DERIVING A DIFFUSION FRAMEWORK AND RESEARCH AGENDA FOR WEB-BASED SHOPPING SYSTEMS

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ABSTRACT

Although the research on electronic commerce is plentiful, there is little empirical research related to Web-Based Shopping Systems (WBSS). This is especially so in global electronic commerce circumstances. WBSS are the fastest growing segment of digital economies and are perceived as driving forces of electronic commerce in terms of global markets and digital business. Using WBSS, organizations have new opportunities to successfully evolve their business as global marketers. This paper develops a model to assess the diffusion of WBSS. Factors that impact WBSS diffusion are identified and analyzed as the basis for empirical testing. A set of propositions is developed that allows operationalization of the model. The ultimate goal is to provide new theoretical insights and practical guidelines for organizations wishing to undertake WBSS.

Keywords: Electronic Commerce, Web-Based Shopping Systems, Diffusion Framework

1. Introduction

Recently, information and communication technology (ICT), in particular the Internet and electronic commerce, has been increasingly recognized as a means of positive sustainability for driving the global digital economy (OECD, 2000; Howcroft, 2001; Brynjolfsson and Kahin, 2002; Hudson, 2002). In this context, a growing body of literature has noted that Internet technologies play a significant role in expanding the volume and scale of global electronic commerce (Rayport and Bernard, 2001; Porter, 2001; Feeny, 2001; Looney et al., 2002; Chaudhury and Kuilboer, 2002). Among various types of e-businesses, the most well-known model is the so called dot-com (Porter, 2001), which utilizes several types of Web-based shopping systems (WBSS) applications. WBSS can be described as Internet-based shopping systems for selling and buying products, information, and services (Arlitt et al., 2001).

Business on the back of WBSS appears to be revolutionizing the way customers and organizations interact, independent of the time and place constraints associated with traditional forms of business. WBSS are network systems that connect customers, suppliers, collaborators and even competitors, enabling organizations to conduct new digital business not undertaken previously (Korper et al., 2000). It appears that previous information technologies such as EDI were mainly used in order to automate data processing or to improve effectiveness and competitiveness at the intra- and inter-organization level (Kalakota and Whinston, 1996; Timmers, 2000). However, WBSS provide a new digital infrastructure that can integrate economic, social and community activities, commerce, entertainment and education (Korper et al., 2000; Arlitt et al., 2001). Thus, WBSS appear to offer new opportunities for firms, in the form of increased market access and information, decreased operating and business costs, provision of high-quality products, rapid service, and greater shopping convenience to customers. Well-known dot-coms such as Amazon.com, eBay.com and Tesco.com incorporate their WBSS applications with security systems, certificate systems, supply chain management systems, customer relation management systems and so on.

Businesses relying on WBSS are diffusing rapidly across national boundaries, taking their place between organizations and customers, and enterprises and the global market, across countries (Korper and Ellis, 2000; Looney and Chatterjee, 2002; Slyke et al., 2002). This global phenomenon of WBSS diffusion is of particular interest and can be considered utilizing the theory of innovation diffusion, because such research seeks to explore and explain why particular new technologies do diffuse quickly and widely, while others do not (Newell et al., 2000; 242). So far, diffusion theory has been frequently used to explain the complex nature of new ICT diffusion (e.g., Zmud, 1982; Liang, 1986; Brancheau and Wetherbe, 1990; Krcmar and Lucas, 1991; Bouchard, 1993; Kettinger,

1997; Westland et al., 1998; Standing et al., 2000). Most previous research on ICT diffusion has been focused at the organizational level before electronic commerce appeared on the commercial scene. However, the diffusion of WBSS takes place between organizations and customers, and enterprises and the global market. Given the global phenomenon that is Web-based shopping business, this paper reviews a category of ICT diffusion research and presents a framework that offers insight into and characteristics of global WBSS diffusion. We do so in the belief that this will help in achieving a grasp on the fundamental characteristics of WBSS diffusion. The goal of this paper is to present a WBSS diffusion framework, identifying fundamental factors related to WBSS diffusion specifically. In doing so we address the research variables that may facilitate and help explain the phenomenon of WBSS diffusion. The model is used to develop a set of propositions that drives the empirical work in assessing the diffusion of WBSS in contemporary electronic commerce circumstances.

2. Conceptualising Web-Based Shopping Systems

There are various types of configuration of WBSS such as those adopted by amazon.com, eBay.com, Del.com, Tesco.com and so on. Figure 1 provides a multi-tier architecture for WBSS – one which is adopted for the purposes of this research. It is taken from Arlitt et al. (2001; 47).

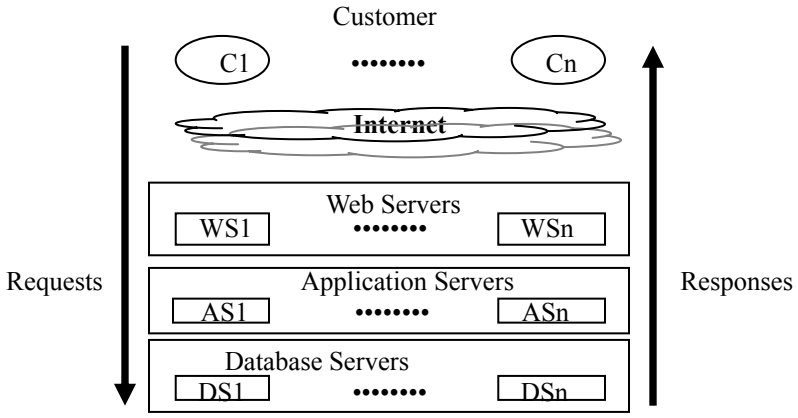

Figure 1. Multi-tier Architecture of Web-Based Shopping Systems (Arlitt et al. 2001)

As can be seen in Figure 1, WBSS consist of Web servers, application servers, and database servers (Arlitt et al. 2001). First, Web servers support Web-based shopping between seller and buyer, merchant and customer, and manufacturer and supplier. Web servers fill the role of middleman between the back-end systems and front-end clients (Korper and Ellis, 2000). Web clients use Web browsers that supply a graphical interface to view and interact with all the information available on the World Wide Web (Loshin, 1995; Kalakota et al., 1999; Korper and Ellis, 2000). Second, application servers support information retrieval, personalization, transaction management, security management, and payment management. They include shopping agents or search engines, security systems, certificate systems, customer relationship management (CRM) systems, and payment systems (Korper et al., 2000; Arlitt et al. 2001). For example, Amazon.com incorporates WBSS applications for order processing, invoicing, payment, shipment, inventory management and procurement on its Web site. Finally, database servers manage all data that are related Web-based shopping between WBSS and clients.

