A FRAMEWORK FOR THE IMPLEMENTATION OF MOBILE COMPUTING IN A UNIVERSITY ENVIRONMENT – *A CASE STUDY OF STRATHMORE UNIVERSITY*

RESEARCH PROJECT BY

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Mobile Computing - Introduction

- *Mobile computing* – use of portable devices offering computing and communication functionalities with the aim of providing seamless and ubiquitous computing environment for mobile users (Gupta, 2008)
- Mobile phone shipments at 1 billion per year by 2007.
- Africa has 300 million mobile subscribers by end of 2008.
- Kenya has 14 million subscribers by end of 2008 (CCK, 2008)
- Notebook shipments total 11.76 million in 2008.
- Smart phones to hit 139.3 million in 2008
- The number of laptop computers available to university users to increase as the prices reduce and they become more affordable (Green, 2008)


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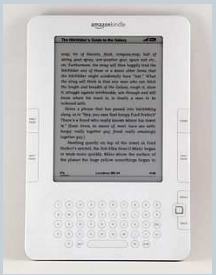



Eee PC

Literature Review

- Research based on the following concepts
  - Technology Adoption Models
    - Technology Adoption Model (TAM)
      - By Davies in 1989
      - Perceived usefulness
      - Perceived ease of use
    - UTAUT
      - Performance expectancy
      - Effort expectancy
      - Subject norms (social Influence)
      - Facilitating conditions
    - Theory of Planned behavior
      - Attitude towards a behavior
      - Prevailing subjective norms
      - Perception of behavioral control

- Technology Diffusion Models
  - Facilitating conditions (Ely, 1999)
  - Innovation adoption (Everett, 1995)
  - ACOT model of technology integration (Apple inc, 1980s)
- Readiness Assessment Frameworks
  - The Association of African Universities
  - The Center for International Development, Harvard
  - The KENET e-readiness studies

Literature Review –A critique

- TAM lacks the specifity of user's opinion on specific systems or technology
- One model cannot explain decisions and behavioral across a wide range of technologies, adoption situations and differences in decision making and decision makers.
- Rate of technology change quickly outgrows existing models.
- Most readiness studies are focused on telecommunication and availability of connectivity to the internet through use of PCs.
- Convergence of technologies, increased computational power combined with availability of new applications demand new frameworks for studying mobile computing.

Research Problem

- As the adoption of ICT drives the business of university, mobile devices will play a key role
- Currently no frameworks exists to guide the adoption and main-streaming of mobile computing devices
- The research project aims to develop a framework to guide in the adoption of mobile devices in Kenyan Universities.

Research Objectives

- Identify mobile computing technologies/frameworks / adoption models
- Develop a framework appropriate for mobile devices adoption
- Apply the framework to a case of Strathmore University

