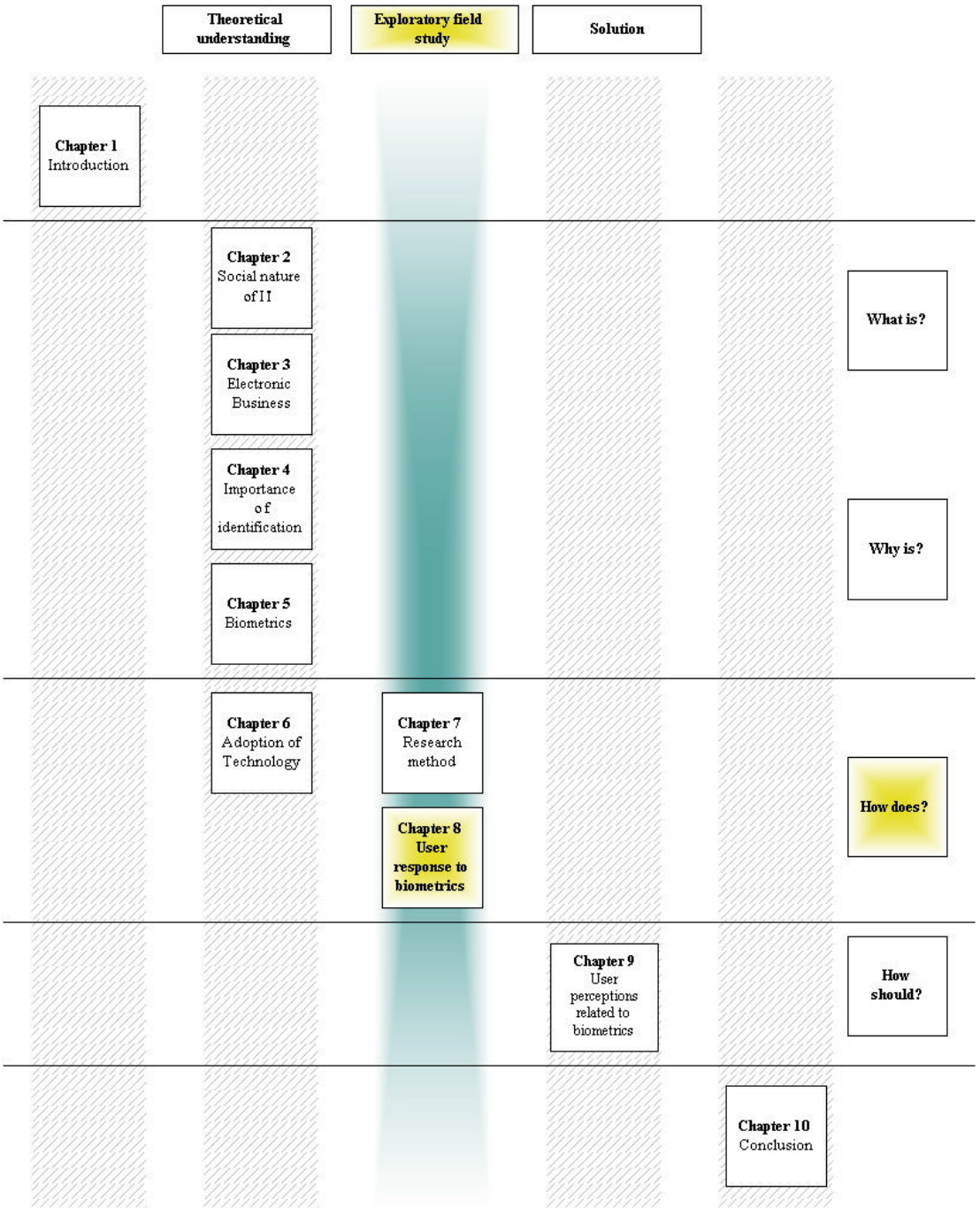
8. CHAPTER 8: USER RESPONSE TO BIOMETRICS

"You cannot teach a man anything, you can only help him find it within himself."

Galileo

Figure 8-1: Thesis roadmap – Chapter 8



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8.1 Introduction

This chapter compares results of the exploratory field study undertaken to investigate the research questions:

- 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?

The answers to and/or perceptions of the research questions will be obtained by summarizing the findings of the questionnaire in tables and schematic diagrams and drawing conclusions based on this data. As mentioned in Chapter 7 – Research method, the questionnaire was distributed amongst eighty employees of DexIT. Twenty-six employees responded and the research study evaluation was based on their answers to and/or perceptions of the questions within the questionnaire.

8.2 Demographic information

This section provides demographic information on the employees that responded to the questionnaire and includes each of the employees' gender, age group, preferred home language, educational qualification, industry type, average years' experience in their industry, their occupation and whether a PC is used as part of their daily job.

8.2.1 Gender distribution

Table 8-1: Gender distribution

Themes	Selected	Rank
Question 1: Are you male or female?		
Male	12	2
Female	14	1

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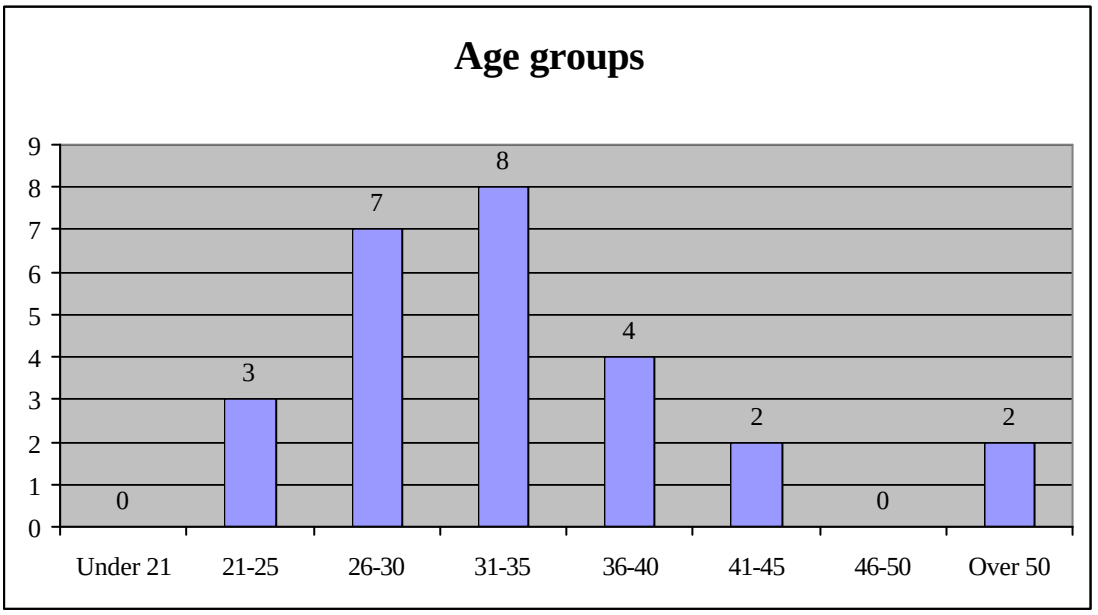
8.2.2 Age groups

Table 8-2: Age groups

Themes	Selected	Rank
Question 2: How old are you?		
Under 21	0	6
21 – 25	3	4
26 – 30	7	2
31 – 35	8	1
36 – 40	4	3
41 – 45	2	5
46 – 50	0	6
Over 50	2	5

Figure 8-2: Age groups



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8.2.3 Preferred home language

Table 8-3: Preferred home language

Themes	Selected	Rank
Question 3: What is your preferred home language?		
English	11	2
Afrikaans	15	1

Besides English and Afrikaans, no other home languages were represented in the group.

8.2.4 Educational qualifications

Table 8-4: Educational qualifications

Themes	Selected	Rank
Question 4: What is your highest educational qualification?		
Standard 8	0	5
Matric	4	3
Relevant professional job training	5	2
Diploma/Post graduate diploma	6	1
B degree	5	2
Honours/Masters/Doctors degree	5	2
Other	1	4

The “other” educational qualification has been listed as CA (SA).

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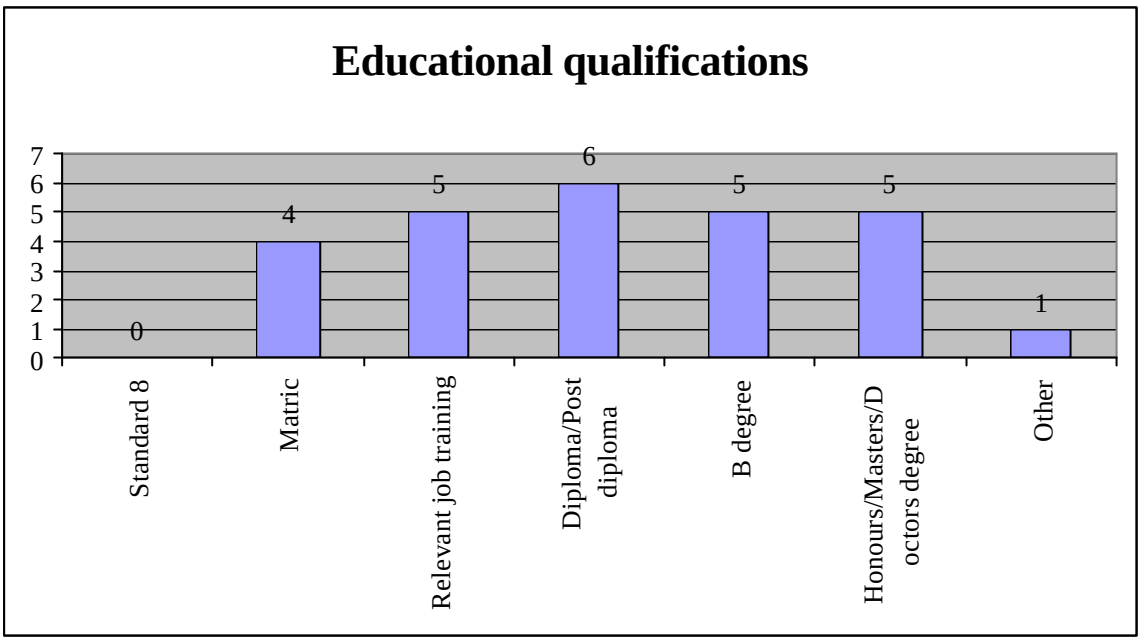
Figure 8-3: Educational qualifications



