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FACTORS EFFECTING USER ADOPTION OF IDENTITY MANAGEMENT SYSTEMS: AN EMPIRICAL STUDY

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Abstract

This study focuses on Web-based Identity Management Systems (IdMS), a new and emerging field where technology and business processes are integrated for the creation of identity-centric approaches to the management of users, their attributes, authentication factors and security privileges across the Internet and within an organisation. Understanding factors that affect user adoption of information technology is of interest to researchers in a diversity of fields. Although previous studies have addressed an extensive range of factors related to user adoption of information technology applications and products, there is no research examining the adoption of IdMS. In addition, no studies have investigated the conceptualisation and measurement of adoption factors in the IdMS context. The main objective of this study is to fill this clear gap by aiming to explore and understand the important factors influencing the user adoption of IdMS.

Keywords: Online Identity, Identity Management Systems, Adoption, Behaviour Intention.

1 INTRODUCTION

The advent of Web 2.0 and Web 3.0 was followed by online services that have contributed to the growth of online identities, which contain a great deal of information about users including personal attributes and behavioural preferences as well as access-related metadata. For instance, social networking sites such as Facebook encourage users to create detailed user profiles and to replicate and develop real world social networks. These services represent a shift not only from a technical development perspective but also from a traditional concept of identity to one that is socio-technically driven toward facilitating social interactions and services (McLaughlin et al. 2010). The growing use of information and communications technology in numerous contexts such as the increasing presence of organisations on the Internet have increased the need for users to examine closely how they represent themselves online and who they are actually interacting with (Koch 2002; Josang et al., 2007). Threatening behaviours in the online world are also on the rise, particularly those associated with identity theft. Identity theft significantly affects the economic decisions that people make (Akerof & Kranton, 2000) and poses security risks targeting both organizations and individuals (Swartz 2009; Finklea 2010). Nevertheless, whereas proving claims of theft in the normal offline (brick-and-mortar) world are made according to well-known procedures, online identity management lacks the same degree of recourse for consumers (Poetzsch et al. 2009). Thus, identity management (IdM) solutions try to manage the identity disorder generated from the use of many separate applications while supporting a methodology that increases productivity and security and reducing the costs related to using the system (Lee 2003; Smith 2008). The issue of control over how people present themselves online is technologically challenging. Therefore, the need for effectively implemented identity management systems (IdMS) is increasingly critical. IdMS is a new and emerging field in which business processes and technology are combined to create identity-centric approaches to the management of users, their attributes, security privileges and authentication factors across the Internet within an organization (e.g., government, commerce, education etc.). Identity management is an essential component for the successful growth and development of the next, so-called “2.0”, user-centric Internet services. Furthermore, secure, reliable and user friendly identity management is considered fundamental in establishing trust, such as in e-commerce applications (Alpar 2011). As digital identity becomes more and more important in the online world, the emergence of IdMS has brought about primary changes to e-transactions. Thus, researchers suggest that additional research into IdMS studies should include the interaction between users and the system (Ivy et al. 2010; Roussos et al. 2003; Seltsikas & O’Keefe 2010). Some researchers suggested that IdMS is a basic feature of the IT infrastructure and should be put in place before governments, organisations and commercial enterprises start rethinking citizen/customers and services relationships to accommodate the changes induced by Web 2.0 (Ostergaard & Hvass 2008; Smith 2008). Furthermore, in 2008, Forrester Research, a technology and market research firm that studies trends in technology and its impact on consumers and business, forecasted that the IdMS market would grow from nearly \$2.6 billion in 2006 to more than \$12.3 billion by 2014 (Cser & Penn 2008). In addition, over the course of the next seven years, the buying behaviours of consumers and business will migrate from point-projects to identity-suites (Karch 2011).

