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DEVELOPMENT AND VALIDATION OF A MODEL FOR ASSESSING THE SUCCESS OF EMPLOYEE PORTALS

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Abstract

Many companies utilize employee portals to improve information exchange and communication between their employees as well as to better support business processes. Owing to limited IT budgets and the need to justify portal investments, assessing employee portal benefits is important. In this article, we propose a model for measuring employee portal success on the basis of the DeLone and McLean IS Success Model as well as an extensive review of employee portal success measurement literature. The resulting model is put forward as the foundation for future empirical work in this area. A card-sorting and item-ranking approach as well as a survey trial is conducted in order to validate the survey instrument. Methods of classical test theory are proposed for the further validation of the survey instrument and the assessment of the measurement model.

Keywords: Employee Portals, Business-to-Employee, IS Success, IS Effectiveness

1 INTRODUCTION

The ways employees handle information, communicate, as well as execute business processes have significantly changed with the emergence of web-based technologies and the subsequent emergence of employee portals. Over the past decade, company intranets transformed from collections of static web pages into highly integrated and interactive information systems (IS). Whereas the first-generation intranets only provided a single interface to information, today's employee portals enable the integrated support of information, communication, applications, and business processes.

Technically speaking, an employee portal offers a browser-based user interface which provides access to personalized information, resources, and applications. In many cases, an employee portal is the primary tool through which employees do their work. Ideally, employee portals yield different benefits to both organizations and employees, such as reducing information overload, reducing organizational costs, improving corporate communication, and enhancing employee productivity (Tojib & Sugianto & Sendjaya 2006).

Today, many companies, especially large ones, offer their employees portals. A 2006 US study by Forrester Research, Inc. indicates that 46% of large companies offered an employee portal, and another quarter planned to establish one by 2008 (Forrester 2006). The use of employee portals has been growing steadily and, despite restricted IT budgets in many companies, investments in portal solutions are still growing (Remus 2006). Although IT departments and decision-makers have to justify portal investments, a significant number of companies do not assess the actual benefits of their portal implementations (Brown & Mines & Moore & Barnett 2007).

Companies which do assess their portal benefits have often used monetary indicators such as return on investment (ROI) or total cost of ownership (TCO) and other cost-benefit analysis methods (White 2003). These success-measurement approaches do not take into account intangible impacts and intervening environmental variables. Clearly, in order to be comprehensive, success measurement would need to consider both tangible and intangible effects in order to truly judge portal success, to detect potential improvements, and to justify present and future investments in portal solutions.

To date, only a few studies have scientifically investigated single aspects of employee portal success such as user satisfaction (bin Masrek 2007, Sugianto & Tojib & Burstein 2007) and service quality (Cheung & Lee 2005). None of the reviewed studies examined employee portal success comprehensively and in an integrated way. The dominant model for measuring IS success is the DeLone and McLean IS Success Model (D&M IS Success Model) (DeLone & McLean 1992, DeLone & McLean 2003). It is considered a sound basis for measuring employee portal success, as it is a comprehensive evaluation framework with validated measures and associations; it has also been applied to several types of IS (Urbach & Smolnik & Riempp 2008).

In this paper, we report on our development of a conceptual model, based on the D&M IS Success Model, which considers the specific requirements of employee portals. Where possible, we employ existing measures that have been tested and proved. The following section 2 describes the theoretical foundations of employee portals and a literature review on measuring IS and portal success. In section 3, we explain how we developed our employee portal success model and discuss the characteristics of its success dimensions. Section 4 outlines our steps for validating the survey instrument applying a card-sorting and item-ranking approach as well as conducting a survey trial. The future validation of the survey instrument and the assessment of the measurement model are presented in section 5. To conclude, we summarize the paper's contribution, refer to the limitations, and present suggestions for additional future research.

2 FOUNDATIONS

The starting point for developing the conceptual model for assessing employee portal success was studying the existing research in the field. We thus reviewed relevant literature on employee portals, information systems success, and existing approaches for evaluating portals.

