

















































































































































































Table 34:Competitive Pressure Item Statistics

Scale Items	Mean	Std. Deviation	N
ECP1	2.68	1.249	28
ECP2	2.50	.962	28
ECP3	2.11	.956	28
ECP4	3.54	1.071	28

Table 35:Competitive Pressure Item-Total Statistics

Scale Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
ECP1	8.14	5.312	.776	.619	.657
ECP2	8.32	6.745	.734	.580	.695
ECP3	8.71	7.397	.582	.463	.763
ECP4	7.29	7.767	.406	.242	.843

For the Vendor Support scale, Table 35 shows that EVS1 had a mean value of 3.50 and Table 36 showed that the Cronbach's Alpha value would be .893 if deleted. Therefore, EVS1 was dropped at this stage of the analysis. See Table 36 and 37.

Table 36: Vendor Support Item Statistics – No.1

Scale Items	Mean	Std. Deviation	N
EVS1	3.50	.984	32
EVS2	2.88	1.040	32
EVS3	3.06	1.162	32
EVS4	3.09	1.201	32

Table 37: Vendor Support Item – Total Statistics – No.1

Scale Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
EVS1	9.03	9.580	.514	.269	.893
EVS2	9.66	8.684	.638	.414	.850
EVS3	9.47	7.096	.845	.891	.762
EVS4	9.44	6.835	.860	.895	.754

The test was performed again with only three items (EVS2, EVS3 and EVS) of the Vendor Support scale. EVS2 had a low mean statistic of 2.88 and the Cronbach's Alpha value would be .970 if the item was deleted. Thus, EVS2 was dropped at this stage of the analysis. See Table 38 and 39 respectively.

Table 38:Vendor Support Item Statistics – No.2

Scale Items	Mean	Std. Deviation	N
EVS2	2.88	1.040	32
EVS3	3.06	1.162	32
EVS4	3.09	1.201	32

Table 39:Vendor Support Item Total Statistics – No.2

Scale Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
EVS2	6.16	5.426	.634	.403	.970
EVS3	5.97	4.096	.879	.891	.768
EVS4	5.94	3.931	.883	.893	.763

After deletion of these items from the analysis, reliability tests were performed again on Security Concern, Compatibility, Top Management Support, Competitive Pressure and Vendor Support scale items.

Table 40 presents a summary of the results of the scales which exceeded the acceptable Cronbach's Alpha value of 0.7.

Table 40: Cronbach's Alpha table per scale

Scale	No. of items	Valid Cases	Excluded Cases	Total Cases	Cronbach's Alpha
Relative Advantage	5	52	7	59	.872
Compatibility	2	5	54	59	.824
Security Concern	4	57	2	59	.801
Top Management Support	2	5	54	59	.961
Organization Readiness	3	54	5	59	.867
Competitive Pressure	3	28	31	59	.843
Vendor Support	2	32	27	59	.970

#### 4.6.2 Factor Analysis (Validity)

Principal component factor analysis was performed on the scale items to validate the study's constructs using SPSS (version 19). The principal component analysis (PCA) extraction method was used to extract the components of the study. Prior to carrying out factor analysis, analysis of the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity values were evaluated, as well as communalities and factor-loading values to verify that the sample size was adequate to perform factor analysis. Factor analysis was performed twice, first with scale items related to two or all groups of participants, second with scale items related to one group only (the Principal Network Controllers).

KMO and Bartlett's significance tests were conducted for all scale items of Relative Advantage, Security Concern, Organization Readiness, Competitive Pressure and Vendor Support. The KMO sampling value was 0.678 and the Bartlett's test of sphericity significance value had a value of  $p < 0.001$ . The KMO value was at the acceptable level of 0.6 and the Bartlett's test of Sphericity was significant at the 0.001 level. See Table 41.

Table 41: KMO and Bartlett's Test

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.687
Bartlett's Test of Sphericity	Approx. Chi-Square	257.349
	df	153
	Sig.	.000

According to Dr. Field (2005), Kaiser recommends accepting values greater than 0.5 as acceptable. In addition to the KMO and Bartlett's significance values, the Communalities of the scale items had values of 0.6 and above, except for two scale items (TRA4:0.576 & TRA5:0.516) in Relative Advantage and one scale item (TS5:0.566) in Security Concern. See Table 42 below.

Table 42: Communalities

<b>Communalities</b>		
Scale Items	Initial	Extraction
TRA1	1.000	.765
TRA2	1.000	.860
TRA3	1.000	.753
TRA4	1.000	.576
TRA5	1.000	.516
TS2	1.000	.692
TS3	1.000	.840
TS4	1.000	.699
TS5	1.000	.566
OOR1	1.000	.882
OOR2	1.000	.879
OOR3	1.000	.674
ECP1	1.000	.808
ECP2	1.000	.806
ECP3	1.000	.780
EVS3	1.000	.941
EVS4	1.000	.965
Extraction Method: Principal Component Analysis.		

According to Kinuthia [74], performing factor analysis can be justified if the communalities value of the items is more than 0.6 or the average communalities of the scale items is 0.7. The average communalities of Relative Advantage and Security Concern were 0.7 and communalities of all other scale items were 0.6 and above. Therefore, it was justifiable and deemed adequate to conduct factor analysis for this study.

Varimax with the Kaiser Normalization rotation method was used to obtain factor loadings for the scale items. Items are considered practically significant if they load higher than 0.5. Most items had loadings higher than 0.5 and above. TS5 had the lowest factor loading of 0.566. The items were extracted and loaded into five components as expected. Table 43 presents the factor loadings of the items and the rotated components.

Table 43: Rotated Component Matrix

Rotated Component Matrix <sup>a</sup>					
	Component				
	1	2	3	4	5
TRA2	.875				
TRA1	.849				
TRA3	.845				
TRA5	.712				
TRA4	.669				
TS3		.910			
TS2		.803			
TS4		.795			
TS5	.355	.566			
OOR1			.926		
OOR2			.911		
OOR3	.316		.696		
ECP3				.872	
ECP1				.857	
ECP2				.855	
EVS4					.951
EVS3					.947
Extraction Method: Principal Component Analysis.					
Rotation Method: Varimax with Kaiser Normalization.					
a. Rotation converged in 5 iterations.					

Another analysis of these measures (KMO and Bartlett’s significance) was conducted separately for scale items of Compatibility and Top Management Support as these scale items were related to only one group (Principal Network Controllers) of participants with a sample size of five and had to be treated separately. The scale items of these two constructs were overlapping as these items loaded into the same component. See Table 44 for Component Matrix results of these two item scales.

Table 44: Component Matrix – TMS and Compatibility

<b>Component Matrix<sup>a</sup></b>	
	Component
	1
OTM3	.984
TC2	.968
OTM2	.963
TC3	.845
Extraction Method: Principal Component Analysis.	
a. 1 component extracted.	

The factor loading for OTM3 was higher at 0.984, followed by TC2 at 0.968 and OTM2 with 0.963, TC3 had the lowest loading among the three scale items with a value of 0.845. Thus, TC3 was dropped from the analysis. The top three items (OTM3, TC2 and OTM2) were constructed into one construct: Top Management Support. The KMO value of these scale items was 0.769 and the Bartlett’s test of sphericity was at a significance level of  $p < 0.05$ . Table 45 presents these results.

Table 45: KMO and Bartlett's Test – TMS and Compatibility

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.769
Bartlett's Test of Sphericity	Approx. Chi-Square	11.114
	Df	3
	Sig.	.011

The KMO measure of sampling statistic was acceptable and the Bartlett’s test of sphericity statistic was significant to conduct factor analysis. In addition, the communalities measure of the scale items exceeded the acceptable value of 0.6. It was therefore justifiable and adequate

to perform factor analysis in this study. The solution was not rotated because only one component was extracted.

Table 46 provides a summary of the factor analysis results for six constructs (Relative Advantage, Security Concern, Top Management Support, Organization Readiness, Competitive Pressure and Vendor Support).

Table 46: Factor Analysis

Scale Items	Components						Communalities
	Rotated Component Matrix					Component Matrix	
	Relative Advantage	Security Concern	Organization Readiness	Competitive Pressure	Vendor Support	Top Management Support	
TRA2	.875						.765
TRA1	.849						.860
TRA3	.845						.753
TRA5	.712						.576
TRA4	.669						.516
TS3		.910					.692
TS2		.803					.840
TS4		.795					.699
TS5		.566					.566
OOR1			.926				.882
OOR2			.911				.879
OOR3			.696				.674
ECP3				.872			.808
ECP1				.857			.806
ECP2				.855			.780
EVS4					.951		.941
EVS3					.947		.965
TC2						.989	.979
OTM2						.982	.965
OTM3						.980	.960
<b>Eigenvalue</b>	4.463	3.136	2.235	1.825	1.342	2.904	
<b>% of Variance</b>	26.253	18.448	13.146	10.737	7.895	96.791	
<b>Cumulative %</b>	26.253	44.701	57.847	68.584	76.478	96.791	
TRA= Relative Advantage; TS= Security Concern; OOR=Organization Readiness; OTM=Top Management Support; ECP=Competitive Pressure; EVS=Vendor Support							

### 4.6.3 Descriptive Statistics

Descriptive statistics of the computed Relative Advantage, Security Concern, Top Management Support, Organization Readiness, Competitive Pressure and Vendor Support were obtained to see the distribution of data. The descriptive statistics obtained are presented in Table 47.