To sum up, WBSS carry out global electronic commerce and digital business based on the following characteristics: WBSS are global network systems that include Web servers, application servers and database servers. WBSS are also open systems based on TCP/IP enabling them to communicate on different hardware and software platforms. WBSS include an electronic payment system that can handle monetary exchange transactions, such as credit cards, smart cards, debit cards, e-cash, e-checks, e-wallets and so on, electronically. Thus, it can be seen that WBSS are quite different from traditional information systems in terms of system objects, system architecture, system application, technical components, and network configuration (Korper and Ellis, 2000; Cheung and Lee, 2000; Choi and Whinston, 2000; Arlitt et al., 2001). The role of WBSS can be seen as providing product information, managing business transactions, supporting payment systems, and ensuring the security of systems to customers or buyers. It might be concluded that the application of WBSS promises to be a driving force for electronic commerce by allowing organizations to create global electronic markets, increase efficiency, and lower costs through digital transaction with customers and businesses around the world.

3. Reviewing Previous Studies of ICT Innovation Diffusion

The theory related to ICT innovation diffusion is relevant to this study because "research of innovation diffusion seeks to explore and explain why particular new technologies do diffuse quickly and widely, while others do not" (Newell et al., 2000; 242). Hence, we review a range of ICT diffusion research here.

Technology innovation diffusion theory has helped to explain the adoption and diffusion of different types of new ICT. These include Software (Zmud, 1982), Decision Support Systems (Liang, 1986), spreadsheets (Brancheau and Wetherbe, 1990), MRP (Cooper and Zmud, 1990), strategic information systems (Krcmar and Lucas, 1991), DBMS (Grover et al., 1992), EDI (Bouchard, 1993; Premkumar et al., 1994), telecommunications (Grover and Goslar, 1993), e-mail (Romm et al., 1996; Kettinger, 1997), FMS (Belassi et al., 1998), ATMs (Santos and Peffers, 1998), Expert Systems (Shao, 1999), Electronic Cash (Westland et al., 1998), and the Internet (Press et al., 1996; Charlton et al., 1997; Samaddar, 1998; Standing and Vasudavan, 2000). In order to understand the characteristics of previous ICT diffusion research, an attempt is made here to divide the research into micro and macro level aspects. Micro level research focuses on ICT diffusion at the level of the individual and the organization. Macro level research takes into account diffusion at the level of industry and nation. Table 1 provides a summary of the two groups for a selection of ICT diffusion studies.

Table 1. Summary of Previous ICT Innovation Diffusion Studies

Level	Author(s) and year	Research ICT	Analysis Context	Impact Factors
Micro Level	Zmud (1982)	Software	Software Development Group	· Innovation process · Compatibility · Vested interests
	Liang (1986)	DSS	University Students	· Quality of system · Representation format · Motivation · User attitude
	Lee & Treacy (1988)	General IT	IS Users	· Motivation support · Resources support · Information support
	Brancheau et al. (1990)	Spreadsheet	End-User Computing	· Education · Opinion Leadership · Media Exposure · Internal Communication
	Cooper et al. (1990)	MRP	Manufacture Org'	· Compatibility · Manufacturing methods
	Krcmar & Lucas. (1991)	SIS	Bank Organization	· Cost justification · Seizing on an opportunity · Need for sponsor · Marketing the application · Customer-oriented view · Building on infrastructure
	Grover & Teng (1992)	DBMS	IS Organization	· Organization size · Extent of on-line processing · Ender user computing · Degree of centralization · Size of IS department
	Grover & Goslar (1993)	Telecom-Munication	IS Organization	· Environment uncertainty · Decentralization of decision making
	Bouchard (1993)	EDI	Manufacturers Org'	· Business partners · Actual businesses
	Premkumar et al. (1994)	EDI	IS Manager	· Relative advantage · Compatibility · Costs
	Romm et al. (1996)	E-mail	University Community	· Organizational learning · Organizational culture · Link between organizational learning and culture
	Belassi et al. (1998)	FMS	Manufacturing Organization	· Corporate strategy · Corporate culture · Organization structure · Management style
	Sheng et al. (1998)	Telemedicine Technology	Hospital Organization	· Competitive pressure · Customer support · Internal support · Compatibility · Resource intensity · Benefits of telemedicine
	Shao (1999)	Expert System	Banking Organization	· Communication channels · Organization size · Effect of mass media communication
	Corbitt (2000)	Electronic Commerce Architecture	Organizational Level	· Frequent access by customers · Organizational commitment · Existence of an executive sponsor
	Standing et al. (2000)	Internet Technology	Travel Agencies	· Vendor support · Top management support · Customer support · Effective consultants

Macro Level	Charlton et al. (1997)	Internet	Communities In UK and Merseyside	· Greater public access · Partnerships
	Kettinger et al. (1997)	E-mail	Interorganizational Context	· Broadcast · Task · Social communication
	Santos et al. (1998)	ATM	Banking Industry	· Imitation and communication among industry competitors · Marketing efforts by the IT vendors
	Press et al. (1998)	Internet	Nation	· Telecommunication infrastructure · National security · Markets and choice · Financial resources · Cultural concerns
	Rai et al. (1998)	Internet	Social Level Diffusion	· Commercial use · Technology innovation · Partnerships · Heterogeneous adopters
	Westland et al. (1998)	Electronic Cash	Nation	· Education and change in payment habits
	Storey et al. (2000)	Internet Banking	Internet Banking Industry	· Ability of Internet banking service · Availability of Internet payment applications

To summarize, as can be seen from Table 1, most previous research on ICT diffusion was carried out at the micro level before the Internet and electronic commerce appeared on the commercial scene around the mid 1990s (Ticoll et al., 1998; Timmers, 2000). Most micro level research has sought to identify relevant factors of the ICT diffusion on an organizational basis (e.g., Zmud, 1982; Liang, 1986; Brancheau and Wetherbe, 1990; Krcmar and Lucas, 1991; Bouchard, 1993; Romm et al., 1996; Belassi and Fadlalla, 1998; Standing et al., 2000). These micro level studies tend hardly to be concerned with the factors related to the external environmental issues, focusing on the internal organizational considerations. As mentioned previously, WBSS are network systems, which connect with businesses and customers in global Web-based environments. Therefore, it might well be that existing theory related to the micro level is limited in explaining the global phenomenon of WBSS diffusion: "the micro-level of innovation diffusion research cannot account for differences in diffusion patterns due to variances in environmental and institutional factors" (Damsgaad and Lyytinen, 1997).

