficient to answer our inquiry (see Ifinedo and Davidrajuh, 2005). Finnish companies began adopting ERP systems in the late 1990s, but the software is just beginning to spread to Estonia and other parts of Eastern Europe (van Everdingen et al., 2000; Clouter, 2004; Ifinedo, 2005). The adoption of ERP in Estonian firms has been ranked among the top ten key information systems (IS) management issues for Estonia for the next three years (Ifinedo, 2006b).

Finland and Estonia are neighboring countries with similar cultural values. Hofstede's (2001) cross-national typology includes the following: Power Distance (PD), Individualism-Collectivism

(IC), Uncertainty Avoidance (UA), and Masculinity-Femininity (MF). We will not focus on these issues, but it is worth noting that all the countries in the region have similar scores on Hofstede's indices. Please see Table 1. Mockaitis' (2002) study of the Baltic countries replicated Hofstede's work. Soh et al. (2000) suggested that cross-national cultural differences might have a bearing on ERP implementation processes. Viewpoints from the Baltic-Nordic region on ERP success assessment theme could be useful to both researchers and practitioners, given the regional characterization observed by van Everdingen et al. (2000). Moreover, this study with its inclusion of Estonia complements ongoing efforts in the European Union that aim to assess how IT can be used to hasten socio-economic development in the emerging economies of the region (Bogdanowicz et al., 2003; Ifinedo and Davidrajuh, 2005). Empirical evidence suggests that ERP systems are equally important for firms in both Finland and Estonia (Laukkanen et al., 2005; Ifinedo, 2006a, b), and our study adds to knowledge in this area.

*Table 1.* Cross-cultural indices and economic indicators of four Baltic-Nordic Countries

Country	Cultural dimension				Economy type	GDP per capita	Population
	PD	IC	UA	MF			
Finland	33	63	59	26	Developed	US\$ 29,000	5.2 million
Estonia	40	60	60	30	Emerging	US\$ 14,300	1.3 million
Lowest index score in Hofstede's database	<b>11</b>	<b>6</b>	<b>8</b>	<b>5</b>			

Sources: (Hofstede, 2001; Mockaitis, 2002; CIA World Factbook, 2005)

## Background

### Quality and IT systems

In this paper, we define "quality" using the definition provided in the Oxford Advanced Learner's Dictionary as "a feature of something, especially one that makes it different from something else" (Hornby, 2000, p.1078). Overall, over the past two decades, quality has been identified as a measure leading to improvements in organizational effectiveness or performance when pursued vigorously (Juran, 1988; Wilkin and Castleman, 2003). Accordingly, IS researchers have used "quality" to describe the effectiveness of IT systems (e.g., DeLone and McLean, 1992; Myers et al., 1997). However, assessing the quality of delivered IT systems is a difficult task because quality has several components or measures. Wilkin and Castleman (2003) commented "a definition of quality could have contradictory functions: sometimes implicit/sometimes explicit; at times mechanistic/sometimes humanistic; and sometimes conceptually/sometimes operationally understood. In an IT context, there isn't any single understanding of the term." (p.3). At times, "quality" is assessed by subjective measures that may be insufficient for describing the true qualities of an IT system (Myers et al., 1997). In their original framework, DeLone and McLean (1992) described the quality of IT systems with two dimensions, namely, System quality and Information quality; a third called Service quality was later added. Here, we will exclude the Service quality dimension because the ERP success measurement framework

(Gable et al., 2003) that this study draws from uses the other two perspectives. Additionally, some of the items or issues in the Service quality dimension, for example, customer service, impacts on the individual and units are covered in the other parts of the framework used for this study. System quality refers to the quality of the system itself, and the information quality refers to the output quality of the IT system. Measures or variables used for assessing the quality of an IT system include the following: data accuracy, reliability, and usability (see DeLone and McLean, 1992, Gable et al., 2003). Attributes such as information relevance, conciseness, and availability are used to assess information quality (DeLone and McLean, 1992, Sedera et al., 2002; Gable et al., 2003).

### **Impact and IT systems**

We define “impact” from the same source (Oxford Dictionary) as “the powerful effect that something has on something/somebody” (Hornby, 2000, p. 678). Here, we use *benefits* and *impacts* interchangeably. In the IS field, measuring the impact or benefits of investments in IT systems is both contentious and challenging (Doll and Torkzadeh, 1988; DeLone and McLean, 1992; Grover et al., 1996; Brynjolfsson and Hitt, 1996; Saarinen, 1996; Myers et al., 1996; 1997; Sedera et al., 2002). Measures used for such evaluation could be tangible/intangible, objective/subjective, perceptual/attitudinal, and qualitative/quantitative (Wilkin and Castleman, 2003). For example, one stream of research (e.g., Doll and Torkzadeh, 1988) focuses on the use of attitudinal, perceptual and subjective measures, whereas the other utilizes financial and objective parameters (e.g., Brynjolfsson and Hitt, 1996). In both cases, understanding the benefits or value of the IT systems could be limited when measures are restrictive (Grover et al., 1996; Saarinen, 1996; Myers et al., 1996; 1997). It has to be stressed that there is no consensus among IS researchers on the conceptualization and operationalization of IT systems impacts or benefits evaluations, and some researchers have argued for the use of comprehensive measures (DeLone and McLean, 1992; Grover et al., 1996; Myers et al., 1997; Ballantine et al., 1997). In their work, DeLone and McLean (1992) provided a comprehensive list of measures used in assessing IT systems’ impacts relating to the individual and organization. Gable and colleagues (Gable et al., 2003; Sedera et al., 2003a) validated a few of those measures in the context of ERP. These researchers also considered measures from other frameworks for assessing IT systems (and ERP systems) benefits (e.g., Myers et al., 1997; Shang and Seddon, 2002). Of note, objective measures such as operational performance and productivity data are difficult to gather because firms do not readily part with such information (see Mabert et al., 2003), this research will use subjective and perceptual measures, which compares with the measures used in similar studies (Sedera et al., 2002; 2004; Gable et al., 2003).

### **IT and ERP System Success Evaluations**

The success of IT systems has been discussed using different attributes of “quality” and “impact” (DeLone and McLean, 1992; Grover et al., 1996; Myers et al., 1997; Wilkin and Castleman, 2003). Perhaps it was the plethora of IS success assessment approaches that led Keen (1980) to seek clarification of the “dependent variable.” In response, DeLone and McLean [D&M] (1992) developed an integrated, multi-dimensional, and inter-related IS success model that is now the dominant model for IS evaluation research (Ballantine et al., 1997; Seddon, 1997; Gable et al.,

2003). Their model is a valuable contribution to the IT systems success evaluation research as it established the use of the “quality” and “impact” attributes or dimensions in a single framework. However, the D&M model is not without criticism (Seddon, 1997; Ballantine et al., 1997). Seddon (1997) believes that the original model promotes diverse interpretations not intended by the authors. That said, with regard to ERP system success assessment, Gable and colleagues (Gable et al., 2003; Sedera et al., 2003a) developed an *additive* model that redefines the dimensions in the original D&M IS success model. In brief, Gable and colleagues eliminated (through multi-stage data collection and statistical analysis) the *Use* and *User satisfaction* dimensions. Arguments against dropping them are also available in the literature (e.g., Srinivasan, 1985; Saarinen, 1996; Seddon, 1997; Ballantine et al., 1997). Particularly, *Use* can only be a measure of success where IS use is not mandatory, a fact that DeLone and McLean (1992) themselves pointed out by commenting, “...usage, either actual or perceived, is only pertinent when such use is voluntary” (p. 68). Moreover, participants in our case studies on ERP success assessment in the region indicated that their ERP use is mandatory (Ifinedo, 2005). The retained dimensions of success in the Gable et al. (2003) ERP system success are as follows: *System Quality*, *Information Quality*, *Individual Impact*, and *Organizational Impact*. As previously stated, Myers et al (1996) argued that any IS success model should incorporate *Workgroup Impact* because of the contributions made by work teams and groups toward organizational productivity. Essentially, the underlying philosophy of ERP systems – the harmonization and integration of organizational functions and business processes – underscores the arguments made by Myers et al. (1996). In further refinement of the Gable and colleagues’ ERP success model, we propose an alternative model consisting of five dimensions that includes *Workgroup Impact*. Please see Figure 1 for the schematic illustration of our ERP system success model [Adapted from: Gable et al. (2003) and Myers et al. (1996)].

