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Abstract

Employee portals are systems that provide employees with the timely and relevant information that they need to perform their duties and to make efficient business decisions. Although their use is widespread, the question on how benefits of these portals are materialized for their users has not been fully answered yet. Thus, the purpose of this paper is to gain a better understanding of the utilitarian value of employee portals for individual users. Therefore, we develop a second-order hierarchical conceptual model whose core structure is founded on the theoretical behavioral science concepts embedded in the diffusion of innovations theory, theory of planned behavior, and the research stream of engineering psychology. We empirically test the model by means of component-based structural equation modeling. For this, we collected 5,783 employees' responses in a survey of 19 companies. Our results indicate that amongst the theorized factors, the quality of support provided to users is the most important factor that affects employee portal related performance gains. Furthermore, collaborative functionalities of an employee portal acts as a critical mediator that channels benefits arising as a result of efficient support and ergonomic employee portal design towards increasing goal oriented breadth of employee portal usage. Finally, we find that with increasing knowledge-intensity of employee tasks, ergonomicity of an employee portal and breadth of use has a stronger effect on performance gains.

Keywords: Employee Portals, Utilitarian Outcomes, Engineering Psychology, Human Computer Interaction.

1 Introduction

The term employee portal (EP) refers to a specific type of enterprise portal which aims at providing employees with timely and relevant information that they need to perform their duties and make efficient business decisions (Benbya et al. 2004). An early definition of a portal in the corporate context appeared in a Merill Lynch report (Shilakes & Tylman 1998). In this report, a portal was considered an application that integrates the company's information and provides users with a single interface. As reflected in various publications (e.g., Shilakes & Tylman 1998, Detlor 2000, Chan & Chung 2002, Chan & Liu 2007), the perception of portals has changed over time. Before portal technology was available, the web-based intranet was used to build workforce commitment (Azzone & Bianchi 2000). Although these intranets yielded benefits for organizations in this regard, they 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 EPs (Tojib et al. 2006). An EP is a web-based interface that employees can use to access personalized information, resources, applications, and e-commerce functionalities. Using the EP, employees can reach a range of internal and external sources via a network connection in a password-protected setting (Sugianto & Tojib 2006). In addition, business applications are increasingly being integrated into EPs (Schelp & Winter 2002). Thus, the role of the EPs has become crucial in many organizations, especially when an entire business process can be completed by means of the portal (Chan & Chung 2002).

Even though EPs are pretty much widespread (Forrester 2006), the question of how benefits of these portals are materialized for their users has not been fully answered. Empirical research on portal evaluation is relatively scarce. Most of the few existing studies investigate single aspects of portal success. Sugianto et al. (2007) and Tojib et al. (2008) have proposed using the B2EPUS model for measuring user satisfaction with EPs, which goes back to the work of Doll and Torkzadeh (1988). Bin Masrek (2007) has proposed another approach to assessing user satisfaction with campus portals, which is based on a subset of the IS Success Model (DeLone & McLean 2003). Focusing on the user-perceived service quality of web portals, Yang et al. (2005) developed and validated an instrument based on different conceptual models in the areas of IS and technology adoption. Based on the Technology Acceptance Model (TAM) (Davis 1989), de Carvalho et al. (2008) analyzed the effects of technological and organizational features on intranet and portal use. The study of Urbach et al. (2010) is one of the few that aims at comprehensively examining the success of EPs, on the basis of the IS Success Model (DeLone & McLean 2003).

The purpose of our research is to go beyond previous work by developing a fresh perspective on the realization of performance benefits through EP use and explaining how these benefits are materialized for users. To achieve this, our study attempts to answer the following question: How does the alignment of EP characteristics with user's cognitive characteristics lead to an increase in the individuals task-related productivity? For that purpose, we develop a second-order hierarchical conceptual model whose core structure is founded on the theoretical behavioral science concepts embedded in the diffusion of innovations theory, theory of planned behavior, and the research stream of engineering psychology. We then empirically test the model by means of component-based structural equation modeling to finally reach our research objectives.

Our paper is structured as follows: In Section 2, we explain how we developed our conceptual framework, outlining the different theories we referred to. In Section 3, we outline our approach to operationalizing the constructs and collecting empirical data as well as report on the measurement models' and structural model's assessment by means of structural equation modeling. Finally, in Section 4, we summarize and discuss our results, and we outline the implications, limitations, and contributions of our research.

