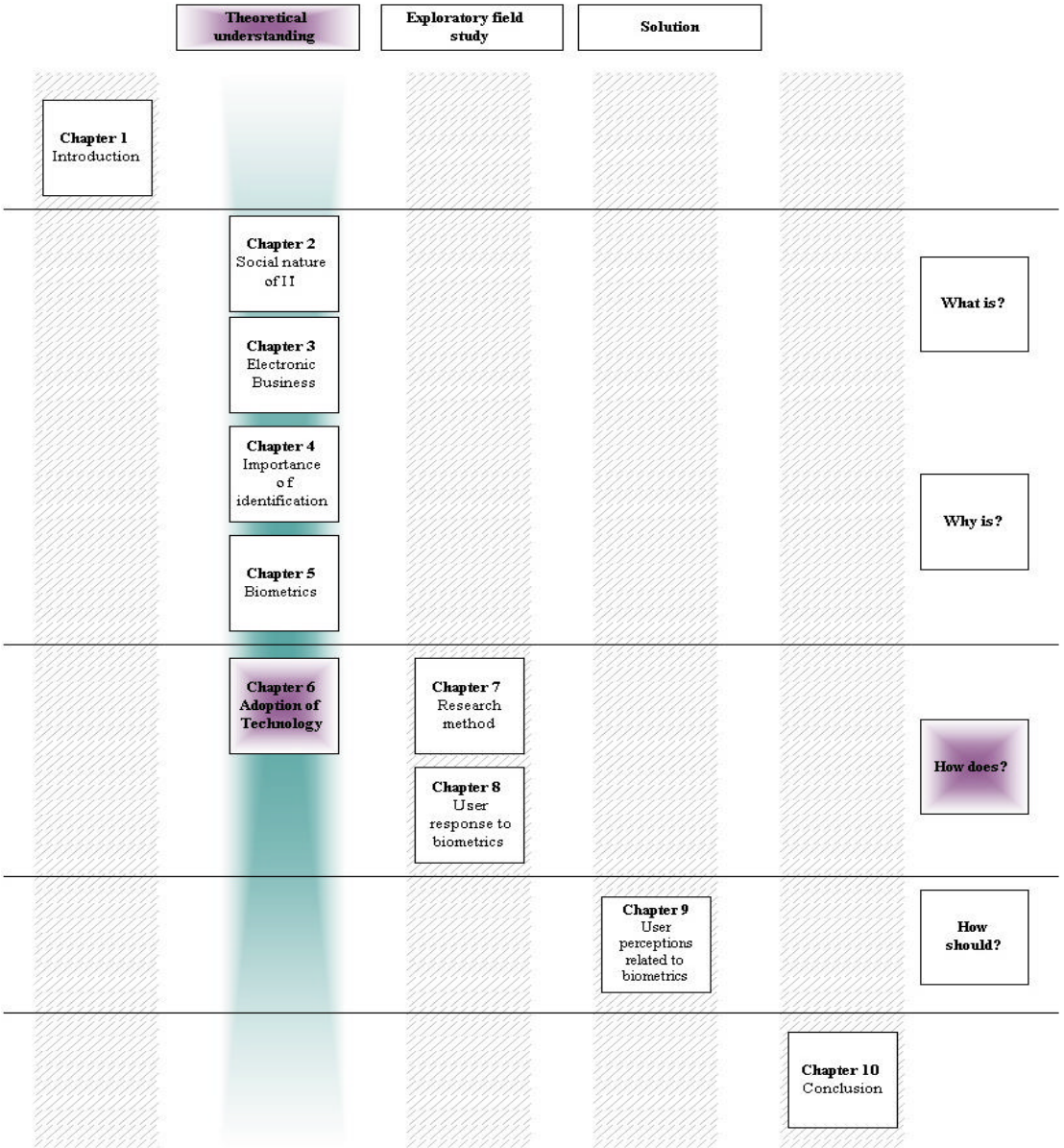
# 6. CHAPTER 6: ADOPTION OF TECHNOLOGY

*"Information work is thinking work. And, when thinking and collaboration are significantly assisted by computer technology, you have a digital nervous system. It consists of the advanced digital processes that knowledge workers use to make better decisions. To think, act, react, and adapt."*

**Bill Gates, Microsoft**

**Figure 6-1:** Thesis roadmap – Chapter 6



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# CHAPTER 6: Adoption of technology

## 6.1 Introduction

This chapter provides a theoretical understanding of "Adoption of technology", addressing the research question: "How does a technology adoption process work?" This chapter has the following sections:

- Discussing the impact of technology adoption, specifically user perceptions related to biometric identification methods.
- Discussing a technology adoption model.
- Developing a specific Technology Adoption Model for the research study problem statement before moving on to the chapter's summary and conclusion sections.