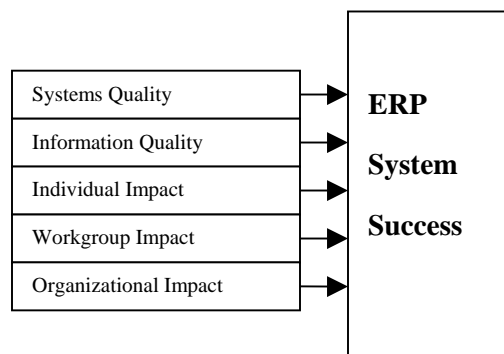


Figure 1. Conceptualization of ERP System Success with Five Dimensions

At this point, it is important to define our concept of ERP system success. Our notion of ERP success refers to the use of such systems to enhance organizational efficiency and effectiveness (DeLone and McLean, 1992; Grover et al., 1996; Gable et al., 2003; Sedera et al., 2003b). In contrast to ERP implementation success that refers to the technical installations success of such systems wherein the measurement indicators include cost overruns, project management metrics, etc. (Martin, 1998; Markus and Tanis, 2000; Markus et al., 2000).

## Research Method

The results in this exploratory study were obtained in a three-step fashion, including both qualitative and quantitative research approaches to enhance the validity of our findings. We started by consulting the relevant literature before we conducted a preliminary survey. Next, we interviewed case companies in the two countries, and finally carried out the main survey for the study. The research phases are illustrated in Figure 2. Each stage along with the results will be discussed in the next sections.

### The Preliminary Survey

First, an online preliminary survey was designed to elicit the views of participants in the two countries. Researchers (e.g., Laukkanen, et al., 2005) in the region indicated ERP adoption rates were higher in the retail/wholesale, electronics, and manufacturing sectors. Given this information, we decided to sample views from these industries.

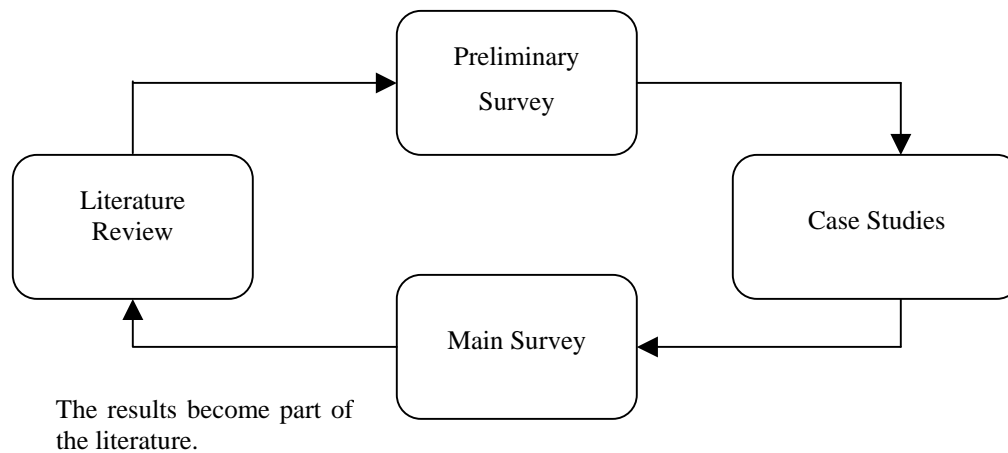


Figure 2. The Research Phases of the Study

The selected firms were generated from online databases of companies in both countries. We randomly selected 75 and 150 firms from the above-named sectors for Estonia and Finland, respectively. In particular, a firm was chosen if we could find the email addresses of organizational key personnel including senior and unit managers. Sedera et al. (2004) indicated that these groups of employees are the most knowledgeable about ERP success in organizations. As the unit of analysis of the study is at the firm level, these organizational actors could provide the relevant information that we were seeking.

We designed a one-page (A4) questionnaire that was cross-checked by two senior IS faculty members and one ERP consultant. It was converted to a web page (in local languages) with scripts to prevent multiple submissions. We sent each participant an e-mail explaining the purpose of our study. Using the local languages, we motivated the participants with the promise of receiving a summary of our findings. The web link of the page was included in the email sent to voluntary participants. The questionnaire included the following questions: What do you

consider the qualities of your ERP since its implementation in your organization? What impacts do you associate with your ERP since its implementation? Importantly, we defined “quality” and “impact” using the definitions provided above, and we stressed that the attributes of “quality” or “impact” could be positive or negative. The participants were asked to list as many attributes of each as they could. Further questions relating to implementation periods of their ERP, ERP types, industry type and job title of respondents were asked. Each participant was sent a reminder about 7 days after the initial email. This phase of the study was conducted between February and March 2005. The purpose of the preliminary study was to: 1) make sure that regional contextual influences were accounted for, 2) enhance the content validity of the main instrument to be developed later, and 3) to test the possibility of using a web-based survey as a research approach for the main study.

### **Results of the Preliminary Survey**

Sixteen (16) Estonian and twenty-seven (27) Finnish firms replied to our emails declining participation or indicating that they did not have or use ERP. Four (4) and Seven (7) participants, from Estonian and Finnish firms, respectively, responded positively to this preliminary survey. Low response rates for studies are common in the region (e.g., Nissinen, 2002), and researchers in the region have relied on contacts to boost their response rates (e.g., Laukkanen, et al., 2005). Overall, web-based surveys usually have low response rates. The job titles of our respondents included the following: Quality manager, Accounts Manager, SAP manager, Sales Manager and IT Managers. There were 9 males and 2 females of which the majority were college graduates. Their ERP software included SAP, Scala, and IBS, most of which were acquired in the late 1990s and early 2000s. The quality attributes listed by the participants included reliability, flexibility, ease of use, automation, centralization of data, speed, and connection with customers. The impact attributes mentioned included integration of organization-wide processes, data resource management, teamwork productivity improvements, cost reductions, smooth operations, and time saving advantages. On average, each participant mentioned 5 attributes, and the 11 participants listed distinctive 28 quality and impact attributes of ERP in all. It is worth noting that our respondents enumerated both positive and negative aspects of the attributes. For example, one Sales Manager (Estonian retail firm) wrote: “Our ERP is not easy to use”, and another Business Manager (Finnish wholesale firm) noted, “Our ERP is slow; it adds mistakes [to the job], and does not support creativity.” We also asked participants how they assess their ERP success in their various organizations. 7 out of 11 participants indicated they did not have or know of such evaluations in their firms. In summary, the attributes of “quality” and “impact” listed by the participants are consistent with those reported in the literature (DeLone and Mclean, 1992; Shang and Seddon, 2002; Sedera et al., 2002; Gable et al., 2003). Thus, we are assured that no peculiar regional contextual considerations or attributes exist that will not be accounted for in our future research efforts. And, having gained the knowledge that the uncovered measures garnered from our 11 participating firms in this phase compared reasonably well with those available in the literature on ERP quality and impact evaluations, we can develop our main survey instrument. Finally, the poor response rate with the web survey approach discouraged us from considering its use as a possible data collection method in the future.