2 Conceptual Framework and Related Propositions

Even though EPs are now widespread, there is no known parsimonious theoretical framework for understanding how aligning EP characteristics to human needs elevates EP functionalities as well as increases EP usage and consequently user task-related productivity. We develop a conceptual model whose core structure is founded on theoretical behavioral science concepts. The concepts are embedded in the diffusion of innovations theory (DOI) (Rogers 2003), theory of planned behavior (TPB) (Ajzen 1991), and the research stream of engineering psychology (Wickens 1991), which is the science of human behavior in the operation of systems. While each of these theories examine human-computer interaction from a unique perspective, their complementary use provides a more holistic insight into the problem at hand. The theoretical underpinning basis from which each construct is derived in the following leads to inference of causality and ultimately to our propositions forming the conceptual framework.

Utilitarian Outcome (UO): The usefulness of an EP is reflected in the perceived outcome that would be generated through its use, originating in an individual's mind through cognitive mechanisms that relate to goal attainment. Marketing researchers have termed this task-related outcome *utilitarian value*, which seeks to provide instrumental value to the user – such as increasing task performance, efficiency, and productivity (van der Heijden 2004). Such utilitarian outcomes are practical in nature and are the consequences of purposeful, rational, and task-related undertakings. However, research in the field of consumer behavior suggests that there is another source of value that EP might generate – *hedonic value* (Babin et al. 1994). Hedonic value is generated as a result of enjoyable experiences that a person might encounter in its own right by using an EP. These experiences are completely separate from any performance consequences that may be anticipated, reflecting the distinction between using an EP because "it is fun" as opposed to doing it because "it helps to complete a task" (which is the case in utilitarian usage) (Babin et al. 1994). Since EPs in an organizational setting are primarily expected to help the employees fulfill their job duties effectively and efficiently (Benbya et al. 2004), the concept of utilitarianism can be used to operationalize performance benefits which a user can achieve by using an EP. Consequently, in our study utilitarian outcome serves as the dependent variable.

Breadth of Use (BOU): Individuals need to use EP to realize EP-enabled productivity. However, use alone is not sufficient to ensure sustained productivity gains. This implies that the use of an EP is a necessary condition, though not necessarily sufficient, to achieve task-related performance gains (Jain & Kanungo 2005). This problem is reflected in conflicting results, reported in previous studies on the relationship between information systems (IS) use and productivity gains (for an overview, consult Jain & Kanungo (2005)). This might be the case because traditionally, IS use behavior has been studied in terms of time duration and frequency. However, these quantitative dimensions of use behavior fail to capture the qualitative differences in end-user behavior (i.e. how IS is used) such as superficial symbolic use or deeply ingrained committed use, intentional use versus habitual use, or voluntary use versus mandatory use (Jain & Kanungo 2005). As such, "simply saying that more use will yield more benefits, without considering the nature of this use, is clearly insufficient. Researchers must also consider the nature, quality, and appropriateness of the system use" (DeLone & McLean 2003, p. 16). We therefore attempt to capture the qualitative difference in the nature of EP usage behavior by determining whether the full functionality of a system is being used for the intended purposes, as suggested by DeLone and McLean (2003). This is done via the breadth of use (BOU) construct, which reflects the diversity of EP usage. Based upon the hierarchy of behavior that has been identified in cognitive psychology (i.e. abstract and physical behavior), breadth of EP use consists of two dimensions: i) *Passive use* (PU), which reflects the goal oriented search, extraction, collection, and storage of information by using an EP, i.e. knowledge-enhancement (e.g. using an EP to find out contact details of a business partner or colleague), and ii) *Active use* (AU) which expresses passive use through action (e.g. using EP functions to contact, communicate or network with a business partner or colleague). Given the wide range of use scenarios that the two dimensions address, the BOU construct

is conceptually closest to the extended and emergent use suggested by DeLone and McLean, as mentioned earlier. High BOU therefore implies a high degree of passive as well as action-oriented, active EP usage, and is expected to improve task performance of users.