8.2.5 Industry types

Table 8-5: Industry types

Themes	Selected	Rank
Question 5: In which industry do you work or provide a service to?		
IT	13	1
Tele-communications	0	5
Manufacturing/Electricity	0	5
Mining	0	5
Healthcare	0	5
Government	0	5
Retail	0	5
Travel/Entertainment	0	5
Financial services	10	2
Insurance	2	3
Other	1	4

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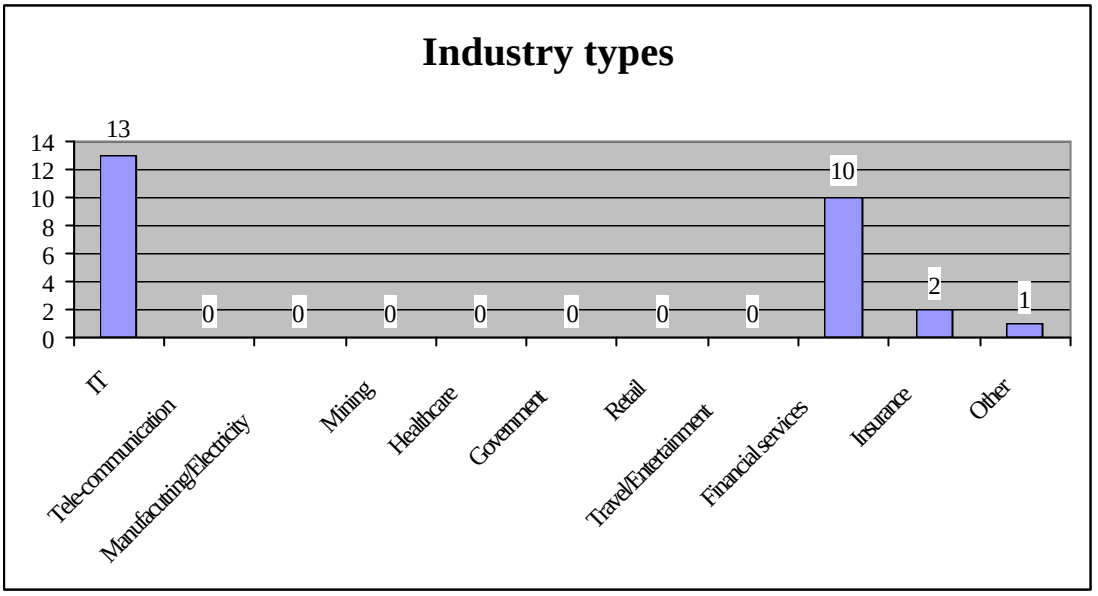
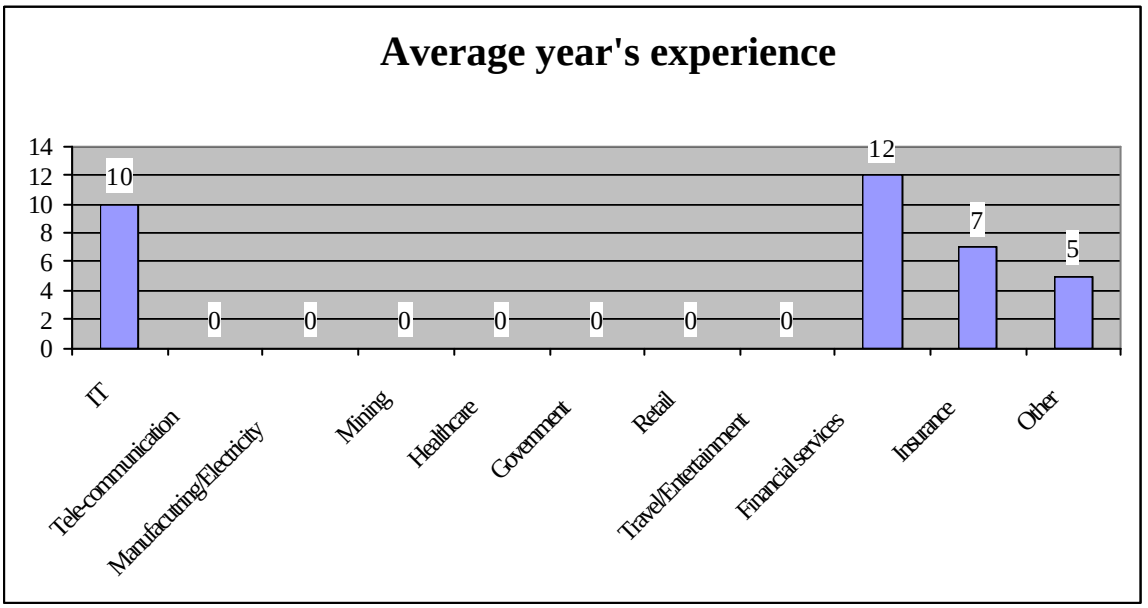
The "other" industry type has been stated as construction.

Figure 8-4: Industry types



The average years' experience (Question 6) in the main industry types were ten years for Information Technology, twelve years for financial services and seven years in the insurance industry category.

Figure 8-5: Average year's experience



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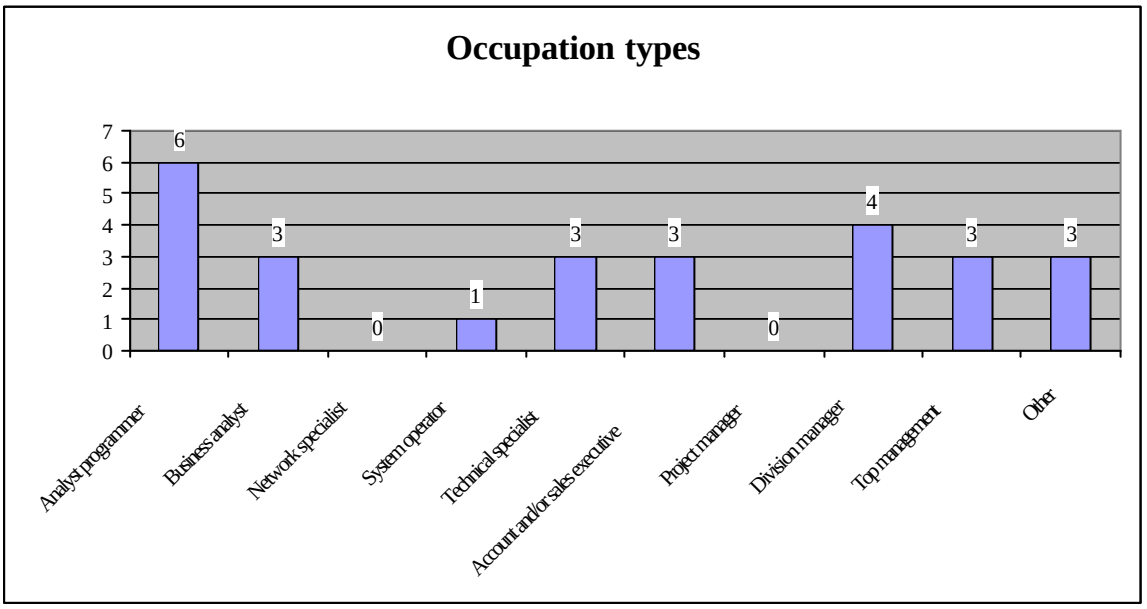
8.2.6 Occupation types

Table 8-6: Occupation types

Themes	Selected	Rank
Question 7: What best describes your occupation?		
Analyst programmer	6	1
Business analyst	3	3
Network specialist	0	4
System operator	1	5
Technical specialist	3	3
Account and/or sales executive	3	3
Project manager	0	4
Division manager	4	2
Top management	3	3
Other	3	3

The "other" occupation types have been listed as system administrator, bookkeeper and financial consultant.

Figure 8-6: Occupation types



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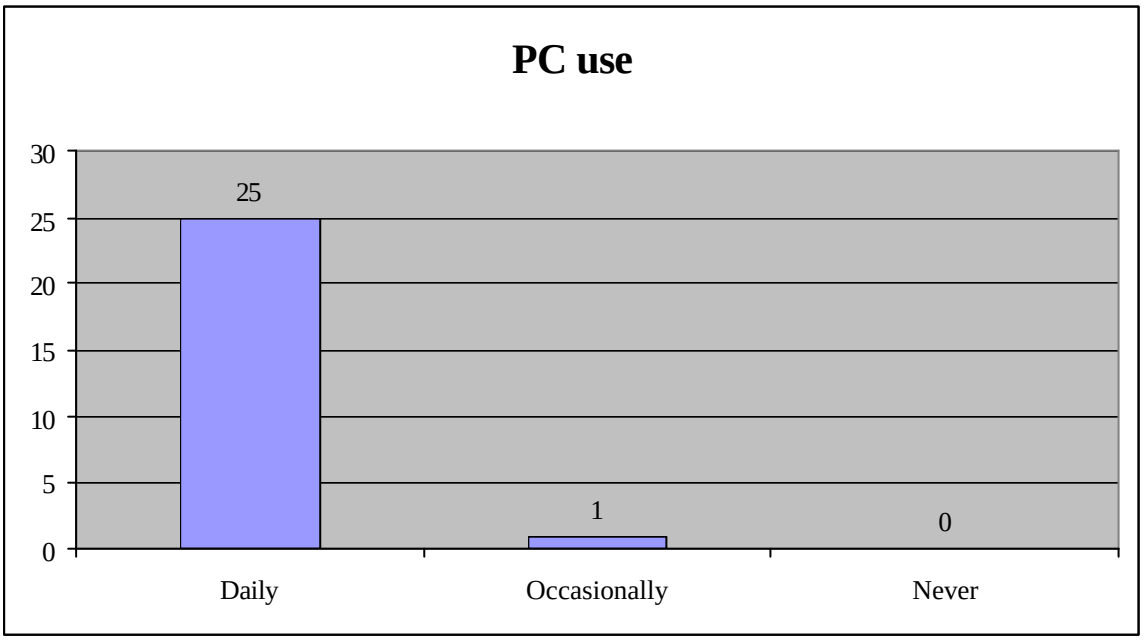
8.2.7 PC use

Table 8-7: PC use

Themes	Selected	Rank
Question 8: Does your job require the use of a PC?		
Daily	25	1
Occasionally	1	2
Never	0	3

Figure 8-7: PC use



To conclude, male and female employees responded to the questionnaire, with age groups varying between twenty-one years and over fifty years of age. Their preferred home language was almost evenly distributed between Afrikaans and English. An even distribution in educational qualifications exists amongst the employees and the main industry types varied between Information Technology, financial services and insurance, with the average years' experience being ten years, twelve years and seven years respectively. The occupation types include all available options, except for network specialist and project manager, which were not selected at all. Lastly, almost

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all the employees' jobs required the daily use of a PC, with the exception of one employee (occasionally).

