

ACCEPTANCE OF ENTERPRISE RESOURCE PLANNING SYSTEMS BY SMALL MANUFACTURING ENTERPRISES

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Abstract: ERP systems are widely used by large enterprises for managing functional areas of the enterprise. However, recently ERP systems have also been introduced to the small enterprise market. ERP systems are now considered an important small enterprise management aid that may contribute to the sustainability and growth of the small enterprise. Although there are several acceptance factors that may impact on the acceptance of ERP systems, limited research has been done to understand the acceptance of ERP systems by small enterprises. This paper addresses this gap by considering the strategic, business, technical and human factors that influence the acceptance of ERP systems in small manufacturing enterprises in South Africa. The consultative list of acceptance factors flowing from this research may guide future initiatives aiming to ensure the acceptance of ERP systems by small manufacturing enterprises.

1 INTRODUCTION

Traditionally ERP systems were synonymous with large enterprises. This trend is changing as small and medium enterprises (SMEs) have started to use ERP systems in order to become more competitive and responsive to business demands and to improve operational performance (Deep et al., 2008). According to Buonanno et al. (2005), the use of ERP systems within small enterprises also leverages enterprise growth. The market for ERP systems for large enterprises has become saturated and ERP system vendors are increasingly competing in developing and marketing ERP systems that cater to the needs of small and medium enterprises (Equey and Fragnière, 2008).

Although a substantial body of research has been carried out on ERP system acceptance and adoption in larger enterprises research reports related to the acceptance of ERP systems within small enterprises are scarce. This lack of research can be attributed to the fact that ERP systems were rarely used by small enterprises in the past, mainly due to knowledge and resource constraints (Malhotra and Temponi, 2010). Laforet and Tann (2006) also emphasize that there is a lack of industry specific literature on ERP

system acceptance.

For ERP developers, it is important to understand what the factors are that influence adoption of ERP systems. There is no consultative list of ERP system acceptance factors for small enterprises. An understanding of the factors that influence the acceptance of ERP systems in small enterprises could assist researchers and industry to develop and distribute appropriate ERP systems that are acceptable to the small enterprise market.

We used the small manufacturing industry in South Africa as a case study to investigate the factors that influence the acceptance of ERP systems in small enterprises. The outcome of this investigation is a list of strategic, business, technical and human factors that influence the acceptance of ERP systems in small manufacturing enterprises in South Africa. This list is the first step in compiling a more generic list for other industry domains.

In section 2 we provide an overview of applicable key concepts related to our investigation, namely acceptance and adoption, ERP systems, small manufacturing enterprises, and the manufacturing industry. In section 3 the research design is presented. In section 4 we focus on the data collection from the literature study, survey of small

manufacturing enterprises (both currently using and not using ERP systems) and interviews with ERP consultants. Section 5 presents key findings from the research. Section 6 reflects on the research conducted and presents recommendations for future research.

2 BACKGROUND

In this section, we first introduce background on some key concepts related to our research, including acceptance and adoption (section 2.1), ERP systems (section 2.2), small enterprises (section 2.3), and the manufacturing industry, as the application domain for our research (section 2.4). In section 2.5 we provide a synopsis of the current standing of ERP systems in small manufacturing enterprises and emphasize what the gap in the current literature is with regard to ERP system acceptance in small manufacturing enterprises.

2.1 Acceptance and Adoption

Numerous studies investigated the concept of technology acceptance and technology adoption (Venkatesh and Davis, 2000, Davis, 1989, Malhotra and Galletta, 1999). The diversity within the technology acceptance field, specifically in terms of successful acceptance of information systems, makes it difficult to define and distinguish the concept of technology acceptance from technology adoption.

According to Renaud and Van Biljon (2008:211) technology acceptance can be seen as ‘an attitude towards a technology’, influenced by various factors. Technology acceptance is considered as a process initiated when a user of technology becomes aware of the technology and has an intention to use that technology.