Table 47: Descriptive Statistics

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Relative Advantage	59	2	5	4.45	.090	.693
Security Concern	59	1	5	3.82	.130	1.002
Top Management Organization	5	2	5	2.90	.620	1.387
Readiness	54	1	5	3.20	.176	1.292
Competitive Pressure	28	1	4	2.43	.176	.929
Vendor Support	33	1	5	3.08	.200	1.146

The score for organization size was computed separately by calculating the average of the number of employees and the number of patients per day per healthcare facility. These two variables were answered by the senior management personnel (number of employees) and medical staff (number of patients). To calculate the average, the two responses were added together per health facility according to the codes given to identify these health facilities. For example, for facility A, the response from the senior management personnel at facility A and the response of the medical staff at facility A were added together, and the average would be the organization size. Table 48 presents the descriptive scores of this variable.

Table 48: Descriptive Stats - Organization Size

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Organization Size	25	1	5	2.52	.170	.848

#### 4.6.3.1 Group Statistics

The number of cases (N), Mean, Standard Deviation, and Standard Error of the Mean for each predictor variable scale are as follows:

**Relative Advantage.** Relative Advantage scored a Mean value of 4.45, a Standard Deviation of .693, a Standard Error of the Mean value of .090 and an N value of 59.

**Security Concern.** Security Concern scored a Mean value of 3.82, a Standard Deviation of 1.002, a Standard Error of the Mean value of .130 and an N value of 59.

**Top Management Support.** Top Management Support scored a Mean value of 2.90, a Standard Deviation of 1.387, a Standard Error of the Mean value of .620 and an N value of 5

**Organization Readiness.** Organization Readiness scored a Mean value of 3.20, a Standard Deviation of 1.292, a Standard Error of the Mean value of .176 and an N value of 54

**Competitive Pressure.** Competitive Pressure scored a Mean value of 2.43, a Standard Deviation of .929, a Standard Error of the Mean value of .176 and an N value of 28.

**Vendor Support.** Vendor Support scored a Mean value of 3.08, a Standard Deviation of 1.146, a Standard Error of the Mean value of .200 and an N value of 33.

**Organization Size.** Organization Size scored a Mean value of 2.52, a Standard Deviation of .848, a Standard Error of the Mean value of .170 and an N value of 25.

An independent samples t-test was conducted to compare the response on the intent to adopt for respondents who have no knowledge of cloud computing and those who have knowledge of cloud computing. There was no significant difference in the scores for respondents with no knowledge (M=3.97, SD=0.773) and respondents with knowledge (M=3.91, SD=0.767) of CC;  $t(57) = 0.288, p = 0.774$ . These results suggest that knowledge of CC has no impact on how respondents respond on the intent to adopt. Therefore, the assumption of equality of variance between the two groups was not violated. Table 49 and 50 present these results.

Table 49: Independent Samples Test

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper	
Intent to Adopt	Equal variances assumed	.042	.838	.288	57	.774	.059	.204	-.350	.468
	Equal variances not assumed			.289	49.834	.774	.059	.204	-.351	.469

Table 50: T-test Group Statistics

	Cloud Computing Knowledge	N	Mean	Std. Deviation	Std. Error Mean
Intent to Adopt	No Knowledge of Cloud Computing	35	3.97	0.773	0.131
	Have Knowledge of Cloud Computing	24	3.91	0.767	0.157

Next, the study presents results of the a one-way between subjects' ANOVA.

A One-way between subjects' ANOVA was conducted to compare the response on the intent to adopt between the senior management, medical staff and principal network controllers' roles. There was no significant difference at  $p < 0.05$  level for the three roles [ $F(2, 56) = 1.13$ ,  $p = .330$ ]. These results suggest that the response on the intent to adopt is not influenced by the role of the participant. Table 51 presents these results.

Table 51: One-way between subjects' ANOVA

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.318	2	.659	1.132	.330
Within Groups	32.609	56	.582		
Total	33.927	58			

The final step of the analysis presents the hypotheses testing of the study using the Spearman's Correlation Coefficient.

#### 4.6.4 Hypothesis Testing

The relationship between the independent variables (Relative Advantage, Security Concern, Organization Readiness, Top Management Support, Organization Readiness, Competitive Pressure and Vendor Support) and the Intent to Adopt was investigated using Spearman's Correlation Coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. The correlation coefficient  $\rho$  ( $r_s$ ) measures the strength and direction of a linear relationship between two variables on a scatterplot. A p-value less than 0.05 indicated that there was a statistical significance between the predictor variable and the criterion variable. The results of the Spearman  $\rho$  are presented in Table 52.

Table 52: Spearman's Correlation

Correlations Spearman's rho								
	TRA	TSC	OOR	OTM	OS	ECP	EVS	OI
TRA	1							
TSC	.244	1						
OOR	.358**	.187	1					
OTM	.335	-.300	.	1				
OS	-.005	.156	-.057	.	1			
ECP	.154	.308	.604**	.	-.140	1		
EVS	.009	.237	.391*	.359	-.296	.122	1	
OI	.515**	.312*	.549**	.900*	-.232	.340	.201	1
N	59	59	54	5	54	28	33	59

TSC=Security Concern; TRA=Relative Advantage; OOR=Organization Readiness; ECP=Competitive Pressure; EVS= Vendor Support; OS=Organization Size; OTM=Top Management Support; OI= Intent to Adopt

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Results obtained from the correlation are as follows:

Hypothesis 1: The relationship between Relative Advantage (M=4.45; SD=.693) and Intent to Adopt (M=3.95; SD=.765) had a positive large correlation which was statistically significant at a 0.01 significance level ( $r_s = .515$ ;  $p < 0.01$ ). Therefore, we reject the null hypothesis and accept the alternative hypothesis.

Hypothesis 2: The relationship between Security Concern (M=3.82; SD=1.002) and Intent to Adopt (M=3.95; SD=.765) had a positive medium correlation which was statistically significant at a 0.05 significance level ( $r_s = .295$ ;  $p < 0.05$ ). Therefore, we reject the null hypothesis and accept the alternative hypothesis.

Hypothesis 3: The relationship between Top Management Support (M=2.90; SD=1.387) and Intent to Adopt (M=3.95; SD=.765) had a positive large correlation which was statistically significant at a 0.05 significance level ( $r_s = .900$ ;  $p < 0.05$ ). Therefore, we reject the null hypothesis and accept the alternative hypothesis.

Hypothesis 4: The relationship between Organization Readiness (M=3.20; SD=1.292) and Intent to Adopt (M=3.95; SD=.765) had a positive large correlation which was statistically

significant at a 0.01 significance level ( $r_s = .549$ ;  $p < 0.01$ ). Therefore, we reject the null hypothesis and accept the alternative hypothesis.

Hypothesis 5: The relationship between Organization Size ( $M=2.52$ ;  $SD=.848$ ) and Intent to Adopt ( $M=3.95$ ;  $SD=.765$ ) had no significant correlation at a 0.05 significance level ( $r_s = -.232$ ;  $p > 0.05$ ). This indicates that the healthcare facility's size cannot be associated with its intent to adopt. Therefore, we fail to reject the null hypothesis.

Hypothesis 6: The relationship between Competitive Pressure ( $M=2.43$ ;  $SD=.929$ ) and Intent to Adopt ( $M=3.95$ ;  $SD=.765$ ) had no significant correlation at a 0.05 significance level ( $r_s = .340$ ;  $p > 0.05$ ). This indicates that competitive pressure is not associated with the intent to adopt. Therefore, we fail to reject the null hypothesis.

Hypothesis 7: The relationship between Vendor Support ( $M=3.08$ ;  $SD=1.146$ ) and Intent to Adopt ( $M=3.95$ ;  $SD=.765$ ) had no significant correlation at a 0.05 significance level ( $r_s = .201$ ;  $p > 0.05$ ). This indicates that vendor support had no association with the intent to adopt. Therefore, we fail to reject the null hypothesis.

## Summary

This chapter presented the findings of the study. The data was analyzed using descriptive statistics and inferential statistics. In addition, frequency tables were analyzed to answer questions related to the current state of HIS within the Free State health facilities, which also fulfils one of the study's research aims. After testing the data for reliability and validity, two of the initial nine hypotheses, namely  $H_2$  and  $H_4$  as presented in Section 1.5 of Chapter 1 of this document, were dropped at this stage of analysis because the Cronbach's Alpha value of  $H_4$  was not at the acceptable level of .6, and the scale items of  $H_2$  loaded into the component of  $H_5$ . Furthermore, t-tests were conducted to test for differences on the responses for the intent to adopt between those who had and those who did not have knowledge of cloud computing. A One-way between subjects' ANOVA was conducted to determine if there were differences between the three groups of respondents with regards to their response on the intent to adopt. Lastly, a Spearman's Correlation was conducted to test the study's seven hypotheses on relative advantage, security concern, top management support, organization readiness, competitive pressure and vendor support. The following chapter discusses the findings of the study and answers the research questions and aims.

## CHAPTER 5: DISCUSSION

In this chapter, we discuss the results of the analysis that was carried out in the previous chapter and answers to the research questions. The study aimed to investigate the viability of an integrated cloud-based EMR (ICBEMR) for public health facilities in the Free State (FS) province by exploring factors which influence the intent to adopt cloud computing. In addition, the study's objectives included assessing the current state of HIS in public health facilities in the FS by evaluating the ease and convenience of the paper-based system, determining systems that are utilized for capturing and storing patient data, and the availability of internet facilities.