8.3 Background information

This section provides background information on the employees that responded to the questionnaire with regard to Internet use, e-banking usage, on-line purchasing activities, e-transacting on behalf of their organization and identification, verification and authentication opinions and/or perceptions.

8.3.1 Internet use

This sub-section discusses the employees' Internet use and includes the period for which they have been connected to the Internet, where they connect to the Internet, Internet frequency, the type of Internet activities they conduct, the type of Internet users they consider themselves to be, general concerns they might have with regard to using the Internet and if they have any suggestions on how their Internet concerns can be addressed. The following table summarizes their Internet connectivity options:

Table 8-8: Internet connectivity

Themes	**Selected**	**Rank**
Question 9: How long have you been connected to the Internet?		
Not connected at all	1	2
Less than 3 months	0	3
Between 3 – 12 months	1	2
Between 12 – 36 months	1	2
More than 3 years	23	1

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Figure 8-8: Internet connectivity

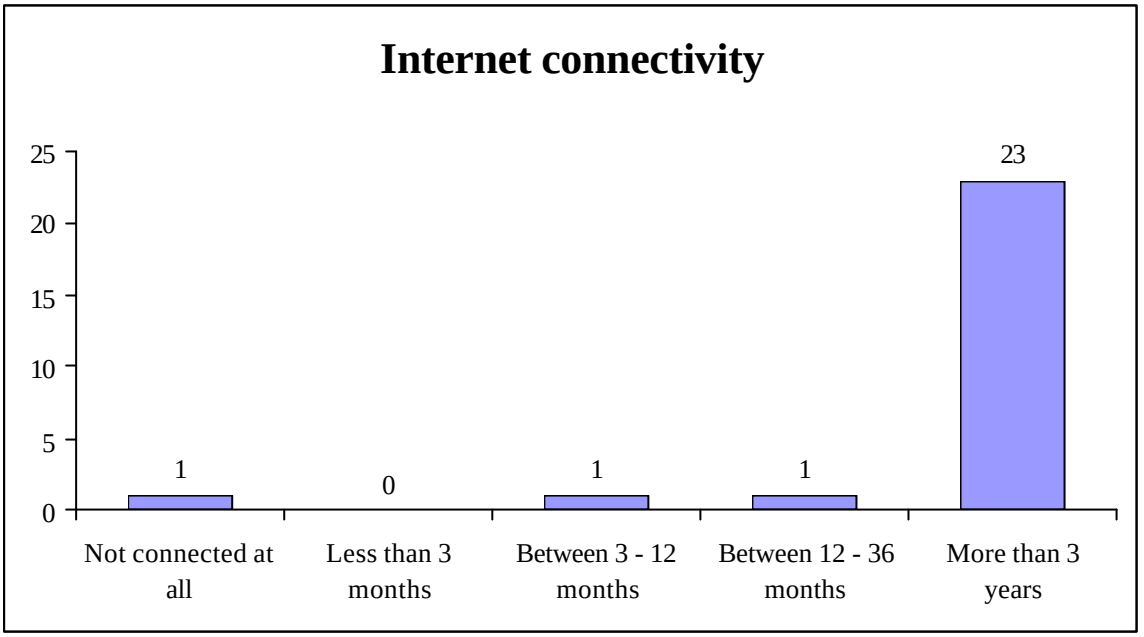

Table 8-9: Internet connectivity – where?

Themes	Selected	Rank
Question 10: Where do you connect to the Internet?		
Not connected at all	1	3
At work	6	2
At home	1	3
At work and home	18	1

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Figure 8-9: Internet connectivity – where?

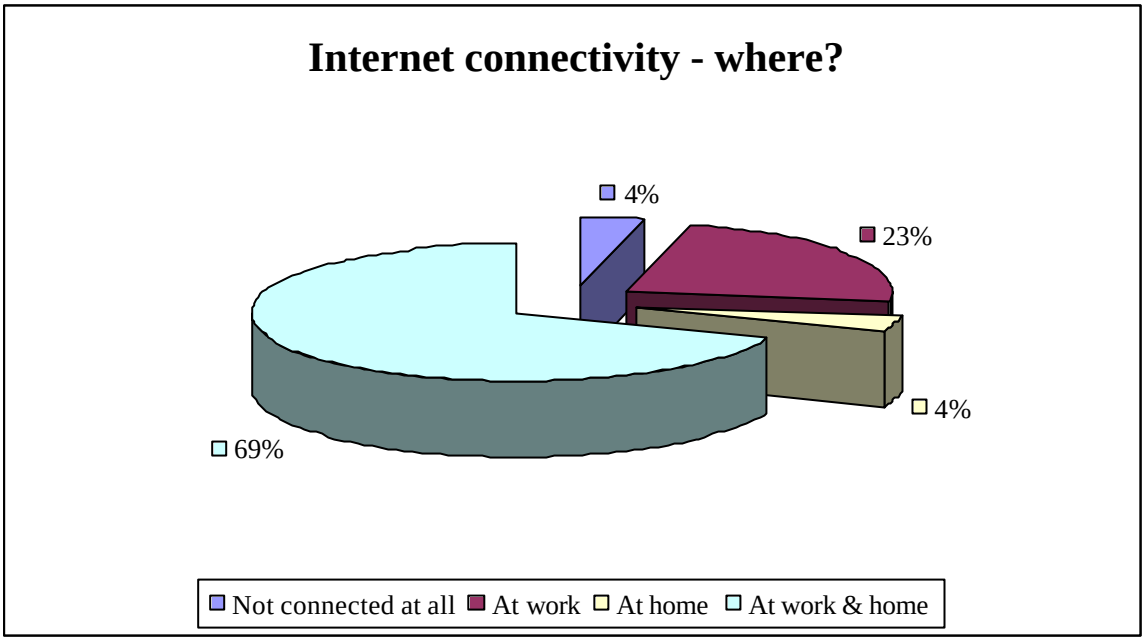

Table 8-10: Internet connectivity frequency

Themes	Selected	Rank
Question 11: How frequently do you use the Internet?		
Regularly	17	1
Occasionally	7	2
Seldom	1	3
Almost never	1	3

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Figure 8-10: Internet connectivity frequency

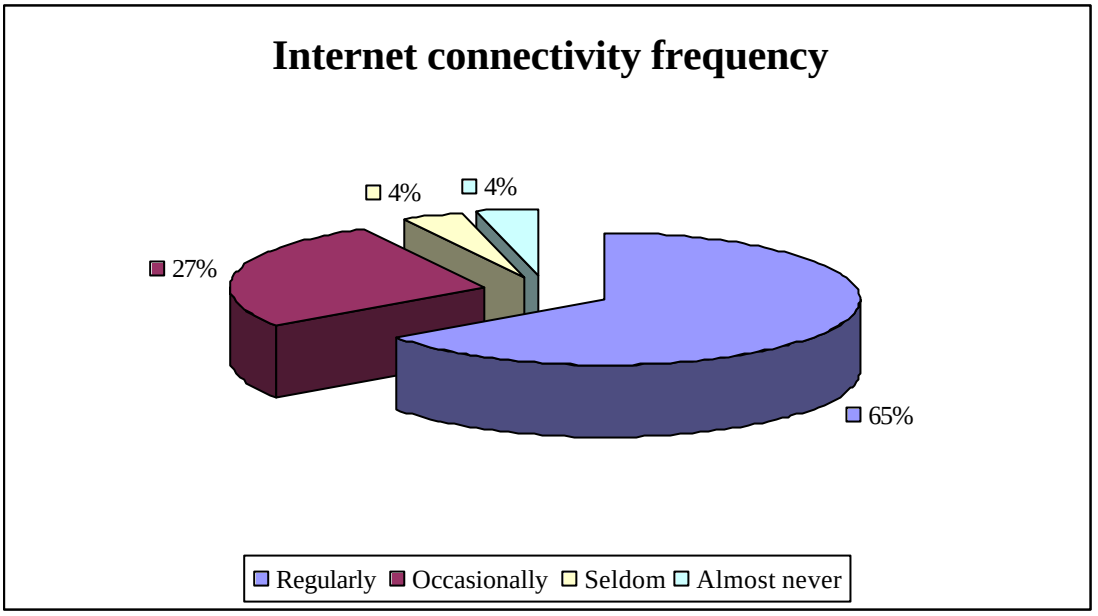

Table 8-11: Internet activities

Themes	Selected	Rank
Question 12: What do you use the Internet for?		
General browsing	18	4
E-mail	21	2
On-line purchasing	10	5
Education/research/gathering information	22	1
Commercial activities e.g. e-banking	20	3
Other	1	6

The employees that participated in the research study questionnaire were asked: "What do you use the Internet for?" and their Internet activities selected are summarized in the following table and illustrated in the following figure. The "other" Internet activity has been listed as on-line gaming.