H1: *Breadth of Use (BOU) will be positively associated with Utilitarian Outcomes (UO).*

Collaboration Support (CS): In light of globalization and outsourcing of organizational activities, employees are no longer confined to the four walls of their offices and work from different geographical locations and times increasing the occurrence of dispersed meetings (Nunamaker 1999). From a knowledge management perspective, individuals therefore need to communicate with each other because of their professional interest in improving their task performance (Ryu et al. 2005). This working with and learning from a large group of people who are dispersed in time and place imposes considerable cognitive stress and can significantly hinder the ability of an individual to fulfill his tasks successfully. In such a scenario, the most important functionality of an EP relates to supporting communication and linking individuals within and between functions and divisions across great distances (Ryu et al. 2005) in a manner that reduces information overload and cognitive effort. Putting it simply, e-collaboration and collaborative functionalities of EPs helps bring geographically dispersed individuals together for virtual meetings across great distances to engage in distributed asynchronous interaction (e.g., e-mail, discussion forum), distributed synchronous interaction (e.g., videoconferences, shared screens), face to face interaction (e.g., group decision support systems), and asynchronous interaction (e.g., project management). This collaboration can help employees to save considerable time and costs, decrease travel requirements (Kock & McQueen 1997), distribute and communicate their ideas more readily, increase task focus, as well as foster faster and better decision making (Meroño-Cerdan et al. 2008). In turn, all these benefits improve their productivity, quality of work, efficiency, and performance. We agree with Meroño-Cerdán (2008) and find that benefits obtained from the use of collaborative functions of EPs and their effect on task-oriented performance of individuals can be analyzed in accordance to the *relative advantage* or *perceived usefulnes*s perspective of DOI and TAM, respectively. Davis (1989) argues that perceived usefulness is the most influential determinant of system usage. This underscores the importance of incorporating appropriate collaborative functional capabilities in new EPs. According to DOI, the more attractive the attributes of an EP are perceived to be, the faster it will be accepted by potential users. Studies based on DOI have consistently found that *relative advantage* of an innovation is the most important attribute in determining its usage (Tornatzky & Klein 1982). As such, collaborative functionalities of EPs are expected to increase EP usage and work as an ideal vehicle to channel the potential of users, allowing them to develop their individual knowledge and accomplish their tasks in an effective and efficient manner (Meroño-Cerdán 2008).

We use the term *collaborative support* as a surrogate term for EP "perceived usefulness" as specified in TAM, or "relative advantage" in DOI because, as pointed out by Moore and Benbasat (1991) the terms "perceived usefulness" and "relative advantage" are not very specific "… becoming a "garbage can" into which a variety of advantages can be tossed". Thus the term "collaborative support" has significant intuitive appeal since it helps to filter out materialistic and hedonic benefits and allows us to focus on the task-oriented collaborative usefulness relevant to this study.

H2a, H2b: *Collaboration Support (CS) will be positively associated with BOU and UO.*

Ergonomicity (EG): As Sanders and McCormick (1987) point out, it is easier to change systems to match the needs of its users than to change the user itself. The research stream on *ergonomics* – an aspect of engineering psychology – is dedicated precisely to this and is concerned with adapting the equipment and environment to people, based upon their psychological capacities and limitations, with the objective of improving overall performance. Therefore, we investigate how EP design affects the performance of its users. While physical ergonomics focuses on studying motor biomechanical reactions (interaction of physical body with machines), cognitive ergonomics emphasizes topics that are "above the neck", i.e. interaction of the mind with machines. In case of intangible software systems such as EP, which involve little physical interaction with the system, the later view is more

