

# IMPROVING THE USABILITY OF ERP SYSTEMS THROUGH THE APPLICATION OF ADAPTIVE USER INTERFACES

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**Abstract:** A need exists to improve the overall usability of enterprise resource planning systems. Current research has shown that the user interfaces of these systems are too complex and difficult to use. Enterprise resources planning systems for small enterprises are currently too rigid and are not flexible enough to match the constantly changing business landscape of small enterprises. This paper proposes the use of adaptive user interfaces as a means to improve the overall usability of enterprise resource planning systems for small enterprises. Adaptive user interfaces are capable of improving system usability by reducing user interface complexity and improving the overall user experience. This could provide small enterprises with the flexibility and adaptability that they require from enterprise resource planning systems.

## 1 INTRODUCTION

Enterprise resource planning (ERP) systems are integrated business information systems (IS). An ERP system can be defined as a single integrated and packaged information system. The aim of these types of IS are to integrate and manage the different business processes and information flows within an organisation (Boudreau, 2003; Ragowsky & Gefen, 2008; Yeh, 2006).

Vendors of ERP systems are now targeting small enterprises (SEs). ERP systems were traditionally aimed at large enterprises (LEs), ERP vendors are now designing systems to meet the business needs of SEs (Nach & Lejeune, 2008a; Vilpola, Kouri, & Väänänen-Vainio-Mattila, 2007a). The need to focus on SEs is a result of the oversaturation of ERP systems in the LE market.

SEs require software that is flexible, customisable, inexpensive and easy to use. Due to the dynamic

environment in which they operate, SEs need to be flexible in terms of their processes and business models in order to adapt to sudden internal and external changes (K. A. S. Olsen, P., 2007). ERP systems are typically rigid and do not provide SEs the level of customisability required in order to adapt to changes in the business landscape. Another disadvantage is that ERP systems are expensive to purchase and complex to use. This complexity mainly resides in the “unfriendly” nature of the user interface (UI) (Yeh 2006, Boudreau 2002).

UI complexity can negatively affect the usability of ERP systems. The ease of use of an interface is determined by its learnability, memorability and the level of satisfaction achieved by its users (Lee & McCrickard, 2007). These factors assist in determining the usability of a software system (Shneiderman & Plaisant, 2004). Usability is necessary in order to develop UIs that can be used (by a specific user group and within a specific

context) efficiently and effectively (ISO, 2001; Lee & McCrickard, 2007).

A possible solution to improving the usability of a software system lies in the ability to personalise the UI. One such approach which addresses this problem is adaptive user interfaces (AUIs).

AUIs are UIs that are designed for the purpose of personalising and improving user interaction. An AUI aims to improve the exchange of information between the user and the computer in a way which meets the user's requirements, goals and context of use. AUIs meet these requirements by adapting the UI automatically through the use of models which store the individual user's characteristics, behaviour and preferences (Browne, Totterdell, & Norman, 1990; Dieterich, Malinowski, Kühme, & Schneider-Hufschmidt, 1993; Paymans, Lindenber, & Neerinx, 2004).

AUIs are capable of presenting personalised views to match the needs of an individual user. This is achieved by reducing the complexity of the UI and making it easy to learn and use whilst improving the overall user satisfaction (Álvarez-Cortés, Zayas-Pérez, Zárate-Silva, & Uresti, 2007; Dieterich et al., 1993).

This research proposes the use of AUIs in order to resolve some of the usability problems inherent in ERP systems for SEs. The remainder of this paper presents an outline of related work, the research problem, research objectives, the envisaged research methodology, the research contribution and the current status of this research.

## 2 RELATED WORK

Determining the impact of AUIs on the usability of ERP systems for SEs requires that an investigation be performed in order to identify the current ERP systems used by SEs and the problems experienced. This section presents existing literature on SEs, ERP systems, usability of ERP systems and AUIs.