2.1 Employee portals

Employee portals can be regarded a specific type of the broader concept of *enterprise portals*. The latter will therefore be discussed first. In this context, we use *corporate portal*, *enterprise information portal*, *business portal*, and *enterprise portal* interchangeably (Dias 2001).

An early definition of a portal in the corporate context appeared in a Merrill Lynch report (Shilakes & Tylman 1998). In this report, an enterprise (information) portal is considered an application that primarily integrates the company's information and provides users with a single interface to this corporate information. Subsequent definitions tend to include the integration of collaborative applications such as e-mail and calendars (Eckerson 1999). Current enterprise portals not only integrate information and simple tools, but also business applications and processes (Chan & Liu 2007, Daniel & Ward 2005). In summary, enterprise portals have evolved from low-end intranets into highly integrated IS. Today, such portals enable the integrated support of information, communication, applications, and business processes.

Enterprise portals can be classified in terms of their target user group as supplier, customer, and employee portals. Ideally, these three types have the same technical infrastructure. Thus, organizations effectively have one portal with different "windows," that give each user group access to specific functions that are relevant to it (Riempp 2002).

Before portal technology was available, the web-based intranet was a popular tool for building work force commitment (Azzone & Bianchi 2000). Although it yielded benefits for organizations in this regard, these intranets lacked personalization, offered poor navigation, and did not provide centralized access to information, which often led to losses in productive employee time. To overcome these problems, organizations began to implement employee portals (Tojib et al. 2006).

An *employee portal* is a web-based interface to access personalized information, resources, applications, and e-commerce options. Employees can access a range of internal and external information from their computers through a network connection. They are provided with relevant proprietary information, displayed in a password-protected setting (Sugianto & Tojib 2006). In addition, business applications are increasingly integrated into employee portals. Thus, in many organizations, the role of the employee portal has become crucial, especially when an entire business process can be completed through the use of the portal. In some organizations, an employee portal is the primary tool through which employees do their work (Tojib et al. 2006).

Ideally, employee portals provide a number of benefits to organizations and employees. These include:

- structured access to enterprise information;
- common and personalized views as well as collections of portal elements;
- improvement of organizational information gathering as well as knowledge acquisition and management;
- improvement in employee productivity;
- improvement of corporate communication; and
- reduction in human resources' organizational costs (Dias 2001, Sugianto & Tojib 2006).

Our literature review shows that employee portals have received some attention, but that there is a lack of empirical studies to confirm the assumed benefits of employee portal use.

2.2 Research on measuring IS success

The IS literature provides several definitions and measures of IS success. As DeLone and McLean (1992) state, there are nearly as many measures as there are studies. Obviously, there is no ultimate definition of IS success. Since there are different stakeholders who assess IS success in an organization (Grover & Jeong & Segars 1996), each group has a different definition. From a software developer perspective, a successful IS is completed on time and under budget, has a set of features that is consistent with the specifications, and functions correctly. Users may find an IS successful if it improves their work satisfaction or work performance. From an organizational perspective, a successful IS may contribute to the company's profits or create a competitive advantage. Consequently, success is always assessed from a certain stakeholder's point of view. Furthermore, IS success also depends on the type of system being evaluated (Seddon & Staples & Patnayakuni & Bowtell 1999).

In order to provide a more general and comprehensive definition of IS success, one that covers these different perspectives, DeLone and McLean (1992) reviewed existing definitions of IS success and their corresponding measures, and classified them into six major categories. They then created a multidimensional measuring model with interdependencies between the different success categories. The D&M IS Success Model received much attention from IS researchers. Since its publication, many researchers have treated IS success as a multidimensional construct and have measured it as such (Urbach et al. 2008).