Sections in this chapter present a summary of major results, discussion of the research questions in the order they appear in Chapter 1 of this document, and TOE predictors on the intent to adopt.

### 5.1 Summary of Major Results

Data was analyzed to gain more insight on the current HIS system used, the current IT infrastructure and factors that influence the intent to adopt by health facilities in the FS. Results revealed that most public healthcare facilities (78%) in the FS are utilizing a paper-based system with some form of IT to record basic patient details. This places the FS health department at stage 3 according to the SA e-Health Strategy Maturity Stages [31]. In addition, results revealed that 77.6% of these public healthcare facilities are in possession of a computerized system used for medical data. These systems comprise Meditech, PADS, PharmAssist and other electronic systems such as Tier.net, HPRS, Rx Solution, RDM, ETR and DHIS.

However, with internet access being one of the major attributes required for the adoption of a cloud-based EMR system, a major concern was that some health facilities had access to internet, and some did not. Nevertheless, results revealed that more than 60% of these computerized systems had a cloud platform, with the top feature being patient management, followed by the Appointment/Scheduling feature.

Furthermore, according to the results obtained from the analysis, all these public healthcare facilities were willing to adopt a cloud-based EMR system. In addition, specific data was deemed appropriate to be deployed on a cloud-based EMR system, with laboratory results being deemed most important over others, followed by treatment details, appointments, patient details and billing data. This was quite interesting as the researcher expected patient details to be deemed more important than others.

It was further expected by the researcher that there should be no significant difference in response to the intent to adopt between participants who had knowledge about cloud computing and those who did not, the results of the t-test met this expectation. Again, it was also expected that there would be no significant difference in response on the intent to adopt between the different groups of participants who were involved in the study; the results of the one-way between subjects' ANOVA satisfied this expectation. Since the study had targeted the public health sector, the results obtained from the participants were expected to be in support of one another and of the innovation.

The following technological, organizational and environmental factors were tested to see their impact on the intent to adopt: Relative Advantage, Security Concern, Top Management Support, Organization Readiness, Organization Size, Competitive Pressure and Vendor Support. Table 53 presents the hypotheses that were proposed for the study and whether the hypotheses were supported or rejected.

Table 53: Hypotheses results

Hypothesis Number	Hypothesis	Supported/Not Supported
$H_1$	The relative advantage of an ICBEMR has an impact on the intent to adopt.	Supported
$H_2$	Security concern over an ICBEMR system has an impact on the intent to adopt.	Supported
$H_3$	Top management support for an ICBEMR system has an impact on the intent to adopt.	Supported
$H_4$	Organization readiness towards an ICBEMR system has an impact on the intent to adopt.	Supported
$H_5$	The size of the health facility has an impact on the intent to adopt an ICBEMR system.	Not Supported
$H_5$	Competitive Pressure for an ICBEMR has an impact on the intent to adopt.	Not Supported
$H_7$	Vendor support for an ICBEMR has an impact on the intent to adopt.	Not Supported

The following section discusses in depth the research question and the answers obtained from the data analysis and related literature.

## 5.2 The current state of HIS at public healthcare facilities in the FS

The first question (RQ1) of the study was: What is the current state of health information systems (HIS) at public healthcare facilities in the Free State? This question was addressed by asking several questions on the current patient management system used for capturing, processing and storing patient data, the ease and convenience of the paper-based system, electronic medical systems used and their features.

According to the eHealth Strategy South Africa 2012 [31], South Africa is at maturity Stage 3, which is a paper-based system with some form of IT support to record basic patient details. This is due to the availability of resources, trained/skilled human resource and the cost of ICT, leaving some provinces in SA operating at Stage 2(Fully paper-based system with no form of IT support at all) while others are at Stage 4(A centralized EMR per hospital/clinic with less integration between the different EMRs) [31] [34] .

In this study, participants were asked to indicate from the following which state is their patient management system: Fully paper-based; Paper-based system with some form of IT support; Centralized stand-alone EMR; an EMR system that serves our facility BUT is also linked to other external EMRs.

Results revealed that 13.6% of health facilities are still paper-based, meaning they are using paper for capturing, processing and storing patient data. Most of these healthcare facilities (about 78%) are utilizing paper with some form of IT support to store basic patient details, while 1.7% of them have a stand-alone EMR system and 6.8% are utilizing an EMR system linked with other external EMR systems. In addition, 88.5% of participants mentioned that all patient data is processed and filed in paper charts, while only 3.8% had the files scanned into a computer and 3.8% have most or nearly all paper scanned into the EMR.

Next, the study evaluated the ease and convenience of the paper-based system. Firstly, participants were asked to state the ease of having real-time access to patient data, results were in support of prior research stating that lack of real-time access to patient data is associated with the use of paper-based records [29], as most of the participants did not have real-time access to patient data when needed. Additionally, concerning time, results proved that the use of paper records and the compilation of health reports were time-consuming. However, paper records proved to be more user-friendly. The safety and reliability of these paper records proved to have equal cases, where some participants believed paper records to be safe and reliable and other participants were not of the same opinion. Furthermore, the exchange and sharing of medical information with other health facilities was done over the phone or by fax.

Lastly, the different types of electronic systems used and their features were evaluated. As discussed under Summary of Major results, the majority of these health facilities had an electronic system used for medical data. According to the South African e-Health Strategy [31], hospital information systems used in the FS are Meditech and PADS. The study has proved that these two systems are among the electronic systems utilized within the healthcare facilities in FS. The other systems include PharmAssist, Tier.net, HPRS, etc. as mentioned under the Summary of Results section.

Therefore, the study concludes that these healthcare facilities in the FS are still relying mostly on paper for capturing, processing and storing patient data; however, there are electronic systems in place to help with the burden of information stored on paper records.

The next section evaluates the Internet facilities in place at these health facilities.

### **5.3 Internet facilities in place at public healthcare facilities in FS**

The second research question (RQ2) was: What is the current IT infrastructure in place in terms of Internet facilities at health facilities? This question was addressed to the IT personnel of each district in the FS. Results revealed that some (but not all) health facilities have internet facilities. The speed of the internet connection was said to be quite fair. The reliability of the internet connection was proven to be good at some districts, but fair or rather poor at other districts of the FS. The provision to internet facilities was paid for by the South African government. These internet services were quite expensive in other districts but slightly more affordable in some districts.

### **5.4 Willingness of public healthcare facilities in FS to adopt an ICBEMR system**

The third research question (RQ3) of the study was: Are public healthcare facilities in the Free State province willing to adopt a cloud-based Integrated EMR system that permits the sharing of patient data among different health institutions? This question was addressed by asking participants about their willingness to adopt a cloud-based EMR system.

Results revealed that the health facilities were willing to adopt a cloud-based EMR system for the sharing, storing and capturing of patient data and medical data. In addition to this, participants believed laboratory results, patient details, treatment details, appointments and billing data were suitable to be deployed on a shared cloud-based EMR system.

## **5.5 Effects of the Technology-Organization-Environment (TOE) factors on the Intent to Adopt an ICBEMR system**

The study aimed to determine the technological, organizational and environmental factors influencing the intent of public healthcare facilities to adopt an ICBEMR system in the Free State. The study's hypotheses were tested using the Spearman's Correlation Coefficient to answer the main research question (RQ4): What are the technological, organizational and environmental (TOE) factors influencing the intent of public healthcare facilities to adopt an integrated cloud-based EMR system in the Free State? Four of the seven hypotheses were supported by the data as shown in Table 53 previously. The following sections discuss the impact of each factor of each context of the TOE framework.

### **5.5.1 Effects of Technological Factors on the Intent to Adopt.**

Technological factors that were included in the study were Relative Advantage of an integrated cloud-based EMR and Security Concerns around cloud-based EMR systems. In this study, relative advantage was found to have a positive impact on the intent to adopt a technological innovation such as an ICBEMR system. This finding is consistent with prior studies [78] stating that relative advantage is a predictor of cloud computing adoption. The study's results also revealed that healthcare facilities are aware of the advantages provided by cloud computing. Advantages identified by the study included accomplishment of tasks quickly and effectively, improved quality of work, increased productivity, improved access to patient data and cost-effectiveness. In their study, Oliveira *et al.* [78] found cost to be an important driver of relative advantage.

The second key finding was the significant influence of security concern on the intent to adopt. Security concern was found to be a predictor of cloud computing adoption in this study. This is consistent with a study done by Li *et al.* [83] showing reliability and information security of cloud services to have significant positive effects. The study discovered that the more comfortable and at ease people are with the exchange, sharing and storing of medical data on the cloud, there was an aspect of trust that the cloud is more secure and reliable enough to retain such confidential information without any data leakages. This finding was further supported by Li *et al.* [83], stating that the influence of information security on cloud service trust indicates that organizations would trust cloud service more if they thought it was secure enough. Therefore, the fewer risks posed by having such sensitive information on the cloud increases the chances of having the system adopted.

### 5.5.2 Effects of Organizational Factors on the Intent to Adopt.

The organizational context included the following three factors: Top Management Support to adopt an ICBEMR, Organization Readiness for an ICBEMR system and Organization Size. Of the three hypotheses, the hypotheses for Top Management Support and Organization Readiness were supported by the data. The hypothesis for Organization Size was not supported.