## 6.2 User perceptions related to biometrics

Technology creates new opportunities for individuals and organizations (Walsham and Chun-Kwong 1991), but simultaneously it generates new problems. Walsham and Chun-Kwong (1991) stress that technology has a profound impact on humans. The introduction of new technology disturbs the human process of routines and in essence it means that humans must change the ways in which they conduct a certain task. New technologies can influence the values of society by making possible what was not possible before (Walsham and Chun-Kwong 1991). It is therefore, necessary to investigate **user perceptions** related to biometric identification within Electronic Business, as some individuals are quite innovative and entrepreneurial, and are prepared to consider the advantages offered to them, but conversely, others are happy to continue to do things in the same way in which they always have and see no need to investigate or adopt new thinkings (Tatnall and Lepa 2003). For biometrics to be acceptable, it must at least do as well, or better, than any current available alternative (Torbet *et al*. 1995). If a user is not happy about using biometrics it will simply not be used, but if the user is intrigued and enthusiastic about it, it will be used as intended (Ashbourn 1999). Dunstone (2001) further mentions that if users are not comfortable with the way biometrics are used, or do not understand how the



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potential for abuse has been limited, they may simply refuse to use it. Users must perceive the biometric identification system as being usable, reliable and not embarrassing to use (Torbet *et al*. 1995). Albrecht (2002b and 2003), based on the findings of her study conducted in 2002 and 2003, lists a number of criteria that could contribute to higher acceptance rates for biometric implementations amongst users, which include:

1. **Need for certain information** – as mentioned before, users need to know the following on the biometric methodology that is going to be used: how the technology works, where the data is stored, which data is registered, how the data is protected, who has access to the data and who is operating the system.
2. **Personal service and assistance** – the way that users are given assistance during their first contact with a biometric identification system is relevant to its acceptance and their willingness to use it in future. A comprehensive explanation of the system and good operating instructions will have a positive influence on a user's evaluation of the new technology.
3. **Ergonomics of user facilities** – the actual design of the biometric identification system plays an important role. In addition to user friendliness, the manner in which the biometric verification is initiated or how the machine is operated is important. Natural and everyday motions that need not be learned are most readily accepted.
4. **Simplicity, convenience and speed** – the actual operation must be as intuitive and as simple as possible. The convenience, ease of use and the actual duration of the verification are important to users.

One of the core elements in a biometric identification system must be the protection of its data (Albrecht 2003). Biometric data is always personal data and therefore, must have special protection (Albrecht 2003). The storage of the biometric data should be decentralized and only centralized if it is in a form that is anonymous or under a pseudonym (Albrecht 2003). Depending upon the application area, either the use of biometric data must be regulated or

at least the individual's permission must be obtained legally (Albrecht 2003). From time to time an independent data protection officer should verify the processes (Albrecht 2003).

Social interactions and the creation and maintenance of interpersonal networks are more important than the actual innovation itself (Tatnall and Lepa 2003) e.g. some individuals will simply adopt a new innovation so that the world does not pass them by and that they will not be left out of things. TeleTrust (2003a) states, from previous (empirical) studies, that biometrics will only be accepted by individuals when it offers clear added value that includes a **security factor** – real reliance on the procedure in use, clear ascertainment of the communication partner and legally binding verification of the power of disposal, as well as a **convenience factor** – increased convenience through speed and ease of use.

Tatnall and Lepa (2003) conclude by stating that user adoption decisions of users have little to do with any supposedly innate characteristics of new innovations, but rather in specific uses of the innovation that relate to their social interactions and environment. The golden rule to remember is that biometric identification methods should not be forced upon users (Albrecht 2002b).

## 6.3 Technology Adoption Model

An innovation can be defined as "an idea, practice, or object that is perceived as new by an individual" (Tatnall and Lepa 2003). New technologies have an unpredictable nature and could have possible negative impacts. Technology is more than just "technology"; it is a pervasive complex system whose cultural, social, political and intellectual aspects have a bearing on every aspect of human life (Teich 2000). Ghorab (1997) states that user perceptions are influenced by various external factors, including the system's technical design characteristics, user involvement in system development, the type of system



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development process used, the nature of the implementation process and cognitive style.

When an organization wants to implement a new innovation such as a new development, new system, new procedure, new means of identification, etc. it might be tempted to force users to adopt it. Ram and Jung (1991), who studied organizational members' responses when they were forced to adopt a new implementation, show that even innovative individuals resist a new implementation in the context of forced adoption. Ram and Jung (1991) suggest that product trial and repetitive usage will significantly reduce new implementation resistance and create a favourable post-adoption evaluation (attitude, perceptions and satisfaction judgements).