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Figure 8-11: Internet activities

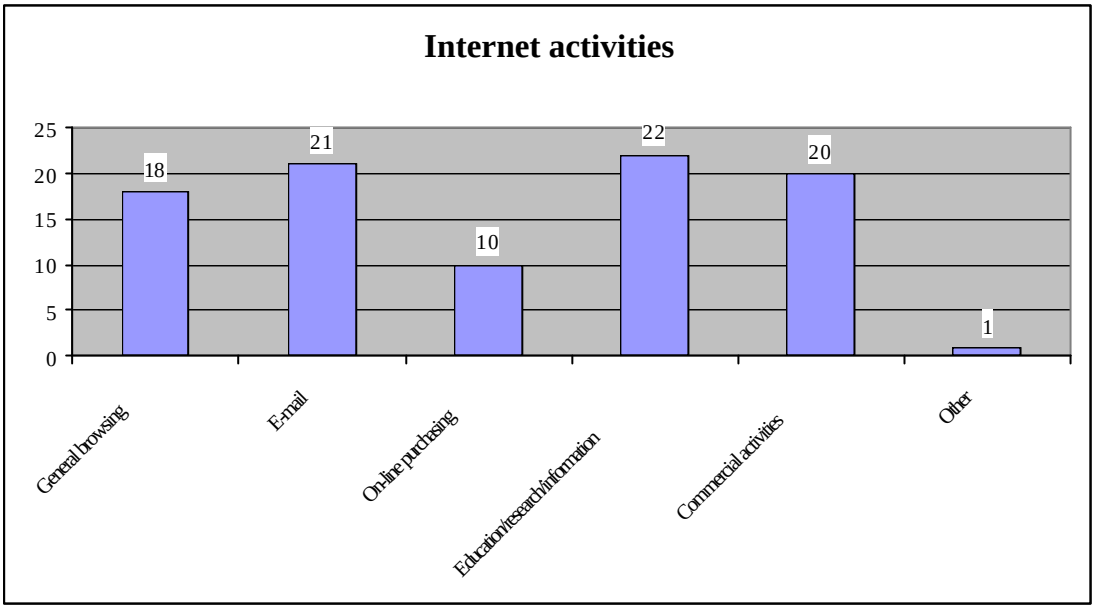

Table 8-12: Internet user type

Themes	Selected	Rank
Question 13: What type of Internet user do you consider yourself to be?		
Expert	8	2
Average	17	1
Novice	1	3

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Figure 8-12: Internet user type

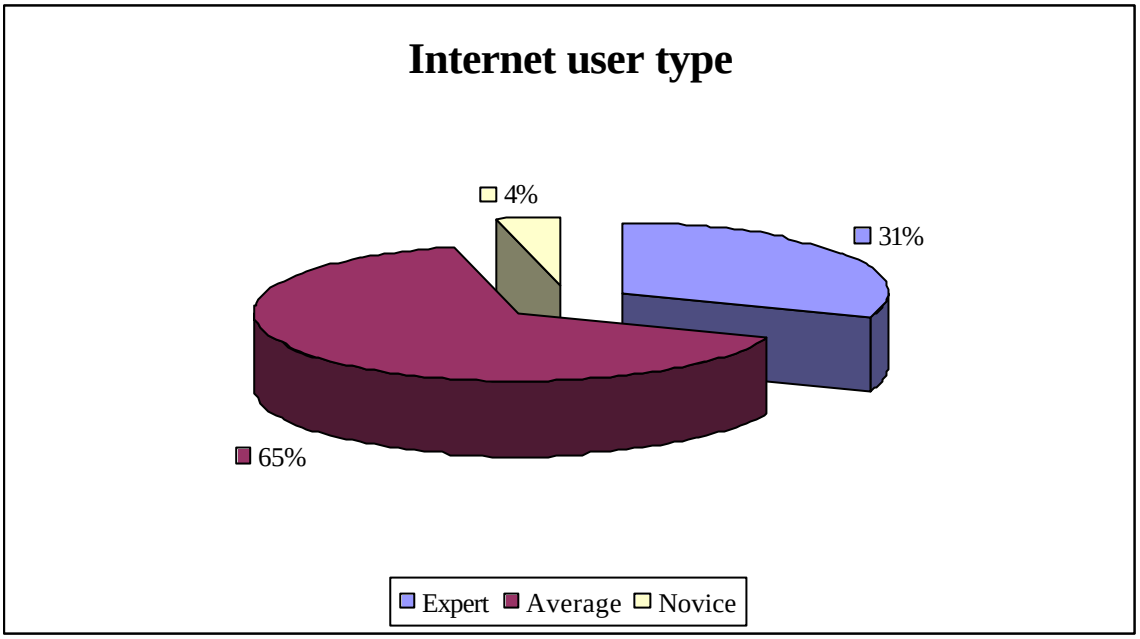

Table 8-13: Internet concerns

Themes	Selected	Rank
Question 14: Do you have any general concerns when using the Internet?		
Trust amongst participants	3	4
Security concerns	15	1
Privacy considerations	13	2
Fraudulent transactions	13	2
Legal implications of transactions	6	3
Customer service	6	3
Other	1	5
None	6	3

The “other” concern has been listed as costs.

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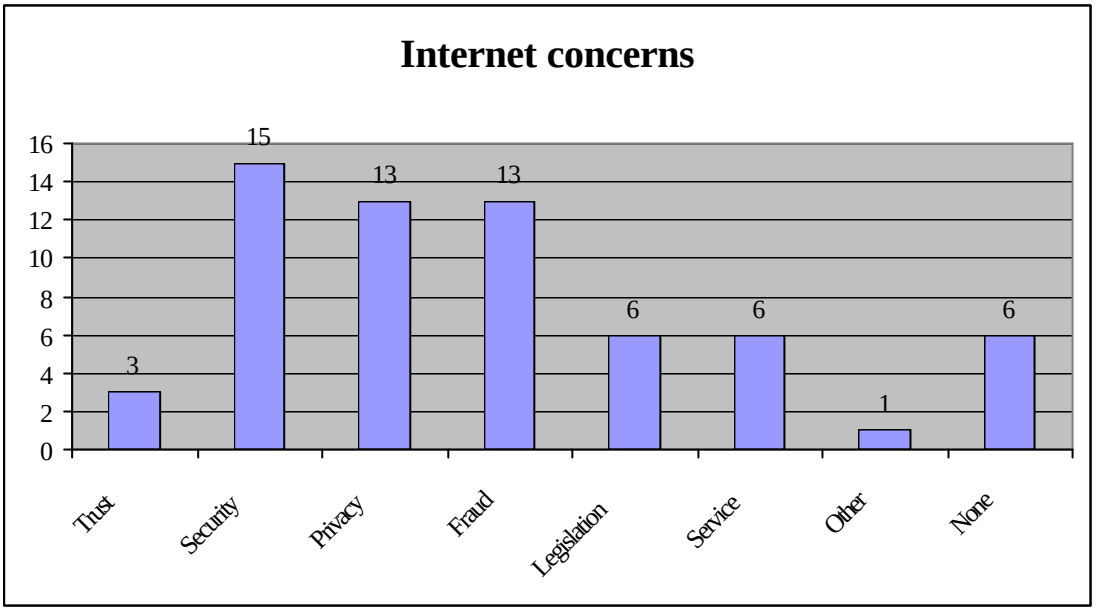
Figure 8-13: Internet concerns



The final question in this section (Question 15) asked: "If you have any concerns related to using the Internet, how in your opinion can they be resolved?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

- Better identification methods – biometric-based digital certificates and encryption using certificate-based PKI is needed, username and password authentication needs to be replaced with another authentication system or method as it is becoming outdated, a secure method of identification is required that is unique and verifiable, secure access via a PKI encryption format to a government or independent international biometrics database would alleviate the trust issues in e-transactions and significantly reduce fraud whilst securing privacy.
- Security improvements – firewall security need to be more strictly applied, better and additional security measures needs to be implemented.
- Educated users – information and training is required.
- Better legislation – managing the Internet through policies, procedures and standards.

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- Customer service improvements – national distributors are needed, as well as a means of complaining/reporting on poor customer service.
- Some employees did not have any idea of how their concerns could be addressed and some even stated that their concerns could never be addressed because hacking will never completely disappear.

To conclude, most of the employees that responded to the questionnaire have been connected to the Internet for more than **three** years. They do so regularly from work and from home and they further consider themselves to be average Internet users. Their most popular Internet activities include using the Internet for educational and/or research and/or gathering information purposes, e-mail, commercial activities e.g. e-banking, general browsing and online purchasing activities. Their Internet concerns include security, privacy, fraud, legislation problems, poor customer service and trust amongst participants. Lastly, the main suggestions that they have for resolving their concerns related to the Internet include better identification methods, improved security measures, educated users, better legislation and customer service improvements.