The topic of the diffusion of innovative information technology (IT) artefacts has been of interest among researchers (Luo et al. 2010). Similar to other innovative technologies, IdMS faces adoption barriers in its early stage (Aichholzer & Straub 2010; Friedman 2011; Ivey et al. 2010). The key to the mass adoption of any solution in the online identity space is the willingness of the user population to accept the proposed solution (Margaret 2011). Moreover, in the case of the commercial use of IdMS, it is likely that the value of IdMS will increase as more users adopt it (Poetzsch et al. 2009). Previous researches have indicated that factors including technological advances, better understanding of technology, and more tech-savvy consumers make today's environment mature for the acceptance and use of innovative technology (Luo et al. 2010). However, little research in user adoption of IdMS has been undertaken. Although many studies have focused on the factors that influence the adoption of IT products (e.g., Behrendt et al. 2011; Yen et al. 2010) or online services such as online banking and online shopping for the past decade (e.g. Cheng et al., 2006; Luo et al., 2010), to the best of our knowledge, no study has empirically examined the adoption and use of IdMS from the users

perspective. Therefore, this study aims to determine and explain factors that influence user adoption of IdMS.

The key contributions of this study are as follows. First, this is the first study that we are aware of to empirically examine the adoption and use of IdMS. Secondly, it provides a better understanding of the characteristics and capabilities of IdMS. Thirdly, this study develops a theory for better understanding the adoption and use of IdMS. From a theoretical perspective, identifying antecedents of user adoption and usage of IT and determining how they differ extends our current state of knowledge (Bhattacharjee & Premkumar 2004; Crowston et al. 2010). This study synthesises and extends previous work of innovation adoption research into a specific context of IdMS. It attempts to contribute to a better theoretical understanding of the antecedents of user acceptance and user resistance to adoption and usage of an emerging class of IT artefact particularly IdMS.

From a practical perspective, knowing which factors are important for adoption and usage enables systems designers and developers as well as providers to employ more targeted implementation efforts. IdMS providers and designers face the challenge of creating policies (Hansen et al. 2004; Seltikas & O'Keefe 2010) in an environment that resists adoption, especially at the individual level (Satchella et al. 2011). This study addresses these challenges by providing an increased understanding of user's perceptions and concerns which in turn will provide IdMS practitioners with a tool that can be used to develop mechanisms and strategies that will encourage IdMS adoption. Hence, the IdMS' stakeholders can greatly enhance their efficiency and effectiveness.

This paper is organized as follows. Section 2 identifies the research objectives and question. Section 3 presents the literature review and theoretical foundations of this research. Section 4 presents the development of the conceptual model. Section 5 discusses the research design and proposed methodology, which is followed by a discussion of the current stage of the research and plans for completion.

2 RESEARCH QUESTIONS

The main objective of this study is to provide a better understanding of the factors influencing IdMS adoption by users. In doing so, it aims to understand the relationship between IdMS and technology adoption. Therefore, the initial research question that guides this study is: *What factors affect the adoption of IdMS at the individual level?* In order answer this question, the following objectives were set:

- To explore and understand the major issues, capabilities and characteristics involved in IdMS;
- To explore and understand theories of user acceptance of technology at the individual level suitable for investigating the adoption of IdMS;
- To identify the factors that may influence the adoption of IdMS;
- To develop, and validate a user adoption model of IdMS.

3 LITRETURE REVIEW

Given that little is known about user adoption of IdMS, it is important to look for support in two main bodies of relevant literature and their particular correlated sub-disciplines: 1) identity management (IdM) and identity management systems (IdMS); 2) user acceptance of technology (UAT) and user acceptance of Web-Based Services and Technologies (UWBST). Because of the lack of studies on user adoption of IdMS and this study focuses on Web-IdMS, we believe that the literature associated with WBST may offer valuable insights into innovative IdMS adoption because of the similarity in terms of human users interacting with Web systems (Luo et al. 2010). However, differences exist in consumers' perceptions of their value. Figure 1 shows a schema of the scope of this literature review. The main objective of examining IdM and IdMS literature is to understand the state of IdMS research while the aim of UWBST review is to identify technology adoption theories and explore factors that could affect individual adoption of IdMS.