### 2.1 Small Enterprises in Emerging Economies

SEs are vital to the growth of emerging economies, such as South Africa. The contribution made by SEs to economic growth and sustainability are job creation and poverty alleviation (Van Vuuren & Groenewald, 2007; Venter & Boshoff, 2007). Towards the middle of 2007 there were an estimated 2.8 million SEs in South Africa. Collectively these enterprises contributed to 40 percent of total

employment and between 27 to 34 percent of national gross domestic product (GDP) (SEDA, 2007).

SEs are heterogeneous in nature and operate in a dynamic, competitive and highly volatile economy. Constant innovation is needed in order for these enterprises to survive in their rapidly changing business landscape (K. Olsen & Sætre, 2007; Shoniregun, 2004; Trimi, 2008). SEs have to provide the highest level of operational efficiency with the limited resources (infrastructure, finance and human resources) available (Shoniregun, 2004; Trimi, 2008). SEs typically operate in different business sectors including Manufacturing, Trade and the Services sector (SEDA, 2008a).

SEs need to utilise information and communications technologies (ICT) in order to survive and remain competitive (Montazemi, 2006; SEDA, 2008b). ICT can assist SEs by means of streamlining and automating business processes and improving the efficiency of operations and the profitability and sustainability of the enterprise (Ndiwalana & Tusubira, 2006; SEDA, 2008b).

The next section discusses one such ICT software solution which aims to support and encourage operational efficiency and sustainability. This type of system aims to integrate the various data flows and processes within an organisation in order to achieve these levels of efficiency and sustainability.

### 2.2 Enterprise Resource Planning Systems

ERP systems can offer significant benefits to SEs by creating an environment whereby the information and related business processes are integrated. Improvements in SE operations are provided in terms of efficiency, productivity, service quality, reduction in service costs, automation of business process and the adoption of best practice business models (Nach & Lejeune, 2008; Ngai, Law, & Wat, 2008; Ragowsky & Gefen, 2008).

Some SEs are already using ERP systems. An SE Survey conducted in South Africa in 2006 revealed that between 2003 and 2006 the total percentage turnover allocated to ICT by SEs remained fairly constant. This figure was stable at less than one percent (Goldstuck, 2006). A majority of that one percent was invested in ERP systems or accounting software. The study further revealed that SEs employing between 100 to 200 full-time employees (FTEs) were more likely to use an ERP system over a financial accounting system

(Goldstuck, 2006). This shows that as the size of an SE increase there is a need for a more comprehensive and integrated business system.

ERP systems for SEs need to reflect the dynamic and flexible nature of SEs. The ability of SEs to obtain a competitive advantage through agile business processes needs to be reflected by their choice of ERP system (Trimi, 2008; Vilpola & Kouri, 2006). ERP systems designed for SEs should be different from those designed for LEs. The reasons for this are that ERP systems for SEs need to be: (Vilpola & Kouri, 2006; Vilpola, Kouri, & Väänänen-Vainio-Mattila, 2007):

- Cheaper to purchase;
- Easier and quick to implement and use;
- Localised and customised;
- Assist SEs to implement business process re-engineering (BPR) in an incremental manner; and
- Need to be adaptable and flexible to support the diversity and individuality of SE business processes.

Most ERP systems for SEs are still too rigid, and complex to use. This is often as a result of poor usability.

### 2.3 Usability of Enterprise Resource Planning Systems

Currently ERP systems suffer from numerous usability issues. As a result of this, the term usability is not often associated with ERP systems. As these systems are typically complex and frustrating to use (Matthews, 2008; Topi, Lucas, & Babaian, 2005). A usability study on an ERP system, conducted in 2005, revealed the following usability issues (Topi et al., 2005):

- Navigation, in terms of finding functionality and information efficiently, was complex and tedious;
- There was limited guidance from the ERP system to ensure accurate navigation and task completion;
- The ERP system lacked the capability to adapt its behaviour to support the users' actions and to ensure task completion;
- Users were unable to retrieve frequently accessed data efficiently;
- The presentation of output was difficult to understand and interpret; and
- The UIs were complex and intimidating to novice users.

A need therefore exists to provide UIs for ERP systems that are usable and personalised (Matthews,

2008; Topi et al., 2005). User satisfaction is often influenced by the levels of experience and expertise of the user (López-Jaquero, Montero, Molina, Fernandez-Caballero, & González, 2003).