appropriate. DeGreen (1980) also argued that the major focus of engineering psychology concerning IS must shift from sensory-motor concerns to cognitive factors. A misalignment between the design of IS and the cognitive capabilities of humans can increase a person's mental workload. For particular users, this misalignment has been found to cause a number of problems, such as cognitive overload, disorientation, and stress, which adversely affects their performance. As such, an ergonomic EP that is designed to fit a user's mental capabilities and information processing capacity can stimulate, modulate, and trigger his or her cognitive dynamics in a way that the intended task(s) can be accomplished with minimal (cognitive) effort (Stary & Peschl 1998), thereby increasing quality and performance. Ergonomicity of EPs is reflected in the following dimensions: i) *Skill based ergonomicity* (SE) refers to the degree to which an EP is compatible with the users' skills and knowledge. This particular aspect of ergonomic system design has received considerable attention and support, based upon Bandura's (1986) social cognitive theory and has been empirically established thought the behavioral and technical models of TPB (perceived behavioral control) and TAM (ease of use). ii) *Visual ergonomicity* (VE) refers to the degree to which the look and feel of an EP reduces comprehension time, and increases the ability of a user to process information. Web portals present huge amounts of information using strong visual stimuli such as animations and colorful text, which can lead to cognitive burden and overload. There exists a dearth of empirical evidence that shows that visual elements such as link arrangement in menus, sparse grouping of words, graphical layout, color effect, and image size have a high impact on the cognitive abilities of users such as surveying, chaining, monitoring, browsing, distinguishing, filtering, and extracting information (for an detailed overview consult Rau et al. (2007)). Since we acquire three-quarters of our knowledge visually (Hoxmeier & Kozar 2000), this is an important concern in designing ergonomic EPs. iii) *Functional ergonomicity* (FE) refers to the degree to which EP functions enable automation. This in turn helps to reduce the cognitive effort and stress that is produced by repetitive and highly standardized work processes (Gilad 1995).

H3a, H3b, H3c: *Ergonomicity (EG) will be positively associated with CS, BOU, and UO.*

Facilitating Conditions (FC): Facilitating conditions are objective factors that make an act easy (or difficult) to do. It can therefore be understood as the degree to which a user believes that organizational resources are available helping him or her use an EP. The conceptual foundation of facilitating conditions lies in TPB (Ajzen 1991), theorized as "perceived behavioral control", and has been validated in a number of empirical studies. In the context of our research, these desirable organizational resources relate to service support, which is offered by organizational institutions such as the IT department in the form of guidance in the correct usage and customization of the EP functions to suit the user's needs. The more a user believes that external support will be provided when he or she needs to solve technical and customizing issues related to EP usage, the more ergonometric he or she will perceive the EP to be, the more confidence he or she will have in successful usage, and the more inclined he or she will be to use that EP (Ajzen 1991). Interest in service quality, by both practitioners and researchers, was spurred on through the work of Parasuraman et al. (1988) who developed the SERVQUAL model, a multiple-item instrument, which has been widely tested for measuring customer perceptions of service quality. Since the manner in which support is given is an integral part of the service, perceptions of behaviors of the support staff, such as their willingness to help and their trustworthiness, need to be considered in overall support quality evaluation (Grover et al. 1996). In order to achieve this, we grouped the items of SERVQUAL into two conceptually distinct dimensions that reflect the behavior of support personnel and helps to provide deeper insights into the functioning of the construct: i) *Reliable-Competent* (RC), which can be defined as the ability of the service department to provide support, dependably and accurately, displaying a depth of knowledge and a high degree of competence in the area of concern, and ii) *Responsive-Empathetic* (RE), which reflects willingness to help users and provide prompt support in a caring manner, taking into consideration the individual needs of the users. While the former evaluates the technical knowledge and dependability of the support staff (i.e. the job will get done), the latter focuses on how quick support is provided keeping in mind the individual needs of the user.

H4a, H4b, H4c, H4d: *Facilitating Conditions (FC) will be positively associated with EG, CS, BOU, and UO.*

Multidimensional Nature of Constructs: Conceptual definitions of constructs, as used in this paper, are often specified at a more abstract level, which sometimes include multiple lower-order dimensions (Jarvis et al. 2003). It is argued that such multidimensional or hierarchical construct models allow for more theoretical parsimony, reduce model complexity, allow matching the level of abstraction for predictor and criterion variables, as well as exhibit a higher degree of criterion-related validity (Wetzels et al. 2009). Based on these conceptual and empirical advantages, this paper views BOU, EG, and FC as aggregate, second-order constructs that cause the first-order constructs. Thereby, the underlying higher order (multidimensional) construct is thought to cause the variation observed in the measures (Wetzels et al. 2009), and changes in the second-order constructs are hypothesized to cause changes in the first-order constructs (Jarvis et al. 2003). Second-order factors are therefore specified as a "*Type I*" reflexive first-order – reflexive second-order latent model (Jarvis et al. 2003). In such a constellation, a series of first-order latent factors have reflective indicators and these first-order factors are themselves reflective indicators of an underlying second-order construct (Jarvis et al. 2003), as depicted in Figure 1. Owing to the fact that the specific dimensions of the second-order constructs are expected to be correlated with each other (a key criteria) (Wetzels et al. 2009), we consider this approach appropriate.