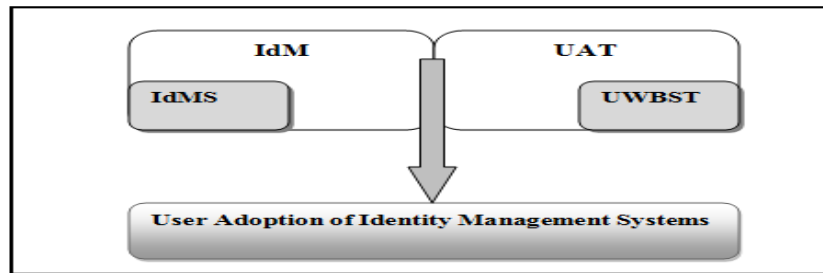


Figure 1. Informing Disciplines (map of the literature review)

3.1 Identity Management and Identity Management Systems

The term, identity management (IdM) has become widely used, both in academia and in practice. However, a commonly accepted meaning for the term is lacking. This lack of a common understanding can be clarified by the fact that IdM is quite a new term whose meaning has not yet been completely established (Lips & Pang 2008). The literature indicates that IdM is strongly related to processes in emerging digital environments (Lips & Pang 2008). Josang et al. (2005) defined IdM as a process of representing and recognising entities as digital identities in computer networks. The concept of identity management systems (IdMS) is confusing because the different stakeholders' concerned (users, identity providers and service providers) have different requirements and different perspectives (Alpar et al. 2011). IdMS have been defined as the integration of important personal information from multiple systems into one collaborative and unique identity (Meints 2009). In this study, we define IdMS as the business processes, policies and emerging technologies, for the creation, maintenance and use of online identities across the Web.

Most IdMS studies have focused on technical issues that deal with the underlying security technologies and designing privacy protection solutions (e.g., Josang 2007; Rossudowski 2010) or providing guidelines about how to design a decentralized web IdMS (e.g., Dhamija & Dusseault 2008). IdMS use and context (from the IS perspective) and the adoption of IdMS technologies and services by the end-user are not well examined in the published literature, which is sparse with regard to the topic of directly examining IdMS (Satchell et al. 2011; Seltsikas 2009; Seltsikas & O'Keefe 2010). Digital identity schemes have been well documented from the providers' perspective but have received much less attention in relation to the perception of IdMS from the user's perspective (Satchell et al. 2011). Although limited studies have identified and suggested some factors and metrics aimed towards the adoption of IdMS (Alkhalifah & D'Ambra 2011; Ivy et al. 2010; Poetzsch et al. 2009), no study to date empirically explores and measures factors that may impact the user adoption of IdMS. This study is an attempt to both fill this important gap and contribute to the literature by conducting research in IdMS adoption in the context of focusing on the perspective of the end-user.

3.2 Theoretical Foundation

During the previous years of IS research, a varied body of theoretical work has been gathered on the diffusion and adoption of IT-based innovations (Benbasat and Barki 2007; Taylor and Todd 1995; Venkatesh et al. 2003; William et al. 2011). This section presents a review and the justification of selected theoretical models and variables used in this study.

3.2.1 Technology Acceptance Model

In the context of IS, the technology acceptance model (TAM) has been used to study attitudes towards a new technology and its acceptance. TAM, which was proposed and developed by Davis (1989), is widely used to describe the technology acceptance procedure within diverse contexts. The theoretical foundation for TAM is based on theory of reasoned action (TRA) (Fishbein & Ajzen 1975). TAM presents two independent variables: *perceived usefulness (PU)*, which is defined as "the degree to

which a person believes that using a particular system would enhance his or her job performance” (Davis 1989, p. 320); and *perceived ease of use (PEOU)*, which is defined as “the degree to which a person believes that using a particular system would be free of effort” (Davis 1989, p. 320). TAM suggests that beliefs about ease of use and usefulness are essential elements in determining user attitude towards using a new technology (Davis 1989).