## The Case Studies

For the second phase, we decided to use structured interviews to gain more insights from case companies. Seven firms (3 Estonian and 4 Finnish firms) were identified through local contacts and were interviewed from April to May 2005. We chose only firms that had more than one ERP module, and had completed their ERP acquisition in the last three years. This was done to reduce response bias - not distinguishing between ERP implementation success from overall ERP system success. The firms participated voluntarily, though they requested anonymity; as such, we used pseudonyms only to refer to them. We had sixteen (16) interviewees and we encouraged them to present views representative of their various companies. The job titles of the interviewees included the following: Chief Executive Officer, Chief Accountant, General Sales Manager, ERP Manager, and IT Manager. All participants were college graduates and had worked for several years in their various organizations (please see Appendix 1).

The interviewees clearly distinguished their ERP systems from other IT systems, and were explicit about the qualities and benefits of their ERP (Grover et al., 1996; Sedera et al., 2002; 2004). Prior to each interview, the protocol questions were sent to the interviewees to prepare them for the interview. On average, each interview lasted for an hour and half. In all the cases, we met with at least two interviewees. The use of multiple informants was intended to enhance the reliability and validity of the findings. During the interview sessions notes were taken, which were then transcribed as soon as possible (usually within two-three days). The reports were sent back to the interviewees to peruse and for changes to be made to potentially confusing information. Documents and reports from some organizations were collected that assisted the research effort. Upon obtaining the relevant information for the study, which we summarized in Appendix 1, we concluded by asking each interviewee to provide general comments about what he or she considered relevant or important when assessing the success of their ERP. It was somewhat surprising that the majority of the interviewees commented on the role of their ERP providers. One interviewee captured the views of others when he commented, "As for me, I consider the support from the vendor, their expertise and commitment levels to be critical to our ERP success" (Finance Director/Head of IT, Co-A). Given the importance of ERP providers as noted by the case companies, we had to redefine our ERP success model to incorporate this dimension. In fact, the quality and role of vendors/consultants throughout the life span of any ERP adoption has been described as imperative for any ERP implementation (Markus and Tanis, 2000; Westrup and Knight, 2000, Wang and Chen, 2002; Gefen 2004; Ko et al., 2005). Markus and Tanis (2000) highlighted "dependence on vendors" as a key issue in ERP implementations that differentiates these systems from other IT implementations. Ko et al. (2005) underscored the crucial role that vendors/consultants play by transferring knowledge to organizations during ERP implementation. Importantly, we grouped both vendors and consultants together because they represent an external source of expertise to the organization regarding ERP implementation. Sedera et al. (2003b) found that "consultant and vendor items loaded together yielding a new factor named External knowledge player" (p. 1411). Also, when the implementation of such systems go awry both the vendor and consultant face a similar penalty (Markus and Tanis, 2000).

Thus, our updated conceptualization of ERP system success is shown in Figure 3. It is worth mentioning that the extended model has a better predictive (explanatory) power than one using four dimensions (e.g., Gable et al., 2003) or five dimensions (as indicated in Figure 1). The

discussion on this aspect of our research is beyond the scope to this present paper, but is available elsewhere (see Ifinedo, 2006a).



Figure 3. The Revised ERP System Success Framework

Before presenting the qualities and impacts of ERP mentioned by our participants, we would like to discuss other findings in this phase as follows. Some participants (e.g., Co-A) noted that their organizations made use of steering teams or encouraged company-wide participation during the implementation of their ERP to enhance success. Others (e.g., Co-E and Co-G) informed us that they have outsourced their IT functions, but they retain the services of “Super Users” to ensure transfer of necessary skills to other organizational members. Co-G changed its ERP software from a top-of-the-line brand to a mid-market product due to changes in organizational structure. Many of the case companies (Co-A, Co-B, Co-D, Co-E, and Co-F) still use their aging IT legacy in conjunction with their newly acquired ERP software, and seemed to be satisfied with them. This is a paradox considering that ERP are widely reported to be acquired to replace legacy systems. On the whole, comments received from our participants indicated that their respective firms are satisfied with the qualities, impacts, and success (enhancing organizational efficiency, and effectiveness) of their ERP systems. Next, we highlight some of the key responses relating to the qualities and impact of ERP for the interviewed firms. Appendix 1 summarizes the profiles and results of the participating organisations.

## The Results from the Case Studies

### *Systems, Information and Vendor/Consultant Qualities*

The responses of our 16 participants varied on the system quality dimension perhaps because of their different ERP software. For example, one Chief Accountant (Co-A) stated, “[Our ERP] is easy to use, and has good features..., but sometimes minor mistakes are seen with the accuracy when calculating Risks calculations.” The Finance Director/Head of IT of the same company (Co-A) expressed similar views to the Chief Accountant on several other issues, but indicated that the anomalies specifically noted by the Chief Accountant might be due to problems relating to currency conversions or decimals approximations. Many of the interviewees appeared not to find their ERP difficult to use, though some of them complained about the flexibility of their ERP software. This is consistent with the known shortcomings of such systems (see Davenport, 2000; Sammon et al., 2003). For instance, one Estonian Finance Manager (Co-B) commented, “[Our ERP] is easy to use, but it is not user-friendly and flexible.” Finnish counterparts in Co-F and Co-

G., espoused comparable views. Specifically, the Marketing Manager in Co-G said, “Though, [our ERP] is easy to use, and reliable; sometimes it is difficult to understand”, and one General Sales Manager (Co-E) noted, “[Our ERP] is accurate, reliable, and allows for integration with other computer systems.” With regard to the Information Quality dimension, the majority of our interviewees indicated that their ERP systems have poor information format (see Sammon et al., 2003). Many of the interviewees also believed that their ERP generate timely and accurate information. We noticed that participants from larger enterprises using some of the top-of-the-line ERP (e.g., SAP and Oracle) associated the success of their ERP with their consultants/vendors’ commitments and efforts as already discussed. The same is not true with smaller firms who tend to have less use for their vendors/consultants after the systems’ acquisition. To illustrate, one Finance Manager (Co-B) commented, “When we bought Scala from a local consultant, he helped us with the initial installations, and our in-house IT people did the rest. Anyway, we’ve not had any need to contact him because the system works well.”