Technology adoption stems from acceptance and results in the actual use of the technology (Premkumar and Bhattacharjee, 2008). Through the process of adoption, the user’s intention to use the technology may change and affect both the adoption and acceptance of the technology. Thus, technology

Several technology acceptance and adoption models have been put forward over time. One of the most prominent of these models is the Unified Theory of Technology Acceptance and Use of Technology (UTAUT) model formulated by Venkatesh, et al. (2003). UTAUT unified eight previous models and theories on technology

acceptance and technology adoption, namely theory of reasoned action (TRA), theory of planned behaviour (TPB), technology acceptance model (TAM), combined TPB and TAM, motivational model, model of personal computer utilisation, innovation diffusion theory, and social cognitive theory. The aim of the UTAUT model is to assist managers to understand factors impacting on an individual’s acceptance of new technology in an enterprise. As illustrated in Figure 1, UTAUT defines four determinants that influence intention of usage and behaviour (Venkatesh et al., 2003):

- *Performance expectancy* refers to ‘the degree to which an individual believes that using the system will help him or her to attain gains in job performance’ (Venkatesh et al., 2003:447). It is a direct determinant of intention to use a technology and ‘the strength of the relationship varies with gender and age such that it is more significant for men and younger workers’ (Venkatesh et al., 2003:467).
- *Effort expectancy* refers to ‘the degree of ease associated with the use of the system’ (Venkatesh et al., 2003:450). It was found that ‘the effect of effort expectancy on intention is also moderated by gender and age such that it is more significant for women and older workers, and those effects decrease with experience’ (Venkatesh et al., 2003:467).
- *Social influence* refers to ‘the degree to which an individual perceives that important others believe he or she should use the new system’ (Venkatesh et al., 2003:451). For example, this can relate to value chain partners or competitors influencing the use of a technology. Social influence is moderated by gender, age, experience and voluntariness factors that together influence intention to use a technology.
- *Facilitating conditions* refer to ‘the degree to which an individual believes that an organisational and technical infrastructure exist to support use of the system’ (Venkatesh et al., 2003:453). It was found that facilitating conditions are ‘only significant when examined in conjunction with the moderating effects of age and experience, i.e. they only matter for older workers in later stages of experience’ (Venkatesh et al., 2003:467).

The impact of these four key determinants is influenced by gender, age, experience, and voluntariness.

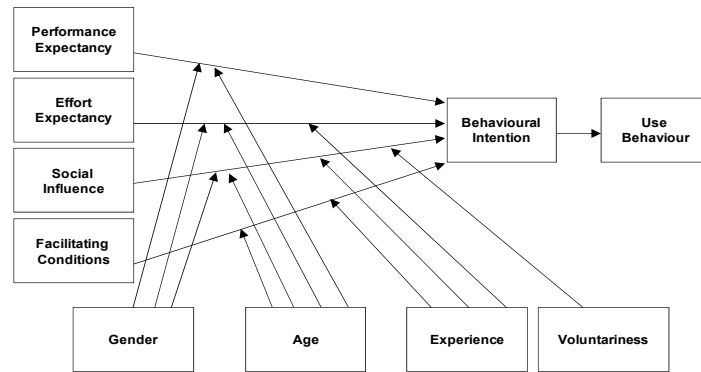


Figure 1: UTAUT Model (Venkatesh et al., 2003).

2.2 ERP Systems

During the 1990s, ERP systems emanated from extended materials resource planning (MRP-II) systems (Klaus et al., 2000). A new term was required to differentiate these new systems from MRPs and Gartner labelled it enterprise resource planning - commonly referred to as ERP systems (Wylie, 1990). There are several definitions for ERP systems. The characteristic integration feature of ERP systems is evident in all definitions reviewed.

For the purpose of this paper, we define ERP systems as *integrated, holistic, enterprise-wide business management systems that provide constant information across and within different business functions. An ERP system enables efficient and effective communication and collaboration between the enterprise and its suppliers, as well as the enterprise and its clients.*

We limit our investigation of ERP systems to those applicable to *small enterprises*. Section 2.3 briefly introduces the concept of small enterprises.

2.3 Small Enterprises

A formal understanding of small enterprises in South Africa is presented in the National Small Business Amendment Act, 2004, (SA, 2004:2) The South African government defines *small enterprises* as: ‘a separate and distinct business entity, together with its branches or subsidiaries, if any, including co-operative enterprises and non-governmental organisations, managed by one owner or more which, including its branches or subsidiaries, if any, is predominantly carried on in any sector or subsector of the economy mentioned in column 1 of the Schedule and which can be classified as a micro, a very small, a small or a medium enterprise by satisfying the factors mentioned in columns 3 [the total full-time equivalent of paid employees], 4 [total

turn-over] and 5 [total gross asset value (Fixed property excluded)] of the Schedule’.

Table 1 presents an excerpt of the classification of medium, small, very small and micro manufacturing enterprises found in this Act, where **C** represents *Column* and [m] represents a million of South African Rands (currency).

