



Organizational use of the internet

Scale development and validation

Organizational
use of the
internet

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Received October 2003
Accepted September 2004

Abstract

Purpose – To contribute to the development of a theoretically grounded measure of organizational internet use (OIU) by conceptualizing and operationalizing it as a theoretical construct, and by empirically assessing its reliability and validity

Design/methodology/approach – The focal construct OIU was conceptualized as an abstract collective object with three components, forming an index with formative, causal indicators. A multi-method research design – including a cross-sectional drop-and-collect survey among small technology-based firms (STBFs) in Germany and an observational study of web sites – was applied to assess empirically the theoretically developed construct OIU. This was achieved by using the component-based partial least squares (PLS) structural modeling technique using PLS-Graph.

Findings – The empirical assessment of the scale, applied to the international business domain, proved to be reliable and valid in the structural model and across assessment methods.

Research limitations/implications – The focal construct was assessed among a very specific population. This limits the claims that can be made with regard to applying it in other industries, countries, and firms. Future research should address this by applying OIU in maximally different research contexts.

Practical implications – The developed construct has important implications for both managers and researchers. It should help in assessing levels of organizational internet use in a consistent fashion across populations and studies. It can be used for benchmarking purposes – of specific interest to managers – and it can be used to explore antecedents and consequences of organizational internet use – of specific interest to researchers.

Originality/value – Internet research is moving from anecdotal and exuberant internet euphoria to internet pessimism to internet realism. Only theoretically grounded, reliable and valid measures can support such a required transition. With this paper we have made an initial contribution for such a development to occur.

Keywords Internet, Organizational analysis, Organizational processes, International business

Paper type Research paper

Introduction

Management-focused internet research is at a critical crossroad. After the burst of the “internet-bubble” overoptimistic and empirically ungrounded claims as to the “paradigm shifting” powers of the internet are making ways for more realistic claims of its role in the economy (e.g. Coltman *et al.*, 2001; Porter, 2001; Petersen and Welch, 2003). While these more realistic claims are much welcomed theoretically grounded empirical assessments are still in an embryonic state, particularly with regard to



Internet Research
Vol. 15 No. 1, 2005
pp. 67-87

© Emerald Group Publishing Limited
1066-2243

DOI 10.1108/10662240510577077

The authors would like to thank Wynne Chin for providing and explaining the PLS software.

organizational internet research (e.g. Porter, 2001). Key for such a development to occur is measurement with an explicit recognition that it cannot be divorced from a grounding theoretical base. Indeed, if we agree to view a theory as a systematically related set of statements that are empirically testable (Hunt, 1991), it becomes evident that the required empirical content be measured in a reliable and valid way. This research intends to contribute to the development of a theoretically grounded measure of organizational internet use by conceptualizing and operationalizing it as a theoretical construct, and by empirically assessing its reliability and validity.

The paper is structured as follows. In the first section the focal construct of this study is conceptualized by defining the internet and its three generic uses. Subsequently, the construct is operationalized by applying it to the international business use domain and empirically assessed based on a survey and an observational study. A presentation and discussion of the findings, including other possible use domains and its limitations, close the paper.

Background and conceptualization

A lot has been written about the internet and its presumably revolutionary impact on individuals, organizations and nations. But despite an explosion in conferences, papers, articles, and books dealing with the phenomenon internet, serious empirical studies focusing on organizational use of the internet are still in an embryonic state (e.g. Coltman *et al.*, 2001; Porter, 2001; Petersen and Welch, 2003).

In order to change this three aspects have to be addressed. First, organizational internet use (OIU) as such needs to be defined. It needs to be conceptualized as a distinct theoretical construct with clear boundaries. Second, the theoretical construct OIU needs to be operationalized to give it empirical content. Third, OIU needs to be tested empirically by assessing its reliability and validity.

Definition: the internet

Before conceptualizing OIU it is required to provide a clear definition of what is meant by the term "internet". The internet is a global, computer-mediated information resource and communication infrastructure (e.g. December, 1996; Leiner *et al.*, 1997; Cox and Koelzer, 2003). It is a network of connected computer networks using an open, media independent, standard technical protocol known as TCP/IP (transmission control protocol/internet protocol) (December, 1996; Comer, 2000), offering a variety of different communication services such as file transfer protocol (ftp), electronic mail (e-mail), newsgroups, internet relay chat (irc), videoconferencing, and the world wide web (www). Following key elements of December's (1996) definition, the internet is thus defined as:

- computer-mediated communication, including
- information dissemination and
- information retrieval that
- involves data (bits) exchanges taking place on the
- global collection of computer networks using
- the TCP/IP protocol suite for data transfer.

Use dimensions of the internet

The definition of the internet is a necessary but not sufficient first step in conceptualizing OIU. The second step requires defining its use domain.

In order to distinguish between the possibility of using the internet as a global pool of information that can be retrieved by organizations and individuals in order to enhance their knowledge about an area of interest and the possibility of using the internet as a global marketing medium, the two terms “information pull” and “information push” are used.