This study selected some TAM’s basic variables for several reasons. First, many researchers suggested that a deeper understanding of factors contributing to ease of use and usefulness is needed (Bagozzi 2007; Benbasat & Barki 2007; Djasmasbi et al. 2010). Furthermore, existing measurement items for TAM have repeatedly been shown to be robust and to display excellent reliability and validity in a wide diversity of settings (e.g. King & He 2006; Recker & Rosemann 2010). Finally, although TAM-related research, is one of the most widely studied areas of IS research, there are still a number of productive research avenues, including the role of individual characteristics (Djasmasbi et al. 2010), as well as new and different contexts (Benbasat & Barki 2007; Turner et al. 2010). Turner et al. (2010) argued that “it should be possible to predict future technology use by applying the TAM at the time that a technology is introduced” (p. 464). Recently introduced, IdMS are in the early stage and researchers have not examined whether PU and PEOU perceptions and external variable remain sufficient for explaining users’ behaviour toward using IdMS artefact.

3.2.3 *Task- Technology Fit*

Task- Technology Fit (TTF) was developed by Goodhue and Thompson (1995) in order to gain an understanding concerning the link between individual perception and IS. TTF is the extent to which a technology aids an individual to be accepted if the functions of the technology (fit) correspond with the tasks that must be performed (Cane & McCarthy 2009). The main constructs of TTF are task characteristics and technology characteristics. Tasks are defined as a set of actions carried out by individuals to run inputs into outputs in order to satisfy their needs (Goodhue & Thompson 1995). Task characteristics are those tasks where a user might employ IT in order to perform them. Technology characteristics refer to the technology used by individuals in carrying their tasks. Some researchers found that task and technology characteristics have an effect on user behaviour toward using an innovative technology (Chang 2010; Yen et al. 2010).

TTF is a critical construct both before and after individual decisions about technology use (Goodhue 2007). An investigation using the TTF model provides an understanding of the hypothesis involved in comprehending technology use and clarifies technical areas needing future examination (Cane & McCarthy 2009). The extant TTF-based research has been focused on user adoption of IT in work settings (e.g. Dishaw & strong 1999, 2003; Gebauer et al. 2010; Yen et al. 2010) and rarely considers the effect of the task technology fit in non-work setting (Alkhalifah & D’Ambra 2011; Chang 2010; Shang et al. 2007). Previous studies have examined the affect of fit on performance (Goodhue & Thompson 1995), tool usage (Dishaw & Strong 1999, 2003). There is a lack of studies that examine the effect of fit on behavioural intentions (Alkhalifah & D’Ambra 2011; Yen et al. 2010). Moreover, to our knowledge, no study has conceptualised and measured fit and examined its effect on users’ intention to adopt in IdMS context. The current study tries to fill this gap and contributes to fit models by conceptualising fit as moderation and examining its effect on user’s behaviour intentions toward the use of IdMS.

3.2 Risk , Trust and Privacy Concerns

In the early adoption stage of an IT-enabled artefact such as IdMS, individuals are uncertain about not only the services or product but also the soundness of the underlying technology platform (Luo et al., 2010). Therefore, this dual uncertainty raises the importance of studying the factors that constitute the major dimensions of the users’perceived risks and the mechanisms that are effective in helping consumers overcome their uncertainties about the services, products or underlying technical platform.

Risk, trust and privacy concerns are most important issues related to online identity management and IdMS (Satchell et al. 2011; Seltsikas & O’Keefe 2010; Rossudowski 2010). Previous identity

management studies addressed these issues from the technical perspective. Theoretical, social and regulatory dimensions have not been well addressed in the literature (Adjei 2011). Furthermore, IdMS providers and designers face the challenge of creating security and privacy policies (Hansen et al., 2004; Seltsikas and O'Keefe, 2010) in an environment that resists adoption, especially at the individual level (Satchella et al., 2011). Therefore, many identity management researchers suggested that risk, trust and privacy concerns as well as the relationship among them using IdMS should be investigated and formulated (Adjei & Olesen 2011; Alpar et al. 2011; Roussos et al. 2003; Seltsikas & O'Keefe 2010). The current study offers an increased understanding of user's concerns, which in turn will provide designers with a tool that can be used to develop trust-building mechanisms and risk-reducing strategies that will encourage IdMS adoption.