Moderating Influences: In our research, we examine moderating effects because – besides examining direct effects – scholars are increasingly seeking to understand complex relationships (Henseler & Fassott 2010). While the importance of moderation has been emphasized repeatedly in the literature, its neglect has led to a lack of relevance, as "relationships that hold true independently of context factors are often trivial" (Henseler & Fassott 2010, p. 716). We consider a moderator variable to be one that affects the strength of the relationship between an independent or predictor variable and a dependent or criterion variable (Baron & Kenny 1986). In the context of our study, the nature of the task is expected to moderate the strength of the predictors of user performance, since a good task-fit is argued to be a critical determinant of performance (Easton et al. 1990). To be more specific, we propose that employees who usually perform *knowledge-intense tasks* (KIT) (measured in terms of the level of complex knowledge and understanding, as well as the amount of information required to fulfill their work tasks) need to communicate and collaborate intensively with a diverse set of individuals to effectively fulfill their task requirements (Dahui et al. 2004) This is a direct result of division of work and the consequent task specialization that has led people to develop a high depth of knowledge (related to content) at the cost of breadth (i.e. diversity of knowledge) (Ryu et al. 2005). As such, in the case of knowledge-intense tasks, which require know-how from experts in diverse fields, a higher breadth of EP usage will lead to greater productivity gains. Similarly, in the case of knowledge-intense tasks, ergonomic EP and greater quality of service support will have a stronger positive effect on employee performance.

H5a, H5b, H5c, H5d: *The influence of FC, CS, BOU, EG on UO will be moderated by Knowledge-Intensity of Tasks (KIT) such that the effect will be stronger for individuals with high KIT.*

3 Research Methodology

Data Collection: The entire development process that led to the final survey instrument followed Straub's (1989) recommendations. Initial pool of measures were selected based on their empirical validation in prior research and were modified for use in the EP context. Items for the constructs Reliable-Competent Responsive-Empathetic were adapted from Pitt et al. (1995). For collaborative support items were derived from Benbya et al. (2004). For active and passive use items were derived from Almutairi and Subramanian (2005) and for utilitarian outcome we used measures from Davis (1989), and Seddon and Kiew (1994). Measures for Skill based, visual, and functional ergonomicity were derived from Ahn et al. (2004), McKinney et al. (2002). For the construct Knowledge-intensity of task new items derived from Eppler et al. (1999).Instrument refinement was conducted based on interviews with four subject matter experts, a Q-sorting exercise with eight participants, and a web-

based pre-test with 20 participants. Finally, all items were embedded in survey questions using a 7-point Likert-type scale anchored at strongly disagree (1) and strongly agree (7). Throughout the entire instrument development process, three researchers were always involved who discussed each issue and formulated improvements. This triangulation of researchers and methods provide a strong substantiation of a valid and reliable instrument. Data was collected via an online survey from 19 multinational firms. We invited these organizations to participate in a benchmarking study, with the hope of securing a wide industry representation, including different-sized firms. We provided each organization with a hyperlink to the online survey, asking them to distribute it to all or a subset of their EP users via e-mail. In order to minimize bias caused by differences in addressing the survey participants, we also provided the organizations coordinating person with invitation templates. The invitations to the EP users were sent out at the beginning of the survey period. Two weeks later, we asked the companies' contact persons to send their employees a reminder. After the survey period of about five weeks, we closed the online survey. In total we received more than 10,000 responses, leading to an average response rate of 36.7 % across all participating organizations. After a rigorous data cleansing (i.e. considering only complete data sets), we considered 5,783 user responses for our analysis. The majority of data records referred to SAP Netweaver portal platform (62%), followed by MS Sharepoint (14%), and TIBCO (14%). The aviation industry (47%) was most widely represented, followed by the automotive industry (14%), and then the banking industry (12%). The participants were mainly male (63%) and between 41 and 50 years of age (30%).

Data Analysis and Results: The research model and propositions were tested and the psychometric properties of the scales were assessed with the software SmartPLS (version 2.0 M3). We used partial least squares (PLS) because, compared to covariance-based approaches, it is advantageous when the research model is relatively complex and has a large numbers of indicators (Fornell & Bookstein 1982). We assessed the statistical significance of the parameter estimates using a bootstrapping procedure with 1,000 resamples.