Information pull (active and passive)

Information pull refers to organizational or individual activities related to synchronously or asynchronously pulling information from the internet, by either reading messages on newsgroups or listservs (mailing lists), retrieving information from databases on telnet, gopher or www or by “browsing” through web pages and its content. Information pull can be active or passive, with searching the www by for example using search engines like Google referring to the former and subscribing to mailing lists referring to the latter. Subscribing to mailing lists is a passive, non-specific information pull activity, because the subscriber does not know exactly what specific kind of information he or she receives prior to his or her subscription.

The information pull aspect of organizational internet use encompasses other, more loosely defined terms used in the internet literature like “competitive intelligence” (Cronin *et al.*, 1994), “customer and market research” (Auger and Gallagher, 1997), “information search and retrieval” (Ellsworth and Ellsworth, 1995), “market intelligence” (Hamill, 1997), “information gathering” (Soh *et al.*, 1997), “information collection” (Samiee, 1998), or “information scanning” (Zaheer and Manrakhan, 2001).

Information push (active and passive)

On the other hand, information push refers to organizational or individual activities related to pushing information into the internet, by either sending non-personalized messages to newsgroups or listservs (mailing lists) or by setting-up a corporate web site, pushing its content into the internet. Like information pull, information push can be passive or active. Active information push refers to organizations actively marketing its information push activities. Active information push activities in the case of a corporate web site include for example creating virtual links from other web sites by registering the web site with search engines (e.g. Hamill, 1997; Kiani, 1998; Cox and Koelzer, 2003). In contrast, passive information push refers to, for example, organizations setting up a web site without any promotions.

The nature of the information push activities, either passive or active, are important, because the communication space (Culnan and Markus, 1987) of the internet is mainly an information pull medium, where individuals or organizations seek information (information pull) rather than individuals or organizations pushing information to a selected audience. The commercial failure of push-technology-based internet products (*Economist*, 1998) strongly underlined this point. Thus, active information push activities are more likely to be effective than mere passive information push activities.

The information push aspect of organizational internet use encompasses other, more loosely defined terms used in the internet literature like “information dissemination” (Auger and Gallagher, 1997; Changsu and Galliers, 2004),

“marketing and sales promotion” (Ellsworth and Ellsworth, 1995; Hamill, 1997), “marketing and advertising” (Soh *et al.*, 1997), “information delivery and on-line distribution” (Samiee, 1998), or “world-wide broadcasting” (Changsu and Galliers, 2004).

Interaction

Interaction is the internet’s third potential use for organizations or individuals. The main difference between information push/pull and interaction is that interaction involves non-anonymous, asynchronous or synchronous personal exchange of information between known communication parties. Both information pull and information push is at least partially anonymous. In contrast to the interactive, two way characteristics of the internet from a technological perspective interaction as understood here means computer-mediated personal interaction between known users or parties; or in the words of the relationship marketing literature – thought to be particularly relevant to the internet (Long *et al.*, 1998) – interaction constitutes a relational information exchange rather than a discrete information exchange.

When an organization pushes corporate information to the communication space of the internet, it does not know *ex ante* who might actually retrieve and read its content. The same applies for posting non-personalized messages to newsgroups or mailing lists, because the sender does not know in advance who will read his message and who will not. In addition, the sender does not know the identity of all the receivers, unless he or she is the initiator and owner of the mailing list requiring subscribers to reveal their identity during the subscription process. Newsgroups however always remain partially anonymous. The same applies in the case of information pull. Although users accessing a web page or internet-based databases leave “digital fingerprints” (Drèze and Zufryden, 1997) and web sites can send so called “cookies” to users accessing a web page, users pulling information from the internet can remain anonymous if they wish to. Browsers like Microsoft’s Internet Explorer offer, for example, the option of cookie warnings, providing the user the option to refuse cookies. Anonymizer software (Hagel and Singer, 1999) even masks the identity of the user further by filtering the digital fingerprints that are sent to an accessed web site. Therefore, both cookies and digital fingerprints cannot necessarily identify the actual user identity. In contrast, interaction as defined here involves the one-to-one or one-to-many exchange of information between pre-specified and known parties. For example sending e-mails to an individual or to a group of individuals, or sending an individualized message to a known newsgroup participant. The key of the interaction use sub-dimension is a value exchange between the participating parties. So defined, the term interaction includes commercial on-line monetary transactions (direct on-line ordering and selling) and the establishment of permanent (communication) links between and within organization in the form of extranets and intranets.

The interaction aspect of organizational internet use encompasses other, often more narrowly understood terms used in the internet literature, like “interfirm collaboration” (Ellsworth and Ellsworth, 1995), “network communication” and “relationship marketing” (Hamill, 1997), “electronic transactions” (Soh *et al.*, 1997), “customer service and support” (Soh *et al.*, 1997), “transactions” (Samiee, 1998), “conversations” (Cox and Koelzer, 2003), or “electronic commerce” (Changsu and Galliers, 2004).

All three above-mentioned generic uses of the internet are interrelated, with information pull activities potentially being influenced by and leading to information push activities and interaction activities and vice versa. Also, the three uses relate to similarly interrelated activities taking place in the non-mediated marketplace.

In terms of construct development the internet and its three generic uses thus constitute an abstract collective object with three components (Rossiter, 2002). This is an important observation in terms of construct development, because such a construct type consists of item parts for each component, each forming an index rather than a construct with reflective indicators (Rossiter, 2002). Thus, OIU needs to be constructed with formative, causal indicators (Diamantopoulos and Winklhofer, 2001)[1].