Research Questions

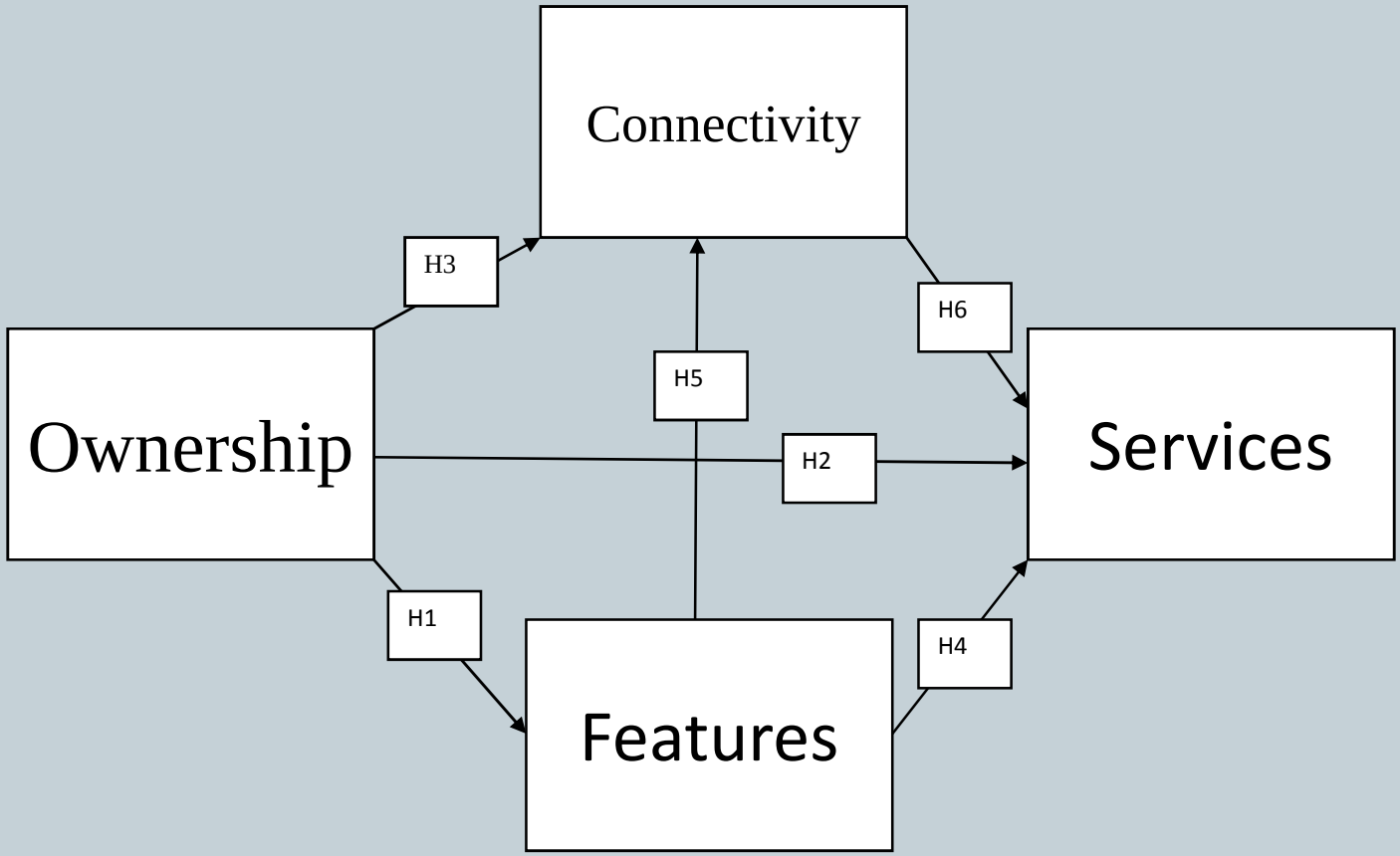
- What technologies adoption framework have been developed to study mobile computing?
- What frameworks are applicable to mobile computing in universities?
- Are these frameworks applicable to Kenyan Universities? Strathmore University?

Research Hypothesis

- **Hypothesis 1**: The ownership of a mobile device is influenced by the features of the device.
- **Hypothesis 2**: The ownership of a mobile device will be dependent on the services available to the user.
- **Hypothesis 3**: The ownership of a mobile device will be dependent on the connectivity options available to the user.
- **Hypothesis 4**: The features of a mobile device directly influence the services that users can access.
- **Hypothesis 5**: The available connectivity will affect the features of the mobile devices used.
- **Hypothesis 6**: The services accessible to a mobile device will depend on the type of connectivity available.

Proposed Research Model

- Model with hypothesis



Research Methodology

- Use of case study method
- Adopt guideline by Yin in 1994
- Simple random without replacement

Case Research Method - Pros

- Brings to an understanding a complex issue or subject.
- Extend experience or add strength to what is already known through previous research.
- Emphasis detailed contextual analysis of a limited number of events/condition and their relationships.

Case Research Method - Critique

- The study of a small number of cases can offer no grounds for establishing reliability or generality of finding.
- The intense exposure to study of the case biases the finding.
- It is useful only as an exploratory tool.

Research Design

- Sample taken from students and staff
- Equation (Cochran, 1963)
  - $n_o = (_Z{}^2pq) / e^2$ .....(1) Population > 50,000
  - $n = n_o / (1 + (n_o - 1) / N)$.....(2) Population < 50,000
- Where
  - N = sample size
  - z = critical standard score
  - p = the size of population that will be male
  - q = The size of population that will be female
  - e = Margin of error
  - N = Size of the student population