As hypothesized by the study, results support the notion that the more support obtained from the top management, the greater the intent to adopt would be. This is no surprise as the main decision makers are at the top management level of the organization as they dictate which technology solutions should be implemented. Furthermore, Oliveira *et al.* [78] state that top management can influence the adoption of cloud-computing by supporting the innovation financially, providing necessary resources and being involved in the process. This finding is consistent with prior studies on the adoption of cloud computing [78], [74].

Furthermore, the organization's readiness to embrace new technology has an impact on the adoption of an innovation. In this study, it was found that the readier the organization is for the new technology the greater the intent to adopt would be. Prior studies have shown that organization readiness has a positive significant impact on the adoption of technology [74]. The organization's readiness is determined by its financial and technological readiness to adopt an innovation. These two factors can drastically affect the organization's intent to adopt positively or negatively. The better prepared the organization is financially and technologically, the easier it will be for the organization to transition to a new technology. In this study, these two aspects were considered to be predictors of organization readiness. The results proved the organization to be both financially and technologically ready to adopt the innovation.

The study also hypothesized organization size to be a predictor of cloud computing adoption. However, the study's results did not support this hypothesis. The results revealed that the size of the organization was insignificant to the organization's intention to adopt an ICBEMR system. This result differed from the findings discovered in prior studies [76] where size had a significant impact. These studies predicted that the bigger the organization's size, the more likely it was that the innovation would be adopted. In another study [74], size was found to be a predictor of adoption in that larger organizations were more likely to adopt an innovation to accommodate expansion whereas smaller ones could still manage to carry out day-to-day business without new technology. This was not the case in this study. As far as the literature reviewed in this study is concerned, there is no prior research consistent with the results obtained in this study. The results in this study were therefore acceptable and to be expected, due to both public primary healthcare (PHC) and secondary healthcare (SHC) being under

one umbrella, and whatever decision or innovation would be adopted, it would be to the benefit of all public healthcare facilities as they all report to one entity. Despite the size of the healthcare facility, they should all be in one accord working towards the same goals.

### **5.5.3 Effects of Environmental Factors on the Intent to Adopt.**

The environmental context included the following two factors: competitive pressure and vendor support for a cloud-based EMR system. These factors were found to have no significant impact on the intent to adopt.

The study proposed that competitive pressure would have a significant impact on the intent to adopt. Results revealed otherwise. It was found that competitive pressure could not be associated with the intent to adopt and could therefore not predict adoption. This finding is not surprising to the study due to the divide between the private and public health sectors, with each sector focusing only on its own growth and improvements which are not propelled by competition. The other reason as mentioned in the above section, was that all healthcare facilities under the public health sector are governed by the same management and they all carry out what has been instructed by the DoH. In addition, prior research supports the findings that competitor pressure may not be of as much importance as other cloud-computing adoption issues such as cost reduction [94]. In this case, the healthcare facilities seem to be more interested in the benefits and advantages offered by cloud computing, rather than competing with the private sector. Findings contrary to this were carried out at different enterprises and in the private health sector. In his study, Mamatela [89] found that competitive pressure among different health enterprises predicted adoption.

Similar to this is vendor support. The study hypothesized that vendor support would have a significant impact on the intent to adopt. In this study, this was not the case. The study's results revealed that vendor support had no significant impact on the intent to adopt. This finding was not consistent with prior research on the adoption of cloud computing. The reason leading to such results might be that the Department of Health in the FS had assigned its own in-house IT personnel to handle technology-related issues. Contrary to this are the findings made by Dunne [65] and Kinuthia [74]. In their study, they found vendor support to have a significant impact on the adoption as it would encourage organizations to adopt cloud services. In addition, Kinuthia [74] believes that vendors can take the opportunity to showcase their capabilities when they offer free training sessions and technical support for the adopted technology. Although this may be the case, the analysis does not support the hypothesis for this factor.

## Summary

This chapter presented a summary of the major results of the study and elaborated further on the results by discussing each research question. The study consisted of four research questions. The chapter then discussed the current state of HIS within healthcare facilities in the FS, showing that most healthcare facilities still relied on paper records but had an electronic system in place to record specific details of patient data. In addition, the current paper-based system proved to be easy to use but time-consuming at the same time. Furthermore, not all healthcare facilities had access to internet services, which could present a challenge when deciding to move to a cloud-based system. The study also showed that there were several TOE factors which predicted the intent to adopt an ICBEMR system. Among these factors, relative advantage and top management proved to be the most important factors for adoption. Similarly, security concern and organization readiness also predicted adoption. The next chapter gives a summary of the study, the implications of the results, recommendations and future research, and concluding remarks.

## CHAPTER 6: CONCLUSION

This chapter concludes the study by presenting an overall overview and summary of the study, implications of the study, and recommendations and future research.

### 6.1 Summary of the Study

This section presents a summary of the entire study by outlining the important aspects presented in each chapter of the study.

Chapter 1 introduces the study by presenting the study's problem statement, purpose of the study, research questions, hypotheses, significance of the study, methods, assumptions and limitations. The study had identified that most public healthcare facilities were still relying on paper to record patient data. Although there are electronic systems in place, these systems were not integrated. Cloud computing might offer a cost-effective solution of integrating diverse EMR systems. According to literature, cloud computing can solve the many challenges faced with paper records and help improve healthcare. However, the adoption of cloud computing is slowest in healthcare and factors influencing the adoption of cloud computing have not been widely explored. The study's main objective was to investigate the viability of adopting an integrated cloud-based EMR system by identifying TOE factors influencing the intent to adopt. The study's objectives included assessing the current systems used in capturing, storing and analyzing patient data at public healthcare facilities in the FS, investigating the viability of adopting an integrated cloud-based EMR system that is accessible to key stakeholders in the FS public health sector, and identifying TOE factors influencing the adoption of a cloud-based EMR system.

Chapter 2 presented a review of literature to give the reader an insight into the topic. First, a review of literature on the paper-based medical records was carried out. This first section of this chapter presented related literature on paper records and its challenges. Some of these challenges included lack of real-time access to patient data, inability to exchange and share data, inadequate data, and inability to monitor patient health progress. The second section of this chapter provided a review of literature on Electronic Medical Record systems, inclusively touching on the South African e-Health Strategy and extended on challenges faced with standalone EMR systems. The third section provided a review of literature on cloud computing (characteristics, service models and deployment model; benefits and challenges) and an integrated cloud-based EMR system. Lastly, a review of literature on adoption theories and on the theoretical framework used in the study was conducted. The TOE factors identified were as follows: **Technological factors** included: Relative Advantage, Compatibility, Availability of Resources and Security Concern; **Organizational factors** included: Top

Management Support, Organization Readiness and Organization Size; **Environmental factors** included: Competitive Pressure and Vendor Support.

Chapter 3 described the methods and research design used to carry out the study. The study conducted a cross-sectional survey research. The target population for the study involved public healthcare facilities in the FS. Participants included senior management personnel, medical staff (nurses and doctors) and IT personnel from each FS district. The study surveyed 31 healthcare facilities including five IT personnel. Questionnaires were hand- distributed to healthcare facilities involved in the study with arrangements made with CEOs/Managers of these healthcare facilities. A pilot test was carried out to test the effectiveness of the questionnaire and to improve it. The final questionnaire was then developed and distributed to health facilities.

In Chapter 4, data was analyzed by performing different statistical procedures for different types of data. The first section of the chapter presented frequency tables on the categorical data. The questionnaire was tested for internal consistency and validity using SPSS. All constructs except Availability of Resources proved to be reliable with scale items having Cronbach's Alpha values of .7 and above. Principal component factor analysis (PCA) was performed to validate the study's constructs. Six constructs were extracted from the analysis: Relative Advantage, Security Concern, Organization Readiness, Top Management Support, Competitive Pressure and Vendor Support, including Organization Size. Descriptive statistics of the continuous variables: Relative Advantage, Security Concern, Organization Readiness, Top Management Support, Organization Size, Competitive Pressure and Vendor support were also presented. Additionally, an independent samples t-test was done on cloud-computing knowledge. A one-way between subjects' ANOVA was conducted on the Role variable to test for response difference on the intent to adopt. Finally, a Spearman's Correlation Coefficient was used to test the study's hypotheses and to identify which factors predicted the adoption of cloud computing. The results obtained from this chapter were discussed in Chapter 5 of the study.

In Chapter 5, a summary of major results was discussed as well as answers to the research questions. The study aimed to assess the current systems used in capturing, storing and analyzing patient data, and assess the current state of HIS, which is tied to RQ1. Results revealed that most healthcare facilities are paper-based with some form of IT to record basic patient and medical information, which according to the eHealth Strategy South Africa is maturity stage 3. The IT part referred to the electronic medical systems utilized at these healthcare facilities. These systems included Meditech, PADS, PharmAssist, Tier.net, HPRS, Rx Solutions, RDM, ETR and DHIS. However, not all healthcare facilities have these electronic

systems: minority of them are still fully paper-based. Secondly, the study evaluated the availability of internet facilities at healthcare facilities. Results revealed that there are internet facilities at some of these healthcare facilities. The speed of the internet connection is said to be fair, and its reliability good at some districts. The study also evaluated the willingness of healthcare facilities to adopt cloud computing, and it was tied with RQ3. The study found that healthcare facilities were willing to adopt an integrated cloud-based EMR system. Lastly, the study's main aim was to identify TOE factors that affected the intent to adopt. Data supported four hypotheses of the study and three were not supported. Results revealed that all factors except Organization Size, Competitive Pressure and Vendor Support are predictors of cloud-computing adoption.