#### *Individual, Workgroup and Organizational Impacts*

Here, the responses provided by our participants were mainly subjective. They were reticent to share objective data with the research for fear of not contravening their companies’ rules. Overwhelmingly, the interviewees indicated that their ERP is useful and crucial for their various organizations as noted above. For example, one ERP Manager (Co-C) noted “[Our ERP] has improved our operational efficiency a lot; it has enabled us to better integrate our data with the Data Warehousing unit [of our business].” One Marketing Manager (Co-G) said that their ERP permitted better departmental coordination and enhanced operational linkages with their business partners. The General Sales Manager in Co-E commented “[Our ERP] creates a sense of responsibility for all the employees in our firm; one knows that one’s actions are being watched by everybody (subordinates, peers and superiors).” In all, the interviewees seemed to have positive views about the impacts of ERP on their various organizations. Cost reductions and operational efficiency for the enterprise appeared to be the most mentioned attributes in this regard. This is consistent with the reasons for ERP adoption in the literature (Davenport, 1998, 2000; Mabert et al., 2003), and for Finnish firms’ adoption of the software in particular (Laukkanen, et al., 2005). However, a good number of the interviewees did not believe that their ERP software is capable of giving them any competitive advantages in the market.

### **The Main Survey**

The survey for the third phase of the study was carried out from July to September 2005. We sampled firms generated from local contacts, ERP User Groups, and customers lists obtained from the webpages of ERP vendors, as well as published lists of Top Enterprises for 2004 for both countries. Firms were chosen for this present study by our ability to obtain contact addresses of key organizational personnel from the aforementioned sources. We identified 350 firms in Finland and 120 firms in Estonia. In order to ensure data validity and reliability, four knowledgeable individuals completed the questionnaire prior to our mailing it, and their comments helped us improve the quality. The questionnaire was designed for subjects to indicate agreement with statements using a 7-point, Likert-type scale (Please see Appendix 2). The questionnaire also had sections for other information such as company turnover, workforce, ERP

type, and demographic profiles. We also included a section that enabled the respondent to give us direct feedback.

Since the unit of analysis of this study was at the firm level, only key organizational informants including senior and unit managers as with the preliminary survey received a packet consisting of a cover letter, questionnaire, and a self-addressed, stamped envelope. Forty percent (40%) of the mailings were matched pairs (*two* questionnaires in the packet), and the recipients were encouraged to give one of the questionnaires to an appropriate person within their organization. Low response rates from previous studies prompted us to use this method. It was felt that multiple respondents from one organization would enhance the validity of the study, as common source bias would be minimized. The other 60% of the mailings included only one questionnaire. We instructed the respondents to present views representative of their organization.

### **Results of the Main Survey**

We used SPSS 13.0 to analyze the data. Our respective response rate was 29 firms (8.5 %) and 15 firms (12.5%) for Finland and Estonia, and 9.5% combined for the two countries. We received 62 individual responses: 39 from Finland and 23 from Estonia. 26 (42%) were senior executives and 36 (58%) were in mid-level management positions. The job titles of our respondents included chief executive officer, chief information officer, chief accountant, IT manager, finance manager, and analyst. There were 35 (56.5%) men and 27 (43.5%) women in our sample. On average, they had 9 years of work experience in their respective organizations. Of the respondents, 40% had college degrees, 20% had technical and other vocational education, and 43 (69.3%) were between 31 and 50 years old.

Of the 62 respondents, 33.9% had SAP in their organizations, 14.5% had Movex, 9.6% had Scala, 8.1% had Hansa, and the remaining 33.9% had other mid-market ERP including Concorde, Nova, etc. The majority of firms implemented their ERP between 1998 and 2002. The annual turnover of the firms in the sample ranged from €1 million to a little over €2 billion, with €19 million as the median. The workforce ranged from 10 to 13,000 employees, with a median of 120 employees. We received responses from a wide range of industries, including manufacturing, financial services, IT firms, pharmaceuticals, food processing, retail, and warehouse businesses. The two largest groups in our sample are manufacturing with 9 firms (20%) and the retail/warehouse business with 12 firms (27%). Our sample classified by workforce using guidelines provided by EC (2003) and Laukkanen et al. (2005) included 15 (24%) small companies, 22 (36%) large firms, and 25 (40%) medium-sized. It is difficult to establish whether the firms in our sample are representative of the population of firms in the two countries that have adopted ERP since no demographic information on ERP adoption is available. However, our data is consistent with the study by Laukkanen et al. (2005) indicating that ERP adoption in Finland is higher in the retail and manufacturing sectors, and our earlier study (Ifinedo, 2005) suggested that SAP is the commonest ERP software among large firms in Finland. Finally, our informal discussions with ERP consultants in the two countries confirmed that small and medium-size firms in the region usually adopt mid-market ERP products (i.e., Movex, Scala, Hansa, etc.) as our data showed.

### Instrument Development, Validity and Reliability

We considered the “quality” and “impact” attributes mentioned by our participants and other relevant measures in the literature as we developed the research instrument for the main study.

Table 2. Research Variables

<b>Dimension</b>	<b>No. of measures</b>	<b>Cronbach Alpha</b>	<b>Sources</b>	<b>Examples of questions in the instrument</b>
<i>System Quality</i>	11	0.852	(Gable et al., 2003; Sedera et al., 2003a; DeLone and McLean, 1992)	“Our ERP has accurate data.” “Our ERP is easy to use.”
<i>Information Quality</i>	8	0.822	(Gable et al., 2003; Sedera et al., 2003a; DeLone and McLean, 1992)	“The information on our ERP is understandable.” “The information on our ERP is relevant.”
<i>Vendor /Consultant Quality</i>	5	0.876	(Thong et al., 1994; Ko et al., 2005).	“Our ERP vendor/consultant is credible and trustworthy.”
<i>Individual Impact</i>	6	0.769	(Myers et al., 1997; Gable et al., 2003; Sedera et al., 2003a; DeLone and McLean, 1992)	“Our ERP improves individual productivity.” “Our ERP is beneficial for individual’s tasks.”
<i>Workgroup Impact</i>	7	0.810	(Myers et al., 1996; 1997; Ifinedo, 2005)	“Our ERP helps to improve workers’ participation in the organization.” “Our ERP create a sense of responsibility.”
<i>Organizational Impact</i>	8	0.867	(Myers et al., 1997; Gable et al., 2003; Sedera et al., 2003a; DeLone and McLean, 1992)	“Our ERP reduces organizational costs.” “Our ERP increases customer service/ satisfaction.”
<i>(Overall) ERP system success measures</i>	3	0.942	(Gable et al., 2003; Sedera et al., 2003a)	Overall, the impact of our ERP on <b>i)</b> me, <b>ii)</b> my workgroup (department), and <b>iii)</b> my organization has been positive”

In essence, we incorporated a few of the uncovered measures in our preceding stages into validated instruments developed by Gable and colleagues (Gable et al., 2003; Sedera et al., 2003a). Table 2 shows the sources of the measures and the reliability of the research variables.

The measures or items are listed in Appendix 2. Clearly, the Cronbach Alpha for each dimension is above the 0.70 limit recommended by Nunnally (1978), indicating a reasonably high reliability of the research measures and dimensions. Similarly, the item-to-total correlation coefficients of the measures on their respective dimensions (omitted due to space limitations) are high. In summary, values for each dimension or construct ranged as follows: System Quality (0.55 to 0.79), Information Quality (0.50 to 0.76), Vendor/Consultant Quality (0.70 to 0.89), Individual Impact (0.53 to 0.71), Workgroup Impact (0.62 to 0.76), Organizational Impact (0.59 to 0.81), and ERP success (0.94 to 0.95). Further, the inter-correlations among the constructs, i.e. dimensions of success range from 0.44 to 0.81. We also examined the construct validity of our instrument through principal component analysis. The results of factor analyzing the 45 measures using Varimax with Kaiser Normalization for the six constructs explained 64.29% of the variance in the ERP success model (Figure 3).