This section investigates a technology adoption model that deals with the adoption and diffusion of technology in society and assesses its suitability for the purposes of this research study. Many different models exist, e.g.:

1. **Adopter-centered process oriented model**

   This technology adoption model deals with individual perceptions and attitudes that form part of an adoption process (Pereira 2002) that could have an impact on the user adoption of biometrics as an identification method within Electronic Business.

2. **Rogers model of diffusion of innovations**

   Rogers model of diffusion of innovations technology adoption model deals with individual perceptions and attitudes and highlights that user adoption is nothing more than a communication process, an information seeking and processing activity (Rogers 1983).

But for the purpose of the research study Davis's (1989) technology acceptance model (TAM) has been selected, as it divides individual perceptions and attitudes into perceived usefulness (PU) and perceived ease of



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use (PEOU) and it is also one of the most widely used technology adoption research models predicting Information Technology adoption.

### 6.3.1 Technology acceptance model (TAM)

Davis developed the technology acceptance model (TAM) in 1989 and according to Gefen (2002) it is one of the most widely used technology models predicting Information Technology adoption. Legris *et al*. (2003) add to Gefen's statement by saying that the technology acceptance model (TAM) has proven itself to be a useful theoretical model in helping to understand and explain user behaviour in Information Systems implementations.

Davis (1989) asks the question: "What causes people to accept or reject Information Technology?" and answers the question by stating that individuals tend to use or not use an application to the extent they believe it will help them perform their job better; in other words, perceived usefulness (PU). He further states that even if individuals believe that a given application is useful, they may, at the same time, believe that the application is too difficult to use and that performance of usage is outweighed by the effort of using the application; in other words, perceived ease of use (PEOU).

Davis's (1989) technology acceptance model (TAM) emphasizes that users' perceptions about "how-useful-is-this-for-me" and "how-easy-is-it-to-use" are **two** powerful factors that influence the adoption of technology and are fundamental determinants of user acceptance.

The technology acceptance model (TAM) defines **two** perceptions by users of technology that have an impact on their adoption thereof. These **two** perceptions combined will create a favourable or unfavourable disposition for the individual towards using a particular technology:

1. **Perceived usefulness (PU)** – according to Davis (1989), PU relates to the degree to which an individual believes that using a particular Information



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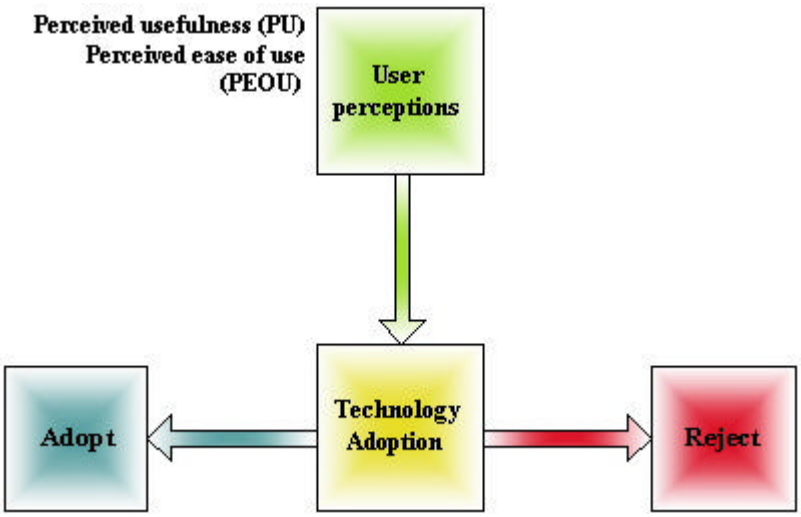
System would enhance his or her job performance. Davis's definition follows from the definition of the word "useful" i.e. capable of being used advantageously. It reflects the **extrinsic** characteristics of the technology itself, such as task efficiency and task effectiveness.

2. **Perceived ease of use (PEOU)** – according to Davis (1989), PEOU relates to the **intrinsic** characteristics of the technology e.g. ease of use, easy to learn, flexibility; in other words, the degree to which an individual believes that using a particular Information System will be free of effort. Davis's definition follows from the definition of the word "ease" i.e. freedom from difficult or great effort.