The remainder of this chapter addresses the implications of results on practice and theory, recommendation and future research, and concluding remarks.

## **6.2 Implications on Practice**

Results from the study will benefit both the patients and public healthcare facilities. This study informs healthcare facilities of the benefits that can be accrued by adopting cloud computing. One of these benefits is ease of access to medical data or patient information. Having patient data stored electronically on the cloud makes it easier for healthcare providers to have real-time access to patient data when needed. It also helps in monitoring a patient's health progress to offer continuity of care. Access to information when needed leads to an increase in productivity and efficiency. Collecting medical data through manual methods can be time-consuming and may hinder productivity, but having the data accessible on the cloud makes it easier for physicians to get hold of the medical data needed for them to perform their duties. It also helps in terms of research, as they can have access to the medical data they require to carry out their research and to bring more solutions to the medical field.

The study further informs the public health sector of improvements they may need to consider in terms of their internet facilities. Adopting cloud computing requires reliable and steady internet connections to administer the flow of data within the health sector. Without proper internet facilities in place, transitioning to the cloud may become a challenge as all administrative tasks will be done on the internet. This may hinder production and patient care may be compromised. However, this opens an opportunity for Internet Service Providers (ISPs) to present their services to the DoH and the offers they have in place. Financial implications of outsourcing an ISP should be considered; however, the cost-effective solutions offered by cloud computing bring about a balance within the IT infrastructure and the health facilities. Investments in IT infrastructure and a well-established network will be a great improvement for healthcare.

Based on the results, the DoH FS may need to review the health information systems in place. Results show that primary healthcare (PHC) utilize a different HIS to capture patient data and specific medical data than that utilized by secondary healthcare (SHC). It would be good to consider having one system used by every healthcare facility rather than having multiple systems whereas all these healthcare facilities are under the same management and are committed to a similar agenda. A study done by Mamatela [89] on eHealth technologies used by SA medical enterprises found that the non-standardization of eHealth explains why the inter-organizational eHealth benefits (access to other clinician's patient data, reduced clinical error, reduced cost of services rendered to patients, reduced clinician time per patient, etc.) were not realized. Having an inter-connected system used by all public healthcare facilities would be more beneficial and cost-effective.

Furthermore, the study informs us that healthcare facilities are ready to move from paper to cloud. Results revealed that most healthcare facilities are willing to adopt cloud computing, which is an indication of a move in the right direction. The willingness of healthcare facilities to embrace this technology will make it easier for its implementation with support from healthcare providers.

Top managers play a vital role in the organization. They are the ones who make the final decision, authorize the use of resources needed and release financial resources. Without their support, the adoption of cloud computing cannot be carried out. Therefore, the top management's decision is of great importance to the organization and should be taken into consideration.

### **6.3 Implications on Theory**

The study was grounded on the TOE framework, which is a theoretical model that was developed by Tornatzky and Fleischer, explaining elements which influence a firms' decision on the adoption of an innovation [19] [20]. This model considered the technological, organizational and environmental aspects influencing the intent to adopt. According to Kinuthia [74], this framework was proved to be consistent with the diffusion of innovation theory (DOI). Nevertheless, the TOE framework was deemed appropriate to be used in this study.

The study investigated seven variables within the proposed research framework. The most important context with the highest effect size in this study was the organizational context, followed by the technological context. The environmental context had no significant importance on the intent to adopt. Results revealed that the most critical factors on the intent to adopt were: top management support, organization readiness, relative advantage and

security concern. This study adds to the knowledge body in the field of cloud computing. Researchers can depend on the results obtained from this study for future research on cloud computing adoption in health.

The study can, however, be improved by applying other theoretical models to explore factors influencing the intent to adopt.

## **6.4 Recommendations and Future research**

The study recommends the use of one centralized system to which all public healthcare facilities can have access and on which they can store patient and medical data. This will help reduce the cost associated with the maintenance of different systems at different facilities. Having a patient's details and information about the patient's health history available at all healthcare facilities will help reduce the time it takes before the patient is treated. In addition, to make the use of cloud computing in health a success, the study recommends having a steady internet connection at all public healthcare facilities. Policies and regulations regarding access to patient details will need to be formulated as well, to protect both the patient and the healthcare providers.

An opportunity exists for similar research on cloud computing to be carried out in other South African provinces or nationally. In this study, only a limited number of TOE factors were investigated. The study can still be expanded by including more factors such as complexity, cost, network reliability, regulatory support and external support. The study can also be improved by applying other theoretical models or integrating the current model with other theoretical models such as the Diffusion of Innovation (DOI). The study can be extended by including the private health sector and investigating how an integration of medical systems can improve healthcare and reduce costs, and how technology can be used to bridge the gap between services rendered at private and public health sectors.

The theoretical model adapted in this study can be tested using different statistical software packages such as SEM. This may yield different results from those obtained in this study or give an insight into new knowledge. In addition, more research can be done on the existing HIS at public healthcare facilities to establish if these systems are dynamic to accommodate their integration. Future projects include developing and pilot testing a prototype of an integrated cloud-based EMR system at selected public healthcare facilities in FS.

## **6.5 Concluding Remarks**

Integrating information technology with healthcare can bring a significant change within the medical field. The main role of healthcare facilities is to provide quality services and care to

patients and improve their health. As literature suggested, cloud computing can help achieve these goals. Not only will it help improve patient care, but it will also assist healthcare providers with their day-to-day tasks and provide the necessary data to conduct research. This study has contributed to existing cloud computing adoption and theoretical model literature. The model used to conduct the study will inform the public health sector of the important factors they should consider when they intend to adopt cloud computing. The study also provides information about the current state of HIS in the FS and the improvements required. The study indicated the benefits of adopting an integrated cloud-based EMR system and how it can improve healthcare.

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## APPENDIX A: ETHICAL CLEARANCE

### Appendix A1: Free-State Department of Health Approval Letter



health

Department of  
Health  
FREE STATE PROVINCE

19 June 2017

Ms. N Masana  
Dept. of Computer Science and Informatics  
CUT

Dear Ms. N Masana

**Subject: Investigation of the viability of an integrated cloud-based electronic medical records for health Clinics in Free State, South Africa.**

- Please ensure that you read the whole document, Permission is hereby granted for the above – mentioned research on the following conditions:
- Participation in the study must be voluntary.
- A written consent by each participant must be obtained.
- Serious Adverse events to be reported to the Free State department of health and/ or termination of the study
- Ascertain that your data collection exercise neither interferes with the day to day running of the Selected facilities nor the performance of duties by the respondents or health care workers.
- Confidentiality of information will be ensured and please do not obtain information regarding the identity of the participants.
- **Research results and a complete report should be made available to the Free State Department of Health on completion of the study (a hard copy plus a soft copy).**
- Progress report must be presented not later than one year after approval of the project to the Ethics Committee of the University of Free State and to Free State Department of Health.
- Any amendments, extension or other modifications to the protocol or investigators must be submitted to the Ethics Committee of the University of Free State and to Free State Department of Health.
- **Conditions stated in your Ethical Approval letter should be adhered to and a final copy of the Ethics Clearance Certificate should be submitted to [sebeelats@fshealth.gov.za](mailto:sebeelats@fshealth.gov.za) before you commence with the study**
- No financial liability will be placed on the Free State Department of Health
- Please discuss your study with the institution manager/CEOs on commencement for logistical arrangements
- Department of Health to be fully indemnified from any harm that participants and staff experiences in the study
- Researchers will be required to enter in to a formal agreement with the Free State department of health regulating and formalizing the research relationship (document will follow)
- You are encouraged to present your study findings/results at the Free State Provincial health research day
- Future research will only be granted permission if correct procedures are followed see <http://nhrd.hst.org.za>

Trust you find the above in order.  
Kind regards

  
Dr D Motau

HEAD: HEALTH

Date: 27/06/17

Head : Health  
PO Box 227, Bloemfotein, 9300  
4<sup>th</sup> Floor, Executive Suite, Bophelo House, cnr Maitland and, Harvey Road, Bloemfotein  
Tel: (051) 408 1646 Fax: (051) 408 1556 e-mail: [khusem@fshealth.gov.za](mailto:khusem@fshealth.gov.za) / [chikobvup@fshealth.gov.za](mailto:chikobvup@fshealth.gov.za)

[www.fs.gov.za](http://www.fs.gov.za)

## Appendix A2: UFS Health Sciences Research Ethics Committee (HSREC) Approval Letter



IRB nr 00006240  
REC Reference nr 230408-011  
IORG0005187  
FWA00012784

26 July 2017

MS NOMABHONGO MASANA  
DEPT OF COMPUTER SCIENCE AND INFORMATICS  
CUT

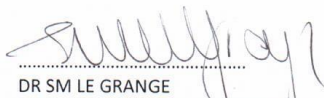
Dear Ms Nomabhongo Masana

**HSREC 54/2017 (UFS-HSD2017/0481)**  
**PRINCIPAL INVESTIGATOR: MS NOMABHONGO MASANA**  
**SUPERVISOR: MR GM MURIITHI**  
**PROJECT TITLE: INVESTIGATION OF THE VIABILITY OF AN INTEGRATED CLOUD-BASED ELECTRONIC MEDICAL RECORD FOR HEALTH CLINICS IN FREE STATE, SOUTH AFRICA**

### APPROVED

1. You are hereby kindly informed that the Health Sciences Research Ethics Committee (HSREC) approved this protocol after all conditions were met at the meeting held on 25 July 2017.
2. The Committee must be informed of any serious adverse event and/or termination of the study.
3. Any amendment, extension or other modifications to the protocol must be submitted to the HSREC for approval.
4. A progress report should be submitted within one year of approval and annually for long term studies.
5. A final report should be submitted at the completion of the study.
6. Kindly use the **HSREC NR** as reference in correspondence to the HSREC Secretariat.
7. The HSREC functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act. No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 50, 21 CFR 56; CIOMS; ICH-GCP-E6 Sections 1-4; The International Conference on Harmonization and Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite), Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the HSREC of the Faculty of Health Sciences.