AUIs could provide a possible solution to the usability issues inherent in most ERP systems. These types of interfaces attempt to provide interaction that is personalised, easy and effective to use in order to ensure efficient task completion (Álvarez-Cortés et al., 2007; Dieterich et al., 1993).

### 2.4 Adaptive User Interfaces

A need exists for personalised UIs in order to reduce UI complexity. Today, a diverse range of interaction techniques exist and are necessary in order to cater for a variety of users. One of the ways in which to address this issue is to provide UIs that are capable of adapting themselves to an individual user at run-time (López-Jaquero et al., 2003; Paymans et al., 2004). The need for personalised UIs emerged to take into account the different habits, preferences and work ethics of the individual user within a specific community of users (Álvarez-Cortés et al., 2007). Personalised UIs aim to reduce complexity inherent in modern UIs by tailoring the application environment according to the individual needs of the user (Dieterich et al., 1993).

Intelligent user interfaces (IUIs) were initially proposed to address the need for personalised UIs (Álvarez-Cortés et al., 2007). There are three different types of IUIs, namely AUIs, intelligent help systems and intelligent tutoring systems. AUIs support UI adaptivity through the use of artificial intelligence techniques (Álvarez-Cortés et al., 2007; Dieterich et al., 1993).

AUIs can be used to develop UIs that are personalised and more usable. The goals behind using an AUI is to provide a UI that has the following properties (Browne et al., 1990; Dieterich et al., 1993):

- Is efficient and effective to use;
- Reduces the complexity of a system;
- Supports finding and delivering appropriate information more efficiently and effectively;
- Provides the user with what he/she wants to see;
- Makes the system simple to use; and
- Improves the overall experience of the user.

These goals address the need to provide a UI that is personalised whilst trying to improve the usability of a system.

AUIs can reduce the complexity of a system and enhance system usability by supporting (Dieterich et al., 1993):

- Task simplification;
- Error correction;
- Active and intelligent help;
- Simplification; and
- Improved user satisfaction.

The application of AUIs to the domain of ERP systems could potentially improve the usability of ERP systems. This could be accomplished by:

- Providing efficient navigation in terms of finding functionality and information;
- Providing guidance from the ERP system to ensure accurate navigation and task completion;
- Providing the capability to adapt to the behaviour of the user's actions in order to ensure task completion; and
- Reducing the complexity of the UIs in an attempt to make the system easy to use.

### 3 RESEARCH PROBLEM

As discussed above, ERP systems are currently too rigid and complex to be used effectively by SEs. SEs operate within a dynamic business landscape and require software to be flexible and adaptable to match changing landscape.

The complexity of the UI of an ERP system directly impacts on the usability of the system making it frustrating to use. ERP systems are rigid and do not adapt to support the user's actions and ensure task completion

There is need to improve the overall usability of ERP systems in order to provide an ERP system to SEs that is adaptive and usable. This is required in order to efficiently integrate information and business processes to improve productivity. Poor usability can have a negative effect on the effectiveness and efficiency with which users can complete tasks.

AUIs could improve the usability of ERP systems by providing task simplification, active and intelligent help, efficient navigation, adaptability to match the user's actions and preferences and improved user satisfaction.

The aim of this research is to determine the impact of AUIs on the usability of ERP systems for SEs. The thesis statement is that AUIs can improve the usability of ERP systems for SEs.

## 4 RESEARCH OBJECTIVES

Table 1 presents a list of objectives that have been identified for this research

Table 1: Research Objectives.

No.	Objective
1.	Identify criteria for evaluating the usability of ERP systems for SEs.
2.	Determine the current problems impacting on the usability of an ERP system for SEs.
3.	Determine how an AUI should be designed and implemented for an ERP system for SEs.
4.	Evaluate the benefits of incorporating AUIs into ERP systems for SEs.
5.	Identify the theoretical and practical contributions of incorporating AUIs into an ERP system for SEs.