On the other hand, as shown in Table 1, there are a growing number of studies of ICT diffusion at the macro level. These reflect the dynamic nature of the Internet for commercial purposes, since the Web emerged in the 1990s (Ticoll et al., 1998; Timmers, 2000). Innovative characteristics of Internet technologies are constantly reshaping the business landscape in terms of transaction costs, lowering cycle times across business processes, and enhancing customer service (Nath, et al., 1998; El Sawy et al., 1999). This phenomenon is reflected in academic research related to electronic commerce diffusion (e.g., Charton et al., 1997; Santos et al., 1998; Rai et al., 1998; Westland et al., 1998). However, it appears that the research relevant to the macro-level tends to underestimate the role of Internet technologies, so that it rarely concerns factors related to the Internet technology per se. Among the most forceful drivers of social and economic change in recent years is the revolution in communications and information processing brought about by ICT, in particular Internet technology (McKenney, 1996; Feeny, 2001; Porter, 2001). Moreover, "the Internet phenomenon is indeed a paradigm shift governing both business and information systems" (Wigand, 1997; 2). On this basis, it would appear necessary to take a balanced view regarding the factors related to both the technical and non-technical issues, in exploring the global phenomenon of WBSS diffusion.

4. Toward a Conceptual Research Framework

We attempt to explore the conceptual inter-relationship of the factors highlighted in previous ICT diffusion studies, in order to establish a theoretical foundation for the diffusion framework of WBSS by refining chosen variables. With regard to the review of factors affecting ICT diffusion, it can be seen that a wide range of factors appear to influence the diffusion of WBSS interacting in a global and dynamic fashion. However, in building a conceptual research framework, this research attempts to focus on certain points passed over by the previous ICT diffusion studies by taking a balanced view of both internal and external factors, as well as technical and non-technical issues.

WBSS are global-oriented network systems that link organizations, customers and business partners around the world. WBSS transactions occur between buyer and seller, merchant and customer, and manufacturer and supplier. Therefore, the external environment of WBSS diffusion will influence the level of digital transaction in a WBSS with a company's customers (B-to-C) and business partners (B-to-B). Also, internal circumstances of WBSS diffusion will affect the internal systems integration with other applications, such as the payment systems or database systems, and the degree of internal usage of WBSS. Hence, the variables identified from the above review are arranged into two groups – internal factors and external factors – in order to identify meaningful implications, as indicated in

Table 2.

Table 2. Internal and External Factors of Previous Research Variables

Domain	Research Variables		Reference
Internal Factors	· Experimenting with a new marketing tool	· Financial considerations	Brancheau et al. (1990) Liang (1986) Krcmar et al. (1992) Grover et al. (1992) Romm et al. (1996) Auger et al. (1997) Belassi et al. (1998) Loh et al. (1998) Foo et al. (1998) Corbitt (2000) Cheung et al. (2000) Standing et al. (2000)
	· Real value of a new system	· Trading behaviour	
	· Perceived ease of use	· Computing resource	
	· System architecture and techniques	· Trustworthiness	
	· Executive sponsor	· Organizational commitment	
	· Quality of system	· Education	
	· Internal communication	· Building on infrastructure	
	· Extent of on-line-processing	· Organizational culture	
	· Top management support	· Corporate strategy	
External Factors	· building the company's image	· Competitive considerations	Krcmar et al. (1992) Bouchard (1993) Premkumar et al. (1994) Auger et al. (1997) Loh et al. (1998) Rai et al. (1998) Press et al. (1998) Sheng et al. (1998) Storey et al. (2000) Corbitt (2000) Standing et al. (2000)
	· Customers' concerns	· Network performance	
	· Availability of Internet payment applications	· Compatibility	
	· Frequent access by customers	· Marketing application	
	· Customer-oriented view	· Business partner	
	· Relative advantage	· Costs	
	· Competitive pressure	· Customer support	
	· Vendor support	· Partnerships	
	· Telecommunication infrastructure	· Commercial use	
	· Marketing efforts by IT vendors	· Technology innovation	

In addition, as mentioned earlier, information and communication technology (ICT) has become a major technological force influencing business success, electronic commerce and WBSS diffusion (Allen & Scott Morton, 1994; Choi et al., 2000; Feeny, 2001; Porter, 2001; Arlitt et al., 2001). The Gartner Group estimates that "75% of all e-business ventures will fail, due to a lack of technological understanding and poor business planning" (Lord, 2000). Hence, the factors related to ICT appear to be important with regard to the successful diffusion of the WBSS (Mahadevan, 2000; Korper et al., 2000; Porter, 2001; Arlitt et al., 2001). On the basis of this observation, we attempt to classify, in Table 3, the factors identified in previous related research in terms of ICT-related factors and non-ICT related factors. The factors can therefore be divided into four dimensions: 1) internal factors not related to ICT; 2) internal factors related to ICT; 3) external factors not related to ICT; and 4) external factors related to ICT, as illustrated below in Figure 2.

As can be seen from Table 3, internal factors not related to ICT include perceived ease of use, organizational commitment, trustworthiness, executive sponsor, internal communication, education, top management support, organization culture, corporate strategy, experimenting with a new marketing tool and so on. Thus, these might be called "internal organization factors". Internal factors related to ICT include the real value of a new system, computing resource, system architecture and techniques, quality of system, building on infrastructure and extent of on-line-processing. Therefore, these factors may be interpreted as "internal system factors". External factors not related to ICT are competitive considerations, customer concerns, customer-oriented view, business partner, competitive pressure, customer support, partnerships, commercial use and so on. So, these factors may be labelled "external market factors". External factors related to ICT include network performance, compatibility, relative advantage, costs, telecommunication infrastructure, vendor support, marketing efforts by IT vendors, technology innovation and availability of Internet payment applications. External factors related to ICT may be therefore called "external technical factors".