Yours faithfully



DR SM LE GRANGE  
CHAIR: HEALTH SCIENCES RESEARCH ETHICS COMMITTEE

Health Sciences Research Ethics Committee  
Office of the Dean: Health Sciences  
T: +27 (0)51 401 7795/7794 | E: ethicsfhs@ufs.ac.za  
Block D, Dean's Division, Room D104 | P.O. Box/Posbus 339 (Internal Post Box G40) | Bloemfontein 9300 | South Africa  
www.ufs.ac.za



## APPENDIX B: FINAL QUESTIONNAIRES

### Appendix B1: Questionnaire for Senior Management Personnel

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# Questionnaire(CEO/Manager/Head)

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**Project Title:** Investigation of the Viability of an Integrated Cloud-Based Electronic Medical Record for Health Clinics in Free State, South Africa

**Investigator:** Nomabhongo Masana, Central University of Technology.

**Terms:**

**Electronic Medical Record (EMR):** a digital/electronic medical record that can be shared and transferred among different health institutions

**Cloud Computing:** a new emerging technology (also phrased as the “cloud” or “Internet”) where you can store and access data and programs over the Internet instead of your computer’s hard drive.

**Introduction/Purpose of the study:** This study is part of Master’s dissertation research project. The purpose of the study is to explore your perception about the adoption of an integrated cloud-based EMR system in the health sector with regards to the technological, organizational and environmental (TOE) factors and how they affect the adoption of an integrated cloud-based EMR system.

**Outline:** The questionnaire is divided into two sections. The first section (**Section A**) will contain questions about your demographic details, your organization, how medical information is handled in your organization and challenges you are facing with the current medical systems you are using at your work places. The second section (**Section B**) contains questions about the TOE factors that may influence the decision to adopt an integrated cloud-based EMR system. The questionnaire takes 10-15 minutes to complete.

**Confidentiality:** Please note that the data collected here will be used for research purposes only and will not be divulged to third parties in its raw form, all responses will be kept anonymous. Information such as your name will not be collected as part of this survey. Your responses will not be tied to you as they will be anonymous.

**Voluntary Participation:** You have been asked to participate in a research study. Please note that by completing this questionnaire you are voluntarily agreeing to participate in this research study. You will remain anonymous and your data will be treated confidentially at all times. You may withdraw from this study at any given moment during the completion of the questionnaire. The results of the study may be published.

**Contact:** For any questions or more information regarding the questionnaire, you may contact:

**Nomabhongo Masana**

Central University of Technology

Department of Information Technology, Private Bag X20539, Bloemfontein, 9300

Email: [nnomabhongo@cut.ac.za](mailto:nnomabhongo@cut.ac.za) / [nnomabhongo@gmail.com](mailto:nnomabhongo@gmail.com)

## Section A

### Demographic Questions

**1. In which Free State District is the facility located?**

Motheo  Xhariep  Lejweleputswa  Thabo Mofutsanyana  Fezile Dabi

**2. Type of Health Facility**

District Hospital:  Community Health Centre:   
Regional Hospital:  Tertiary Hospital:   
Central Hospital:  Other (Please Specify) : \_\_\_\_\_

**3. Please indicate the approximate number of Employees in your Institution / Facility**

1-10  11 -50  51 – 100  101- 500  >500

**4. Which of the following positions best describes your current role/profession at the Institution?**

Chief Executive Officer  Supervisor   
Hospital Manager  Other (Please specify) : \_\_\_\_\_

**5. Gender**

Male  Female

**6. Age Group**

18 - 25  26 - 35  36 - 45  46 - 55  56 - 65  66+

**7. Please indicate your Highest Qualification**

Master's Degree   
Bachelor's Degree   
Diploma   
National Senior Certificate   
Higher National Diploma   
PhD   
Higher Certificate   
Other (Please Specify)  : \_\_\_\_\_

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## Current Patient Management System / EMR System

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**8. Is there any computerized system to store medical data at the health facility?**

Yes

No

**9. If Yes, which of the following system(s) do you use? Select all that applies**

Delta 9  Pro-Clin

Meditech  PALS

PADS  ReMed

Soarian MedSuite  Medicom

PharmAssist  Nootroclin

PHCIS  PAAB

Clinicom  JAC Pharmacy

Other (Please Specify)  : \_\_\_\_\_

**10. What are the features of the system(s) in the previous question? Choose all those that apply.**

Health Information  Decision Support

Laboratory Management  Electronic Communication

Diagnostics Management  Patient Support

Medication Management  Administrative Processes

Referrals  Practice Reporting

**11. Which of the following statements best describes your current patient management system (Capturing, Processing and Storing patient data?)**

Fully Paper Based System with no form of IT support at all.

Paper-based system with some form of IT support to record basic patient details.

Computerized – A centralized standalone EMR that serves only our facility. It is not linked to other external systems.

An EMR system that serves our facility BUT is also linked to other external EMRs.

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## Cloud Awareness

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**12. How familiar are you with the term Cloud Computing?**

- I have no Idea what this means
- I have sufficient knowledge on what the term means
- I have expert knowledge on what the term means

**13. Is any of your Health Information System (HIS) services Cloud Based i.e. accessible Online?**

- No  Yes

**14. If yes, which of the following services are cloud based or online? Select all that applies**

- Patient Management
- Accounting / Billing
- Prescriptions
- Appointments/Scheduling
- Pharmacy / Dispensing Drugs

## Section B

This section gauges your perception regarding the use of Cloud Based EMR systems. In our context, **Cloud EMR** denotes an integrated cloud-based platform that enables different institutional EMRs to share and exchange selected medical data among health institutions online, making it possible to access such data anywhere, anytime, from any internet ready device. By sharing this data, healthcare providers can quickly access important patient data such as a patient's medical history, chronic conditions, latest X-Ray scans etc. even if the patient has not visited the facility before. Such an online system has both benefits and challenges. We would like to hear your view regarding this.

**15. Which of the following data do you perceive as being suitable for deployment on a shared Cloud EMR platform? Select all that applies**

- Patient Details (Names, Addresses, etc.)
- Appointments (e.g. When to See Which Doctor)
- Treatment Details (e.g. ailments, diagnosis, etc.)
- Billing Data
- Lab Results (X-Rays, Blood Tests, etc.)

**Please make one choice per statement, unless stated otherwise**

<b>Based on the current health system(paper/computerized) in your institution, rate the extent to which you agree with the following statements in as far as adopting / transitioning to a Cloud based EMR is concerned (1 - strongly disagree, 5 strongly agree)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Cloud EMR will enable me to accomplish my job tasks quickly and effectively.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using Cloud EMR will improve the quality of my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using Cloud EMR will increase the organization's productivity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using Cloud EMR will improve help access patient data easily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adopting Cloud EMR system is more cost effective than purchasing traditional EMR systems (systems that are not on the cloud)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For Security, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Internet security is a major concern to our firm when deciding to adopt Internet/Cloud based technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am comfortable with exchanging and sharing medical data online within my organization/colleagues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am comfortable exchanging and sharing medical data online with other health facilities in my area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am comfortable exchanging and sharing medical data online with other health facilities provincially	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe Cloud EMR system is more secure than manual medical records	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For Organizational Readiness, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Our organization has enough technological resources required to adopt a Cloud EMR system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our organization has the necessary financial aid to implement a Cloud EMR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our organization is willing to fund the implementation of a Cloud EMR system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For Competitive Pressure, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Our industry is pressuring our organization or company to adopt Cloud EMR system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
There is government pressure on our organization or company to adopt Cloud EMR system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
There is pressure from other organizations in our industry to use Cloud EMR system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
We understand the competitive advantages offered by cloud computing in our Industry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For Vendor support, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
We ensure that cloud vendors implement strong access and identity management to ensure unauthorized access to cloud computing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Our suppliers expect us to adopt cloud computing technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our suppliers are willing to give us technical assistance in adopting Cloud EMR system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our suppliers are willing to support our staff by training them how to use a Cloud EMR system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For Organizational Intent to Adopt an integrated cloud-based EMR, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
I think that using cloud computing services is advantageous	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am in favor of using the cloud computing services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our organization is likely to adopt and use a Cloud EMR system in the near future.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Would you mind if we contact you for a follow-up interview?**

Yes

No

**Any comments about the adoption of an integrated cloud-based EMR system:**

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**Thank you for completing this questionnaire. We highly appreciate it.**

## Appendix B2: Questionnaire for medical personnel

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# Questionnaire (Doctor/Nurse)

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**Project Title:** Investigation of the viability of an integrated cloud-based EMR system in the Free-State, South Africa.