Validation of the Measurement Models: We used reflective indicators for all constructs. The adequacy of the measurement models was assessed by the reliability of individual items, internal consistency between items, and the model's convergent and discriminant validity. We used Cronbach's Alpha (CA) reliability estimates to measure the internal consistency reliability. In this study, the CA of each construct is greater than .63, which indicates an acceptable reliability for all constructs in our model (Nunnally & Bernstein 1994). Additionally, composite reliability (CR) values for all constructs are higher than .84 and, thus, above the recommended minimum of .70 (Nunnally & Bernstein 1994). Convergent validity is demonstrated as a) the average variance extracted (AVE) values for all constructs were higher than the suggested threshold value of .50 (Fornell & Larcker 1981) and b) all item-loadings were well above the .70 guideline and statistically significant at the .001 level (Hair et al. 2009). Evidence of discriminant validity could be found since a) the square root of all AVEs was larger than the interconstruct correlations, and b) all construct indicators loaded on their corresponding construct more strongly than on other constructs (Chin 1998), and the cross-loading differences were generally higher than the suggested threshold of .10 (Gefen & Straub 2005). The relatively high interconstruct correlations between first-order constructs that belong to a particular second-order factor provide evidence that they are related to their higher-order factor. Furthermore, tests of convergent validity for the first-order factors revealed that the strengths of all paths that connect the second-order constructs to their specific first-order construct were greater than .89, which is much higher than the recommended value of .70 (Chin 1998). In essence, this also shows that the first-order factors tap into the same underlying second-order latent variable as conceptualized. We evaluated common method bias (CMB), using the exploratory method of Harman's one-factor test. Results from this test showed that eight factors are present which explained a total of 79.5% variance and the most variance explained by one factor is only 21.2%, indicating that common method biases most likely did not contaminate the results. Furthermore, we applied a confirmatory method to analyze CMB in SmartPLS, as explained by Liang et al. (2007). We found that while the average substantively explained variance of the indicators is .778, CMB variance is only .013. The ratio of substantive variance to method variance is only about 58:1. As a result of the above evidence, the small magnitude

and insignificance of method variance, we contend that CMB is unlikely to be a significant concern for this study.

Structural Model Results: After the validation of the measurement model, the structural model was independently analyzed, and the proposed relationships between the constructs were tested. Using a blindfolding approach, we measured the cross-validated communality and redundancy via a Stone and Geisser test. Q^2 results for both cross-validated communality and redundancy were greater than 0 suggesting that the model has good predictive validity. A *post-hoc* power analysis with the software G*Power 2 resulted in a value greater than .80, which implies that our model is able to detect small effect sizes (Chin 1998). Finally, we calculated the goodness of fit (GoF) of our model as suggested by Wetzels et al. (2009) who define the GoF as the square root of the product of AVE and R^2. The application of such formula leads to a GoF of .54, which exceeds the cut-off value of .36 for large effect size of R^2 as proposed by Cohen (1988) and allows us to conclude that our model performs well.