8.3.2 E-banking usage

This sub-section discusses e-banking usage and includes results on questions whether the employees conduct e-banking, their e-banking frequency, the type of e-banking activities and their e-banking concerns. The employees' e-banking usage is summarized in the following table:

Table 8-14: E-banking usage

Themes	Selected	Rank
Question 16: Do you conduct e-banking?		
Yes	19	1
No	7	2

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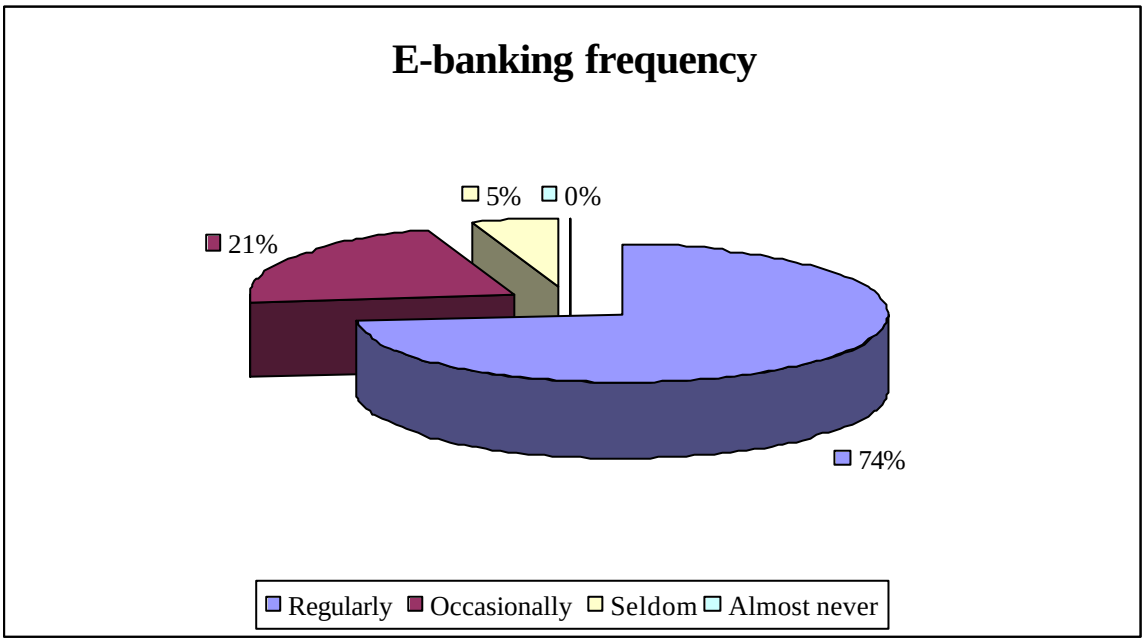
The employees' e-banking frequency is summarized in the following table and figure:

Table 8-15: E-banking frequency

Themes	Selected	Rank
Question 17: How frequently do you use e-banking?		
Regularly	14	1
Occasionally	4	2
Seldom	1	3
Almost never	0	4

Figure 8-14: E-banking frequency



The employees' e-banking activities are summarized in the following table and illustrated below:

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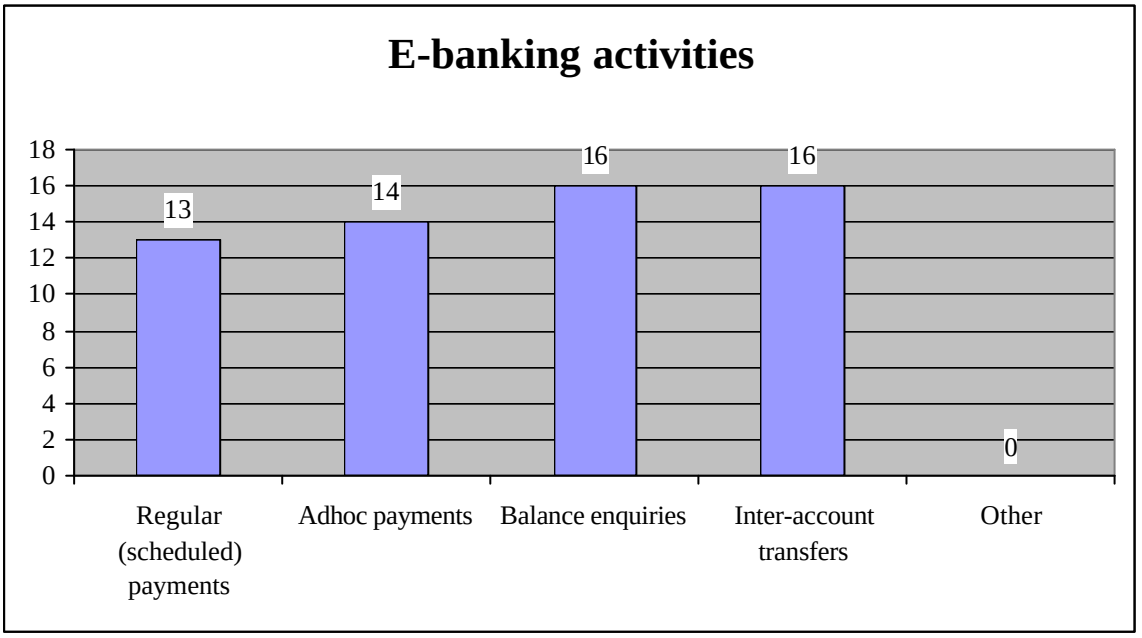
Table 8-16: E-banking activities

Themes	Selected	Rank
Question 18: What do you use e-banking for?		
Regular (scheduled) payments	13	3
Adhoc payments	14	2
Balance enquires	16	1
Inter-account transfers	16	1
Other	0	4

Figure 8-15: E-banking activities



The employees were asked (Question 19): "What are your concerns with regard to e-banking?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

- E-transaction security concerns.
- Information privacy concerns.
- Technology concerns – does the software work, are there any bugs in the system?

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- Security of the actual website – fake front-ends created by hackers to obtain pins and passwords, non-secure data messages on websites.
- It is interesting to note that some employees did not have any e-banking concerns at all.

To conclude, most of the employees are regular e-banking users, whose e-banking activities include balance enquiries, inter-account transfers, adhoc payments and regular (scheduled) payments. Their main concerns with regard to e-banking include e-transaction security, information privacy security, technology concerns and the actual website security.

8.3.3 On-line purchasing activities

This sub-section discusses on-line purchasing activities and includes whether the employees conduct on-line purchasing, their on-line purchasing frequency, the type of on-line purchasing activities they conduct and their on-line purchasing concerns. The employees' on-line purchasing usage is summarized in the following table:

Table 8-17: On-line purchasing usage

Themes	**Selected**	**Rank**
Question 20: Do you purchase items on-line on the Internet?		
Yes	14	1
No	12	2

The employees' on-line purchasing frequency is summarized in the following table and figure:

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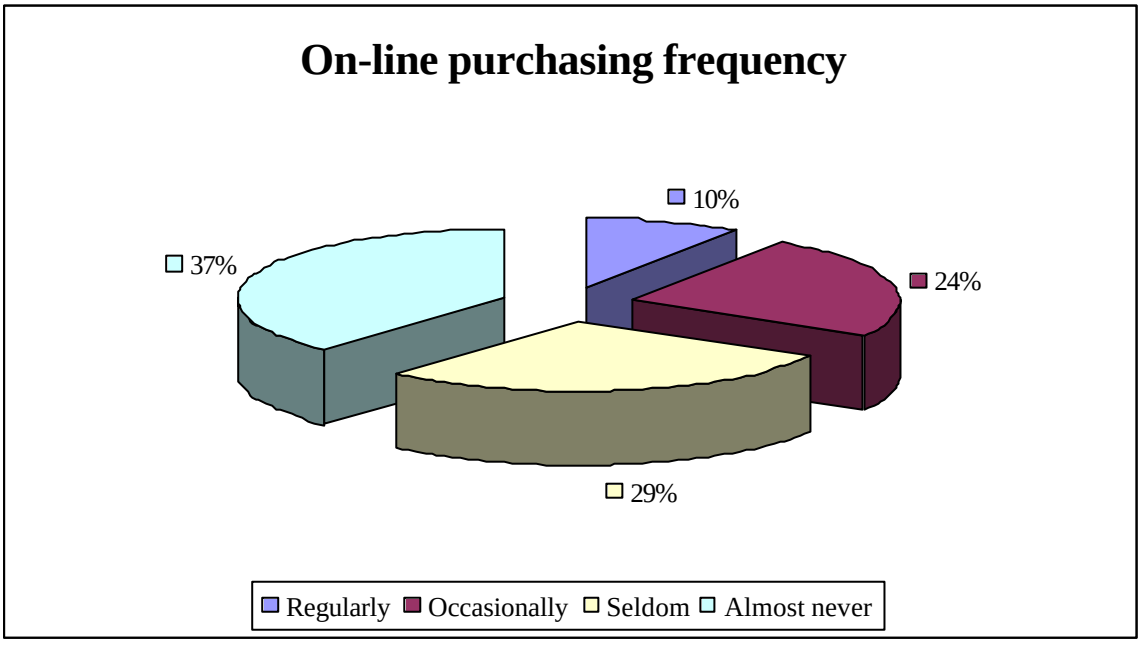
Table 8-18: On-line purchasing frequency

Themes	Selected	Rank
Question 21: How frequently do you use on-line purchasing?		
Regularly	2	4
Occasionally	5	3
Seldom	6	2
Almost never	8	1

Figure 8-16: On-line purchasing frequency



The on-line purchasing activities conducted by the employees are illustrated below. The "other" on-line purchasing activities included buying flowers, entering and paying for cycling events and the purchasing of software.

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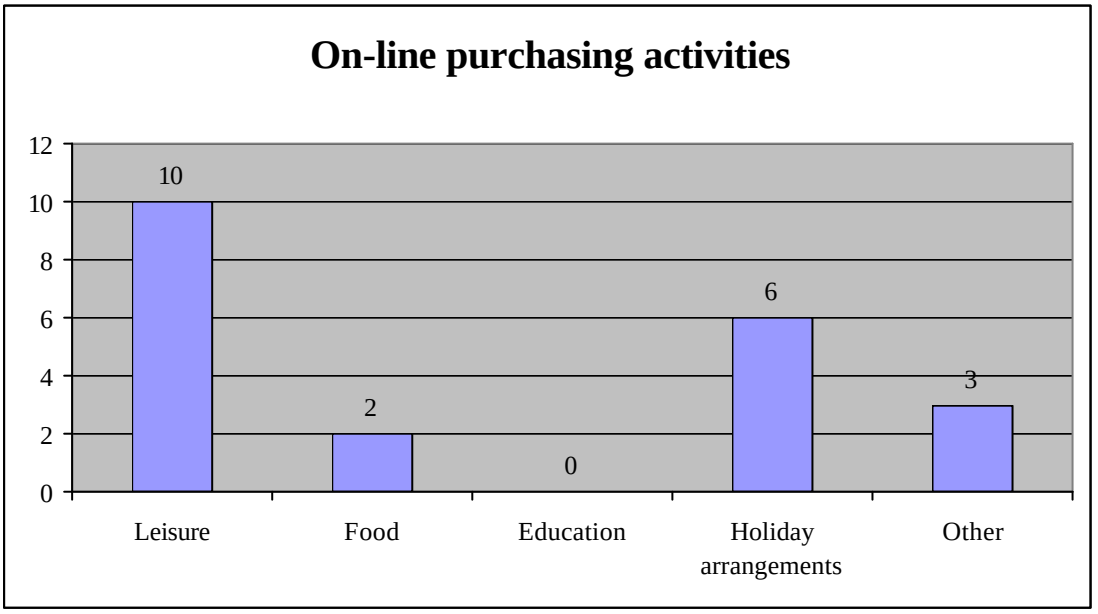
Table 8-19: On-line purchasing activities

Themes	Selected	Rank
Question 22: What type of on-line purchasing do you do?		
Leisure (CDs, books, etc)	10	1
Food	2	4
Education	0	5
Holiday arrangements	6	2
Other	3	3

Figure 8-17: On-line purchasing activities



The employees were asked (Question 23): "What are your concerns with regard to on-line purchasing?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

- The employees mentioned concerns with regard to when their goods would be delivered, the lack of a reliable delivery infrastructure, discrepancies between items ordered and the actual items delivered and no confirmation

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with the bank as to the amount being deducted; in other words, concerns regarding customer service.