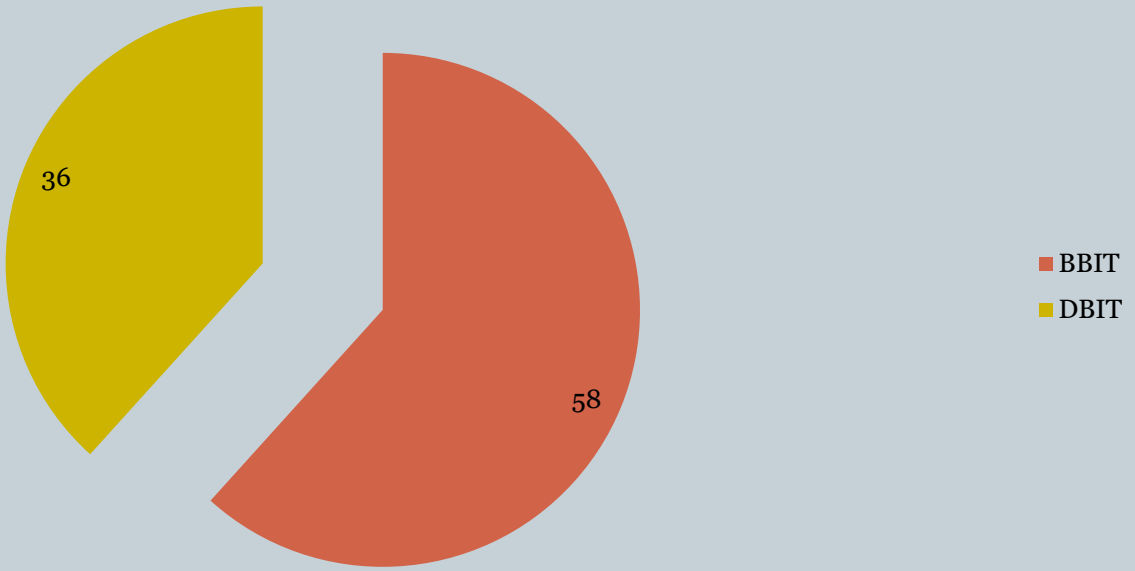
Research Design

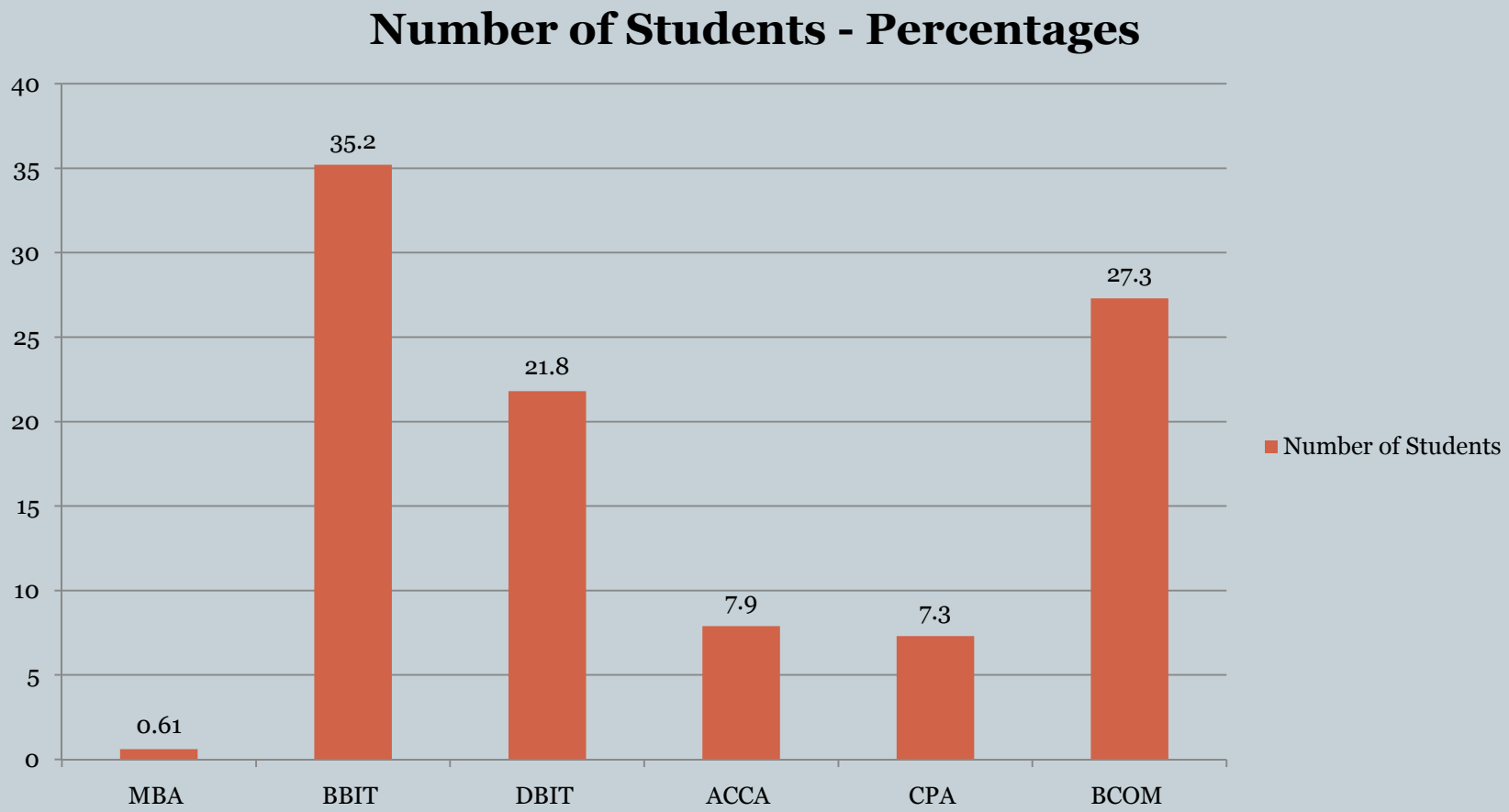
- Exploratory research study
  - Students, n = 250,
  - Staff, n = 60
- Data collected by use a questionnaire
- Response rate
  - Students - 78.6% (165 respondents)
  - Staff – 76% (38 respondents)
- Secondary data from related studies used.
- Selection of questionnaire was because