Operationalization

After clarifying the conceptual domain of OIU by defining its technological scope (the internet) and its use domain (the internet's three use components) the analytical domain needs to be specified by developing theoretically grounded empirical content for the scale. This operationalisation allows for an assessment of the reliability and validity of the construct.

Theoretical frame and nomological validity

Since the internet can be regarded as a relative recent technological innovation, diffusion of innovation theory (Rogers, 1995) was chosen as an appropriate theoretical foundation and previously used organizational post-implementation dimensions were searched for applicable measures. Following the construct suggestions in the literature (Tornatzky and Klein, 1982; Zmud and Apple, 1992; Saga and Zmud, 1994; Rogers, 1995; Price, 1997), several organizational post-implementation dimensions – to allow for validity assessments of the focal construct OIU – were used and operationalized in this study.

The first measure to allow for a validity assessment (nomological validity; Peter, 1981) of the focal construct is internal diffusion. It is a structural dimension that captures the extent of spread of use within an organization. It is especially appropriate with regards to innovations – like OIU – where implementation occurs gradually (Fichman, 1995). It was operationalized as a two reflective item measure, extent of access to the world-wide-web and extent of employees with their own business e-mail address (see Table II).

The second measure to allow for a validity assessment of the focal construct is infusion (Zmud and Apple, 1992; Saga and Zmud, 1994; Fichman, 1995). Infusion is a structural dimension at the technology level as opposed to internal diffusion, which operates at the organizational structural level. Infusion captures the extent of technical configurations of use (Zmud and Apple, 1992). Its sub-dimension extended use (Saga and Zmud, 1994) was represented as the sum of key internet services used (see Table II).

Additional post-implementation indicators for validity assessment purposes like the level of institutionalization (Meyer and Goes, 1988) were not included following the insights from a set of exploratory interviews concerning potential assessment ambiguities and difficulties.

The OIU construct: applied to the international business domain

The focal construct OIU was operationalized as follows. While several use assessment measures do exist, one usually distinguishes between actual use (reported or recorded amount/duration of use) and perceived levels of use. Although the original questionnaire draft included both dimensions, it was decided to focus only on one measure: perceived levels of use. Besides practicalities – the questionnaire was too long if both dimensions were included – the pre-test showed that the appropriateness of the first assessment measure at the firm level was questionable and access to recorded data was also not possible. Thus, we applied the common level of use construct “routinisation of use” (Zmud and Apple, 1992; Saga and Zmud, 1994; Price, 1997). Using an extended seven-point Likert scale (a not used option was included), each component of OIU was included using formative indicators. If appropriate and feasible, multiple items per components were used. Since Internet use needs to be goal directed to become meaningful, we applied OIC to the international business domain. This use driver was chosen because little empirical research in this area exists (Samiee, 1998; Zaheer and Manrakhan, 2001; Petersen and Welch, 2003) and because various authors have argued that using the Internet for international business is a particularly effective and efficient way of internationalization the business (Hamill, 1997; Zaheer and Manrakhan, 2001). The relevant uses were derived from the international business literature (e.g. Hamill, 1997; Leonidou and Adams-Florou, 1999). Details are presented in Table I.

In addition to infusion and internal diffusion, which should correlate significantly and positively with OIU if nomological validity is to be established, a third measure was added to allow for an assessment of OIU's predictive, or to be more precise, concurrent validity (Cronbach and Meehl, 1955), a special form of nomological validity (Peter, 1981). This measure was derived from international business theory, since OIU was applied to this use domain. In international business theory foreign market entry, in terms of location, entry mode and timing, is of pivotal interest (Young *et al.*, 1989). Applied to this research context, one could postulate that if an organization uses the internet to a very high degree for its international business operations, its role in selecting certain foreign market should increase. Following internationalization theory (Johanson and Vahlne, 1977) and research that investigated the role of information in international business (e.g. Magee, 1977; Welch, 1996) three indicators were used to form the country selection construct (see Table II). To demonstrate predictive validity OIU should significantly and positively explain variance in this construct; to a degree that exceeds the predictive power of the other two construct infusion and internal diffusion. Ideally, only OIU predicts the country selection construct in a significant manner.

Method and empirical base

In order to assess OIU empirically, a survey was conducted in Germany in the federal state of North Rhine Westphalia. After a series of exploratory interviews, a peer review and a pre-test of a questionnaire subsequently developed, the final questionnaire was sent to owner manager or managing directors – the rater entity for the OIU construct (Rossiter, 2002) – of small technology-based firms (STBFs) located in science parks following the methodology of past research studies into STBFs (e.g. Jones, 1999). A drop and collect survey achieved a net response rate of 40 per cent, with 112