- The speed of the actual on-line transaction.
- E-transaction security concerns, including security of banking details.
- Information privacy concerns e.g. spam e-mail and unauthorized use of credit card information
- Trust amongst participants.
- Some employees did not have any concerns at all.

To conclude, most of the employees almost never conduct on-line purchasing activities. Their main on-line purchasing activities include leisure (CDs, books, etc), holiday arrangements and food purchases and their main concerns with regard to on-line purchasing include customer service, the speed of the transaction, e-transaction security, information privacy concerns and trust amongst participants. It was interesting to note that the majority of the employees connect to the Internet and perform e-banking on a regular basis but just over half of the employees almost never perform on-line purchasing activities. This could be because the employees perceive e-banking to be more private and secure than on-line purchasing activities or because even if the security and privacy concerns have been addressed that their customer service concerns will still be unresolved.

8.3.4 E-transacting on behalf of their organization

This sub-section discusses the employees' e-transacting on behalf of their organization and includes whether they conduct e-transacting on behalf of their organization, the frequency of the e-transacting, the nature of the e-transacting activities and their e-transacting concerns.

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Table 8-20: E-transacting

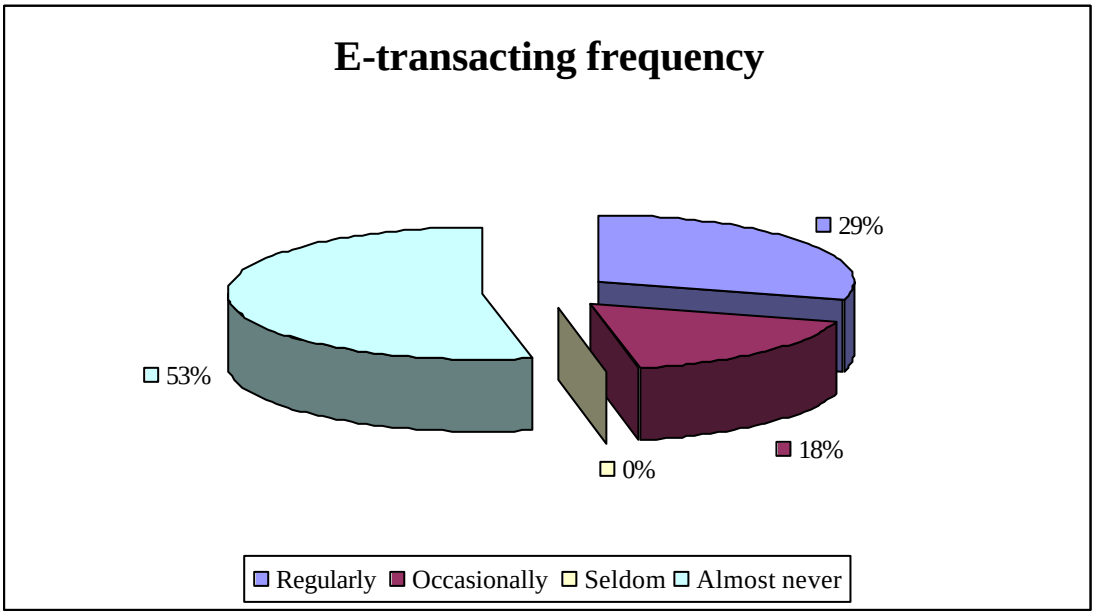
Themes	Selected	Rank
Question 24: Do you conduct e-transactions on behalf of your organization?		
Yes	8	2
No	18	1

The employees' e-transacting frequency is summarized in the following table and figure:

Table 8-21: E-transacting frequency

Themes	Selected	Rank
Question 22: How frequently do you conduct e-transactions on behalf of your organization?		
Regularly	5	2
Occasionally	3	3
Seldom	0	4
Almost never	9	1

Figure 8-18: E-transacting frequency



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The employees were asked (Question 26): "What is the nature of your organization's e-transactions?" The employees' responses are listed from the most to the least mentioned answers to indicate the strength of the themes:

- E-banking (payment/debit order) activities.
- On-line purchasing activities.
- On-line business transactions.
- Training arrangements via the Internet.
- Hardware and/or software purchasing and licensing activities.
- Money management transactions.
- Short-term insurance activities.

The employees were asked (Question 27): "What are your concerns with regard to e-transacting on behalf of your organization?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

- The employees had concerns with regard to when the organization's goods would be delivered.
- E-transaction security concerns.
- Information privacy.
- The speed of the actual on-line transaction; in other words, ease of use.
- Some employees did not have any concerns at all.

To conclude, only a few employees almost never conduct e-transacting on behalf of their organization. The nature of the e-transaction activities include e-banking (payment/debit order) activities, on-line purchasing activities, on-line business transactions, training arrangements via the Internet, hardware and/or software purchasing and licensing activities, money management and short-term insurance activities. Their main concerns with regard to conducting e-transacting on behalf of their organization include customer service, e-transaction security, information privacy and the speed of the actual on-line transaction.

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8.3.5 Identification, verification and authentication

This sub-section provides some insight into how the employees think that transaction security on the Internet should be handled. The employees were given a list of identification methods to select from in order to improve e-transacting and their responses are summarized in the following table and figure:

Table 8-22: Identification methods

Themes	**Selected**	**Rank**
Question 28: Which of the following, in your opinion, will improve transaction security on the Internet?		
User-id and password verification	5	3
User-id, password and PIN verification	10	2
Biometric verification (e.g. fingerprint verification, retinal scanning, iris scanning, face recognition, voice recognition and signature verification)	15	1
Digital certification	10	2
Encrypted data transfer	15	1
Legislation (ECT Act.)	4	4
Information availability of the participants	3	5
Other	0	7
None	1	6

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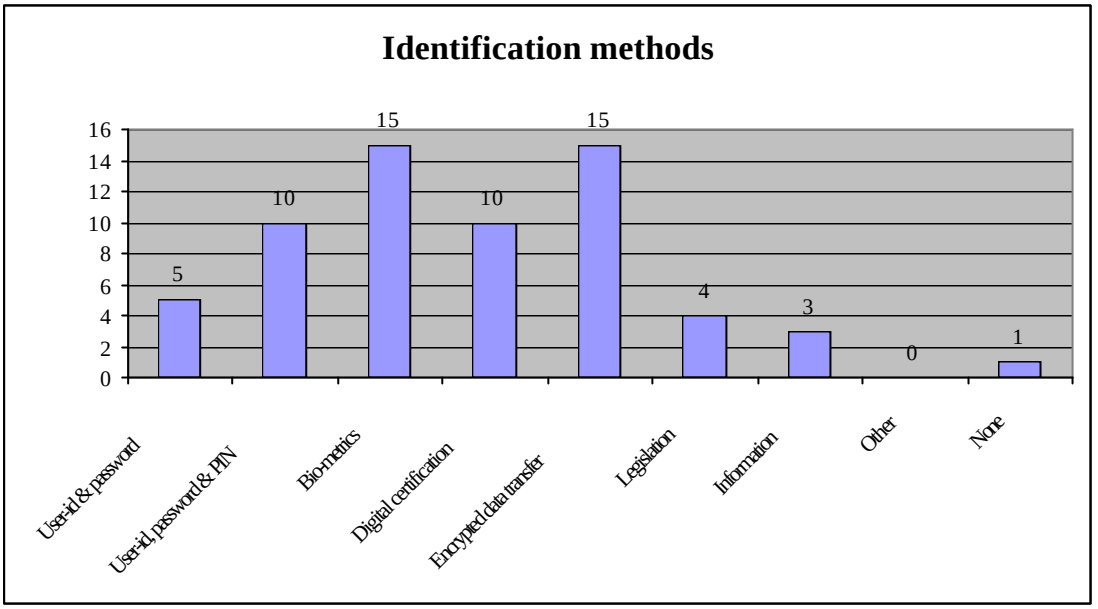
Figure 8-19: Identification methods



It is interesting to note that one employee said that none of the above means would improve his or her Internet security concerns, because hacking will never completely disappear.

The employees were asked (Question 29): "Do you think that user identification and verification are important in Electronic Business?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

- Better identification will lead to proper accountability; in other words, trust will be built amongst the participants in Electronic Business, which will lead to the protection of clients and business information.
- Security will be improved, but needs to be combined with data encryption, authorization and verification.
- It can be used to obtain information (MIS – Management Information Systems) by means of an audit trail.

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A final interesting comment included *"Ensuring users that their data is protected will encourage them to make further use of the Internet and will allow Electronic Commerce to grow and be more widely utilized".*

Lastly, they were asked (Question 30): "Do you think that traditional identification methods such as user-id, password, and PIN verification are sufficient and if they are adequate for future use in business transactions over the Internet?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

1. **Yes – traditional identification methods are sufficient**
   - The combination of user-id, password and PIN should be adequate.
   - It takes up to **three** years to "hack" an eight-digit password.