Risk, trust and privacy concerns have been viewed as antecedent beliefs, which influence users' behavioural intention toward using a particular technology. Prior studies that examine the influence of risk, trust and privacy concerns on individual behavior have been limited and typically test them disjointedly as a single construct (Cho, 2006; Dinev & Hart 2006; Lee 2009; Lee & Cranage 2010) or investigate them disjointedly as multi-constructs (Junglas et al. 2008; Luo et al. 2010). Few studies have incorporated perceived risk, trust and privacy concerns as a key antecedent of behavioral intention toward web-based technology or service (Shin 2010; Liao 2011). There is a lack of studies that investigate and test these three factors as multi-dimensional constructs. Furthermore, as risk, trust and privacy concerns have been shown to be important, we know little about the factors that influence each one (Junglas et al. 2008; Luo et al. 2010; Xu et al. 2011). Even though few suggested that these factors are likely to be influenced by each other or external variables, neither proposed a theoretical foundation for such a study. Thus, the relationship between perceived risk, trust and privacy concerns remains unclear and infrequently tested. In addition, they have not been investigated and tested to examine individual behavioural intention toward IdMS. Therefore, this study contributes to the literature by establishing the correlations of these related factors and addressing this gap by examining users' beliefs about multi-dimensional security, trust and privacy constructs in IdMS context. We believe that this study can theoretically contribute to IdMS and IS literature relating to risk, trust, and privacy and emerging IT artefact acceptance.

3.3 Individual Differences

Individual differences have been shown as a direct affect on user behavioural intention toward diverse technologies (Djamasbi et al. 2010; Venkatesh et al. 2003). However, many information technology acceptance studies have ignored moderating impacts of individual factors (Sun & Zhang 2006). When a complex context is faced (such as IdMS); additional factors (moderating) are needed to capture the complexity of the context (Sun & Zhang 2006). There is also a need for studies that examine the individual characteristics that influence behaviour (Djamasbi et al. 2010). Moreover, situational factors play a crucial role on IdMS adoption (Poetzsch et al. 2009). Therefore; we propose that individual differences have a direct and a moderate impact on behavioural intention to adopt IdMS.

3.4 Research Questions Revised

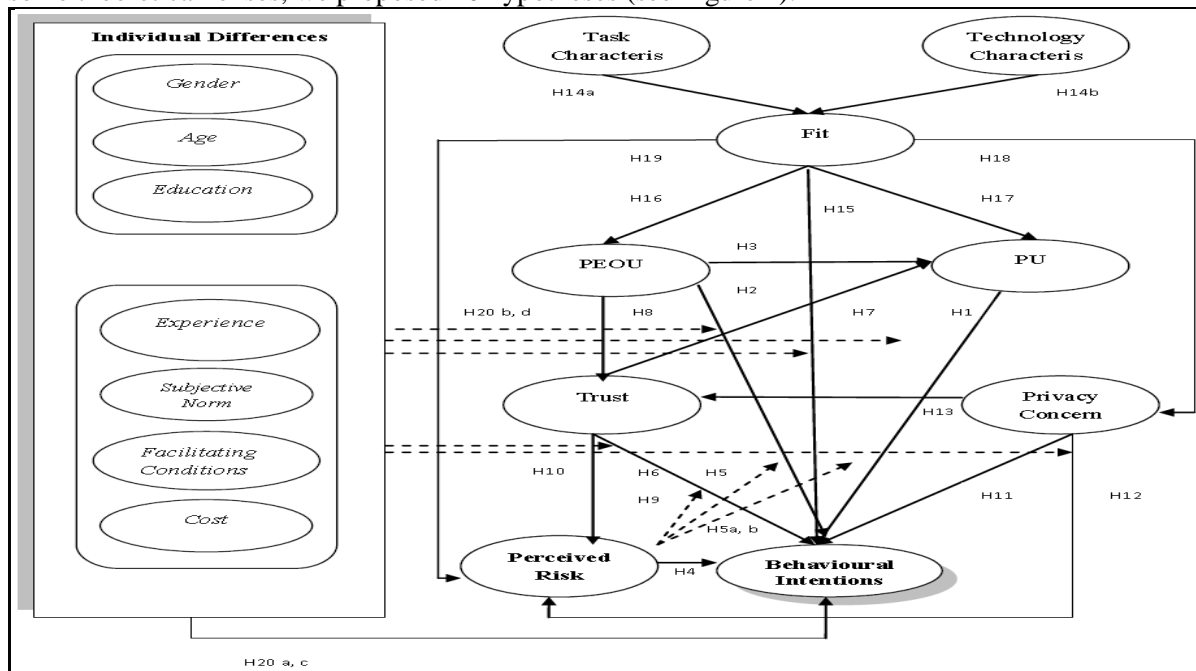
The first three objectives (presented in section 2) were successfully accomplished by the comprehensive literature review on IdM, IdMS, user acceptance of technology and UWBST. The literature review allowed the identification of theoretical concepts that were fundamental for the development of the conceptual model of user adoption of IdMS. In order to achieve the set of the objectives, and answer the research question, four research sub-questions were posed to guide the empirical phase of this study:

- *How do user perceived factors that effect IdMS adoption?*
- *Does the interaction between IdMS tasks and functions (fit) effect user adoption of IdMS?*
- *How do perceived risk, trust and privacy concerns effect users' behavioural intentions to adopt IdMS?*
- *Is there any effect of individual differences on user adoption of IdMS?*

4 RESEARCH MODEL

The research model presented in Figure 2 was proposed and developed based on three considerations: 1) literature review, 2) variables that determine the behavioural intentions of IdMS, 3) conceptual links between the model variables and the research hypotheses. The model is composed by six key elements: (1) technology perceptions constructs: perceived usefulness and perceived ease of use; (2) technology and task characteristics of IdMS and the interaction between them (Fit);(3) perceived risk ;(4) trust ;(5) privacy concerns and (6) individual differences. An integrated model is proposed because both models and variables make a significant contribution to the study of technology adoption, specifically the adoption of IdMS. This study excludes consequence factors as it focuses on user behavioural intentions rather than actual usage. The proposed model asserts that *behavioural intention* is a key variable in determining IdMS adoption.

Trust construct includes trust belief (trust in IdMS providers and trust in IdMS artefact) and institution based trust (trust in Internet). In addition we propose perceived risk construct in six facets including performance, financial, time, psychological, social, and overall risk such as identity theft and potential fraud. This study also extends privacy construct and includes concern for information privacy (CFIP) (Smith et al. 1996) and Internet users' information privacy concerns (IUIPC) (Malhotra et al. 2004) measures consisting of seven dimensions: errors, collection, improper access, secondary use, control, choice, and awareness. Our study examines the interaction effect of task (identity life cycle) and the technology characteristics (design dimensions of IdMS) on individual' intention to adopt IdMS technologies services and suggests that users are more likely to adopt IdMS if there is a fit between the dimensions of the identity life cycle (create, maintain and control online identity) and the dimensions of the IdMS design (minimal disclosure of information, human interaction, authentication and authorization, anonymity, mobility (locability), identity provisioning and single-sign-on). In this study individual differences include two elements: demographic variables and situational variables. Demographic variables are defined as characteristics relating to individual users including gender, age and education. Situational variables refer to characteristics particular to the context including experience, facilitating conditions, subjective norm and cost. Drawing from the literature review and some theoretical lenses, we proposed 20 hypotheses (see Figure 2).