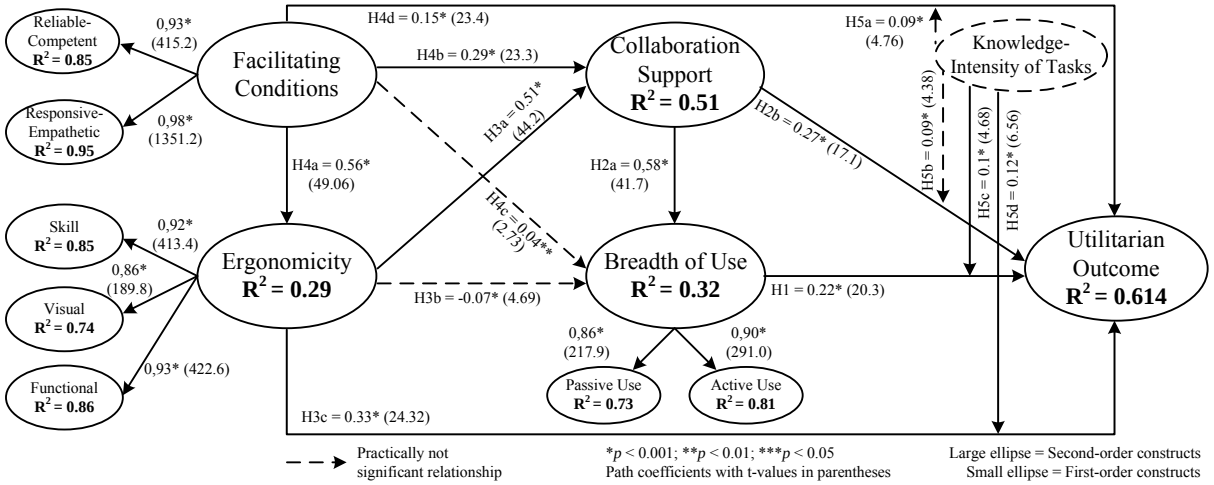

Figure 1. Results

In assessing the PLS model, we examined the squared multiple correlations (R^2) for each endogenous latent variable. We evaluated the structural paths to determine their significance. We considered proposed relationships to be supported if the corresponding path coefficients had the proposed sign and were significant. Although some of the paths between variables were statistically significant (with large samples such as ours, statistical significance becomes practically meaningless), they did not meet the criterion of practical significance suggested by Kerlinger and Pedhazur (1973), which is repeatedly emphasized by researchers (e.g., Meehl 1990, Chin 1998) for inclusion in a path diagram. Therefore, as per recommendation of Meehl (1990), only betas with values of .10 or higher, and which are significant at the .05 level or better, are reported. Figure 1 shows the PLS structural model results. Ten of the fourteen hypotheses were found to be practically significant: CS (β=.27, p<.001), BOU (β=.22, p<.001), EG (β=.33, p<.001), and FC (β=.15, p<.001) together explain 61.4% of the variance in the dependent variable UO. However, the effect of FC and EG on BOU was found to be practically not significant. In order to provide further clarification on why these two relationships turned out to be practically not significant, we conducted a *post-hoc* analysis and found CS to *totally* mediate (also known as perfect mediation (Baron & Kenny 1986)) the effect of both FC → BOU and EG → BOU. We conducted mediation analysis, as recommended by Baron and Kenny (1986), in a multi-step process. First, the effect of FC→BOU (β=.21, p<.001) was calculated without the presence of CS. It showed a significant effect. Second, the mediator CS was introduced into the model, resulting in significant effects of FC→CS (β=.57, p<.001), and CS→BOU (β=.59, p<.001). Third, paths FC→BOU and BOU→UO were controlled, which resulted in the previously significant path FC→ BOU becoming practically not significant (β=-.04, p<.01). Further post-hoc mediation analysis conducted in a similar manner revealed that CS also totally mediates the effect of EG on BOU, since

the introduction of CS reduced the previously strong path from EG→BOU, from (β=.34, p<.001) to (β= -.07, p<.001). This implies that both ergonomicity and facilitating conditions increase breadth of EP use, however indirectly, by improving collaborative functionalities of an EP. Furthermore, FC emerged to be the construct with the biggest total effect: (.55) - indirect + direct - on UO, followed by EG (.52).

Regarding moderation effects, we followed Chin et al.'s (2003) guidelines and recommendations to test and analyze interaction effects with PLS. The process included three steps: 1) standardizing indicators for the main and moderating constructs, 2) creating all pair-wise product indicators, i.e. each indicator from the main construct was multiplied with each indicator from the moderating construct, and 3) using the new product indicators to reflect the interaction construct. In a recent review of moderating effects in PLS models, Henseler and Fassott (2010) also recommended the product indicator approach for large sample sizes. For a variable to be a moderator, it is desirable that the variable has low correlation with the predictor (independent) variable, because multicollinearity can lead researchers to falsely conclude that moderation effect exists, when there is in fact a nonlinear effect in disguise (Baron & Kenny 1986). In our study, the inter-correlations are relatively low, ranging from .019 to .11 with an average of .073. This suggests that this error is unlikely. In order to provide deeper analysis, we calculated the effect size using the F-test. We used the difference between the squared multiple correlations to assess the overall effect size f^2 for the interaction where it has been suggested that $f^2 < .02$ = practically no effect, $.02 \leq f^2 < .15$ = small effect, $.15 \leq f^2 < .35$ = moderate effect, and $f^2 \geq .35$ = large effect, respectively (Cohen 1988). We found that while FC (f^2=.03), CS (f^2=.07), BOU (f^2=.08) had a small effect, EG showed a moderate effect (f^2=.03) on UO. Regarding BOU, we found that CS (β=.58, p<.001) had a moderate effect (f^2=.24) and EG (f^2=.004), and FC (f^2=.001) had practically no effect. This provides further support for our decision to exclude the relations EG→BOU and FC→BOU from our model.