Motivated by DeLone and McLean's call for further development and validation of their model, many researchers have attempted to extend or respecify the original model. A number of researchers have claimed that the DeLone and McLean Model is incomplete; they either suggest that further dimensions should be included in the model, or they present alternative success models (Seddon 1997, Seddon & Kiew 1994). Other researchers have focused on the model's application and validation (Rai & Lang & Welker 2002). Although some weaknesses have been revealed, the D&M IS Success Model has become a dominant model for measuring IS success (Hu 2003).

Ten years after the publication of their first model, and based on the evaluation of the many contributions to it, DeLone and McLean proposed an updated IS Success Model (DeLone & McLean 2003). The updated model consists of six interrelated dimensions of IS success: information, system and service quality, (intention to) use, user satisfaction, and net benefits. It can be interpreted as follows: A system can be evaluated in terms of information, system, and service quality; these characteristics affect subsequent use or intention to use and user satisfaction. As a result of using the system, certain benefits will be achieved. The net benefits will (positively or negatively) influence user satisfaction and further information system use.

The updated D&M IS Success Model appears to be a sound basis for measuring the success of employee portals because:

- it is a comprehensive evaluation framework;
- the proposed associations have been validated by a large number of empirical studies;
- there are many validated measures for the proposed success dimensions that can be reused;
- it has been applied to several types of information systems;
- web-based systems other than employee portals have been evaluated by applying this model; and
- it is the dominant evaluation framework in IS research (Urbach et al. 2008).

2.3 Research on portal success

Existing measurement approaches to assess portal success in practice usually utilize monetary indicators. Typical examples are return on investment (ROI), total cost of ownership (TCO), or other cost-benefit analysis methods (White 2003). Building business cases on the basis of such indicators is questionable because non-monetary impacts and intervening variables are not taken into account.

There is little documented research on employee portal success measurement. Some studies investigate single aspects of employee portal success, but none of the studies we reviewed took a comprehensive, integrated approach.

In order to measure user satisfaction with employee portals, Sugianto et al. (2007) proposed the model of the B2E Portal User Satisfaction (B2EPUS) on the basis of the End-User Computing Satisfaction measure (EUCS) developed by Doll and Torkzadeh (1988). Another approach for assessing user satisfaction with campus portals was proposed by Bin Masrek (2007) on the basis of an extract of the updated D&M IS Success Model (DeLone & McLean 2003). Focusing on the user-perceived service quality of web portals, Yang et al. developed and validated an instrument based on different conceptual models in the areas of IS and technology adoption (Yang & Cai & Zhou & Zhou 2005).

In our review of the IS success literature, we found no study specifically aimed at comprehensively examining the success of employee portals. Consequently, we built our measurement model for employee portal success on the above-mentioned focused studies. Secondly, we extended our literature review by analyzing studies focusing on the evaluation of web-based systems (WBS), which are similar to employee portals. Additionally, since employee portals have commonalities with web-based knowledge management (KM) systems, we reviewed empirical studies focusing on KM system success with the objective of adapting measures to our conceptual model.

3 CONCEPTUAL MODELING

Since employee portals are widespread, but there is no known comprehensive, integrated theoretical framework for measuring their success, we propose a conceptual model of employee portal success that is based on the D&M IS Success Model (DeLone & McLean 2003).

3.1 Success dimensions

We modified the dimension definitions of the D&M IS Success Model for application in the employee portal context. To this end, we examined the definitions of the original success dimensions, contrasted them with the specific characteristics of employee portals, and merged the different points of view into a revised classification scheme. Consequently, we propose a conceptual model for measuring employee portal success consisting of the following success dimensions:

- *System quality*, which consists of measures of the employee portal as a system in itself. It considers performance characteristics, functionality, and portal usability, among others.
- *Information quality*, which focuses on the quality of the employee portals' output, (i.e., the quality of the information that the portal provides) and its usefulness for the user. Information quality has been shown to be a prominent success factor when investigating overall IS success, especially in the context of web-based systems (Schaupp & Fan & Belanger 2006).
- *Service quality*, which includes measures of the overall support delivered by the service provider. In the context of employee portals, this success dimension covers aspects such as responsiveness, reliability, empathy, competence, and the overall quality of the portal owner.
- *Portal use*, which measures the perceived use of the employee portal by a company's staff. To assess *use* in this context, we propose to measure the perceived time of use of the different functionalities such as e-mail, searching for information, as well as the overall portal usage time. Since we assume that portal use is typically non-mandatory (Tojib & Sugianto & Sendjaya 2008), we believe that perceived use is a sufficient indicator. Thus, we omit measuring the intention of using the portal as a surrogate for portal use.
- *User satisfaction*, which is the affective attitude of the employee who interacts directly with the portal towards the portal (Doll & Torkzadeh 1988, Tojib et al. 2006). User satisfaction is considered one of the most important measures when investigating overall IS success. The

proposed construct evaluates adequacy, efficiency, effectiveness, and overall satisfaction with the portal.

- *Individual portal benefits*, which subsume measures of the perceived individual benefits gained by the employee through the use of the portal. These benefits cover aspects like task performance, job efficiency, improved use and exchange of knowledge, improved communication, and overall usefulness.

With this model, we focus on individual performance impacts as the final dependent variable of interest – instead of organizational performance. The difficulty of measuring the organizational impact of individual IS initiatives has been discussed and demonstrated by many researchers (e.g., Gelderman 1998, Goodhue & Thompson 1995). Thus, we do not consider the organizational impact in our model, although the impact of utilizing employee portals is very likely greater than the individual impact.

3.2 Conceptual model and hypotheses

Our research model for measuring employee portal success on the basis of the updated D&M IS Success Model is shown in figure 1. The proposed model assumes that system, information and service quality are linked to user satisfaction and to use an employee portal, and that these, in turn, influence the portal’s benefits for individuals. Furthermore, user satisfaction and portal use are interrelated. In addition, we propose knowledge intensity of tasks, the level of process standardization, and the organizational culture with respect to using the employee portal as control variables, since we expect that these factors may influence some of the constructs and relationships.