Table 3. Classification of Previous Research Factors

Domain	Classification	Factors	Reference
Internal	Non ICT Related Factors	· Financial considerations · Trading behaviour · Organizational commitment · Executive sponsor · Internal Communication · Education · Top management support · Organization culture · Corporate strategy · Trustworthiness · Experimenting with a new marketing tool	Brancheau et al.(1990) Romm et al. (1996) Auger et. al. (1997) Belassi et al. (1998) Cheung et al. (2000) Corbitt (2000) Standing et al. (2000)
	ICT Related factors	· Real value of a new system · Computing resource · System architecture and techniques · Quality of system · Building on infrastructure · Extent of on-line-processing	Liang (1986) Krcmar et al. (1991) Grover et al. (1992) Loh et al. (1998) Foo et al. (1998)
External	Non ICT Related Factors	· Competitive considerations · Customer' concerns · Customer-oriented view · Business Partner · Competitive pressure · Customer support · Partnerships · Commercial use · Frequent access by customers · Marketing Application · Promote products and build the company's image	Krcmar et al. (1991) Bouchard (1993) Auger et al. (1997) Loh et al. (1998) Sheng et al. (1998) Rai et al. (1998)
	ICT Related Factors	· Network performance · Compatibility · Relative advantage · Costs · Telecommunication infrastructure · Vendor support · Marketing efforts by IT vendors · Technology innovation · Availability of Internet payment applications	Premkumar et al.(1994) Rai et al. (1998) Foo et al. (1998) Press et al. (1998) Santos et al. (1998) Corbitt (2000) Storey et al. (2000) Standing et al. (2000)

To summarize, we have arranged the factors that appear to be closely relevant to WBSS into four categories: "internal organization factors", "internal system factors", "external market factors", and "external technical factors". As a result of this, a conceptual inter-relationship of the four categories can be proposed and is shown in Figure 2. This represents a conceptual research framework for WBSS diffusion and offers a theoretical background for further research on this particular aspect of ICT diffusion.

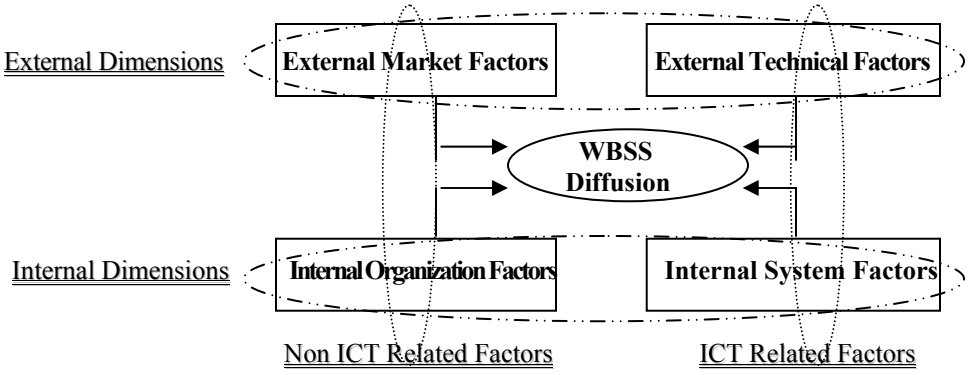

Figure 2. A Conceptual Research Framework

5. Towards a Diffusion Framework of Web-Based Shopping Systems

The goal of this paper is to present a diffusion framework of WBSS, identifying fundamental factors related to WBSS diffusion specifically. Based on the conceptual research framework developed from the review of previous ICT diffusion research (ref. Figure 2), we attempt to modify earlier research results in order to identify the research variables that may facilitate and explain the phenomenon of WBSS diffusion. The diffusion framework is used to develop a set of propositions that will drive the empirical work in assessing the diffusion of WBSS in Web-based

shopping contexts. Since little comprehensive research has been undertaken until now, the WBSS diffusion framework presented in this paper may be a step towards developing a growing body of research for Web-based shopping, and electronic commerce more generally.

In order to do this, we identify the variables that may influence the process leading to the diffusion of WBSS. As can be seen from the conceptual research framework illustrated in Figure 2, there are five categories of variables: one category of dependent variables and four categories of independent variables. In line with this, according to Pries-Heje (2002), "diffusion begins after the initial resistance offered by the consumers is overcome … if the resistance is too high, the innovation dies and there is no diffusion." Notwithstanding the demise of many dot-coms in the early 2000s, the diffusion of Web-based shopping business and electronic commerce is on-going (Porter, 2001; Feeny, 2001; Howcroft, 2001; Rifkin and Kurtzman, 2002; Pinker et al., 2002; Looney and Chatterjee, 2002). As such, we propose research hypotheses on WBSS diffusion from a positive perspective, and using this theoretical background as a starting point, we identify four categories of independent variables (that may facilitate WBSS diffusion), and then dependent variables (that may measure the extent of WBSS diffusion).

5.1 External Market Factors

Whereas initially the Internet was perceived as a source of information for researchers, it has now become the fastest growing market place in global business (Riggins, 1999; Mahadevan, 2000; Watson et al., 2000; Porter, 2001). WBSS can enable organizations create a global market for selling and buying products, information and services. Therefore, external market factors are critical elements that could be expected to affect WBSS diffusion. We attempt to introduce new variables, because external market factors are one of the distinguishing elements in the WBSS diffusion framework. The detailed reasons for the chosen variables are based on the following.

5.1.1 Global Electronic Markets

Internet technologies enable global electronic markets that act as intermediaries between seller and buyer, and merchant and customer (Schubert et al., 2000; Nour et al., 2000). These global electronic markets facilitate a wide range of seller and customer activities to converge into value-creating activities, including marketing, order processing, distribution, payments and production that involve several separate firms (Strader et al., 1997; Lindemann et al., 1999; Porter, 2001). A number of electronic markets are available to customers to buy products ranging from CDs to automobiles (Lindemann et al., 1999; Nour et al., 2000). WBSS enable firms to provide global electronic markets in diverse business ranges, such as auction houses, stock exchanges, retailers, digital products and so on. Thus,

Proposition P1: *The extent of the expansion of the global electronic markets within an industry is positively related to the extent of WBSS diffusion.*

5.1.2 Digital Business

"The fact that images, sounds and words can be stored in bits and bytes makes it possible to transfer them in seconds, from one place to another, even if they are thousands of miles apart" (van Hout et al., 2000; 200). Organizations can deliver digital business products such as news, literary works, images, music, information, books, magazines, movies, electronic games and software on WBSS anytime, and given the availability of the necessary technological infrastructure, anywhere in the world. It has been argued that digital business is turning the commercial world upside down (Tapscott, 1995; Hammond, 1996; Barua et al., 2000). Thus, digital business via WBSS is recognised by many companies as an enabler of new business opportunities. As such,