2. **No – traditional identification methods are not sufficient**
   - Better identification methods are needed – biometrics should be introduced as a norm; security measures should always be changed to pre-empt the misuse, more is needed than just a user-id, password and PIN; traditional identification methods only ensure that the individual entering the information knows the information and does not verify the individual; and due to the increase in cyber crime more innovative and secure methods of verification are needed to ensure that Internet users do not become victims of cyber crime. Individuals who become victims of cyber crime are more likely to stop using the Internet and this will cause more businesses to withdraw their web-sites due to lack of customers willing to utilize the Internet facility.
   - Improved security together with data encryption is needed to counteract fraud and to protect private information.
   - Traditional identification methods are outdated and unreliable and need to be improved.

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3. **Uncertain**
   - More information is needed on the advantages and disadvantages of traditional identification methods before a decision can be made.

To conclude, biometric verification and encrypted data transfer are seen as the most reliable means of identification in order for Internet security to be improved. All the employees stated that identification and verification are important in Electronic Business in order to build trust amongst participants, provide a better audit trail and encourage users to make further use of the Internet. Most of the employees stated that traditional identification methods are not sufficient to address their concerns.

8.4 What concepts do users have of what biometrics can do?

The research study questionnaire contained a question on the knowledge that the employees have about biometrics, as well as asking what type of information they would like to receive before starting to use biometrics as an identification method. The employees' responses are summarized in the following table:

Table 8-23: Biometric knowledge

Themes	Selected	Rank
Question 31: Do you have any knowledge about biometric methods (e.g. fingerprint verification, retinal scanning, iris scanning, face recognition, voice recognition and signature verification)?		
Basic	13	1
Average	7	2
Good	3	3
Expert	0	5
None	2	4

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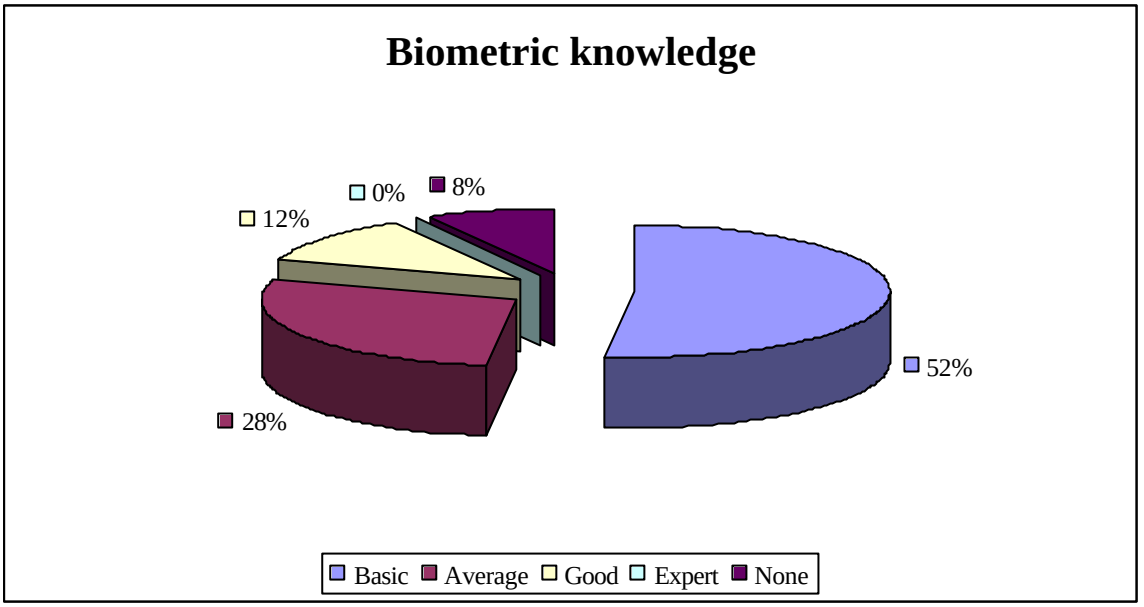
Figure 8-20: Biometric knowledge



With regard to the question (Question 37): "What type of information would you like to receive before starting to use biometrics as an identification system?" The employee's responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

- Background information on biometrics.
- Advantages and disadvantages of the biometric identification method.
- User guide on the use of the biometric identification method.
- Results from comparable sites, users and case studies conducted.
- Technical specifications on the scanning equipment and comparison techniques used as part of the biometric identification method.
- Database information – where the biometric data is stored, the security of the system storing the biometric data, the security of the path getting it to the database and who has access to the biometric database.
- Costs involved in implementing a biometric identification system.
- Support service and maintenance available as part of the biometric identification system.
- How secure it really is and how the security works.
- Privacy protection on the biometric data.

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- Legal implications – a guarantee that the biometric data is secure and private, with full legal recourse against offending parties.
- Future improvements and enhancements planned for biometric identification methods.

8.5 How do users respond to biometrics?

The results of the research study's questionnaire show that when the employees were asked (Question 32): "How would you feel about making use of biometrics as a possible means of identification?" Their responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

1. Positive attitude

- Biometrics as a possible means of identification will satisfy their security concerns.
- Biometrics will ensure that only authorized users gain access to certain information.
- Biometrics is a good idea because a user's identity cannot be re-produced by someone else – uniqueness.
- Biometrics is a more workable solution than traditional identification methods because it is easier to use.
- The cost of implementing biometrics as an identification system will have to be controlled.
- The use of biometrics as a possible means of identification will provide more confidence in the security of on-line transactions; in other words, trust amongst participants within Electronic Business.

2. Negative attitude

- The employees will only start to use biometrics as a possible means of identification if the technology regarding it improves and
- They need to know whether it has been in practice long enough to smooth out security issues.

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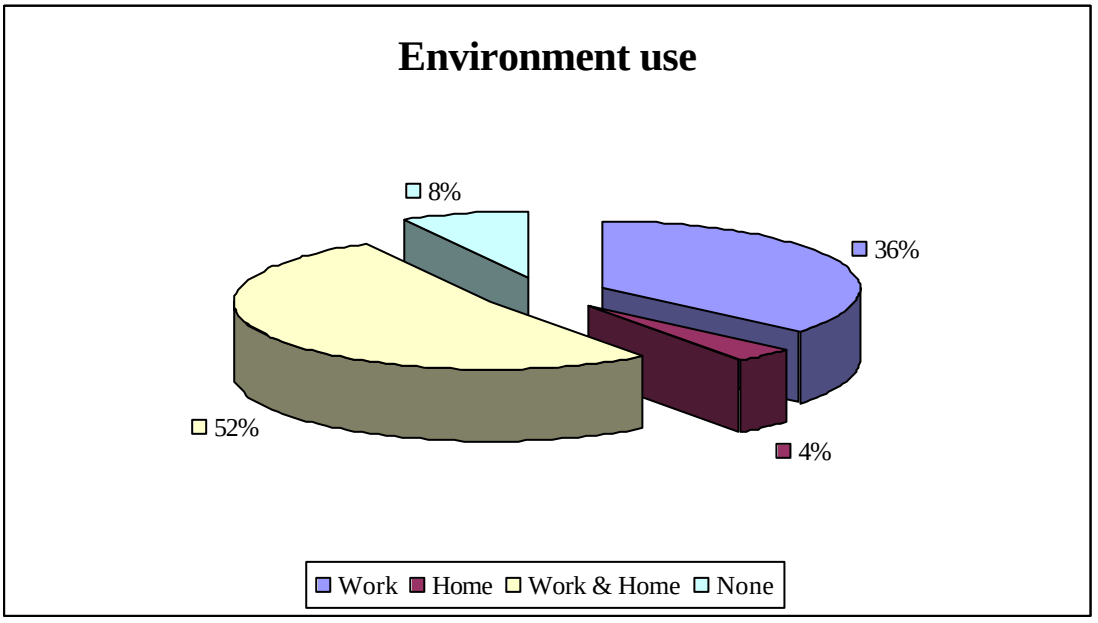
- They see it as an invasion of their privacy.
- Biometrics creates a feeling of "big brother is watching you".
- Some even felt that additional security is not needed at all.

The results, which further indicated that the employees differentiate between using a biometric identification system in different environments, are summarized in the following table and figure:

Table 8-24: Environment use

Themes	Selected	Rank
Question 34 and 35: Would you feel more comfortable using biometrics solely in a work or home environment, or rather in a home and work environment?		
Work	9	2
Home	1	4
Work and home	13	1
None	2	3

Figure 8-21: Environment use



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8.6 Do users respond differently to different kinds of biometrics?

The employees were asked (Question 33): "Would your feeling differ depending on the type of biometrics used as an identification method?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

1. No – they would not feel different

- Any types of biometric identification method should be sufficient, as long as it is a proven safe method and cannot cause physical harm to the individual.
- As long as the biometric identification method is easy to use.

2. Yes – they would feel different

- Fingerprint verification – should be adequate enough.
- Voice recognition – is it my voice or a tape recorder?
- Signature verification – is outdated and could differ each time.
- Retinal or iris scanning – perhaps in a few years from now.
- The less intrusive method of all should be used so that it would not feel as if their privacy was being invaded.