Research Findings

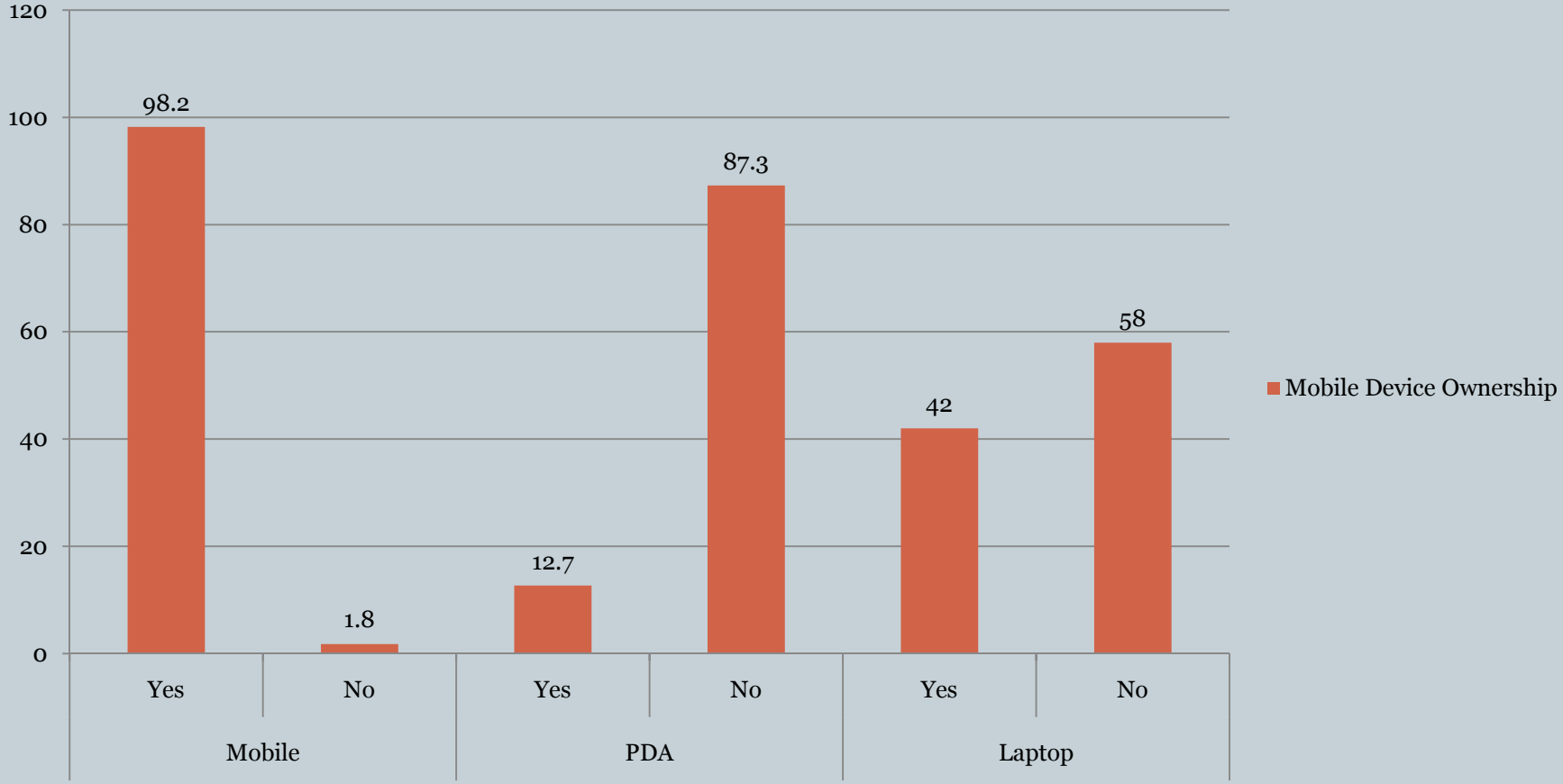
- Grouped as
  - Faculty
  - Device Ownership
  - Main services/features used
  - Connectivity methods