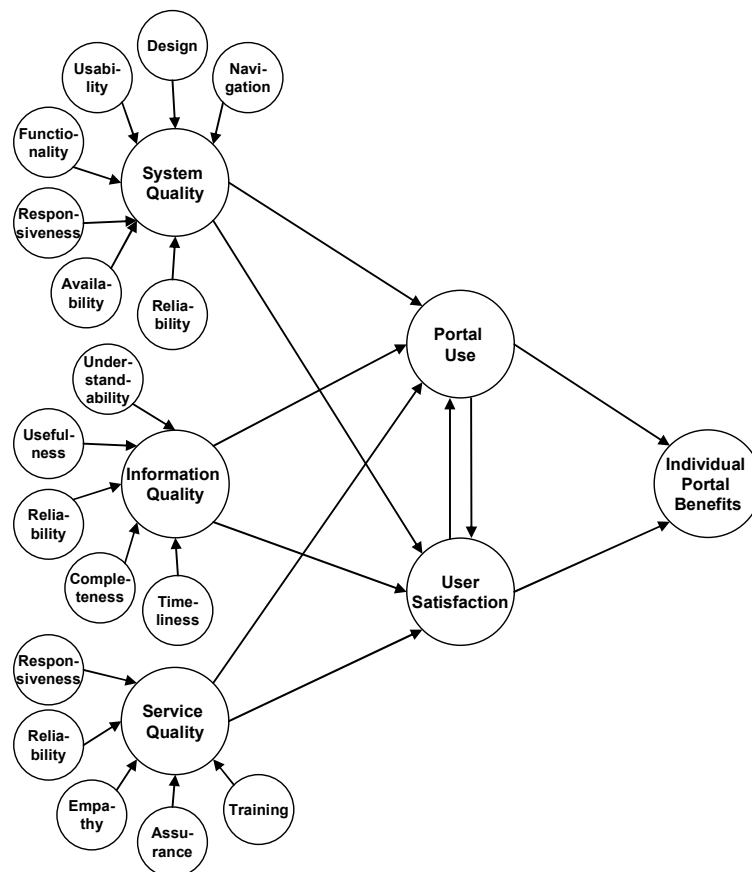


Figure 1. The Conceptual Model

3.3 Constructs and measures

In order to operationalize the constructs of the conceptual model, we follow the recommendation by various authors (e.g., Bharati & Chaudhury 2004, DeLone & McLean 2003, Sugianto & Tojib 2006) to use tested and proven measures if possible. Thus, we adopted items identified in previous studies and modified them for use in the employee portal context. For measuring system, information, and service quality we used second-order multidimensional constructs as discussed by Petter et al. (2007). The sub-constructs are operationalized with reflective indicators, and the relationships between sub-constructs and constructs under study are formative. Portal use, user satisfaction, and individual portal benefits are measured as reflective first-order constructs.

After surveying the literature for existing instruments, initial item pools were created for each of the constructs. We added additional items where important aspects of the content domain of a construct have not been covered. In doing so, we followed suggested item writing principles found in the literature (e.g., Dillman 2008). All of the constructs used within the study except *portal use* should be measured using a seven-point Likert-type scale (1 = Strongly disagree, 7 = Strongly agree). *Portal use* should be measured in terms of actual daily use and the frequency of use. In table 1, we present an overview of the items we have used to operationalize the constructs.

| Constructs | Items adapted from | Original context |
|--|--|-----------------------------|
| System Quality: Navigation | McKinney et al. (2002), 1 new item | Online shopping |
| System Quality: Design | Ahn et al. (2004), 3 new items | Online shopping |
| System Quality: Usability | McKinney et al. (2002), 1 new item | Online shopping |
| System Quality: Functionality | 4 new items | N/A |
| System Quality: Responsiveness | McKinney et al. (2002), 2 new items | Online shopping |
| System Quality: Availability | 4 new items | N/A |
| System Quality: Reliability | 4 new items | N/A |
| Information Quality: Understandability | McKinney et al. (2002) | Online shopping |
| Information Quality: Usefulness | McKinney et al. (2002), 1 new item | Online shopping |
| Information Quality: Reliability | McKinney et al. (2002) | Online shopping |
| Information Quality: Completeness | Yang et al. (2005), McKinney et al. (2002), 1 new item | Web portal, Online shopping |
| Information Quality: Timeliness | Lin & Lee (2006), 3 new items | Online communities |
| Service Quality: Responsiveness | Pitt et al. (1995) | Computer use |
| Service Quality: Reliability | Pitt et al. (1995) | Computer use |
| Service Quality: Empathy | Pitt et al. (1995) | Computer use |
| Service Quality: Assurance | Pitt et al. (1995) | Computer use |
| Service Quality: Training | Chang & King (2005), 2 new items | IS function |
| Portal Use | Iivari (2005) | Accounting systems |
| User Satisfaction | Seddon & Kiew (1994) | Accounting systems |
| Individual Portal Benefits | Davis (1989) | Various information systems |

Table 1. Measures of the Item Pool

This initial item pool will be revised and developed further in the validation phase of the research project. We will start with a larger item pool than we will use in the final questionnaire and successively reduce the number of items. A generally suggested minimum is three questions per construct (Kankanhalli & Tan & Wei 2005). Because of the relatively high number of constructs in our research model, we consider a number of three items per each of it as reasonable, since a larger number would result in a too long questionnaire that probably leads to low response rates.

4 VALIDATION OF THE SURVEY INSTRUMENT

Our development of the conceptual model on the basis of theoretical considerations is the first step of a long-term research project that seeks to present a reliable and valid instrument for measuring the success of employee portals. Before it can be applied in practice, it needs further development and validation. We apply methods of classical test theory to validate the survey instrument and assess the measurement model (Churchill Jr 1979). The first step to be taken prior to the field studies is the validation of the survey instrument.