				Organizational use of the internet
Construct: abstract collective object	Formative indicators/items (1-7 Likert scale)	Use dimension	Source	
organizational level of internet use for international business (routinization of use) (7 items)	“Using the internet ^a for international personal business communication (e.g. via e-mail) is a daily business routine” [PCOMUSE]	Interaction	Derived from the diffusion of innovation literature and the international business	73
	“Using the internet to search for international business information is a daily business routine” [INFOPULA]	Information pull		
	“Using the internet to internationally advertise our firm and its product is a daily business routine” [INFOPUSH]	Information push	literature	
	“Using the internet to order foreign products on-line is a daily business routine” [ECONMER1]	Interaction		
	“Using the internet to sell our products internationally online is a daily business routine” [ECONMER2]	Interaction		
	“Using the internet for electronic links with our international business partners (e.g. via weblinks or an extranet) is a daily business routine” [ELINKS] ^b	Interaction		
	“Receiving international business information from the internet (e.g. from listservs or newsgroups) is a daily business routine” [INFOPULP]	Information pull		
Notes: ^a The term “internet” was explained – along the lines of the definition developed in this paper – in the questionnaire prior to this set of questions; ^b The rater population suggested the inclusion of this item during the pre-test of the instrument				Table I. Indicators of OIU

participating firms. Respondents and non-respondents were compared in order to test potential response bias. The only relevant and known variable for all sample frame members was their location, as identified by their five-digit postcode. Since this five-digit postcode was not a truly metric variable and its distribution was not normal, the non-parametric Mann-Whitney U test was used and the postcodes were tested for differences across the two groups (respondents and non-respondents). The results (z -value -1.32 , p -value 0.19) suggested that no significant response bias existed between the groups.

The particular population of STBFs was purposely selected for a number of reasons. First, STBFs are known to have a strong international orientation at an early stage (e.g. Knight and Cavusgil, 1996). Second, STBF entrepreneurs are known to be early adopters of new technology (Brock, 2000). Third, science parks provide a supportive infrastructure. These combined factors are crucial for a study such as this,

Indicator	Reflective indicators/items (dichotomous)	Source
Infusion (1 summed-up item; INFUSION)	Which of the following internet ^a services are used within your firm: e-mail (Yes/No) www (Yes/No) own homepage (Yes/No) web server (Yes/No) extranet (Yes/No) intranet (Yes/No) internet telephony (Yes/No)?	Derived from the diffusion of innovation literature and the IT literature
internal diffusion (two items)	Reflective indicators/items (ratio scale) How many employees (full-time equivalent) have direct access to the internet from their own office computer? [INTDIFF1] How many employees (full-time equivalent) have their own business e-mail? [INTDIFF2]	Derived from the diffusion of innovation literature and the IT literature
Foreign country selection (three items)	Reflective indicators/items (1-7 semantic differential scale) To what degree have the following factors influenced your firm's decision to do business in your current foreign markets? Information search (your firm searched for foreign firms/markets/customers on the internet which led to international business activities) [IMPIPULA] Receipt of information (your firm received international business information over the Internet which led to international business activities) [IMPIPULP] Business inquiry (your firm has received unsolicited business inquiries over the internet which led to international business activities) [IMPUINQ]	Derived from the international business literature

Table II.
Indicators used to assess
the nomological and
predictive validity of OIU

Note: ^aThe term "internet" was explained – along the lines of the definition developed in this paper – in the questionnaire prior to this set of questions

since in-depth infusion and use routinization of the internet for international business purposes among average firms is not yet high (Brock, 2000). However, STBFs in science parks constitute a population rich in internationally active and internet active firms, thus allowing for an assessment of the OIU construct.

Validation

To test the OIU construct in terms of its reliability and validity simultaneously, the component-based partial least squares (PLS) structural modeling technique was applied using PLS-Graph (Chin and Frye, 2001). PLS has several strengths in comparison to covariance, full information-based structural modeling techniques – such as the ones implemented in LISREL and EQS – that made it appropriate for this empirical investigation. First, PLS is robust against multicollinearity and skewed

responses (Cassel *et al.*, 2000). The latter characteristic was found in this study. Second, its small sample size requirements allowed for its use in this study. With 105 usable observations to assess the full model (see below) it exceeded the minimum requirements of ten times the scale with the largest number of formative indicators (Chin, 1997). Third and most importantly, the PLS method can handle formative indicators which are required for the focal construct of this study. For covariance-based structural modeling technique the inclusion of formative measures is problematic and has been shown to lead to identification problems (MacCallum and Browne, 1993). Although still not used often, PLS has been viewed as a reliable alternative to standard structural modeling techniques for quite some time now (Fornell and Bookstein, 1982). Figure 1 shows the results of this analysis.

Quality assessment of OIU: reliability

Following traditional guidelines in order to assess the reliability of a construct, researchers are usually asked to report on the internal consistency of the construct (Churchill, 1979). However, for constructs that consist of formative indicators such an approach is not applicable (Diamantopoulos and Winklhofer, 2001). For such indicators their weights need to be considered to identify their relevance in the measurement model (Chin, 1998). Although no minimum thresholds for indicator weights have been established, the statistical significance of the weights can be used to determine their relevance in forming the latent variable (Ravichandran and Rai, 2000). These were estimated using the bootstrap resampling technique. As recommended (Hair *et al.*, 1998), 1,000 sub-samples were used to estimate the parameter means and