Incorporating the above factors from the technology model selected for the research study with the theoretical contribution sections in previous chapters (Chapter's 2-5) of the research study, leads to the Technology Adoption Model below for the research study problem statement:

**Figure 6-2:** Technology Adoption Model




## 6.4 Summary

This chapter discussed Davis's (1989) technology acceptance model (TAM) that deals with the adoption and diffusion of technology in society, as it continues to be of value for researchers trying to unlock the relationship



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between human kind and technology. The model focuses on user perceptions, which include perceived usefulness (PU) and perceived ease of use (PEOU), which are **two** important factors that guide the adoption of unknown technologies by users. This is due to the fact that these perceptions will either create a favourable or unfavourable disposition in the user toward using the innovation or not (Davis 1989). Davis (1989) postulates that individual perceptions about "how-useful-is-this-for-me?" and "how-easy-is-it-to-use?" are **two** important perceptions that influence the adoption of technology. Incorporating the factors from the technology model selected for the research study with the theoretical contribution sections in previous chapters (Chapter's 2-5) of the research study, led to the compilation of a specific Technology Adoption Model for the research study problem statement.

## 6.5 Conclusion

It was concluded in this chapter, the last chapter that formed part of the theoretical understanding section, **Chapter 6 – Adoption of Technology**, that user adoption decisions have little to do with any supposedly innate characteristics of new innovations, but rather with specific uses of the innovation that relates to their social interactions and environment. The above factors from the technology model selected for the research study were incorporated with the theoretical contribution sections found within previous chapters (Chapter's 2-5) of the research study to create the initial Technology Adoption Model compiled for the research study problem statement.

This chapter has therefore, addressed the research question: "How does a technology adoption process work?"

Before moving on to the exploratory field study section of the research study, it is important to revisit what has been discussed so far as part of the theoretical understanding section of the research study's theoretical contribution process (Eisenhardt 1998). The theoretical understanding was obtained from:



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- Chapter 2 – The social nature of Information Technology,
- Chapter 3 – Electronic Business,
- Chapter 4 – The importance of identification,
- Chapter 5 – Biometrics, and
- Chapter 6 – Adoption of technology.

It was concluded that information provision (Rogerson and Fidler 1994) within an organization has evolved through advances in Information Technology and the use of computer-based Information Systems. Information Technology has had a radical impact on Information Technology users, their work and their work environments. In fact, Information Technology plays a role in many, if not most, of the everyday operations of today's organizations and has an underlying social nature (Chan 2002). Technology creates new opportunities for organizations and people within an organization, and it is developed by people for people; in other words, rooted within human nature (Roode 1993).

Electronic Business, on the other hand, is open to the same social factors and user perception obstacles as Information Technology, including the security of on-line transactions, privacy considerations, trust amongst participants, legal implications, etc. Electronic Business will only survive if the users feel that their privacy and safety (Udo 2001) are protected and if trust (So and Sculli 2002) exist. For this to occur, both security and privacy concerns have to be addressed simultaneously. Can a foolproof identification system then perhaps provide a possible solution?

It was established that identification was always social rather than economical in nature, but as the complexity of economic transactions developed the need arose for accurate identification (Clarke 1994). A variety of means for identification are available, but the key focus should be on establishing accurate identity. Therefore, for the purpose of the research study, biometric identification methods were discussed as the preferred means of identification, keeping in mind that the identity of an individual and the use of biometric methods provokes many debates relating to social



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factors such as privacy invasion, human rights etc (Soutar 2002). In essence, user adoption decisions have little to do with any supposedly innate characteristics of new innovations, but rather with specific uses of the innovation that relates to their social interactions and environment; in other words, user perceptions. Therefore, a technology adoption framework, as defined in this chapter, needs to be followed that addresses user perceptions related to biometrics as an identification method within Electronic Business.

The main focus of the exploratory field study section of the research study will be on user perceptions related to biometric identification methods and on enhancing the Technology Adoption Model compiled within this chapter. This will be done by gathering user perceptions regarding the Internet, Electronic Business, biometrics and user adoption via a questionnaire. In the next **two** chapters (Chapter 8 and 9) the exploratory field study that has been undertaken will be reported on. These chapters (Chapter 8 and 9) will attempt to address the following research questions as identified through Roode's (1993) process-based research framework for Information Systems:

- What concepts do users have of what biometrics can do?
- How do users respond to biometrics?
- Do users respond differently to different kinds of biometrics?
- Why do users respond to biometrics in the way they do?
- Why would users adopt biometrics?
- How user perceptions, related to biometrics, should be taken into consideration to ensure success with the implementation of identification through biometrics in Electronic Business?

However, before moving on to the exploratory field study section of the research study, it is necessary to first discuss interpretive research in more detail in Chapter 7 – Research method.



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