4.1 Content and construct validity

The main focus of the first stage was to ensure *content validity* of the item pools, i.e. the degree to which the pools reflected all relevant facets of their underlying constructs. We therefore discussed the choice of items with a group of four IS experts. Based on the experts' feedback both the choice of items as well as the wording has been refined. Finally, we chose four items for each of the sub-constructs and a larger set of items for the other constructs.

Our next step targeted the refinement of the items into scales with a high level of *construct validity*. We used a card-sorting and item-ranking approach similar to the one adopted by Davis (1989), Moore & Benbasat (1991), and Kankanhalli et al.(2005). In this approach, a group of IS researchers and practitioners, serving as judges, are given cards with the definition of a target construct, as well as cards with one of the items. Each judge is (independently) asked to assign each item card to one of the construct cards. Items that are sorted into the same category by more than half of the judges can be regarded to having *face validity* for that construct. If items are consistently assigned to one construct, they can also be considered to demonstrate *convergent* validity with their construct and *discriminant* validity with the other constructs. Items not meeting the validity criteria can be considered candidates for modification or deletion. In a second stage, each judge is asked to rank the items according to their representativeness in respect of the specific construct. Items considered to represent the construct weakly are also candidates for modification or deletion.

Instead of cardboard cards, we used a computer-based spreadsheet solution to support the sorting procedure. Eight experts (other than the experts that were consulted to develop the items) participated as judges, who were independently asked to assign each item to one of the constructs or an extra "Ambiguous/Unclear" category. Additional space was provided allowing for comments and suggestions on the items. The card-sorting and item-ranking approach was limited to the sub-constructs of system quality, information quality, and service quality for two reasons. Firstly, in contrast to the other constructs, existing items have been modified to a high degree and additional items have been created. Secondly, a sorting and ranking of all items of the initial pool was not acceptable to the judges.

To assess the consistency of the assignments, we used the item placement ratio (IPR), i.e. the percentage to which judges have assigned items to the intended target construct. In order to increase the construct validity and to shorten the questionnaire, we eliminated the one item of each sub-construct with the lowest IPR. In cases where this criterion was ambiguous, we drew on the results of the item-rankings and eliminated the item with the lowest average ranking. The results for both the initial and the revised item pools are reported in table 2. The overall IPR of .91 for the revised pool indicates satisfactory item placement consistency. However, the operationalization of the assurance sub-construct with an IPR of 42% appeared to be problematic, although we used well established items. Accordingly, we modified the wording of the items on the basis of the judges' feedback.

| Constructs | Initial item pool | | Revised item pool | |
|--|-------------------|--------|-------------------|--------|
| | No. of items | % Hits | No. of items | % Hits |
| System Quality: Navigation | 4 | 78 | 3 | 88 |
| System Quality: Design | 4 | 88 | 3 | 100 |
| System Quality: Usability | 4 | 81 | 3 | 100 |
| System Quality: Functionality | 4 | 97 | 3 | 100 |
| System Quality: Responsiveness | 4 | 100 | 3 | 100 |
| System Quality: Availability | 4 | 91 | 3 | 100 |
| System Quality: Reliability | 4 | 91 | 3 | 96 |
| Information Quality: Understandability | 4 | 100 | 3 | 100 |
| Information Quality: Usefulness | 4 | 94 | 3 | 96 |
| Information Quality: Reliability | 4 | 91 | 3 | 96 |
| Information Quality: Completeness | 4 | 75 | 3 | 88 |
| Information Quality: Timeliness | 4 | 97 | 3 | 100 |
| Service Quality: Responsiveness | 4 | 66 | 3 | 83 |
| Service Quality: Reliability | 4 | 63 | 3 | 79 |
| Service Quality: Empathy | 4 | 78 | 3 | 79 |
| Service Quality: Assurance | 4 | 34 | 3 | 42 |
| Service Quality: Training | 4 | 97 | 3 | 100 |
| <i>Total</i> | 68 | 83 | 51 | 91 |

Table 2. *Item Placement Ratios*

4.2 Test trial

In the next stage, we combined the initial item pool into a draft survey instrument for pre-testing. The questionnaire therefore had to be translated in the target language of the companies that will participate in the upcoming field surveys. The committee (or parallel) approach was used for this translation (Harkness & Schoua-Glusberg 1998). Three translators competent in the target language and in the skills required for survey work translated the questionnaire independently. At a reconciliation meeting, the translators compared the translations, reconciled discrepancies, and agreed on a final version that was considered the best of the independent translations.