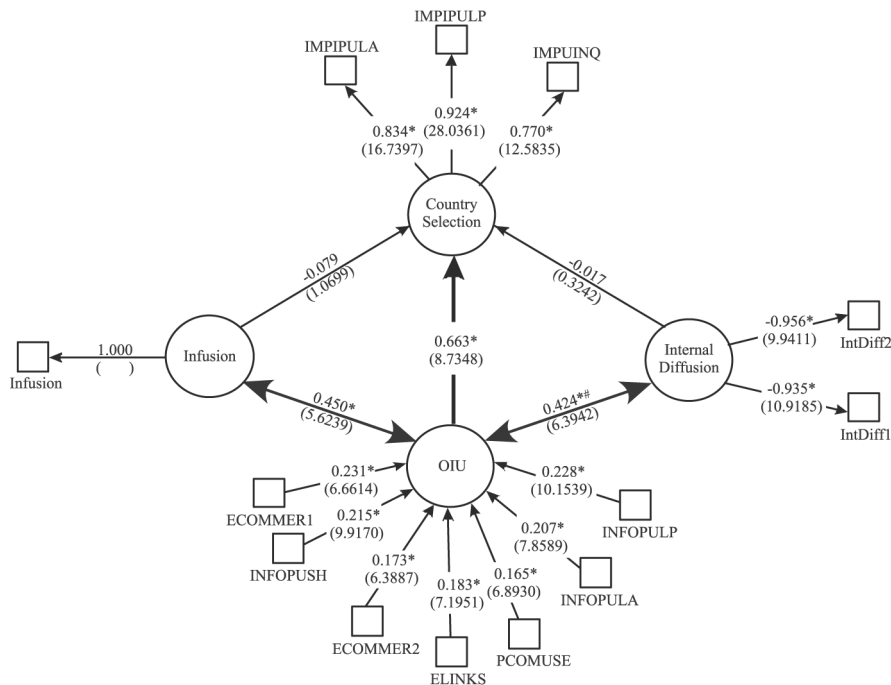


Figure 1.
OIU PLS model results

standard errors. As can be seen in Figure 1, all of OIU's items are statistically significant and are of roughly equal importance in causing OIU. In consequence, no indicators needed to be retained in order to re-estimate OIU. The other three constructs, which were conceptualized by reflective indicators, also exhibited satisfactory levels of reliability (composite reliability for internal diffusion: 0.944; composite reliability for country selection: 0.882; Average Variance Extracted (AVE) for internal diffusion: 0.894; AVE for country selection: 0.714)[2].

Quality assessment of OIU: validity

Table III presents the findings of the discriminant validity of the used constructs. The diagonal elements represent the average variance extracted (AVE) of the respective construct and the lower triangle elements represent the inter-construct correlations or shared construct variance. All diagonal element values exceed the inter-construct correlations and discriminant validity can thus be assured.

Following diffusion of innovation theory (Rogers, 1995) OIU should significantly co-vary with infusion and internal diffusion. As can be seen in Figure 1, paths between OIU and infusion and internal diffusion are both significant. Nomological validity can thus be demonstrated, too.

To assess the predictive validity of OIU, OIU's paths with the country selection construct should be significant according to internationalization theory as proposed above. Figure 1 shows that this is indeed the case. Moreover, only the paths between OIU and country selection is significant. Neither infusion nor internal diffusion have a significant relationship with country selection.

Avoiding the common method bias: observational study of web sites

Thus far, the empirical assessment of OIU demonstrated its reliability and validity. However, an empirical assessment and validation of a given construct using the same method is problematic (Churchill, 1979). This is so because a common method bias may lead to a construct that is only valid in terms of the instrument used. In order to avoid this, an observational study of web sites was included into the research methodology, representing a maximally different research investigation and instrument as recommended in the literature (Churchill, 1979). Thus, the questionnaire also asked each sample member to state the address of its firm's web site.

Since a comprehensive model for systematically assessing firms' web sites has not yet been introduced (Evans and King, 1999; Burton and Walther, 2001; Huang, 2003) a synthesis based on previous research was required. Various models were proposed in

	OIU	Infusion	Country selection	Internal diffusion
OIU	0.506			
Infusion	0.203	1.000		
Country selection	0.403	0.52	0.714	
Internal diffusion	0.180	0.189	0.070	0.894

Table III.
Correlations of latent
variables to assess
discriminant validity

Note: Diagonal elements represent the average variance extracted (AVE) of the respective construct and the lower triangle elements represent the inter-construct correlations or shared construct variance. To demonstrate discriminant validity of the constructs the diagonal element values should exceed the inter-construct correlations

the past, ranging from simple scoring models (e.g. Ho, 1997) to more advanced scoring models (e.g. Evans and King, 1999); from simple two-dimensional matrix categorizations (e.g. Quelch and Klein, 1996) to more advanced multi-dimensional classification schemes (e.g. Berthon *et al.*, 1997). The direct use of any of these previous approaches is problematic for the purpose of this study. They cannot readily be applied because they are either industry specific (e.g. Berthon *et al.*, 1997), focused on only a few salient factors (e.g. Quelch and Klein, 1996; Huang, 2003) or potentially subjective in their assessment technique (scoring models), thereby re-introducing the common method bias that we wished to avoid. Therefore, it was decided to synthesize the current state of the literature on web site assessments and extract salient characteristics of web site design and sophistication. In order to achieve the highest possible level of objectivity, it was decided to either use binary measures ("Does A exist? Yes or No?") for the rater or objective measures based on specific software tools (see below). This procedure avoids the subjectivity of scaling dimensions on a metric or quasi-metric scale.