The employees were asked to rate certain biometric identification methods in order of precedence. The following table and figure summarize the results:

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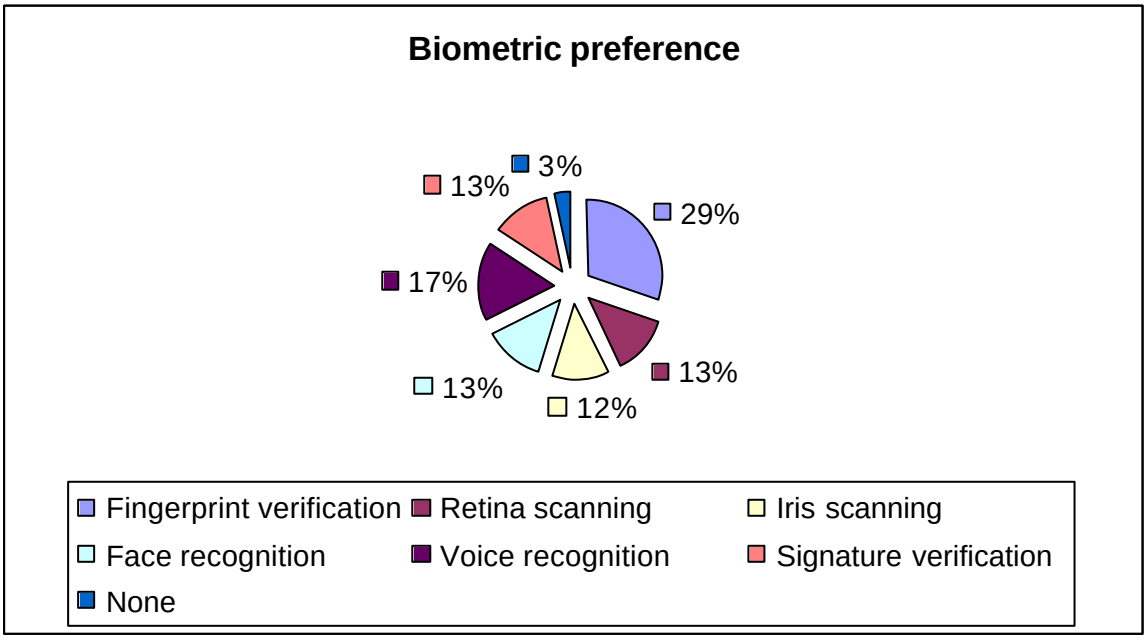
Table 8-25: Biometric identification

Themes	Selected	Rank
Question 36: Would you prefer a certain biometric identification method above another (Rate in order of precedence)?		
Fingerprint verification	120	1
Retinal scanning	50	4
Iris scanning	46	5
Face recognition	51	3
Voice recognition	67	2
Signature verification	50	4
None	13	6

Figure 8-22: Biometric identification



8.7 Why do users respond to biometrics in the way they do?

The research study questionnaire tried to establish if a biometric identification system would address employees' concerns with regard to e-transacting over the Internet, by presenting the following questions to them:

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1. **Would biometric identification reduce your concerns with regard to e-transacting on the Internet?**

Table 8-26: Reduce concerns

Themes	Selected	Rank
Question 39: Would biometric identification reduce your concerns with regard to e-transacting on the Internet?		
Yes	19	1
No	6	2

2. **How would biometric identification address your concerns with regard to e-transacting on the Internet** (Question 40)**?** The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

Yes – it would address the concerns

- Security – biometric identification would provide additional e-transacting security; it would prevent fraudulent transactions and provide additional protection against hacking; some employees stated that they would not have any more security concerns at all.
- Trust – identification and verification would increase trust and the participants would be more certain that they are communicating with the correct participant on the other side.
- Privacy – it would ensure that no one can trade or act on your behalf.
- It should be combined with digital certification.

No – it would not address the concerns

- Biometric identification takes too long.
- Biometric identification will impact on Internet bandwidth.
- Biometric identification results in additional costs.
- Biometric identification requires additional software to be installed.
- Biometric identification is seen as an invasion of privacy.

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- Biometric identification should be used together with some other means of identification as well.

3. **Are there any concerns that will not be addressed by biometric identification within Electronic Business** (Question 41)**?** The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:
   - Customer service can still not be guaranteed, together with a guaranteed delivery of goods.
   - When re-direction takes place and the credit card number becomes known it could still be used on another site not using biometrics.
   - The accuracy of data is seemingly a problem.
   - The implementation of new technology could lead to new, different type of problems.

8.8 Why would users adopt biometrics?

The research study tried to establish if the employees realize that biometrics could provide additional benefits to them by asking (Question 38): "Do you think that a biometric identification system combined with Electronic Commerce could provide additional benefits to you as a user?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

1. **Yes – it would**
   - Increased security would definitely provide additional benefits.
   - It would improve trust within Electronic Business.
   - Fraud and cyber crime would be reduced.
   - Biometric identification improves ease of use, as a user-id, password and/or PIN need not be remembered, and it provides a single login to multiple systems.
   - It would hamper identity theft and reliance on "losable" identity documents, passwords and PINs.

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- User privacy would be protected, as biometric methods make it harder for criminals to obtain confidential and private information from the user.
- It provides a unique identification that could be used to ensure that the individual who purchased something on the Internet is the same individual collecting that item from the deliverer.

2. No – it would not

- The speed of the verification process would hamper acceptance and implementation of biometrics as an identification system.
- Hacking will always take place.

The research study questionnaire tried to obtain **two** views on factors that would prevent user adoption of biometrics and factors that would motivate user adoption of biometrics, one from a user perspective and one from a developer/implementation perspective related to biometrics.

8.8.1 User perspective

The employees were first asked (Question 42): "Which factors would prevent you, as an individual, from adopting biometrics as an identification system?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

- Speed – the speed of the verification process could be time consuming and possibly impact on productivity.
- Ease of use – the process could possibly be too complicated and difficult to use.
- Invasion of privacy – access to security of biometric data without the user's consent.
- Ignorance and the lack of available information.
- Security – security of the system and the security of the database where the biometric information will be kept.

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- Biometric identification system cost implications for the user.
- Reliability of the biometric identification system.
- Lack of trust.
- Personal dislike.

Lastly, they were asked (Question 43): "Which factors would motivate you, as an individual, to adopt biometrics as an identification system?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

- Security – quest for protection and safety, the assurance that biometrics cannot be reproduced, prevention of fraudulent transactions.
- Ease of use – simplicity of the biometric identification system.
- Marketing – positive information on the use of biometrics.
- True identification and verification.
- The protection of privacy – spam e-mail.
- Cost efficiency.
- Proven benefits based on cost and security.
- Freedom of choice – the option to select which means of identification the user prefers and having all options available on all websites.
- Some employees even stated that perhaps it should be a forced adoption process.

8.8.2 Developer/implementation perspective

The employees were first asked (Question 46): "Which factors, in your opinion, would prevent an organization from implementing biometrics as an identification system?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

- Costs – hardware and software costs and unrealistic pricing.
- Information – not being aware of the technology or its benefits, lack of knowledge on biometrics as an identification system.

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- Rollout procedures – complex structures where biometrics needs to be implemented, organization size, the duration of implementing biometrics as an identification system, cumbersome and longwinded implementation process being required.
- Training requirements and difficulties.
- Ease of use.
- Support and maintenance options.
- Invasion of privacy.
- Speed of the verification process.
- Reliability of the biometric identification system.
- User adoption and perception problems associated with the implementation of new technologies.

Lastly, they were asked (Question 47): "Which factors, in your opinion, would motivate an organization to implement biometrics as an identification system?" The employees' responses are listed from the most to the least mentioned answers to indicate the strengths of the themes:

- Security – peace of mind offering to clients, prevention of cyber crime, safety improvements, prevention of unauthorized access, increase security of user data.
- Business reason – to obtain a competitive advantage in the marketplace, "everybody does it so we have to do it too".
- Costs – cost savings in the long run, cost effectiveness and reasonable pricing.
- MIS (Management Information Systems) – proper statistics can be made available.
- Legislation – biometrics as an identification system becoming the norm in the country and universal acceptance by fellow organizations.
- Ease of use – quick and easy to use.
- Speed – high-speed verification process.
- System integration possibilities.

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- Sufficient information availability.

8.9 Conclusion

It was concluded in this chapter, **Chapter 8 – User response to biometrics**, that most of the employees that responded to the questionnaire related to Internet/e-banking/on-line purchasing and conducting e-transacting on behalf of their organization had concerns related to e-transacting security, information privacy concerns, fraud, legislation problems, trust amongst participants, the actual website security, technology concerns e.g. the speed of the e-transaction and poor customer service. The employees further suggested that their concerns could be addressed by means of better identification methods, improved security measures, educated users, better legislation and customer service improvements. All the employees stated that identification and verification are important within Electronic Business and stated that traditional identification methods are not sufficient to address their concerns. They identified biometrics verification and encrypted data transfer as the most reliable means of identification within Electronic Business.

The employees only had a basic knowledge of biometrics and expressed the need to know more about biometric identification in general and for more detailed information on the specific biometric identification method in question. Most of the employees had a positive attitude towards biometrics as a possible means of identification and felt that it could be successfully implemented in both a work and a home environment. They identified fingerprint verification as their preferred biometric identification method and felt that biometric identification would definitely reduce their concerns with regard to e-transacting on the Internet through additional security, better privacy protection and the building of trust amongst participants within Electronic Business. Their only major concern that would not be addressed by biometric identification was customer service and they mentioned that the implementation of new technology would yet again lead to new, different type

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of problems that will have to be addressed. However only time would tell what these problems would be.

From a user perspective, the same factors would prevent/motivate individuals to adopt biometrics as an identification system e.g. a lack of information would prevent them from making use of a biometric identification system because they do not realize what it is capable of, but on the other hand, if they have the necessary information available to them that explains the advantages of a biometric identification system, it would probably motivate them to adopt such a system. From a developer/implementation perspective, the same factors would prevent/motivate organizations to adopt biometrics as an identification system e.g. their perceptions related to the ease of use of a biometrics system would prevent them from using it, but if they could see that it is in fact easy to use, it would actually motivate them to make use of a biometric identification system. It was interesting to note that the speed of the verification process is perceived by the users as being slow, but as being fast from a developer/implementation perspective.

Lastly, the research results indicated that in order to achieve success with the implementation of biometrics as an identification system, issues such as user perceptions related to ease of use (user friendliness), privacy (including data security and the protection of user rights), the performance of the technology, information availability and costs need to be considered.

This chapter, by means of a research study questionnaire, provided some insight into user perceptions related to biometric identification methods and established whether their concerns would be addressed by means of such methods. This chapter has therefore, addressed the research questions:

- 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?

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- Why do users respond to biometrics in the way they do?
- Why would users adopt biometrics?

Chapter 9 forms part of the exploratory field study section of the research study, and will address the final research questions defined through Roode's (1993) process-based research framework for Information Systems.

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