4 Discussion and Conclusion

In general, we were encouraged by the empirical results, as they provided support for the studies' two main objectives. One major objective was related to the development of a fresh perspective on the realization of performance benefits through EP use. We found that the quality of support provided to users has a major influence on performance benefits. Competent and timely support affects employee performance: i) *directly* by minimizing the time they end up investing in solving day-to-day technical problems, and ii) *indirectly* by helping users align EP characteristics and collaborative functionalities to their individual needs and skills, thereby reducing cognitive and informational overload (Meroño-Cerdan et al. 2008). The results of the study indicate that amongst the theorized factors, collaborative functionalities of an EP acts as a critical mediator that channels benefits arising as a result of efficient support and ergonomic EP design towards increasing goal-oriented breadth of EP usage. From a practical viewpoint, this suggests that mature collaborative functionalities should be integrated in an EP. Furthermore, users should be made aware of them through appropriate marketing and informational campaigns, since functionalities that are unknown to the users might never be used. From a theoretical point of view, researchers need to examine which collaborative functions are used in which scenarios and in what manner.

We applied a second-order hierarchical modeling approach to cluster inherent properties of respective factors in conceptually distinct dimensions which sheds further light on how these constructs work. We found that high breadth of EP use involves both passive and active usage which turns the EP into a "one stop shop", offering employees the convenience of fulfilling their task related needs in one spot. Using an EP to not only gather information, but also to act on it, reduces the cognitive effort of the employees, as well as the stress involved (Kock & McQueen 1997) in learning different applications, constantly switching between them to use their specific functionalities, managing their specific data formats etc. These factors contribute to employees' increased efficiency, effectiveness, and personal wellbeing. Results of the hierarchical model also reveal that the often studied *skill*-based "ease of use"

aspect of an IS design should be complemented with *visual* and *functional* ease in order to construct an overall ergonometric EP. While skill-based ergonomicity makes it easy for a user to operate an EP, visual and functional ergonomicity aligns the EP to deep embedded psychological and biochemical needs of the individual making a high degree of usage less stressful and disorienting. While we also propose two distinct aspects of support behavior, the relatively high degree of correlation between them suggests that employees do not consciously differentiate between the technical competence and the softer interpersonal aspects of the way support is provided. However, our findings do not necessarily imply that such a differentiation does not exist. It is possible that our operationalization might simply have failed to capture and reflect the differences. As such, future research should probe further in an attempt to discover how employees perceive the behavior of the support staff.

A second major objective of this study was to find empirical support for the theorized consequence of knowledge-intensity of tasks on the effectiveness of the various determinants as a means to realize utilitarian outcomes through EP usage. We find that with increasing knowledge-intensity of employee tasks, ergonomicity of an EP and breadth of use has a stronger effect on performance gains. This might be the result of the fact that knowledge-intense tasks are often rather multifarious, not very repetitive (the employee needs to do different things in a different way), and require a high degree of interaction with a disconnected set of individuals. Ergonomic characteristics of an EP and a high breadth of usage would thus help individuals in coping with such task related complexities better and be more productive.

Our research has some limitations that we would like to point out. The population consisted only of Western nations, which all have similar cultural, legal and organizational structures. As such, these differences need to be taken into consideration when evaluating the consistency of our findings. Furthermore, perceptions of individuals might be contaminated by recall and confirmation bias. However, to minimize recall bias effects, we structured the questionnaire so that participants focused on their most recent experience. Additionally, we clarified the importance and anonymity of the research to reduce confirmation bias tendency. In conclusion, user acceptance and usage of EPs remains a complex and elusive, yet extremely important, phenomenon. A better understanding of the determinants would enable us to design organizational interventions that would increase EP usage in order to improve employee productivity and quality, as well as to reduce effort. Past research has made progress in unraveling some of its mysteries. The development and testing of our model seeks to advance theory and research on this crucial matter.

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