The following two sub-sections will present the extracted dimensions and their assessment.

Key dimensions of organizational web sites

The main and first challenge of a web site is to attract visitors (Kierzkowski *et al.*, 1996). Therefore, web site promotion is critical (Evans and King, 1999). While important marketplace-based web site promotions of a firm, for example adding web site addresses to print ads, cannot be assessed in this observational analysis, two observable dimensions are suggested in the literature. The first dimension might be termed "searchability". It addresses the important ease with which a potentially interested entity (individual or organization) can find the web site of a firm (Kierzkowski *et al.*, 1996; Evans and King, 1999). The second dimension relates to the importance of extensive external links from other web sites (Palmer *et al.*, 2000) and might be termed "locatability". The higher a firm rates on both these dimensions the easier it is for someone to (actively or passively) find their site. Palmer *et al.* (2000) found empirical support for this argument. Additional promotional activities that are important to promote a web site, like banner ads on the world-wide-web, were beyond the possibilities of this observational analysis.

Once visitors are attracted, it is important to engage and retain them (Kierzkowski *et al.*, 1996). This stage relates to the actual design and content of the web site itself. But while an assessment of the web design and its visual appeal is highly subjective, as well as customer, product and industry specific (Berthon *et al.*, 1996) and still not well researched (Huang, 2003), a set of "meta rules" emerge from the literature. First and foremost is the provision of information (Ho, 1997; Misic and Johnson, 1999; van der Merwe and Bekker, 2003). The web site should provide the visitor with rich (Evans and Wurster, 1999) and up-to-date (Berthon *et al.*, 1996; Kierzkowski *et al.*, 1996; Ho, 1997; Evans and King, 1999) information. Still it is not only important to provide rich and up-to-date information, it is also important for the visitor to easily find the information within the web site. Hence an important element of information provision is the "navigatability" of the site (Berthon *et al.*, 1996, 1997; Misic and Johnson, 1999; Huang, 2003; van der Merwe and Bekker, 2003). It is the ease of finding information and navigating within a web site.

A second key aspect of web sites that takes advantage of its unique media characteristics is interactivity (Kierzkowski *et al.*, 1996; Ghose and Dou, 1998; van der Merwe and Bekker, 2003). The essence of interactivity is exchange and the goal of the web site should be to turn a high number of passive surfers into interactors (Berthon *et al.*, 1996). This is achieved mainly by providing means to allow a dialogue between the visitor and the firm (Berthon *et al.*, 1996; Evans and King, 1999; Cox and Koelzer, 2003).

A related dimension of interactivity that needs to be investigated is e-commerce. E-commerce refers to the possibility of a web site to offer on-line transactions (Berthon *et al.*, 1996, 1997; Quelch and Klein, 1996; Ho, 1997; Evans and King, 1999).

These salient characteristics of web sites (searchability, locatability, navigatability, rich and up-to-date information provision, interactivity and transactions) constitute the generic meta rules suggested in the literature that were assessable via the observational analysis.

The following section presents how these key dimensions were assessed.

Assessment of web site key dimensions: searchability and locatability

Both indicators can be assessed objectively by using web site assessment tools. The use of search engines assesses the searchability dimension. If an individual is interested in a firm and/or in specific products/services (that this firm offers) and he or she is unable to find it in one of the major search engines, the web sites level of attracting potential visitors, its searchability, is low. In order to avoid checking all the major search engines manually, software was developed that can check a range of search engines automatically. All the interested researcher has to do is type in the web site address of the firm (the URL) and the relevant keywords in relation to that firm. The TopDog software was used for this part of the analysis. For each firm the address of their web site and three sets of keywords were used. The keywords included the full name of the firm, the specific industry the firm is operating in and the specific type of products/ services the firm offers. This was considered to be a good proxy of the type of search words used by a potential customer. The information with regards to the words used as keywords in the assessment was derived from the survey and the content of the firms' respective web sites.

For each of the search engines covered by the software, the researcher pre-specified a search depth of 100. This means that the software will give a ranking for the firm's web site from 1 to 100 for each of the search engines. A "1" is the highest possible level of searchability and it simply indicates that the firm's web site is the first listed web site in relation to the keywords used. The lower the rank, the lower is the searchability. The sum of the reversed ranks for each search engine was then used as a proxy for searchability. The higher the value of this variable, the easier it is to locate the web site[3].

The second dimension is locatability. The number of external links to a firm's web site was assessed by using a special search feature of the AltaVista search engine (www.altavista.com). Using the search option "link: 'web site address of the firm'", AltaVista lists all the covered web sites with links to the web site under investigation. The more external links a web site has the higher its locatability.

Assessment of web site key dimensions: information richness and navigability

Information richness and navigatability were measured by summing up a set of binary indicators (0 = feature does not exist, 1 = feature does exist). For information richness the existence of aspects listed in Figure 2 were assessed. Their selection was guided by the technical possibilities of the internet and key organizational attributes of the firms, mainly the firm itself, its products and its business partners. Possible values for the information richness variable ranged from 0 to 10. In order to assess the validity of the information richness scale objectively, its values was correlated with the actual amount of data on a firm's web site (as measured by the total amount of files, bytes and directories of all web pages within three levels below the firm's main domain level). The results showed that the richness indicator correlated significantly with the actual amount of information on a firm's web site ($r = 0.46$; p -value 0.00), providing support for the validity of the indicator.