Proposition P2: *The extent of digital business within an industry is positively related to the extent of WBSS diffusion.*

5.1.3 Market Dynamism

Market dynamism is "the rate of change in customers' preferences and competitors' actions" (Maltz and Kohli, 1996; 52). Companies acting in dynamic markets need to follow changes in their markets more frequently than firms in relatively stable markets (Fisher et al., 1997). Recently, Internet technologies have changed the means by which customers and organizations interact, such as setting new business processes, reducing transaction costs, improving customer relationships and providing new business opportunities (Gebauer et al., 2000; Rosen et al., 2000). In order to cope with today's real time Web-based shopping activities, organizations need to quickly identify and respond to customer needs and changing market conditions, according to Lindroos (1997), Iyer et al. (2000), and Elliot and Fowell (2000). As an enabler of new business, WBSS have distinguishing advantages in meeting various customer preferences, and providing competitor information quickly. Thus, it can be argued that,

Proposition P3: *The extent of the market dynamism within an industry is positively related to the extent of WBSS diffusion.*

5.1.4 Customer Segmentation

"One of the key characteristics of the e-business world is that companies will inevitably move more and more into a customer-centric paradigm in order to increase competitiveness" (Papazoglou, 2001; 71). "Customer

segmentation is of paramount importance to marketers because it helps better understand their shoppers and their needs" (Lee et al., 2000; 21). Customer segmentation includes knowing target customers, their characteristics, their Web-based shopping activities and their shopping expectations such as timeliness, customization and accuracy (Miller, 2000; 93). Therefore, it is important to know who the customers are, who are accessing or will access WBSS. For example, Fastparts.com's target customer is the electronic manufacturing industry, whilst Babyplanet.com is focusing sales on baby clothes. Thus, it can be argued that,

Proposition P4: *The extent of target customer segmentation within a global electronic market is positively related to the extent of WBSS diffusion.*

5.2 External Technical Factors

ICT innovation diffusion is "a form of technological change that is shaped by the characteristics of information and information processing" (Monk, 1987). So, ICT innovation diffusion may produce "not only a dramatic shift in the technological base of modern societies but a dramatic social revolution as well" (Halal, 1993). Therefore, external technical factors are likely to have a significant influence on the conversion from organizational information systems to global WBSS. The detailed reasons for the chosen variables are based on the following.

5.2.1 Interactivity

Internet technologies are providing interactive applications that can be customized for multiple purposes and audiences (Laudon et al., 2000; Looney et al., 2002). Interactivity of Internet technology relates to its real-time and online nature, according to Dutta and Segev (2001; 7). The buyer and seller on WBSS could increase interactions through interactive Internet technologies such as Web sites, e-mail, Internet chat-rooms and Web conferencing (Hoffman and Novak, 1996; Laudon et al., 2000). This kind of global interactivity of Internet technologies is less prevalent with previous generations of ICT. Thus,

Proposition P5: *The extent of perceived interactivity of Internet technologies is positively related to the extent of WBSS diffusion.*

5.2.2 Connectivity

Connectivity is "the ability of computers and computer-based devices to communicate with one another and to share information in a meaningful way without human intervention" (Laudon et al., 2000; 276). The open nature of Internet technology is promoting connectivity that fosters the creation of a global market space (Dutta and Segev, 2001; 7). "The radical increase in connectivity enabled by the Internet technology is giving rise to new communication and co-ordination mechanisms both across organizations and customers, and also with groups of customers themselves" (Dutta and Segev, 1999). The Internet's global connectivity provides WBSS with links directly to customers, business partners or even competitors. Thus,

Proposition P6: *The extent of perceived connectivity of Internet technologies is positively related to the extent of WBSS diffusion.*

5.2.3 Feasibility

"Internet technology provides better opportunities for companies to establish distinctive strategic positionings than did previous generations of information technology" (Porter, 2001; 64). Although Internet technologies have a potentially valuable capability, their feasibility is important and should be considered by organizations when adopting them (Perkowitz and Etzioni, 2000). Feasibility in this context has been defined as "the degree to which a proposed Internet technology can be implemented with the existing hardware, software, and technical resources" (Laudon et al., 2000; 348). Therefore, it is reasonable to expect that,

Proposition P7: *The extent of perceived feasibility of Internet technologies is positively related to the extent of WBSS diffusion.*

5.2.4 Trialability

Trialability is the degree to which a new technology may be experimented with on a trial basis (Rogers, 1995). Organizations evaluate Internet technology in terms of whether the investment is effective or beneficial before making a large scale investment (Karahanna et al., 1999). If Internet technology has high trialability due to the small capital investment and low technical expertise required, it may be expected to affect the extent of WBSS diffusion. Therefore, it can be argued that,

Proposition P8: *The extent of perceived trialability of Internet technologies is positively related to the extent of WBSS diffusion*.

5.3 Internal Organization Factors

Organizational factors are regarded as an important antecedent in the literature on information systems (Swanson, 1994; Tabor, 2000). For a long time, researchers have tried to explain what kinds of factors shape organizational use of ICT (Zmud, 1982; Brancheau et al., 1990; Grover et al., 1993; Belassi et al., 1998; Cheung et al., 2000). In this context, research on organizational factors considers the structure and processes of an organization that might facilitate the diffusion of ICT. Therefore, it will be valuable if our research attempted to explain WBSS

diffusion according to internal organization factors relevant to Web-based shopping business and electronic commerce. The detailed reasons for the chosen variables are based on the following.

5.3.1 E-business Planning

"E-business planning fills the gap between strategic planning and application and provides a common language that executives from marketing, information technology, and manufacturing can all understand" (Kalakota et al., 1999; 334). Therefore, as organizations initiate e-business, it is advisable for them to consider such aspects as: e-business models, business processes, strategic planning, organizational culture, relationships with customers and suppliers, new kinds of system architecture, ICT adoption and so on (Bicknell, 1998; Kalakota et al., 1999; Laudon et al., 2000; Huang, 2001). Thus, we might expect that,

Proposition P9: *The extent of e-business planning of an organization is positively related to the extent of WBSS diffusion*.