Table 1: Medium, small, very small and micro manufacturing enterprises (SA, 2003).

‘SCHEDULE’				
C1	C2	C3	C4 [m]	C5 [m]
Manufacturing	Medium	200	R 51	R 19
	Small	50	R 13	R 5
	Very small	20	R 5	R 2
	Micro	5	R0,20	R0,10

If one uses Table 1 as a guideline, the small manufacturing enterprise can be regarded as an enterprise with a total annual turnover of 13 million South African Rand and 50 people working in the enterprise. Since this paper focuses on the small *manufacturing industry* in South Africa, the nature of the South African manufacturing industry is briefly introduced in section 2.4.

2.4 Manufacturing Industry

According to a report by Statistics South Africa (2009), the manufacturing industry is considered one of South Africa’s most prolific industries, contributing a total income of R1 508 667 million to national income in 2008. Many governments, including the South African government, encourage the development of a diverse and resilient manufacturing industry, which can compete within the global community. In one of the few academic works that explore the manufacturing industry in South Africa, Tregenna (2008) emphasizes that the manufacturing industry enables sustainability and

contributes to employment creation and the structuring of both government policy and corporate strategy.

It is thus due to the nature of the manufacturing industry in South Africa, and the fact that ERP systems have emanated from MRP systems within the manufacturing industry, that this specific industry was selected as a case study environment in our research.

Bourque (2007) points out that the manufacturing industry, which is a secondary industry, faces numerous challenges. One concern is that many products are manufactured in environments where supplies are sourced from different locations, both within and outside the borders of the country of operation. An intricate network of relationships between suppliers, manufacturers and distributors needs to be managed. Many small manufacturing enterprises are confronted with the challenge of tracking procurement and production costs and the costs associated to these activities. The ever changing demands of clients also requires manufacturing enterprises to be agile in order to meet customer demands in terms of right quantity, quality, time and cost (Kettunen, 2009). It is believed that the stated challenges can be addressed through novel systems, such as ERP systems (Bourque, 2007). Although ERP systems are widely used in larger enterprises it does not necessarily mean that smaller enterprises will believe that it may benefit their enterprises, and it is therefore necessary to address the issues related to the acceptance and adoption of ERP systems in the smaller enterprise.

Section 2.5 focuses on the acceptance of ERP systems in small (manufacturing) enterprises.

2.5 ERP System Acceptance in Small Enterprises

Often, there is a tendency to group small and medium enterprises together in a homogenous group, even though these enterprises have different characteristics and unique requirements (Iskanius et al., 2009). However, enterprise size does affect ERP adoption (Laukkanen et al., 2007, Bernroider and Koch, 2000) and, by implication, acceptance.

The work by Iskanius et al. (2009), exploring the experience of ERP system use in small enterprises, is a recent example of small enterprise ERP system research. The study on motivation for using ERP systems within small enterprises resulted in findings stating small enterprises motivation 'to improve planning procedures and customer-specific

flexibility'(Iskanius et al., 2009:9). Additionally, it was found that ERP systems in small enterprises (and small manufacturing enterprises) are still relatively less utilised compared to use of ERP systems by large enterprises. Iskanius et al. concur with the findings of Koh and Simpson (2005) that a lack of knowledge could be attributed to the lack of ERP system use within this category of enterprise.

No literature was found on applying the UTAUT model to assess the intention to use and the acceptance of ERP systems within a small enterprise environment. Xiaoping and Jing (2008) recommend further research that focuses on the application of UTAUT to assess small enterprise acceptance of technology. Xiaoping and Jing argue that small businesses are predominantly individualistic with 'highly centralized ... structures'(Xiaoping and Jing, 2008:326). They affirm that more research is required to test 'the individual adoption in the small business environment' (Xiaoping and Jing, 2008:326).

The comprehensive literature review determined the state of research and practice, with regards to acceptance factors related to ERP systems in the small manufacturing enterprise domain, to be limited. The identified limitations included:

- The use of the holistic UTAUT model in assessing the acceptance of a specific technology, i.e. ERP systems.
- The acceptance of ERP systems amongst small enterprises only, and not small and medium enterprises combined as a single grouping.
- Industry specific research related to acceptance factors, in our case, the manufacturing industry.
- Field study assessment and not only laboratory-based assessment of the acceptance of ERP systems.