For the navigability dimension the existence or non-existence of the following three aspects, considered to facilitate information search and navigation, were considered. The first binary indicator assesses the existence or non-existence of a table of contents, giving an overview of the various pieces of information provided by the web site (e.g. Evans and King, 1999; Huang, 2003). The second binary indicator used assesses the existence or non-existence of navigational aids such as "frames". These aids facilitate the navigation within a web site by offering intra-site links (e.g. Huang, 2003), as opposed to the linear back/ forward options of the browser only. The third and last binary indicator considered assesses the existence or non-existence of an intra-site search option (e.g. Ghose and Dou, 1998; van der Merwe and Bekker, 2003). Such a function allows the visitor to easily search for and pinpoint the specific information he or she is looking for on the web site. The possible values for the navigability variable range from 0 to 3, the higher its value the higher its navigability.

Does the website provide:								
textual	graphical	audio	video	textual	graphical	audio	video	
information about the product(s)/service(s) of the firm				information about the firm itself (its history, size, employees etc.)				information about business partners/previous customers
Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Does the website offer the possibility to download detailed information (e.g. regarding product specifications)								
Yes/No								
0/1								

Figure 2.
Information provision:
binary information
richness indicators used

Assessment of web site key dimensions: updatedness, interactivity and transaction

Using the “page info” option of the world-wide-web, browser Netscape Navigator objectively assessed the newness of the information content of the web site (its updatedness). The page info option gives the date the selected web page was last updated[4]. Deducting its numerical value from the numerical value of the access date of the analysis establishes then the newness of the web page information in days. The lower the value of this variable the more up-to-date the web site is. For each web site either the homepage itself or the “what new”-page was considered as a proxy for content newness.

The level of interactivity was assessed by determining the existence or non-existence of four aspects of establishing interaction (a dialogue) with web site visitors (in parts derived from Ghose and Dou, 1998; van der Merwe and Bekker, 2003) as listed in Figure 3.

The possible values for the interactivity variable ranged from 0 to 4; the higher its value the higher the level of interactivity.

The last dimension, transaction, was assessed at a binary level. If a web site offers on-line transactions it was coded with a “1”, if it does not it was coded with a “0”. As such, I could be treated as a metric variable.

Observational study: results

Table IV presents the results of the observational analysis. As can be seen, all indicators but one correlate significantly with the focal construct OIU. This supports the validity of the construct. However, one might argue that the strength of the correlations is not high in terms of effect sizes and thus the validity of OIU is still questionable. At first sight this appears truly to be the case but one has to remember that OIU was related to a specific use – to support the international operations of the firm. The web sites on the other hand were assessed independent of their focus or foci of use. A web site could for example rank high on all indicators used while the firm might rank low on OIU simply due to the fact that its main focus is, for example, its domestic business operations. Due to the possibility of such combinations the resulting effect sizes reasonable. The estimated coefficients for international web sites only (see Table IV) partially support this argument. Moreover, OIU captures all dimensions of

Does the website allow visitors to establish a dialogue with:			Does the website offer continuous interaction for visitors (e.g. newsletters)?
	individual	the firm’s business community (open discussion forums)	
the firm	employees		
Yes/No	Yes/No	Yes/No	Yes/No
0/1	0/1	0/1	0/1

Figure 3.
Interactivity: binary
indicators used

Observation-based measures	Survey-based measure OIU				Organizational use of the internet
	All web sites ($n = 77$)		Only IB sites ($n = 36$)		
	Coefficient	p -value	Coefficient	p -value	
Navigability	0.174	0.065*	0.179	0.148	81
Transactions	0.193	0.046**	0.334	0.023**	
Locatability	0.387	0.000***	0.590	0.000***	
Searchability	0.231	0.022**	0.249	0.072*	
Info. richness (scale)	− 0.009	0.408	− 0.115	0.252	
No. of files	0.027	0.408	0.114	0.255	
Σ in bytes	0.033	0.388	0.119	0.245	
No. of directories	0.101	0.190	0.271	0.055*	
Updatedness	− 0.199	0.042**	− 0.054	0.376	
Interactivity	0.244	0.016**	0.168	0.163	
Notes: *significant at $p < 0.10$; **significant at $p < 0.05$; ***significant at $p < 0.01$					Table IV. Non-parametric correlations of OIU with observation-based indicators (one-tailed)

organizational internet use, while the observation of web sites only captures the information push dimension.

Conclusion

This study developed a theoretically grounded measure of organizational internet use and tested its properties empirically. The developed measure, OIU, an index-based abstract collective object with three components (cf. Rossiter, 2002), exhibited satisfactory levels both in terms of reliability and validity (discriminant, predictive and nomological). In addition, a cross-method investigation demonstrated lack of a significant common method bias, further strengthening the measure's validity.