Control variables:
 • Individual Differences
 • Perceived Risk

Direct effect ———→
 Moderate effect - - - - -→

Figure 2. The Research Model

5 RESEARCH DESIGN AND METHODOLOGY

The research approach designed and applied in this study is shown in Figure 3. The study is divided into four phases (See Figure 3). This study proposes a positivist research that involves “precise empirical observations of individual behaviour in order to discover...probabilistic causal laws that can be used to predict general patterns of human activity” (Neuman 2003, p. 71). A *quantitative* methodology has been selected as appropriate to the explanatory nature of this research and the positivist paradigm adopted by this study (Straub 1989; Straub et al. 2005). The data collection process will be carried out using an *online survey* method, and the questionnaire will be *Web-based* and accessed through the URL (Gefen et al. 2005; Zhang 1999). The participants will be users of Facebook and LinkedIn as well as people who engage in online shopping and use online payment services. The targeted participants were selected because they have experience with online identity services where individuals create online profiles, make connections with others and share identity information. It is decided to collect data from the aforementioned target population to ensure that there would be a sufficient number of IdMS adopters in the sample. Participants will be recruited via advertisements on Facebook and LinkedIn. Google AdWords will also be used to advertise the survey to recruit respondents who engage in online shopping and use online payment services.

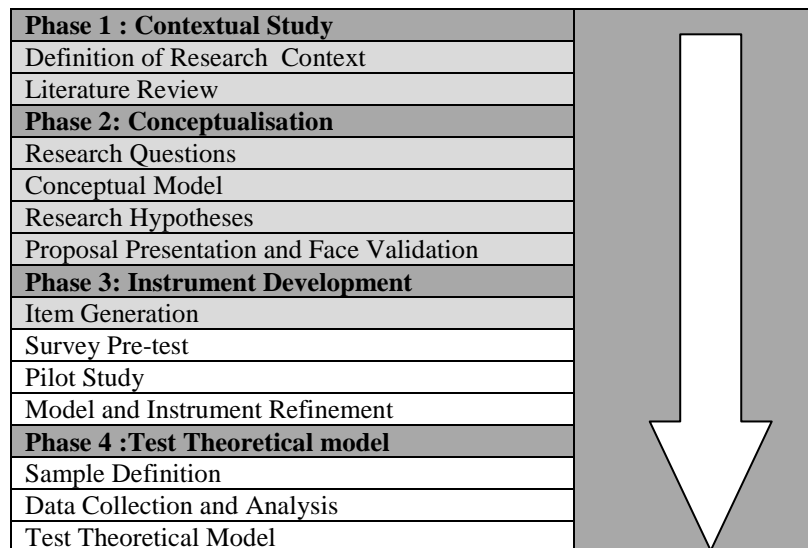


Figure 3. The Research Design

6 CURRENT STAGE AND FUTURE PLAN OF THE RESEARCH

The first two phases of the research are completed (see Figure 3). Defining the research scope, research strategy and a thorough literature review were done in the first phase. In the second phase the research questions were identified, the conceptual model was developed and the hypotheses were established. The candidate successfully defended the thesis proposal. The survey draft is prepared and the initial items were created based on two domains of the IS/IT research literature. First are previous studies on IS/IT adoption to identify the set of items that previous acceptance studies have shown to obtain highest levels of validity and reliability. Second is the identity management literature, which is searched in order to derive items from relevant concept definitions in the IdMS domain. The pre-test stage is currently conducting for refining and validating the research instrument (Moore & Benbasat 1991). After the research instrument is pretested and refined, a pilot test will be conducted to assess the likely response rates and to confirm the scales' reliability (Straub et al. 2004). Once the pilot study is concluded and the instrument is developed, the next step will be to test the theoretical model. The final questionnaire will be presented to a large sample of the target population and the data analysis will be conducted. The data will be analysed using the well-established Structural Equation Modelling (SEM) technique: Partial Least Squares (PLS). It will be used to examine relations between the constructs of the conceptual model and to assess the overall fit of the structural model (Chin 1998; Wetzal et al. 2009). This research commenced on July 2010 and expected to complete in July 2013.

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