This paper addresses some of these limitations and focuses on the identification of acceptance factors that influence the use and acceptance of ERP systems in the small manufacturing enterprises, using the UTAUT model as the primary theory base in determining these factors in the environment in which the small manufacturing enterprises operate. Section 3 addresses the research design adopted.

3 RESEARCH DESIGN

A mixed method qualitative approach using textual, theme, and descriptive data analysis was followed to investigate the factors that influence the acceptance of ERP system in small manufacturing enterprises.

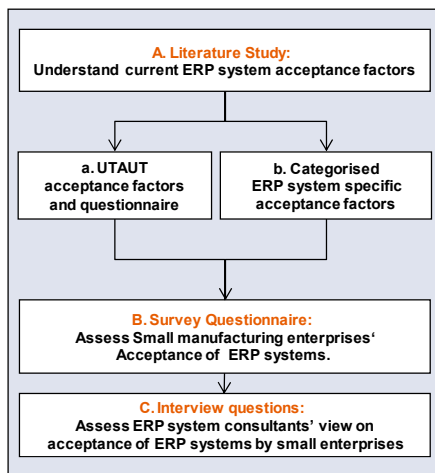


Figure 2: Process used for identifying ERP system acceptance factors for small manufacturing enterprises.

The research design, as illustrated in Figure 2, consisted of four steps below:

1. Questionnaire statements that were used to estimate the original UTAUT model was adapted and included in the survey (Part B) questions. The questions further were customised for (a) small manufacturing enterprises that have experience in using ERP systems, as well as (b) for small manufacturing enterprises that do not have experience in using ERP systems.
2. Appropriate ERP system specific acceptance factors were identified through a textual analysis of existing research literature. Questions related to the identified factors were formulated and included in the survey to determine whether the factors affect the acceptance of ERP systems by the small manufacturing enterprise participants.
3. Using the inputs from Part A, a cross-sectional, interpretive field survey was conducted among small manufacturing enterprises to determine the meaning of multiple research participant perceptions regarding ERP system acceptance in small manufacturing enterprises. Deductive reasoning was used to confirm, refute or comment on the small manufacturing enterprise ERP system acceptance factors explored from literature. The small manufacturing enterprises were selected by consulting business databases and other directories of small manufacturing enterprises in Gauteng, South Africa. This survey used a non-probability purposive sampling technique, as it enabled more freedom in terms of the number of issues that could be

investigated, such as instances that may be different, extreme, unusual or somehow atypical (Oates, 2006:98).

4. As a triangulation exercise Part C involved interviews with two ERP consultants (from companies selected from ERP system use as identified through the survey) to obtain their view and comment on the survey findings.

4 DATA COLLECTION

This section presents data collected from three sources, the literature study (section 4.1), the survey of small manufacturing enterprises (section 4.2) and interviews conducted with ERP system consultants (section 4.3).

4.1 Literature Study

The topics investigated included technology acceptance factors, ERP system selection and acquisition factors and ERP system implementation and use in large, medium, and small enterprises.

Following an analysis of the results, the factors influencing the acceptance of ERP systems were categorized into four identified categories:

- *Strategic acceptance factors* refers to how an ERP system should promote and fit into an enterprise's long term vision, goals, and business plans in order to achieve enhanced decision-making (Poba-Nzaou et al., 2008) and sustainability of the enterprise. The strategic acceptance factors identified in the different resources analyzed ranged from aspects relating to industry use of ERP systems, the enablement and management of business growth, and complexity to long term investment sustainability.
- ERP systems should, ideally, support operational efficiencies within an enterprise (Shang and Seddon, 2002). *Business acceptance factors* relate to how an ERP system can be used to manage the day-to-day operations of the enterprises and how an ERP system can support business processes. The business acceptance factors identified in the different resources analyzed ranged from aspects relating to advancing business operations, improving operational efficiencies, following best business practices, cost savings, and to support analytically-aided decision making.
- *Technical acceptance factors* refer to how ERP

systems are understood to operate in terms of integration and expected performance. The technical acceptance factors identified in the different resources analyzed ranged from aspects relating to the provision of business functionality, to integration of business functionality, access to business functionality and timely implementation periods.

- *Human acceptance factors* refer to non-functional aspects of ERP systems that are important factors that impact on end-user satisfaction with using ERP systems. User experience and training are two important human acceptance factors identified in literature.

These categories are specific to the use of ERP systems and we do not claim that these categories are definitive. Other categories may be applicable in other domains or other industries.