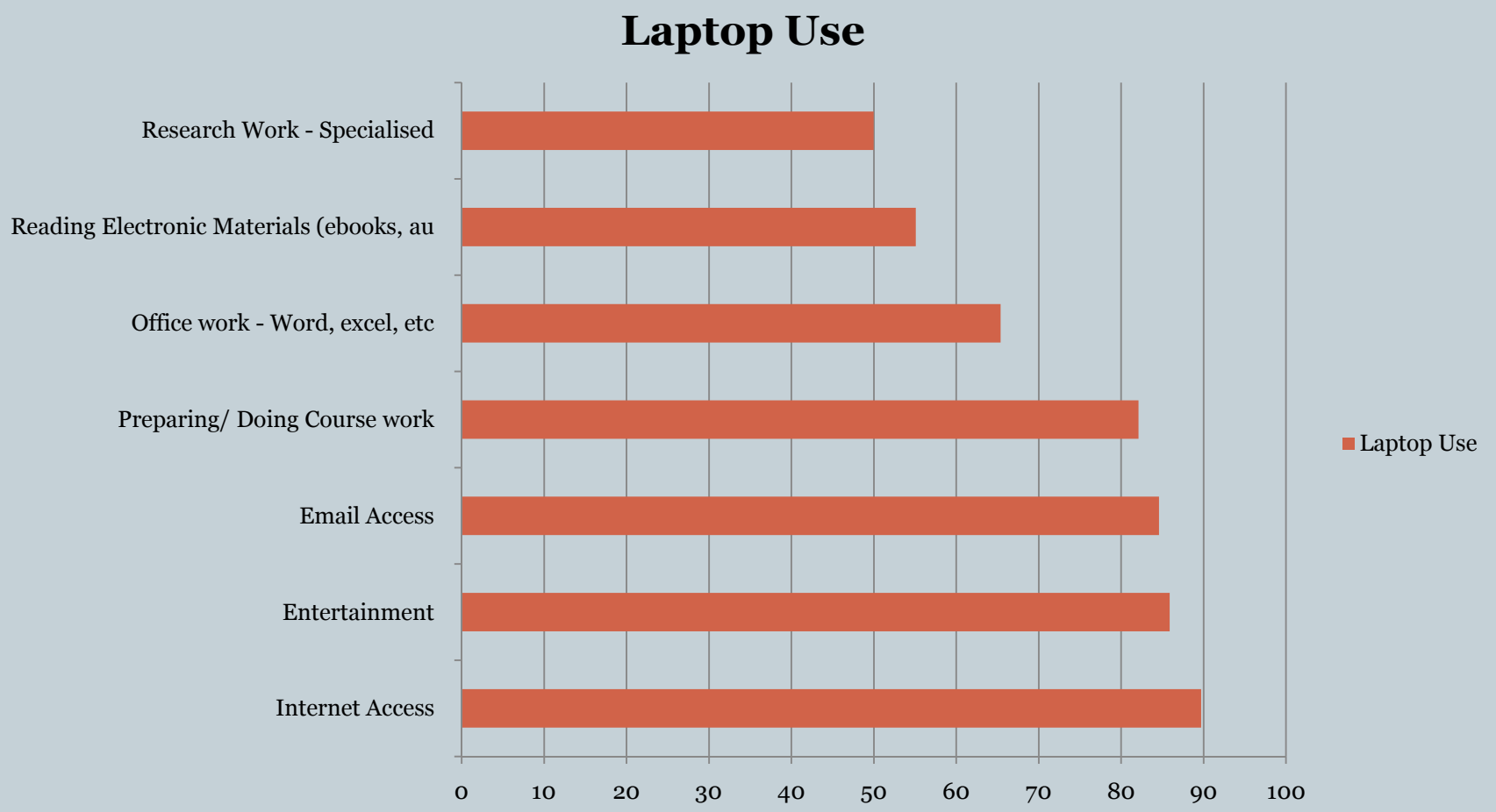
Gender representation - Percentages




Number of Students - Percentages
40
35
30
25
20
15
10
5
0
35.2
27.3
21.8
7.9
7.3
0.61
MBA
BBIT
DBIT
ACCA
CPA
BCOM
Number of Students

Mobile Device Ownership




Laptop Use
Research Work - Specialised
Reading Electronic Materials (ebooks, au
Office work - Word, excel, etc
Preparing/ Doing Course work
Email Access
Entertainment
Internet Access
0
10
20
30
40
50
60
70
80
90
100
Laptop Use

Research Analysis - Hypothesis

- ***Hypothesis 1: The ownership of a mobile device is influenced by the features of the device.***

Cross-tabulation own a laptop/Notebook and Features used						
			Number of Features used			
			Less than 3 features	Between 3-5 features	Above 5 features	Total
own a laptop/Notebook	0	Count	61	3	3	67
		% within own a laptop/Notebook	91.00%	4.50%	4.50%	100.00%
	Yes	Count	5	22	24	51
		% within own a laptop/Notebook	9.80%	43.10%	47.10%	100.00%
	Total	Count	66	25	27	118
		% within own a laptop/Notebook	55.90%	21.20%	22.90%	100.00%

Percentages and totals are based on respondents.

Cross-tabulation of ownership of a mobile phone and the features of the phone						
			Number of features			
			< 3	3 – 5 features	>= 6 features	Total
own a mobile phone	0	Count	0	1	1	2
		% within own a mobile phone	0.00%	50.00%	50.00%	100.00%
	Yes	Count	26	49	36	111
		% within own a mobile phone	23.40%	44.10%	32.40%	100.00%
	Total	Count	26	50	37	113
		% within own a mobile phone	23.00%	44.20%	32.70%	100.00%

Hypothesis 2: The ownership of a mobile device will be dependent on the services available to the user.

Mobile phone ownership and services accessed Crosstabulation												
			Services Accessed									
			University Web Site	General Internet	E-Learning Site	Internet Based mail	Entertainment	Social Networks (e.g. Facebook)	Instant Messaging	Audio Books	Ebooks	Total