5.3.2 Risk Management

WBSS are being established at a rapid rate across national boundaries. Along with the various potential benefits, there are several associated risks, such as penetration by hackers, fraudulent business transactions, electronic theft or payment fraud, false information, and Internet privacy (Cranor, 1998; Weinstein et al., 2000; Bhatnagar et al., 2000). According to Bhatnagar et al. (2000), there are two types of risk associated with Web-based shopping activities. One is product category risk, which is associated with the product itself. "The risk is greatest when the product is technologically complex" (ibid; 99). The other is financial risk, which is associated with the Internet as a purchasing medium per se, rather than the consequences of purchasing particular goods. Therefore, it would appear that the stronger the action taken against risk related to Web-based shopping activities, the more customers' use of WBSS will increase, thus influencing the extent of WBSS diffusion. Thus,

Proposition P10: *The extent of risk management related to Web-based shopping is positively related to the extent of WBSS diffusion*.

5.3.3 Customer Service Quality

It has been argued that it is essential to provide quality customer service in Web-based shopping as a prerequisite for e-commerce success (Kare-Silver, 1998; Elliot et al., 2000; Liu et al., 2000). Indeed, a major complaint of Web-based shoppers has been reported as being that shopping is troublesome due to lack of customer service (Elliot et al., 2000). In addition, Web-based shoppers are dissatisfied because of unfulfilled expectations, malfunctions in the Web site, unsatisfactory responses from site staff and the like (ibid; 329). Thus, it is argued that by providing a high quality service to their customers, WBSS loyalty will be cultivated among Web-based shoppers and will lead to competitive advantage through repeated purchases. Thus, we might expect that,

Proposition P11: *The extent of customer service quality is positively related to the extent of WBSS diffusion.*

5.3.4 Knowledge Intensity

Knowledge is now recognized by many as the core productive and strategic asset of the organization for competive advantage (Eriksson et al., 2000). Furthermore, "the speed of new knowledge creation and knowledge transfer across markets and enterprises becomes a key determinant of enterprise success in an environment which is fast, discontinuous, and volatile" (El Sawy et al., 1999; 307). Thus, it is argued that the success of an organization depends on its ability to gather, produce, maintain, and disseminate knowledge (Eriksson et al., 2000; Laudon et al., 2000). Internet technology has emerged as a valuable tool which deals more easily and quickly with the creation, storage, process dissemination, and sharing of information than previous ICT applications, according to Barua et al. (2000) and Holsapple et al. (2000). As such, we can expect that the extent of WBSS diffusion will be affected by the degree of knowledge intensity in organizations adopting WBSS. Thus,

Proposition P12: *The extent of knowledge intensity in an organization is positively related to the extent of WBSS diffusion*.

5.4 Internal System Factors

Internal system factors are related to the change management issues associated with a move from more traditional information systems to WBSS, and are relevant to the efficient management of new Internet technology adoption (Keen et al., 1999; Koper et al., 2000). Given the distinctive characteristics of WBSS as compared to previous information systems, it would appear less appropriate to apply the preceding variables to WBSS research. Therefore, we attempt to explore the validity of a new set of variables that might help explain the phenomenon of WBSS diffusion. The reasons for each of the chosen variables are based on the following observations.

5.4.1 Usability of WBSS

As more and more companies establish different kinds of Web-based shopping applications, the usability of the system is one of the most important issues Web developers need to address (Iyer et al., 2000; 257). This is because one of the key success factors of WBSS can be judged as the usablity of WBSS access on the part of customers. The major elements of usability include good navigation, content quality, easy procedures, location transparency,

positive customer experience and so on (Iyer et al., 2000; Elliot et al., 2000). Therefore, it can be argued that better usability of WBSS will provide significant benefits, such as increased customer access, which will in turn influence WBSS diffusion. Thus,

Proposition P 13: *The extent of usability of WBSS is positively related to the extent of WBSS diffusion.*

5.4.2 Security Management

According to Backhouse and Dhillon (1999; 2), "security management holds the key to success or failure of a company's well-being in light of the turbulent future and the existing competitive trends faced by the organizations." Security management is becoming one of the principal issues in Web-based shopping activities for both customers and sellers (Korper et al., 2000; Elliot et al., 2000; Joshi et al., 2001). For example, customers do not want to expose their information and transmit insecure payments for Web-based shopping transactions. Also, sellers need to be protected against computer hackers, viruses or other forms of network intrusion which can have a detrimental effect and can shut down their system. Thus,

Proposition P 14: *The extent of security management of an organization is positively related to the extent of WBSS diffusion.*

5.4.3 Network Infrastructure

A network infrastructure refers to the capabilities of communication networks that help in the sharing of ICT resources within and across the boundaries of organizations (Yates and Benjamin, 1991). Electronic commerce needs a network infrastructure to transport multiple types of information (Kalakota, 1996; 43). "There is a strong complementary relationship between the network infrastructure, Internet applications and e-commerce" (Barua et al., 2000; 102). Organizations based on a strong network infrastructure can more easily extend their business boundaries to the global marketplace (Laudon et al., 2000). Conversely, a poor network infrastructure will lead to barriers in adopting new Internet technologies or Internet systems. Thus, if organizations have a strong network infrastructure, it can be argued that they will be better able to carry out Web-based shopping transactions with customers in global electronic markets. Therefore, we can expect,

Proposition P15: *The extent of network infrastructure within an organization is positively related to the extent of WBSS diffusion.*

5.4.4 Internet Technology Adaptability

The e-business architecture of the future will need to cope with dynamic business environments, according to Evans (1999; 18). Hence, Internet technology adaptability is considered one of the key enablers in establishing Internet business architecture for gaining continuous competitive advantage (Lazzaro, 1994; Evans, 1999; Cline et al., 2000; Perkowitz et al., 2000). For example, successful dot-com companies such as eBay.com, Dell.com and Amazon.com provide a new business model driven by the innovative application of Internet technologies, as a result of high Internet technology adaptability (Mahadevan, 2000; Barua et al., 2000). Hence, we can assume that,

Proposition P16: *The extent of Internet technology adaptability of an organization is positively related to the extent of WBSS diffusion*.

The following section explains the derivation of a model of WBSS diffusion based on the above observations and propositions. The model provides a platform for empirical research in Web-based shopping contexts. Opportunities for such research are identified in the final section of this paper.