**Investigator:** Nomabhongo Masana, Central University of Technology.

**Terms:**

**Electronic Medical Record (EMR):** a digital/electronic medical record that can be shared and transferred among different health institutions

**Cloud Computing:** a new emerging technology (also phrased as the “cloud” or “Internet”) where you can store and access data and programs over the Internet instead of your computer’s hard drive.

**Introduction/Purpose of the study:** This study is part of master’s dissertation research project. The purpose of the study is to explore your perception about the adoption of an integrated cloud-based EMR system in the health sector with regards to the technological, organizational and environmental (TOE) factors and how they affect the adoption of an integrated cloud-based EMR system.

**Outline:** The questionnaire is divided into two sections. The first section (**Section A**) will contain questions about your demographic details, your organization, how medical information is handled in your organization and challenges you are facing with the current medical systems you are using at your work places. The second section (**Section B**) contains questions about the TOE factors that may influence the decision to adopt an integrated cloud-based EMR system. The questionnaire takes 10-15 minutes to complete.

**Confidentiality:** Please note that the data collected here will be used for research purposes only and will not be divulged to third parties in its raw form, all responses will be kept anonymous. Information such as your name will not be collected as part of this survey. Your responses will not be tied to you as they will be anonymous.

**Voluntary Participation:** You have been asked to participate in a research study. Please note that by completing this questionnaire you are voluntarily agreeing to participate in this research study. You will remain anonymous and your data will be treated confidentially at all times. You may withdraw from this study at any given moment during the completion of the questionnaire. The results of the study may be published.

**Contact:** For any questions or more information regarding the questionnaire, you may contact:

**Nomabhongo Masana**

Central University of Technology

Department of Information Technology, Private Bag X20539, Bloemfontein, 9300

Email: [nnomabhongo@cut.ac.za](mailto:nnomabhongo@cut.ac.za) / [nnomabhongo@gmail.com](mailto:nnomabhongo@gmail.com)

# Section A

## Demographic Questions

### 16. Which Free State District is the facility located?

Motheo  Xhariep  Lejweleputswa  Thabo Mofutsanyana  Fezile Dabi

### 17. Type of Health Facility

District Hospital:  Community Health Centre:   
Regional Hospital:  Tertiary Hospital:   
Central Hospital:  Other (Please Specify) : \_\_\_\_\_

### 18. On average, how many patients does your facility handle per day?

Less than 10  10 – 50  51-100  101 – 150  151 – 200   
200+

### 19. Which of the following positions best describes your current role/profession at the Institution?

Medical Assistant  Clinical Laboratory Technologist   
Nursing Assistant  Family Practitioner   
Physician  Dentist   
Therapist  Nurse Practitioner   
Registered Nurse  Surgical Technologist   
Clinical Laboratory Technician  Physician Assistant   
Dental Assistant  Surgeon   
Other (Please specify) : \_\_\_\_\_

### 20. Gender

Male  Female

### 21. Age Group

18 - 25  26 - 35  36 - 45  46 - 55  56 -  
65  66+

### 22. Please indicate your Highest Qualification

Master's Degree

Bachelor's Degree



Paper-based system with some form of IT support to record basic patient details.

Computerized – A centralized standalone EMR that serves only our facility. It is not linked to other external systems.

An EMR system that serves our facility BUT is also linked to other external EMRs.

## Cloud Awareness

### 27. How familiar are you with the term Cloud Computing?

I have no Idea what this means

I have sufficient knowledge on what the term means

I have expert knowledge on what the term means

## Questions on the current system being utilized for medical records

**Please select one response per question unless stated otherwise**

**28. Are you able to access a patient's information anywhere, anytime to monitor his/her progress?**

Yes

No

**To what extent do you agree or disagree with the following statements:**  
**(This applies to Paper-Based medical records)**

**29. The current medical systems for recording patient data (manually on paper) is time-consuming**

Strongly Agree  Agree  Neither Agree/Disagree  Disagree   
 Strongly Disagree

**30. The current medical systems for recording patient data (manually on paper) is easy to use**

Strongly Agree  Agree  Neither Agree/Disagree  Disagree   
 Strongly Disagree

**31. The current medical systems for recording patient data (manually on paper) is safe and reliable**

Strongly Agree  Agree  Neither Agree/Disagree  Disagree   
 Strongly Disagree

**32. The current data collection and submission methods of health reports is time consuming**

Strongly Agree  Agree  Neither Agree/Disagree  Disagree   
 Strongly Disagree

**33. The current data collection and submission methods of health reports is not easy to use**

Strongly Agree  Agree  Neither Agree/Disagree  Disagree   
Strongly Disagree

**34. It is very easy to have real time Information of a patient**

Strongly Agree  Agree  Neither Agree/Disagree  Disagree   
Strongly Disagree

**35. Having one centralized data storage (like a server) that contains all the information for patient's is a good idea and will help improve healthcare**

Strongly Agree  Agree  Neither Agree/Disagree  Disagree   
Strongly Disagree

**36. How do you manage paper in the office? Please select one of the following answers.**

All patient information is processed and filed in the paper charts.

We scan old records into files on a computer (e.g. as PDF files) that are not connected to any electronic information system.

We are scanning in some paper to an EMR – either for select patients or select pieces of information.

After any incoming results / reports are reviewed they are scanned into the EMR.

Most/nearly all paper is scanned into the EMR and tagged (e.g. as an X-ray or consult) once it is received and then it is reviewed electronically in the EMR.

We have almost no paper coming into the office anymore, all or nearly all patient information is received electronically into the EMR

**37. How do you share medical information with other doctors or health institutions OUTSIDE office (e.g. specialists, hospital), not including formal referrals? Please select one of the answers below**

For the majority of communication, it is by phone / fax. It is kept / documented in the paper chart

Stand-alone, secure electronic communication (e.g. secure email) is used in my community for most of my external communication.

Any external communication is generated outside my EMR but copied / scanned into the EMR for all patients.

I use my EMR to generate outgoing notes, which are printed and faxed. All notes are stored in my EMR.

We have an electronic communication network for much of the communication that is connected to my EMR. Messages arrive in my inbox from others electronically (i.e. are not scanned).

## Section B

This section gauges your perception regarding the use of Cloud Based EMR systems. In our context, **Cloud EMR** denotes an integrated cloud-based platform that enables different institutional EMRs to share and exchange selected medical data among health institutions online, making it possible to access such data anywhere, anytime, from any internet ready device. By sharing this data, healthcare providers can quickly access important patient data such as a patient's medical history, chronic conditions, latest X-Ray scans etc. even if the patient has not visited the facility before. Such an online system has both benefits and challenges. We would like to hear your view regarding this.

**Please make one choice per statement, unless stated otherwise**

<b>Based on the current health system(paper/computerized) in your institution, rate the extent to which you agree with the following statements in as far as adopting / transitioning to a Cloud based EMR is concerned (1 - strongly disagree, 5 strongly agree)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Cloud EMR will enable me to accomplish my job tasks quickly and effectively.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using Cloud EMR will improve the quality of my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using Cloud EMR will increase the organization's productivity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using Cloud EMR will improve help access patient data easily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adopting Cloud EMR system is more cost effective than purchasing traditional EMR systems (systems that are not on the cloud)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For Security, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Internet security is a major concern to our firm when deciding to adopt Internet/Cloud based technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am comfortable with exchanging and sharing medical data online within my organization/colleagues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am comfortable exchanging and sharing medical data online with other organizations locally	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am comfortable exchanging and sharing medical data online with other organizations provincially	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cloud EMR system is more secure than manual medical records	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For Organizational Intent to Adopt an integrated cloud-based EMR, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
I think that using cloud computing services is advantageous	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am in favor of using the cloud computing services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our organization is likely to adopt and use a Cloud EMR system in the near future.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Any comments about the adoption of an integrated cloud-based EMR system:**

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**Thank you for completing this questionnaire. We highly appreciate it.**

## Appendix B3: Questionnaire for IT personnel

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# Questionnaire (IT Personnel)

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**Project Title:** Investigation of the viability of an integrated cloud-based EMR system in the Free-State, South Africa.

**Investigator:** Nomabhongo Masana, Central University of Technology.

**Terms:**

**Electronic Medical Record (EMR):** a digital/electronic medical record that can be shared and transferred among different health institutions

**Cloud Computing:** a new emerging technology (also phrased as the “cloud” or “Internet”) where you can store and access data and programs over the Internet instead of your computer’s hard drive.

**Introduction/Purpose of the study:** This study is part of master’s dissertation research project. The purpose of the study is to explore your perception about the adoption of an integrated cloud-based EMR system in the health sector with regards to the technological, organizational and environmental (TOE) factors and how they affect the adoption of an integrated cloud-based EMR system.

**Outline:** The questionnaire is divided into two sections. The first section (**Section A**) will contain questions about your demographic details, your organization, how medical information is handled in your organization and challenges you are facing with the current medical systems you are using at your work places. The second section (**Section B**) contains questions about the TOE factors that may influence the decision to adopt an integrated cloud-based EMR system. The questionnaire takes 10-15 minutes to complete.

**Confidentiality:** Please note that the data collected here will be used for research purposes only and will not be divulged to third parties in its raw form, all responses will be kept anonymous. Information such as your name will not be collected as part of this survey. Your responses will not be tied to you as they will be anonymous.

**Voluntary Participation:** You have been asked to participate in a research study. Please note that by completing this questionnaire you are voluntarily agreeing to participate in this research study. You will remain anonymous and your data will be treated confidentially at all times. You may withdraw from this study at any given moment during the completion of the questionnaire. The results of the study may be published.