### **Analysis and Discussions**

Next, we discuss the quantitative results from the main survey (the third phase). We highlighted the descriptive statistics of the seven case companies alongside the main ones because 20 of 62 subjects came from these companies. Co-A, Co-B, Co-C, Co-D, Co-E, and Co-G had three (3) participants each, and Co-F had two (2). Four other individuals from these firms enlisted but were not interviewed. More importantly, the results from the seven case studies correlated with those of the main survey, which is good for the validity of our findings.

As mentioned, the objective of this study was to determine the qualities and impacts that ERP adopting firms in the Nordic-Baltic region (Estonia and Finland) associated with their ERP software. The preliminary survey conducted in the two countries did not indicate that firms adopting ERP in the region associate differing attributes of quality and impact than those reported in the literature for such systems. Further, our qualitative study with 16 knowledgeable personnel in 7 firms provided us with relevant insights that became useful for interpreting our survey results.

Upon inspection of mean scores of the dimensions of success (quality and impact) for both countries (see Table 3), we highlighted a few salient parts. The mean score for each dimension was the aggregate of all measures for that dimension or construct (see, Hair et al., 1998). There were no dimensions on which the mean scores were 6 (agree) and above; neither were there any below 4 (neutral). The firms in our study mostly evaluated their ERP success dimensions as being close to “somewhat agree (5)”, suggesting agreement with the statements in the questionnaire. The mean score for the System Quality for Estonia and Finland were 5.10 and 4.58, respectively, with 4.77 as the average for both. Clearly, the Estonian mean was higher than that of Finland, and for the two combined. A plausible explanation for this difference could be the nature of the ERP that our Estonian sampled firms used. We noticed that while many of the Finnish firms indicated having top-brand ERP, such as SAP, their Estonian counterparts had mid-market brands such as Scala and Navision. Additionally, upon inspection of the mean scores for the individual measures comprising the System Quality dimension across both countries, we found that measures like “the flexibility of ERP” for which interviewees in our case studies had diverging views, rated lowly.

Table 3. Descriptive statistics: Qualities and Impacts of ERP Systems Success

Descriptive statistics for System Quality				
Estonian case companies (Mean)	Estonian main survey (n = 23) Mean (Std. Dev.)	Finnish case companies (Mean)	Finnish main survey (n = 39) Mean (Std. Dev.)	Both countries (n = 62) Mean (Std. Dev.)
Co-A (4.55)	5.10 (0.664)	Co-D (4.17)	4.58 (0.918)	4.77 (0.865)
Co-B (4.90)		Co-E (4.57)		
Co-C (5.20)		Co-F (3.10)		
		Co-G (3.57)		
Descriptive statistics for Information Quality				
Co-A (5.14)	5.41 (0.494)	Co-D (4.63)	5.16 (0.884)	5.25 (0.767)
Co-B (5.50)		Co-E (4.96)		
Co-C (5.70)		Co-F (4.28)		
		Co-G (4.48)		
Descriptive statistics for Vendor / Consultant Quality				
Co-A (4.52)	4.95 (0.84470)	Co-D (4.33)	4.52 (1.06989)	4.68 (1.000)
Co-B (4.93)		Co-E (5.00)		
Co-C (4.53)		Co-F (3.60)		
		Co-G (4.80)		
Descriptive statistics for Individual Impact				
Co-A (4.67)	4.58 (0.85113)	Co-D (4.28)	4.47 (0.80038)	4.51 (0.815)
Co-B (4.79)		Co-E (4.44)		
Co-C (4.78)		Co-F (3.67)		
		Co-G (3.72)		
Descriptive statistics for Workgroup Impact				
Co-A (4.55)	4.50 (0.75331)	Co-D (4.24)	4.57 (0.85902)	4.55 (0.816)
Co-B (4.61)		Co-E (5.24)		
Co-C (4.81)		Co-F (4.29)		
		Co-G (4.24)		
Descriptive statistics for Organizational Impact				
Co-A (4.52)	4.18 (0.79672)	Co-D (4.21)	4.56(1.04851)	4.42 (0.973)
Co-B (4.45)		Co-E (4.79)		
Co-C (4.71)		Co-F (3.25)		
		Co-G (4.63)		

Regarding the Information Quality dimension, the mean scores for Estonia and Finland were 5.41 and 5.16, respectively, with 5.25 for both. These values were comparable. It is worth noting that this dimension had the highest mean score, and attributes from this dimension were the most readily mentioned by participants in our preceding research phases. With respect to the mean scores, this suggests that private firms in the region seemed to be more satisfied with the informational quality of their ERP systems than with any other dimension of success. This finding might be dissimilar with the views expressed by other researchers (e.g., Sammon et al., 2003) elsewhere that have called the informational quality of ERP into question. The relative importance accorded this dimension by participants in this study could be interpreted as follows: Participants from private firms in the Baltic-Nordic region might indicate they have fewer problems with informational quality of their adopted ERP, perhaps due to their receptiveness towards technological innovations, which van Everdingen et al. (2000) had discussed. And, we had previously mentioned that both countries are technological-oriented countries (WEF, 2004; CIA: World Factbook, 2005; Ifinedo and Davidrajuh, 2005).

Furthermore, Estonia and Finland rated the Vendor/Consultant Quality dimension, 4.95 and 4.52, respectively, with 4.68 being the mean for both countries combined. Once again, these values are comparable, though the mean score for firms in Estonia appeared higher in comparison. Given the preponderance of mid-market ERP products, and small-sized firms in our sample for Estonia, the finding indicating a higher mean for Estonian firms in this research support other studies that have suggested that smaller firms have constraints in the knowledge domain and may have more need for external sources of expertise regarding the adoption of IT systems, including ERP (e.g., Thong et al., 1994; Laukkanen, et al., 2005).

With respect to the Individual Impact dimension, the mean scores for Estonia and Finland were 4.58 and 4.57, respectively, with 4.51 as the mean for the two countries; once again, these are comparable values. Estonian and Finnish firms' mean scores for the Workgroup Impact dimension were 4.50 and 4.57, respectively, with 4.55 for both countries. As can be seen the value for Finnish firms was higher. The types of ERP being adopted in both countries could possibly explain this difference as well. As previously clarified, perhaps the top-brand ERP systems being adopted by the larger Finnish firms have mechanisms for enhancing cross-functional and inter-departmental operations for firms (Markus and Tanis, 2000; Sammon et al., 2003). It is also possible that mid-market ERP products being less complex and scaled down versions of the top-brands (Somers et al., 2000) could be lacking procedures that support workgroup or wider inter-departmental functioning. Thus, we tentatively suggest that the need to satisfy or meet Workgroup Impact may be less noticeable with less sophisticated mid-market ERP products. In this light, Finnish participants might have rated this dimension higher than did their Estonian counterparts.

Furthermore, the results also showed that Finnish firms indicated having higher Organizational Impact from their ERP systems than did their Estonian counterparts, perhaps due to the same explanations offered in the foregoing. The mean scores for Organizational Impact dimensions for Estonia and Finland were 4.18 and 4.56, respectively, with 4.42 for both. Overall, the ERP systems success (overarching dimension) for Estonia and Finland were 5.17 and 4.88, respectively, with 4.99 for both. A result that could be interpreted by the nature of the differing ERP systems seen across both countries. Please see Table 4.