The developed measure, OIU, has important implications for both managers and researchers. It should help assessing levels of organizational internet use in a consistent fashion across populations and studies. It can be used for benchmarking purposes – of specific interest to managers – and it can be used to explore antecedents and consequences of organizational Internet use – of specific interest to researchers. In the latter case the following important yet unexplored research questions could be addressed:

- (1) What factors (antecedents) at the level of the firm, the industry and/ or country lead to high levels of organizational internet use?
- (2) What impacts (consequences) do high levels of organizational internet use have on:
 - the firm's internationalization process (cf. Hamill, 1997; Brock, 2000)?
 - the need to establish a physical presence abroad (cf. Zaheer and Manrakhan, 2001)?
 - the need to meet people face-to-face (cf. Nohria and Eccles, 1992)?
 - a firm's cost structure (cf. Porter, 2001)?
- (3) Does organizational internet use moderate the technology investment business performance link (cf. Rai *et al.*, 1997)?
- (4) Does organizational internet use mediate the technology investment business performance link (cf. Rai *et al.*, 1997)?

Finally, two main limitations of the present study need to be addressed in order to ensure proper interpretation and application of the measure, as well as opening new paths for future research.

First of all the degree of generalizability of OIU requires attention. On the one hand OIU was applied to the international business use domain and is, strictly speaking, limited to this domain. However, we feel that OIU offers enough customizable elements in its formative index indicators that it could be easily applied to other use domains. Table V provides three examples of other use domains. Nevertheless, each of these possible adaptations needs to be separately assessed before they can be applied. On the

Domestic, general business	Use domain examples International joint ventures	R&D
“Using the internet for domestic personal business communication (e.g. via email) is a daily business routine”	“Using the internet for personal business communication with our international joint venture partners (e.g. via e-mail) is a daily business routine”	“Using the internet for personal business communication in our R&D projects (e.g. via e-mail) is a daily business routine”
“Using the internet to search for domestic business information is a daily business routine”	“Using the internet to search for business information on our international joint venture partners’ web sites, extranets or ftp servers is a daily business routine”	“Using the internet to search for business information relevant to our R&D projects is a daily business routine”
“Using the internet to advertise our firm and its products domestically is a daily business routine”	“Using the internet to advertise the products/services of our international joint venture is a daily business routine”	“Using the internet to advertise our firm and its R&D services is a daily business routine”
“Using the internet to order domestic products online is a daily business routine”	“Using the internet to order products for our international joint venture online is a daily business routine”	“Using the internet to order products or services relevant to our R&D services and/or operations online is a daily business routine”
“Using the internet to sell our products domestically online is a daily business routine”	“Using the internet to sell our international joint venture products/ services on-line is a daily business routine”	“Using the internet to sell our R&D services online is a daily business routine”
“Using the internet for electronic links with our national business partners (e.g. via weblinks or an extranet) is a daily business routine”	“Using the internet for electronic links with our international joint venture partners (e.g. via weblinks or an extranet) is a daily business routine”	“Using the internet for electronic links with our R&D partners (e.g. via weblinks or an extranet) is a daily business routine”
“Receiving national business information from the internet (e.g. from listservs or newsgroups) is a daily business routine”	“Receiving business information from our international joint venture partners via the internet (e.g. from listservs or newsgroups managed by them) is a daily business routine”	“Receiving business information relevant to our R&D projects and/or services from the internet (e.g. from listservs or newsgroups) is a daily business routine”

Table V.
Applying OIU to other use domains

other hand it has to be remembered that the present OIU flavor (international business) was assessed amongst a very specific population, STBFs. While helpful to facilitate the assessment this limits the claims that can be made with regards to applying OIU in other industries, countries, and firms. Future research should address this by applying OIU in maximally different research contexts (Eden, 2002) to gauge its context sensitivity.

Second, further research and refinements to OIU itself are also required. Since it is important in index construction to make sure that all aspects of the construct are covered by the formative indicators (Diamantopoulos and Winklhofer, 2001), it might well be that the low number of indicators for each component is not sufficient and an increase in relevant indicators that address specific sub-components might increase both the reliability and validity of OIU further. Caution to do so needs to be exercised. In contrast to constructs developed with reflective indicators, item redundancy in terms of high levels of multicollinearity (e.g. a high Cronbach α) decreases reliability in an index-based construct (Diamantopoulos and Winklhofer, 2001). Diamantopoulos and Siguaw (2002) provide guidelines regarding how to deal best with the item purification issues in index-based construct development.

In the introduction to this paper it was argued that organizational internet research is at a critical crossroads, moving from anecdotal and exuberant internet euphoria to internet pessimism to – hopefully – internet realism. Only theoretically grounded, reliable and valid measures can support such a required transition. With this paper we have made an initial contribution for such a development to occur.

Notes

1. An example of a similar construct and how it relates to standard reflective indicator based constructs can be found in Diamantopoulos and Siguaw (2002).
2. With only one indicator reliability for infusion could not be assessed.
3. The reasons for limiting the search depth are mainly pragmatic and logical. Higher search depths would not only significantly increase the time of the analysis, but it is also unlikely that an individual interested in a firm or in a specific range of products will scan through much more than 100 web site links.
4. Microsoft's Internet Explorer provides a similar feature that can be found in the File Menu, under the Properties command. This feature provides you with the date of creation and last changes made to the web page of interest.

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