4.2 Small Manufacturing Enterprises Survey

The manufacturing sectors surveyed included various small manufacturers ranging from food products, textiles, furniture, to basic metals. The purpose of this study was not to generalise, but to explore this relatively young research domain. The sample of sixteen small manufacturing enterprises included young enterprises (between 1 and 5 years of operation) and more mature enterprises (over 20 years of operation). Although the sample size may not yield significant statistical results, it provided important qualitative insights into ERP system acceptance by small manufacturing enterprises. The questionnaires used as part of the survey were filled in on-site in the work environment of the small manufacturing enterprises. Owners or managers were asked to complete the questionnaire on behalf of the enterprise. Seven of the small manufacturers had experience in using ERP systems and 9 manufacturers had no experience in using ERP systems.

The survey results indicated that small manufacturing enterprises *that use* ERP systems accept and make use of an ERP system if it supports day-to-day business operations and assists with the strategic development of their enterprise. There is also an indication these enterprises expect ERP systems to aid in fulfilling business activities with minimal effort, in terms of meeting their needs on a performance and effort expectancy level.

It was found that small manufacturing enterprises *that do not use* ERP systems would accept and use

an ERP system if it supported the advancement of their business operations. There is also an indication that our sample of small manufacturing enterprises expects ERP systems to provide a cost-effective solution to manage business functions, with on-demand web access, including mobile access. Brand name is also seen as an important factor to consider when purchasing of an ERP system is considered. All these small manufacturing enterprises also believe they are ready to purchase and use ERP systems, provided the ERP system supports their enterprise in terms of performance and effort expectancy.

All small manufacturing enterprises surveyed believe that, although the enterprise can be influenced by others to accept and make use of ERP systems, it is not seen as a key influence on acceptance. In terms of facilitating conditions, the small manufacturing enterprises, in general, also believe they are knowledge-and-resource ready to accept ERP systems.

The results indicate that all four of the direct determinants of the UTAUT model, namely performance expectancy, effort expectancy, social influence, and facilitating conditions, affect the acceptance of ERP systems.

4.3 Interviews with ERP Consultants

The findings from both the literature study and the survey conducted were then used as a basis for reflective interviews by two ERP consultants. The consultants confirmed all the findings.

The consultants were of the opinion that ERP systems should be used as a harness to support the strategic and business objectives of small enterprisers, and thus promote the growth and general operations of the enterprise. Furthermore, making use of ERP systems should be an easy to use, seamless process with minimal effort. According to the consultants, ERP systems should leverage technological advancements and make access to enterprise systems and information easier.

The consultants, however, expressed caution and advise that small enterprise maturity and change management processes should be carefully considered when making a decision to acquire, implement, use and accept ERP systems.

Some of the comments made by ERP system consultants are provided in Table 2.

Table 2: ERP system consultants' comments.

<p>1. "... small manufacturing enterprises in South Africa have not reached the maturity of medium and large manufacturing enterprises to purchase and use specialised software such as ERP. The smaller companies can suffice using standard off-the-shelf accounting and payroll packages."</p> <p>2. "If a simpler, cheaper system can perform what is required, then consider the option and re-evaluate your need for a more advanced system such as ERP at a later, more mature stage of your enterprise growth."</p> <p>3. "... let us help you to decide if you are ready for a new switch. We will go through a process to assess readiness. Why spend when you are not yet ready to explore the full potential of an ERP system."</p> <p>4. "Using systems such as ERP is a mind shift. There are lots of changes involved ..."</p> <p>5. "... one must be careful of unscrupulous vendors gift-wrapping systems that don't suit the small enterprise. Small enterprises must be smart and spend wisely. They must know what they are buying themselves into."</p>
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5 OVERALL FINDINGS

The acceptance factors identified during the initial phases were perceived to be important. It was found that ERP systems should support strategic planning, and daily operations of the enterprise as key considerations. ERP system should therefore support the efficient and effective functioning of the enterprise. A notable technical factor, as identified from small manufacturing enterprises that have expectations of using ERP systems, is to have the ability to access functionality and information from any location, including mobile and web access. The findings also suggest that the small manufacturing enterprises are in general optimistic about the capabilities of ERP systems.

Table 3 summarises the significant strategic acceptance. In the second column, a list of references to the literature source that lead to the inclusion of the factor is provided, as well as a comment on whether the factor was confirmed during the data collection (survey and interviews) in column 3. Table 4 summarises the business acceptance factors, Table 5 the technical acceptance factors, and Table 6 the human acceptance factors.