Table 4. Descriptive Statistics for ERP System Success

Estonian case companies (Mean)	Estonian main survey (N = 23) Mean (Std. Dev.)	Finnish case companies (FIN) (Mean)	Finnish main survey (N = 39) Mean (Std. Dev.)	Both countries (N = 62) Mean
Co-A (4.95)		Co-D 4.67		
Co-B (5.02)	5.17 (0.76455)	Co-E 5.33		4.99 (1.136)
Co-C 5.22		Co-F 3.50	4.88 (1.30336)	
		Co-G 4.11		

Table 5 shows that the two most important dimensions (by agreement ordering) for respondents from both countries were Information Quality and System Quality. This relative importance ordering is similar to the results for both countries combined. Although the Estonian sub-sample is smaller compared to the Finnish one, it still has mean scores comparable with the total (both countries) on almost all the dimensions. This may suggest that the sample size for Estonian firms in this study was not problematic for our analysis. Importantly, we performed a strict test on our data by randomly selecting an *equal* number from each group, and the mean scores were comparable with the ones retained for the original data set, which is shown and discussed here.

Table 5. Relative ranking of the dimension of ERP success measurement

Dimension	Estonian firms (n = 23)		Finnish firms (n = 39)		Both countries (n = 62)	
	Mean	Rank	Mean	Rank	Mean	Rank
	Systems Quality	5.10	2	4.58	2	4.77
Information Quality	5.41	1	5.16	1	5.25	1
Vendor / Consultant Quality	4.95	3	4.52	5	4.68	3
Individual Impact	4.58	4	4.47	6	4.51	5
Workgroup Impact	4.50	5	4.57	3	4.55	4
Organizational Impact	4.18	6	4.56	4	4.42	6
<b>(Overall)ERP success</b>	<b>5.17</b>		<b>4.88</b>		<b>4.99</b>	

However, the most noticeable differences in Table 5 are as follows. The Finnish participants seemed to value the Organizational Impact and Workgroup Impact resulting from their ERP software more than did their Estonian counterparts. On the other hand, Estonian firms appeared to value the expertise and knowledge of their vendors/consultants more than did their Finnish counterparts. The relative rankings order shown in Table 5 for the dimensions of ERP success must be interpreted with caution. Our use of structural equation modeling technique in analyzing the ERP system success framework (Figure 3) indicated that System Quality and Organizational Impact were in fact the best predictors of ERP success (see Ifinedo, 2006a). Finally, the mean of the overall ERP success in our sampled firms was higher for Estonian firms. We are tempted to ask the following questions: Could these findings be indicating that mid-market ERP products yield favorable results for adopting firms? Could the complexity of ERP systems be a determinant

in how its “success” is perceived? In other words, are less complex ERP systems perceived by firms to be able to yield better indicators of success? The patterns of the results of this study seem to be indicating that differences may exist between top-brand and mid-market products. The following anecdotal evidence lends credence to our observations:

*“DORNBIRN – In a direct comparison between SAP’s SME business software “Business One” and “Navision” from Microsoft Business Solutions, the SME solution from the Walldorf, Germany-based company was clearly the loser. Two specialist teams had to perform the same tasks using both solutions in front of an audience. A panel of experts and the audience rated the approaches. The winner of the duel at the end of the daylong showdown was Microsoft Business Solutions: the Navision software turned out to be the more mature alternative. The comparison did have its weaknesses, however, because the standard version of Business One does not include certain functions like production control, capacity planning and the Web shop as well as the synchronization of the calendar software. Nevertheless, in all the categories in which a comparison was possible, the jury consistently awarded Navision better marks. The audience, made up mostly of users or independent IT specialists, also cast their ballots for Microsoft. The company representatives in attendance were not allowed to vote” (Computerwoche, 2003).*

The secondary objective of this study was to determine whether there were significant statistical differences in the evaluation of ERP system success dimensions between the two countries. We tested the normality of our data variables using the Kolmogorov-Smirnov statistic with such variables as company size, ERP type, etc. Our results showed that our samples (i.e. for each country and both combined) do not conform to a normal distribution. Hence, the choice to use non-parametric tests (Mann-Whitney U-test and Wilcoxon W statistics) to compare the dimensions between the two countries. The Mann-Whitney U and the Wilcoxon W statistics shown in Table 6 yielded analogous interpretations.

Table 6. The Test Results of ERP Success Dimensions for Firms in Both Countries

	System Quality	Info Quality	Vendor / Consultant Quality	Individual Impact	Workgroup Impact	Organiz. Impact	(Overall) ERP success
Mann-Whitney U	290.000	370.500	326.000	386.500	437.000	343.000	390.000
Wilcoxon W	1070.000	1150.500	1106.000	1166.500	713.000	619.000	1170.000
Asymp. Sig. (2-tailed)	.021	.255	.074	.365	.867	.124	.390

Clearly, the only dimension on which significant statistical differences exist for both countries was the System Quality dimension. Sedera et al. (2004) suggested that technical (IT) employees valued System Quality dimension of ERP success the highest in organizations. Studies have also shown that both Estonia and Finland compare reasonably well on IT and technical issues; as such, we are hard-pressed to posit that technical skills of the Estonian participants might be higher than that of their Finnish counterparts, as the difference on this particular dimension suggests. On the other hand, we attribute the divergence in opinions on this dimension to the types of ERP used by

participants in this study across both countries. We noticed that of the 23 Estonian firms in this study, only 4 had top-brand ERP software, namely, 1 Oracle, 2 JD Edwards, and 1 SAP, the rest had mid-market ERP products. It is, however, reasonable to suggest that differences may exist for the sorts of systems that were likely to be adopted in each country due to differing economic climates; that is, the richer country (Finland) might have had more firms implementing top-brand systems than did firms in Estonia. Nonetheless, this proposition is not supported by empirical data.

### **Implications, Limitations, and Future Research**

This study has implications for both practice and research. We found that system quality and information quality are considered the two important dimensions (relative ranking order) in the assessment of ERP success for our sampled firms in Estonia and Finland respectively as exemplars for an emerging economy and a developed economy in the Baltic-Nordic region. Thus, our results seem to be indicating that for acquired ERP software to be considered “successful” in the region management must ensure that software not perceived by key organizational members to be complicated or complex both in terms of its system quality and informational output should be procured. Because of the relatively mid-ranking positions of the Individual and Workgroup impacts in relation to the other dimensions, management in the region could provide relevant training and exposure with respect to acquired ERP systems as well as facilitate inter-department and functional cooperation to ensure that company-wide benefits or efficiency are achieved. Regardless of the type of ERP procured, management must ensure that organizational members and work units within the organization realize adequate impacts or benefits from their software.