## 5 METHODOLOGY

This research will attempt to determine the benefits of applying AUIs to ERP systems for SEs. The primary research method will be a case study focusing on a specific ERP system for SEs. This will be supported by several secondary methods, including a literature study, prototyping and an evaluation of the prototype. The research methods to be used will assist in achieving the research objectives listed in Table 1. Instruments that will be used to aid this research are questionnaires and a test plan.

### 5.1 Data Collection

A literature study of SEs, ERP systems for SEs, usability of ERP systems and AUIs will be performed. The purpose of this literature study will be to gain an in-depth understanding into the field of SEs, the ERP systems currently utilised by SEs, the usability problems associated with these systems and AUIs.

The literature review will also assist in identifying criteria for evaluating the usability of ERP systems for SEs and determining how AUIs could be used to address the usability problems identified.

A pilot study, in the form of a field study, will assist in identifying a particular case study to be used in this research. This case study will focus on a specific ERP system that is used by SEs in a specific sector.



A second field study will be conducted to identify current problems impacting on the usability of ERP systems for SEs. A questionnaire will be used during the field study as well as interviews with the users of an ERP system.

## 5.2 Data Analysis

The design and implementation of an AUI for ERP systems for SEs will be based on the knowledge acquired during the literature study of SEs, ERP systems and AUIs.

Prototype design and implementation will be guided by the case study. The design and implementation phase of this research will fulfil the objective of determining how an AUI should be designed and implemented for an ERP system for SEs.

Usability evaluations will be performed to determine the extent to which the AUI improves the usability of the ERP system. The purpose of these evaluations will be to determine the benefits of incorporating AUIs into ERP systems for SEs. Instruments that will be used to aid the evaluation include pre- and post-test questionnaires as well as a test plan. The evaluations will be conducted within a controlled laboratory environment (usability laboratory).

The various phases of this research along with the findings will be combined and communicated in the form of a research report (thesis).

## 6 RESEARCH CONTRIBUTION

This research aims to contribute to the body of knowledge by applying AUIs to the domain of ERP systems. This contribution will support the identification of usability criteria for evaluating an ERP system. Usability problems experienced by SEs using ERP systems will also be identified. Other contributions include specifying how AUIs can be applied to the domain of ERP systems and the benefits of applying AUIs to ERP systems for SEs.

This research could also result in the proposal of a framework for designing and evaluating AUIs for ERP systems.

## 7 CURRENT STATUS

This research is currently in the literature review and field study stages.

A pilot study was conducted in 2008 to identify a particular case study. This pilot study consisted of sending a questionnaire to the five major vendors of ERP systems to SEs in South Africa (Pastel, Accpac, QuickBooks, Syspro and SAP). The purpose of the questionnaire was to obtain information on the sales of ERP systems to SEs.

The results of pilot study identified that the most suitable ERP system for the case study was SAP's Business One. SAP's Business One was identified as the most suitable system because it supports the core functions of an ERP system and is extensible. The Manufacturing sector was identified as the most suitable sector because it was the most predominant sector amongst the three vendors. The case study for this research will focus on Manufacturing SEs who have selected SAP's Business One as their ERP system.

Currently, a second field study is being performed (based on the case study). The purpose of this field study is to determine the current problems impacting on the usability of ERP systems for SEs. This field study is limited to those SEs using SAP's Business One in the Manufacturing sector in South Africa.

The next stage of this research is to determine how AUIs could be used to potentially resolve usability problems identified in the field study.

## 8 CONCLUSIONS

ERP systems for SEs currently suffer from several shortcomings, including lack of flexibility and complexity. These factors have a negative impact on the usability of these systems.

This paper has proposed that AUIs could be used to address these problems. This would be achieved by improving the navigation, providing task support and reducing the complexity of the UI.

A pilot study was used to identify a suitable ERP system to be used as a case study. The results obtained revealed that SAP's Business One was the most suitable ERP system to be used and that the most appropriate sector was Manufacturing.

Future research will involve evaluating the usability problems of SAP's Business One and designing an AUI to improve the usability of this ERP system.

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