5.5 Extent of WBSS Diffusion

5.5.1 Observation

WBSS link organizations with clients such as customers and businesses via the Internet (Arlitt et al., 2001). According to Korper and Ellis (2000), WBSS are global-oriented network systems which consist of back-end systems, Web-servers and front-end clients, as illustrated in Figure 3.

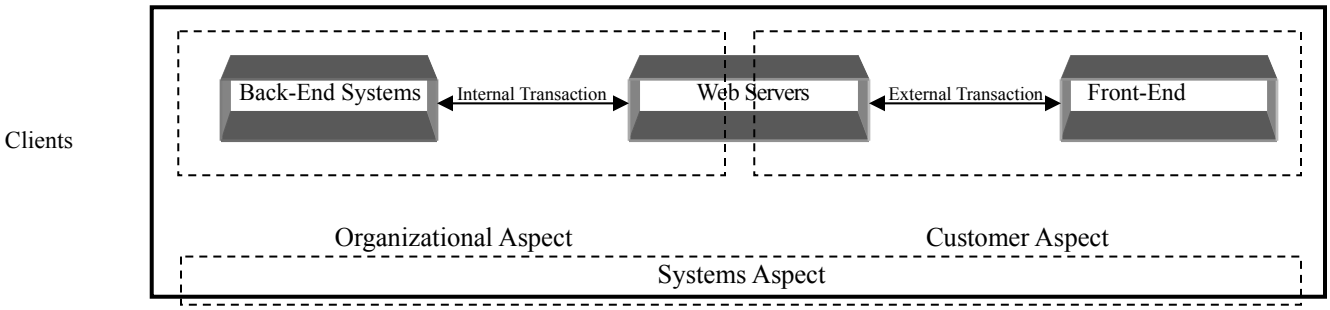

Figure 3. Extent of WBSS Diffusion (Korper and Ellis, 2000)

It appears that the extent of WBSS diffusion depends on three major domains: organizations running the WBSS application, the clients (such as customers and businesses accessing WBSS), and the WBSS itself. Thus, the extent of WBSS diffusion can be measured from three perspectives: the organization, the customer and the systems.

5.5.2 Operationalization

In order to measure the extent of WBSS diffusion in terms of 1) the extent of WBSS access from the perspective of the customer, 2) the extent of internal usage on the WBSS within the organization, and 3) the extent of integration of the WBSS application in systems terms, these variables need to be operationalized.

Table 4. Operationalization

Aspect	Description
• **Customer**	**Extent of WBSS Access by Customer:** • the extent of usage by customers • the extent of the growing number of business transactions • the extent of the services used by customers
• **Organization**	**Extent of Internal Usage of WBSS:** • the degree of internal usage of WBSS for communication • the degree of information sharing on WBSS within the company • the degree of improvement in communications after using the WBSS
• **Systems**	**Extent of Integration of WBSS Application:** • the degree of integration with various other systems such as payment mechanisms, search engines, security systems, and Interanet systems • the extent of use of WBSS application as compared to competitors in the same industry • the degree of the integration with other system applications such as such as supply chain management systems or CRM systems

First, the extent of WBSS access by customer refers to how widely the WBSS is accessed by the customer for Web-based shopping: for example, the extent of usage by customers (Heikkila et al., 2001; Slyke et al., 2002; Looney et al., 2002), the extent of growth in the number of business transactions on WBSS (Korper and Ellis, 2000; Arlitt et al., 2001; Looney and Chatterjee, 2002), and the extent of services used by customers (Baty and Lee, 1995; Heikkila et al., 2001; Slyke et al., 2002). Second, the extent of internal usage of WBSS shows how diversely WBSS is used by internal users within an organization: for example, the degree of internal usage of the WBSS for communication purposes (Koufaris et al., 1999; Korper and Ellis, 2000), the degree of information sharing on WBSS within the company (Salam et al., 1999; Korper and Ellis, 2000; Tiwana and Ramesh, 2001), and the degree of improvement in communications after using the WBSS (Salam et al., 1999; Korper and Ellis, 2000; Tiwana and Ramesh, 2001). Third, the extent of integration of the WBSS application is likely to vary between WBSS. For example, some organizations are running WBSS based on payment systems and database systems, whilst others are carrying out Web-based shopping transactions based on security systems, intelligent agents technology, supply chain management systems, customer relation management (CRM) systems and so on. Therefore, the extent of integration of the WBSS application may be measured by evaluating the following: the degree of integration with various other systems such as payment mechanisms, search engines, security systems, and Intranet systems (Jutla et al., 1999, Korper and Ellis, 2000; Papazoglou, 2001); the extent of use of the WBSS application as compared to competitors in the same industry (Choi et al., 1998; Korper and Ellis, 2000; Kampas, 2000), and the degree of integration with other system applications such as supply chain management systems, customer relationship management systems, or certificate systems (Rachlevsky-Reich, 1999; Fraternali and Paolini, 2000; Korper and Ellis, 2000; Kampas, 2000).

5.6 A Diffusion Framework of WBSS

On the basis of the observations and propositions formed in relation to key impact factors and WBSS diffusion, we illustrate, in Figure 4, the detailed framework of WBSS diffusion.

We identified four groups of factors – external market, external technical, internal organization and internal system factors – that may affect the extent of WBSS diffusion. The expected relationships between the four group of factors and WBSS diffusion have already been discussed and proposed in the propositions. On this basis, this framework consists of five primary dimensions: external market factors, external technical factors, internal organization factors, internal system factors and the extent of WBSS diffusion. The diffusion framework of WBSS will provide a platform for empirical research in Web-based shopping contexts specifically.