Further, this study indicated that operational efficiency and cost reductions are among the most mentioned reasons why firms in the region adopt ERP, yet the majority of case companies did not believe that their ERP provide them with competitive advantages. The relatively low ranking order of “Organizational Impact” - comprising of measures such cost reduction, etc. - compared with the other dimensions of success underscored this fact. In this regard, managers of firms where such systems are being adopted need to realize the limits of expectations from their ERP software (e.g., Sammon et al., 2003). Additionally, businesses in the Nordic region could benefit from knowing that the perception of the success of a complex IT system such as ERP in private firms did not differ among countries with differing national economic status. Against the backdrop of increasing cross-border investments in the IT and related sectors between countries in the region (Nissinen, 2002; CIA: World Factbook, 2005; Ifinedo and Davidrajuh, 2005), corporate managers can use our findings to strategically plan for the deployment of similar systems in the emerging nations of the region where they have interests. An illustration of the sorts of views held by some Western corporate managers was highlighted in the response provided by the Finance/Administration manager in an Estonian subsidiary of a large multinational courier company (Co-B) when asked about decisions for adopting their ERP. She said, “The HQ [in a developed Western country] makes the adoption decisions; mainly, countries in Eastern Europe are to implement mid-market products, in our case Scala, and Western developed countries, SAP.” Our data partially suggests that the perception of ERP efficiency and effectiveness (impacts and success) may in fact be the comparable across the different economies in the region. The fact that the same courier firm in Estonia is changing from its Scala, which it

implemented in 1998 to SAP in 2005, supports our view that national economic climates may not be a permanent differentiator with regard to ERP adoption and success issues. However, further analysis of the foregoing proposition is needed to substantiate our viewpoint.

We believe that firms that have no formal methods of evaluating the success of their ERP software as we reported in our case studies (see Appendix 1) could use our revised ERP system success framework for such an exercise. We might as well add that a practical way to use our ERP system success model (Figure 3) would be to elicit viewpoints of key organizational actors using the “Quality” dimensions during the period preceding acquisition and implementation. Afterwards, the same set of actors or others in the organization could use the “Impacts” dimensions to evaluate the benefits of their ERP at latter periods. The ERP system success model can also be used for assessing the success of other enterprise systems such as Supply Chain Management (SCM) and Customer Relationship Management (CRM) systems.

Vendors of ERP in the region can also use the findings of this study as input for planning and marketing. Our study indicated that private firms in the region value the attributes of the system itself and the quality of information it produces more than they do the other dimensions of success. Thus, ERP providers could pay more attention to these aspects of their products for firms in the region. More importantly, our findings indicated that although smaller firms often adopt mid-market products, they also tend to value quality interactions with their ERP vendors and consultants. ERP providers dealing with smaller firms in the region (and elsewhere) may find this information useful.

The IS discipline is also enriched by this study. Our research demonstrated that ERP system success could incorporate other relevant measures. We proposed an alternative model that includes two pertinent dimensions not considered by Gable and colleagues (Gable et al., 2003; Sedera et al., 2003a). In that regard, this paper is among the first papers to operationalize the Workgroup Impact for IS success evaluation that was proposed by Myers et al. (1996; 1997). The research methodology of this study with its three-phase approach provided a deeper understanding of the subject matter in our chosen region, other studies investigating issues in hitherto understudied regions might benefit from the approach. Also, since very few studies exist, in which ERP success has been investigated with an integrated model involving the dimensions of quality, impact, and an overarching construct of success, it is hoped that our modest contributions in this area would entice other researchers to use our conceptualization of IS (ERP) success.

We investigated ERP success from the perspective of private organizations in contrast to other comparable studies (e.g., Gable et al., 2003; Sedera et al., 2002; 2004) that focused on public sector organizations. As such, we have added to the cumulative knowledge in this area with views from the private sector, and another region of the world. To our knowledge, this research is the first to present ERP issues views from the Baltic, and in many respects, our study complements other studies on ERP issues in Finland (e.g., Laukkanen et al., 2005). Our study is significant for research in that we have attempted to provide comparative analysis between two differing economies in the region to supplement other studies (e.g., Bogdanowicz et al., 2003; Ifinedo and Davidrajuh, 2005).

Specifically, this study showed that private firms in the Baltic-Nordic region of Europe espoused comparable attributes of “qualities” and “impacts” to those in the literature. This implies that research instruments (e.g., Gable et al., 2003) developed elsewhere can be used in the region without considering regional influences. Similarly, our extended research instrument (Appendix 2) can be used in comparable studies elsewhere. Above all, this study supported other studies reporting the derived benefits of ERP systems and provided evidence in support of the reasons why firms in the region adopt ERP (e.g., Laukkanen, et al., 2005). Our findings corroborate findings that smaller firms tend to procure mid-market ERP products (Mabert et al., 2003), and have more need for external sources of technical expertise (Laukkanen, et al., 2005). Importantly, the results in our study may be suggesting that mid-market ERP software that are less complex than the top-of-the-brand products may in fact be more “successful” in adopting firms.

It is difficult to say with certainty whether our findings would exist elsewhere; however, firms in the region sharing similar characterization as our sampled firms may reflect our results. Thus, this research may be replicable and applicable to private firms in small countries in the region to include Latvia, Lithuania, Iceland, and Norway. Comparable studies in the region are needed to validate the findings in this research. Future studies could sample small-to-midsized firms, and larger firms in the region, including both developed and emerging economies, and subsequently comparisons of results can be made across firms’ sizes and countries. Such efforts would add deeper understanding to our discourse. Furthermore, this study when replicated in other regions of the world could enhance our understanding of the issues pertaining to the success of ERP systems, in general. We have made a case for the use of comparable research instruments on such themes. More importantly, it would be interesting to compare how firms in other parts of the world rate their measures and dimensions of ERP success in comparison to those of the Baltic-Nordic region. Such studies may be relevant for global IT management and research. Other fruitful areas of future research on ERP issues in the region could aim at determining whether firms that outsource their IT functions and systems (including ERP) obtain higher success with their ERP compared to those that did not. Does the use of IT legacy systems by organizational members in conjunction with acquired ERP software negatively or positively impact ERP success assessment? Is ERP success likely to be higher for firms that encouraged company-wide participation during the software adoption than those that did not? As this study focused on private sector firms, further research is needed to examine ERP systems success in the public sector in the Nordic-Baltic Region. Research effort is needed to establish whether mid-market ERP products perhaps due to their less complex nature offer higher levels of success.

Overall, there are limitations to this study. It is exploratory, and although a convenient sample of 62 respondents may be adequate, it is insufficient for a conclusive understanding of the issue. Our sample is not random; as such, we do not stake out a claim for its representativeness for ERP adopting firms in the two countries. Nor can we rule out personal bias, even though the respondents claimed to present an average view for their respective organizations on selected issues. We used subjective and perceptual measures in this study; it is likely that objective measures of ERP success will yield different views. We used variables that have been tested and validated for the questionnaire, but in one dimension - Workgroup Impact – we used a relatively new scale that might require validation; this might have affected our results. Moreover, our

Vendor/Consultant Quality dimension might seem more appropriate to larger firms where larger systems requiring closer interactions with vendors/consultants may be needed; due to the low response rate of the study, we considered views from smaller firms in this study, and this might be limiting. As indicated, our sample comprised of mixed ERP software, it is possible that the heterogeneous nature of the ERP systems used for our study could be a limitation to the study. Further, the administered questionnaire was in English. Although managers in Finland and Estonia have a good command of the English language, there is a possibility that completing the questionnaire in a foreign language might have posed a problem and that some issues were misunderstood.