**Contact:** For any questions or more information regarding the questionnaire, you may contact:

**Nomabhongo Masana**

Central University of Technology

Department of Information Technology, Private Bag X20539, Bloemfontein, 9300

Email: [nnomabhongo@cut.ac.za](mailto:nnomabhongo@cut.ac.za) /[nnomabhongo@gmail.com](mailto:nnomabhongo@gmail.com)

## Section A

### Demographic Questions

**1. Which Free State District is the facility located?**

Motheo  Xhariep  Lejweleputswa  Thabo Mofutsanyana  Fezile Dabi

**2. Types of Health Facilities you assist**

District Hospital:  Community health Centre:   
Clinic:  Regional Hospital:   
  
Tertiary Hospital:  Central Hospital:   
Other (Please Specify) : \_\_\_\_\_

**3. Which of the following positions best describes your current role/profession at the Institution?**

Health Information Technician  Network Administrator   
Other (Please specify) : \_\_\_\_\_

**4. Gender**

Male  Female

**5. Age Group**

18 - 25  26 - 35  36 - 45  46 - 55  56 - 65   
 66+

**6. Please indicate your Highest Qualification**

Master's Degree   
Bachelor's Degree   
Diploma   
National Senior Certificate   
Higher National Diploma   
PhD   
Higher Certificate   
Other (Please Specify) : \_\_\_\_\_

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## Current IT Infrastructure at Health Facilities in the District

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### Internet Facilities

**7. Do all health facilities in the district have Internet facilities?**

Yes                       Some                       No

**8. If Yes/Some, how would you characterize the speed of the Internet Connection**

Very Good                       Good                       Fair                       Poor   
 Very Poor

**9. Would you consider the Internet connectivity reliable (i.e. how often is it usually accessible and available for use)?**

Very Reliable                       Reliable                       Fair                       Poor                       Not  
 Reliable at all

**10. Who Pays for the Internet Services?**

- We don't pay for it. It is provided by the government.
- Donor Funded (Please specify the Donor, e.g. Telkom).
- Privately funded (e.g. Owner or Health Centre or the Health Centre).
- I don't Know.

**11. On a scale of 1 to 5 (1 being Very Affordable, 5 Being Very Expensive) how would you rate the Affordability of the Internet connectivity:**

1                       2                       3                       4                       5

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## Current Patient Management / EMR Systems

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**12. Do Health Facilities in the district have any computerized systems to store medical data?**

Yes                       Some                       No

**13. If Yes/Some, which of the following system(s) do they use:**

- |                  |                          |            |                          |
|------------------|--------------------------|------------|--------------------------|
| Delta 9          | <input type="checkbox"/> | Pro-Clin   | <input type="checkbox"/> |
| Meditech         | <input type="checkbox"/> | PALS       | <input type="checkbox"/> |
| PADS             | <input type="checkbox"/> | ReMed      | <input type="checkbox"/> |
| Soarian MedSuite | <input type="checkbox"/> | Medicom    | <input type="checkbox"/> |
| PharmAssist      | <input type="checkbox"/> | Nootroclin | <input type="checkbox"/> |
| PHCIS            | <input type="checkbox"/> | PAAB       | <input type="checkbox"/> |

Clinicom  JAC Pharmacy

Other (Please Specify)  : \_\_\_\_\_

**14. What are the features of the systems in question 13? Choose all those that apply.**

- |                        |                          |                          |                          |
|------------------------|--------------------------|--------------------------|--------------------------|
| Health Information     | <input type="checkbox"/> | Decision Support         | <input type="checkbox"/> |
| Laboratory Management  | <input type="checkbox"/> | Electronic Communication | <input type="checkbox"/> |
| Diagnostics Management | <input type="checkbox"/> | Patient Support          | <input type="checkbox"/> |
| Medication Management  | <input type="checkbox"/> | Administrative Processes | <input type="checkbox"/> |
| Referrals              | <input type="checkbox"/> | Practice Reporting       | <input type="checkbox"/> |

**15. Which of the following statements best describes the current patient management systems (Capturing, Processing and Storing patient data?)**

- Fully Paper Based System with no form of IT support at all.
- Paper-based system with some form of IT support to record basic patient details.
- Computerized – A centralized standalone EMR that serves only our facility. It is not linked to other external systems.
- An EMR system that serves our facility BUT is also linked to other external EMRs.

## Cloud Awareness

**16. How familiar are you with the term Cloud Computing?**

- I have no Idea what this means
- I have sufficient knowledge on what the term means
- I have expert knowledge on what the term means

**17. Is any of the Health Information System (HIS) services at health facilities Cloud Based i.e. accessible Online?**

No  Yes

**18. If Yes, which of the following services are cloud based or online**

- |                           |                          |
|---------------------------|--------------------------|
| Patient Management        | <input type="checkbox"/> |
| Accounting/Billing        | <input type="checkbox"/> |
| Prescriptions             | <input type="checkbox"/> |
| Appointments/Scheduling   | <input type="checkbox"/> |
| Pharmacy/Dispensing Drugs | <input type="checkbox"/> |

**19. Which of the following best describes the type of cloud used for your online services (or intend to use)?**

- Public (Externally hosted by a Public Cloud Service Provider)
- Private (Cloud only available for our health institution and associated clinics)
- Community Cloud (We are part of a consortium of health facilities tied together by a cloud platform that we all share)
- Hybrid (Some of our systems run on our private cloud, others use external clouds)

## Section B

This section gauges your perception regarding the use of Cloud Based EMR systems. In our context, **Cloud EMR denotes an integrated cloud-based platform that** enables different institutional EMRs to share and exchange selected medical data among health institutions online, making it possible to access such data anywhere, anytime, from any internet ready device. By sharing this data, healthcare providers can quickly access important patient data such as a patient’s medical history, chronic conditions, latest X-Ray scans etc. even if the patient has not visited the facility before. Such an online system has both benefits and challenges. We want your view regarding this.

**20. Health Facilities in the district are willing to Adopt a Cloud based EMR**

- Yes  No

**Please make one choice per statement, unless stated otherwise**

<b>Based on the current EMR system at health facilities, rate the extent to which you agree with the following statements in as far as adopting / transitioning to a Cloud based EMR is concerned (1 - strongly disagree, 5 strongly agree)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Using Cloud EMR will increase the organization’s productivity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using Cloud EMR will improve help access patient data easily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adopting Cloud EMR system is more cost effective than purchasing traditional EMR systems (systems that are not on the cloud)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For Compatibility, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
A Cloud EMR system will be compatible with our existing IT infrastructure (system’s format, interface and other structural data) in the organization.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The transition to a Cloud EMR system will not require a new infrastructure (hardware and software)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adopting a Cloud EMR is part of our strategy for the coming years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The adoption of a Cloud EMR system has been implemented in some of the health facilities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<b>For Security, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Internet security is a major concern in the district when deciding to adopt Internet/Cloud based technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am comfortable with the exchange and sharing of medical data online between health employees within the same health facility.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am comfortable with the exchange and sharing of medical data online between health employees at different health facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am comfortable with the exchange and sharing of medical data online between health employees provincially	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cloud EMR system is more secure than manual medical records	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For Availability of Resources, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
We have sufficient technological resources to adopt a Cloud EMR system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
We have high bandwidth connectivity to the internet to support a Cloud EMR system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For the Top Management Support factor, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Top management is likely to consider the adoption of cloud computing as strategically important	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Top management is willing to take the risks involved in the adoption of Cloud EMR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The adoption and use of Cloud EMR in our organization will receive strong support from top management.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For Vendor support, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
We will ensure that cloud vendors implement strong access and identity management to ensure unauthorized access to cloud computing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our suppliers expect us to adopt cloud computing technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our suppliers are willing to give us technical assistance in adopting Cloud EMR system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our suppliers are willing to support our staff by training them how to use a Cloud EMR system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>For Organizational Intent to Adopt an integrated cloud-based EMR, on a scale of 1-5(1-strongly disagree, 5-strongly agree) please rate the extent to which you agree or disagree with the following statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
I think that using cloud computing services is advantageous	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am in favor of using the cloud computing services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our health department is likely to adopt and use a Cloud EMR system in the near future.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our health department is more Likely to Adopt Cloud EMR if a Private Cloud is used	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our health department is likely to consider cloud EMR if a Community Cloud linking similar institutions is put in place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Any Comments about the adoption of an integrated cloud-based EMR system:**

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**Thank you for completing this questionnaire. We highly appreciate it.**

## APPENDIX C: LANGUAGE EDIT CERTIFICATE

**ELIZABETH LE SUEUR**

Language practitioner  
for expert wordwork

editburo@gmail.com

073-254-4995

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### CERTIFICATE

This is to certify that I, the undersigned, have completed the language editing of the dissertation submitted in fulfilment of the requirements of the degree of Master of Information Technology in the Faculty of Engineering and Information Technology at the Central University of Technology, Free State by

NOMABHONGO MASANA  
(Student number 210001534)

titled: INVESTIGATION OF THE VIABILITY OF AN INTEGRATED  
CLOUD-BASED ELECTRONIC MEDICAL RECORD FOR HEALTH  
CLINICS IN FREE STATE, SOUTH AFRICA

I am satisfied that the academic style and language usage are of a very high standard.



ELIZABETH LE SUEUR (BA Hons)  
EDITBURO (est. 1975)

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06 October 2018