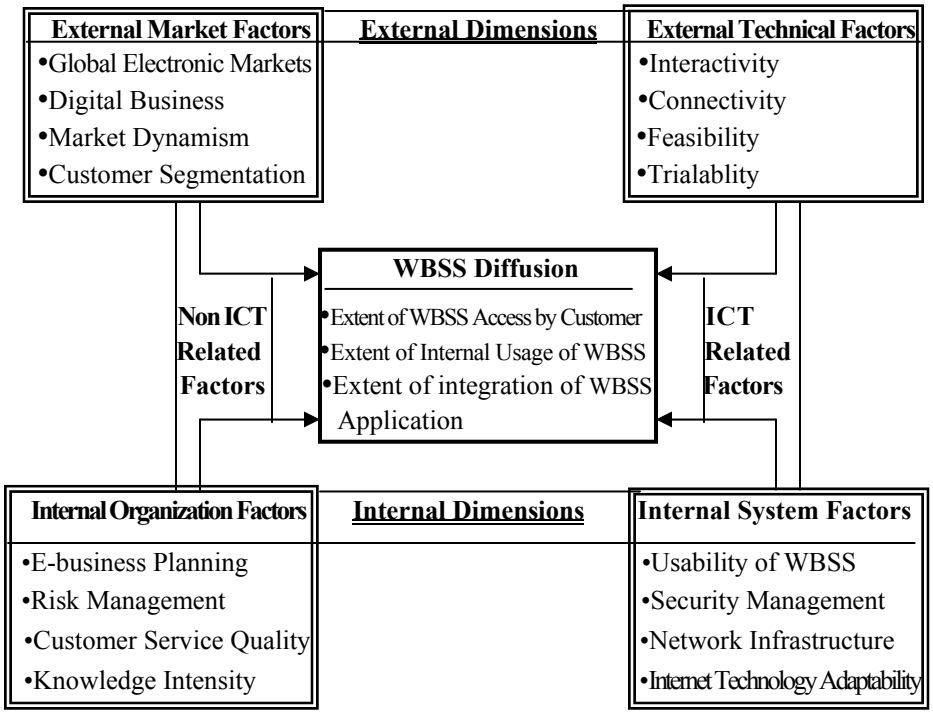

Figure 4. A Diffusion Framework for Web-Based Shopping Systems

6. Conclusion: Opportunities for Further Research

The major characteristics of a diffusion framework of WBSS are as follows. First, as can be seen from previous research, extensive empirical research on WBSS diffusion has yet to be carried out. Research on electronic commerce and the Internet has commenced in many areas; however, much of this research has concentrated on exploratory studies, rather than in-depth empirical research (e.g. Baty et al., 1995; Hoffman et al., 1996; Spiller et al., 1998; Nour et al., 2000; Arlitt et al., 2001). As a result, it can be claimed that this research model is one of the first that will be used empirically to investigate the factors affecting the diffusion of WBSS.

Second, Table 5 provides a means of arranging all the factors identified thus far in relation to previous empirical research concerned with IS generally, IOS, EDI, EC, the Internet and WBSS.

As can be seen in Table 5, only two variables, trialability and customer service quality, have been empirically verified in previous IS research. All the other variables have not, as yet, been empirically tested. Thus, research arising from this analysis will aim to verify their influence on WBSS diffusion. In so doing, it is hoped that these newly identified variables will provide useful insight and a foundation for further WBSS and electronic commerce research.

Additionally, we have emphasized the significance of a balanced view considering both internal and external issues, as well as ICT and non-ICT oriented factors in contemporary electronic commerce research settings. Each factor seems to have a potentially significant impact on WBSS diffusion. Therefore, in order to highlight the significance of both aspects within the electronic commerce research agenda, we attempt to explore major characteristics of WBSS diffusion, concerning both internal and external factors, as well as ICT and non-ICT related issues. Furthermore, the development of this set of variables to assist in the measurement of the extent of WBSS diffusion may provide a useful theoretical background for further research on new ICT diffusion.

A further point to emphasize is that, as a result of this literature review, it has become clear that most previous studies have not classified ICT related factors as a distinct subset in a research model, so previous ICT diffusion research merged ICT related factors into environmental, organizational, or ICT innovation factors. However, it would seem appropriate for ICT related factors to be distinguished from other factors, because they will be one of the critical components that organizations should take into account when establishing electronic commerce architecture, as has been argued by several researchers previously (e.g., Kalakota et al., 1996; Laudon et al., 2000; Barua et al., 2000; Korper et al., 2000; Load, 2000; Arlitt et al., 2001; Porter, 2001; Looney et al., 2002). External technical factors and internal system factors are likely to facilitate the transition from more traditional information

systems to the global WBSS. Thus, we conclude that IT related factors – external technical factors and internal systems factors – are a critical set of factors impacting WBSS diffusion.

Table 5. Reference Comparison of Key Impact Factors

Variables \ Research	WBSS	EC & Internet	IS, IOS, EDI	Reference
External Market Factors				
• Global Electronic Markets	X	X	X	Strader et al., 1997; Nour et al., 2000
• Digital Business	X	X	X	Tapscott, 1995; Hammond, 1996
• Market Dynamism	X	X	X	Maltz &Kohil, 1996; Fisher et al., 1997
• Customer Segmentation	X	X	X	Lee et al., 2000; Papazoglou, 2001
External Technical Factors				
• Interactivity	X	X	X	Dutta et al., 2001; Laudon et. al., 2000.
• Connectivity	X	X	X	Dutta et al., 2001; Laudon et. al., 2000
• Feasibility	X	X	X	Laudon et. al., 2000; Perkowitz et al., 2000
• Trialability	X	X	O	Rogers, 1995; Karahanna et al., 1999
Internal Organization Factors				
• E-business Planning	X	X	X	Kalakota et al., 1999; Korper et al., 2000
• Risk Management	X	X	X	Cranor, 1998; Bhatnagar et al., 2000
• Customer Service Quality	X	O	X	Elliot et al., 2000; Liu et al., 2000
• Knowledge Intensity	X	X	X	El Sawy et al., 1999; Eriksson et al., 2000
Internal System Factors				
• Usability of WBSS	X	X	X	Rumpradit et al., 1999; Lyer et al., 2000
• Security Management	X	X	X	Gupta et al., 1998; Korper et al., 2000
• Network Infrastructure	X	X	X	De et al., 1999; Laudon et al., 2000
• Internet Technology Adoptability	X	X	X	Cline et al., 2000; Perkowitz et al., 2000

O : Variables that have been empirically verified in IS research
X : Variables that have not been empirically verified in IS research

Although the literature discussing electronic commerce is abundant and growing, few research models for WBSS diffusion are available. There is also little empirical research addressing the diffusion of WBSS. Based on various areas of study, the WBSS diffusion framework developed here aims to identify and is a basis for investigating factors that facilitate the diffusion of WBSS. To this end, a set of propositions has been generated. These, however, need to be tested empirically. The propositions developed here allow the operationalization of the issues identified. We expect that the WBSS diffusion framework will prove useful in gaining meaningful insights into WBSS diffusion, and indeed electronic commerce. Since little comprehensive research has been undertaken till now, the diffusion framework of WBSS presented in this paper may be a useful first step towards developing a growing body of research for Web-based shopping and electronic commerce more generally.

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