In order to ensure the quality of the survey instrument design and presentation, we discussed the draft again with four IS experts and modified it according to their feedback. As a final pre-test prior to using the survey in the field, the draft instrument was trialed with a group of 20 information systems PhD students and faculty members serving as test users. The test users were asked to refer to their institute's intranet application which acts as an employee portal when completing the questionnaire. One objective of this first field test was to confirm the results of the card-sorting and item-ranking approach as well as getting additional feedback from the respondents. The full model was estimated using Partial Least Squares (PLS) based on the sample data. Although the sample size of 20 is quite small, the model should possess sufficiently high statistical power to evaluate the reliability of the reflective indicators of the sub-constructs.

The indicator loadings of the items on their respective construct were trialed first to assess the quality of the scales. Items with a loading below .500 can be considered too unreliable (Straub 1989). Based on this criterion, we considered four of the items as candidates for deletion. Surprisingly, none of the four items were deletion candidates at the card-sorting and item ranking stage. In addition, the significance of the indicator loadings was tested using a bootstrapping procedure. Almost all of the loadings were significant at the .001 level. However, the loadings of all four items for 'System Quality: Availability' did not show significance on the commonly accepted .05 level. Thus, these items have to be modified for the final questionnaire.

Furthermore, we tested the model for convergent validity by analyzing average variance extracted (AVE), composite reliability (CR), and Cronbach's alpha. AVE indicators above .500 suggested that

all of the factors possess adequate convergent validity. CR and alpha values for all scales were above the generally recommended level of .700 (Bruce & Gary & Terry Anthony 2005).

5 RESEARCH IN PROGRESS

Since the sample size of the first survey trial was very small, we will explore the survey instrument in a further field test. Data will be obtained from the employees of an international development organization through a web-based survey. The organization employs about 10,000 staff in more than 120 countries. In the first stage, the survey will be conducted at the head office, where around 1,000 people are employed. A non-probability convenience sampling method will be used. Even with the disadvantages inherent in a non-probability sample, it is deemed the most suitable method to achieve a response rate that is as high as possible.

Following the validation guidelines of Straub et al. (2004) and Lewis et al. (2005), we will test the measurement model for reliability, nomological validity, convergent validity, discriminant validity, and predictive validity. We will apply commonly employed decision rules. Given an adequate measurement model, the structural model will be analyzed to test the associations hypothesized in our research model. In order to further test and challenge the model, additional field studies will be conducted in several organizations in different countries. Furthermore, a benchmarking study will be conducted on the basis of the validated model.

6 SUMMARY AND CONCLUSIONS

In our review of the IS success literature, we found no study aiming to comprehensively evaluate employee portals. Based upon the D&M IS Success Model, we propose a model for measuring employee portal success. Furthermore, we present our steps for the development and validation of our survey instrument. Research methodology for further developing and validating the model is proposed.

Our research presented here is limited in that the proposed model is merely based on an extensive literature review, on our experiences, and on expert feedback. The results are the foundation for future empirical work in this area. First validation steps are presented in this paper. However, the model needs further development and validation before it can be applied in practice. Future research within this long-term research study will focus on empirically validating the conceptual model and on applying it in practice, as described in this article.

Having finished our research, we believe that our model together with the survey instrument will be valuable for practitioners who want to evaluate employee portals in their organizations. Furthermore, we hope to expand the IS success literature by presenting a complete validation of the updated D&M IS Success Model in the employee portal context.

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