Table 3: Strategic acceptance factors.

Factors	Literature	Field Research
Competition in industry	(Koh and Simpson, 2007)	Confirmed
Industry necessitates the use of an ERP system	(Muscatello et al., 2003)	Partially confirmed
Manage complexity and cost efficiently adapt to changes	(Tagliavini et al., 2002)	Confirmed
Enable business growth and strategic alignment	(Poba-Nzaou et al., 2008)	Confirmed, Important to small enterprises
Better business planning and consolidation	(Marnewick and Labuschagne, 2005)	Confirmed, Important to small enterprises
Improve stakeholder relationship and trust	(Iskanius et al., 2009)	Confirmed, Important to small enterprises
Long term investment sustainability	(Davenport, 2000, Häkkinen and Hilmola, 2008)	Confirmed
Intelligent aware to alert to market force changes	(Robert Jacobs and Ted' Weston, 2007)	Partially confirmed

Table 4: Business acceptance factors.

Factors	Literature	Field Research
Advance business operations	(Marnewick and Labuschagne, 2005)	Confirmed, Important to small enterprises
Follow industry best practice	(Somers and Nelson, 2003)	Partially confirmed
Promote transparent governance and improve operational efficiency	(Lim et al., 2005, Häkkinen and Hilmola, 2008, Chou and Tripuramallu, 2005)	Confirmed
Manage cash, liquidity and financial risk better	(Klaus et al., 2000)	Confirmed
Manage the workforce through rapid change	(Amoako-Gyampah and Salam, 2004, Davenport, 1998a)	Partially confirmed
Low total cost of ownership – maintenance, upgrades, consultation, training, etc	(Sledgianowski and Tafti, 2007, Ngai et al., 2008)	Confirmed, Important to small enterprises
Cost saving through optimisation of IT (information technology)	(Ziaee et al., 2006)	Confirmed
Timely analytical-supported decision-making ability	(Loh and Koh, 2004)	Confirmed

Table 5: Technical acceptance factors.

Factors	Literature	Field Research
Provision of functionality on-demand with the ability to 'switch on and switch off' functionality	(Dreiling et al., 2005)	Confirmed
Integration with other business systems	(Bernroider and Leseure, 2005, Elbertsen et al., 2006)	Confirmed
Accessibility: anytime, anywhere, including mobile and web accessibility	(Hofmann, 2008, Equey and Fragnière, 2008, Yang et al., 2007)	Confirmed, Important to small enterprises
Quick implementation time	(Markus and Tanis, 2000, Buonanno et al., 2005, Tagliavini et al., 2002)	Confirmed

Table 6: Human acceptance factors.

Factors	Literature	Field Research
User experience should be satisfying – using the ERP system should be simple, easy to use, quick and meet expectation to get the work done	(Marnewick and Labuschagne, 2005, Calisir and Calisir, 2004, Scott and Walczak, 2009, Markus and Tanis, 2000)	Confirmed, Important to small enterprises
“Start and go” self-learning – minimal training costs	(Scott, 2008, Al-Mashari et al., 2003)	Confirmed

6 CONCLUSIONS

The concept of ERP systems is not new to larger enterprises. Recently there have also been several initiatives from ERP vendors to adapt existing ERP functionality to support the smaller enterprise. Both researchers and ERP developers are interested in the factors that influence the small enterprise to accept ERP systems into the enterprise.

In this paper the focus was on the strategic, business, technical and human factors that influence the acceptance of ERP systems in small manufacturing enterprises in South Africa. A mixed-method approach was followed where both the literature and existing small enterprises were consulted to derive a list of acceptance factors.

Although it was not the focus of the research to investigate how ERP systems are perceived by small enterprises, there was evidence that small manufacturing enterprises have a positive and optimistic view of ERP system use. From the

research it was also significant that small manufacturing enterprises that currently use ERP systems and small manufacturing enterprises that intend to implement ERP systems both want a system that can perform and work for them.

Furthermore, a technically sound system does not necessarily translate to acceptance, a number of diverse factors should be considered. Although the various ERP system acceptance factors as identified from this study may not be exhaustive, absolute or optimally applicable to all small enterprises across the various economic industries, this paper contributes as a foundation for further research.

A number of recommendations can be made for future work, including refining the proposed acceptance factors, correlating the proposed acceptance factors with ERP system adoption factors, analysing various moderating effects on acceptance factors and researching the aspect of 'fun' in relation to the use of ERP systems.

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