### Concluding Remarks

Our study investigated issues relating to the quality and impact of ERP systems from the perspective of private sector organizations in two Northern European countries. The major finding is that firms in the region indicated that they value the informational quality of ERP the most, and the dimension relating to the organizational impact of ERP ranked least. Furthermore, our sampled firms across the two differing economies espoused comparable views on the investigated theme: ERP success assessment. And, our data did not suggest the existence of any attributes or measures that should be treated differently, nor did we notice the influence of regional characterization regarding the qualities and impacts that firms associate with ERP (Soh et al., 2000; van Everdingen et al., 2000). Rather what we noticed was that differing views on the qualities and impacts of ERP might be linked to the nature of ERP being adopted by firms. Overall, managers and providers of ERP in the region can benefit from the findings of our study. Likewise, the IS research community is also enriched by our ERP system success model as well as our findings from an important region of Europe.

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*Appendix 1. Profiles and Responses of Case Companies*

		Estonia		
Companies	Co-A	Co-B	Co-C	
Type of company	Independent	Subsidiary	Parent	
Industry	Electrical goods manufacturing	Courier services	Financial services	
Location	Tallinn	Tallinn	Tallinn	
Size (employees)	200	75	2200	
Interviewee	CEO, Chief Accountant, Finance Director/Head of IT	Finance Manager, IT Manager	ERP Manager, Business Officer	
Turnover (euro)	8.6 million	7.2 million	110.0 million	
ERP software	Hansa Financials	Scala	Oracle e-Business Suite	
Time after implementation	3 years	7 years	7 years	
What qualities do ERP adopting firms associate with such systems	<ul style="list-style-type: none"> <li>- Ease of use</li> <li>- Timeliness</li> <li>- Good features</li> <li>- Conciseness</li> <li>- Accuracy</li> </ul>	<ul style="list-style-type: none"> <li>- Ease of use</li> <li>- Not flexible</li> <li>- Reliability</li> <li>- Not User-friendly</li> <li>- Data resource integration</li> <li>- Poor format</li> </ul>	<ul style="list-style-type: none"> <li>- Not user-friendly</li> <li>- Integrates with other systems</li> <li>- Reliability</li> <li>- Availability</li> <li>- Accuracy</li> <li>- Good format</li> <li>- Timeliness</li> </ul>	
What impacts are derived from their ERP?	<ul style="list-style-type: none"> <li>- Productivity is enhanced</li> <li>- Better decision-making</li> <li>- Organizational data resource use</li> </ul>	<ul style="list-style-type: none"> <li>- Productivity is enhanced</li> <li>- Better data flow</li> <li>- Better cooperation in the department</li> <li>- Automation</li> </ul>	<ul style="list-style-type: none"> <li>- Operational efficiency</li> <li>- Productivity is enhanced</li> <li>- Good data warehousing part of the business</li> <li>- e-business enabler</li> </ul>	
How are the qualities and impacts assessed?	None	Internal audit and controls	Scorecards Internal Audit Cost/Benefit	

## Appendix 1. (Continued)

Finland				
Companies	Co-D	Co-E	Co-F	Co-G
Type of company	Subsidiary	Subsidiary	Parent	Subsidiary
Industry	Logistics	Electrical goods manufacturing	Automobile dealerships	Food (retail)
Location	Helsinki	Espoo	Vantaa	Helsinki
Size (employees)	170	800	1200	25
Interviewee	Logistics Manager, IT Manager	General Sales Manager, Segment Manager, SAP Analyst	Director of IT, Sales Manager	Marketing Manager, Brand Manager
Turnover (euro)	10.0 million	40.0 million	350.0 million	6.5 million
ERP software	SAP R/3	SAP R/3	SAP R/3	Movex (Intentia)
Time after implementation	4 years	6 years	9 years	3 years
What qualities do ERP adopting firms associate with such systems	<ul style="list-style-type: none"> <li>- Automatic report generation</li> <li>- Reliability</li> <li>- Not user-friendly</li> <li>- Poor format</li> <li>- Good features</li> </ul>	<ul style="list-style-type: none"> <li>- Good database contents</li> <li>- Accuracy</li> <li>- Reliability</li> <li>- Availability</li> <li>- Timeliness</li> <li>- Data resource integration</li> </ul>	<ul style="list-style-type: none"> <li>- Reliability</li> <li>- Data resource integration</li> <li>- Good features</li> <li>- Availability</li> <li>- Customization</li> </ul>	<ul style="list-style-type: none"> <li>- Easy of use</li> <li>- Availability</li> <li>- Reliability</li> <li>- Poor format</li> <li>- Good, but sometimes difficult to understand</li> </ul>
What impacts are derived from their ERP?	<ul style="list-style-type: none"> <li>- Productivity is enhanced</li> <li>- Departmental co-ordination</li> <li>- Reduces organizational costs</li> <li>- Efficient for operations</li> <li>- enables business</li> </ul>	<ul style="list-style-type: none"> <li>- A feeling of responsibility becomes visible</li> <li>- Productivity is enhanced</li> <li>- Departmental co-ordination</li> <li>- Efficient for operations</li> <li>- e-business enabler</li> </ul>	<ul style="list-style-type: none"> <li>- Productivity is enhanced</li> <li>- Efficient for operations</li> </ul>	<ul style="list-style-type: none"> <li>- Departmental co-ordination</li> <li>- Efficient for coordinating with partners and suppliers</li> <li>- e-business enabler</li> </ul>
How are the qualities and impacts assessed?	None	None	Cost/Benefit Customer feedback	Don't know

## Appendix 2. The measures in the questionnaire

	Measures
1	Our ERP has accurate data
2	Our ERP is flexible*
3	Our ERP is easy to use
4	Our ERP is easy to learn
5	Our ERP is reliable
6	Our ERP allows for data integration
7	Our ERP is efficient
8	Our ERP allows for customization
9	Our ERP has good features
10	Our ERP allows for integration with other IT systems
11	Our ERP meets users' requirements
12	Our ERP database contents is up-to-date
13	Our ERP has timely information
14	The information on our ERP is understandable
15	The information on our ERP is important
16	The information on our ERP is brief
17	The information on our ERP is relevant
18	The information on our ERP is usable
19	The information on our ERP is available
20	Our ERP vendor/consultant provides adequate technical support
21	Our ERP vendor/consultant is credible and trustworthy
22	Our ERP vendor/consultant has good relationships with my organization
23	Our ERP vendor/consultant is experienced and provides quality training and services
24	Our ERP vendor/consultant communicates well with my organization
25	Our ERP enhances individual creativity*
26	Our ERP enhances organizational learning and recall for individual worker
27	Our ERP improves individual productivity
28	Our ERP is beneficial for individual's tasks
29	Our ERP enhances higher-quality of decision making
30	Our ERP saves time for individual tasks and duties
31	Our ERP helps to improve workers' participation in the organization
32	Our ERP improves organizational-wide communication
33	Our ERP improves inter-departmental coordination
34	Our ERP creates a sense of responsibility
35	Our ERP improves the efficiency of sub-units in the organization
36	Our ERP improves work-groups productivity
37	Our ERP enhances solution effectiveness
38	Our ERP reduces organizational costs
39	Our ERP improves overall productivity
40	Our ERP enables e-business / e-commerce
41	Our ERP provides us with competitive advantage
42	Our ERP increases customer service/ satisfaction
43	Our ERP facilitates business process change
44	Our ERP supports decision making
45	Our ERP allows for better use of organizational data resource
46	Overall, the impact of our ERP on me has been positive
47	Overall, the impact of our ERP on my workgroup (department) has been positive
48	Overall, the impact of our ERP on my organization has been positive

Notes: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=neutral, 5=somewhat agree, 6= agree, and 7=strongly agree

\*: Because of their low communalities, these measures may be excluded from future studies.