Mobile device ownership and connectivity to the internet	Yes	Count	20	48	22	33	45	54	18	2	7	69
		% within q35	29.00%	69.60%	31.90%	47.80%	65.20%	78.30%	26.10%	2.90%	10.10%	
	No	Count	2	2	2	1	2	2	2	2	2	2
		% within q35	100.00%	100.00%	100.00%	50.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
	Total	Count	22	50	24	34	47	56	20	4	9	71

Percentages and totals are based on respondents.

Hypothesis 3: The ownership of a mobile device will be dependent on the services available to the user.

Connectivity out of campus and Device used Crosstabulation

			Device Used				
			Laptop/Notebook	PDA``	Smart Phone	Cyber Computers	Total
access the university network while out of the University	Yes	Count	19	3	2	32	44
	No	Count	1	0	0	1	2
	Total	Count	20	3	2	33	46

Percentages and totals are based on respondents.

Hypothesis 4: The features of a mobile device directly influences the services that users can access.

Correlations between features Laptop/Notebooks and services accessed

		Services Accessed	Laptop features
Services accessed	Pearson Correlation	1	-.350**
	Sig. (2-tailed)		0
	N	118	117
Laptop features	Pearson Correlation	-.350**	1
	Sig. (2-tailed)	0	
	N	117	118

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

Hypothesis 5: The available connectivity will affect the features of the mobile devices used.

Connectivity to the internet and the features of a mobile phone Crosstabulation

			Features of the Mobile Phone								
			Making and Receiving Calls	Alarm and Calendar	Short messages (SMS)	Instant Messaging (Chatting)	Internet Access	Entertainment - Music, Games	Store contact information	Play games	Total
connectivity to the internet	Yes	Count	67	66	68	36	62	59	61	51	71
	No	Count	14	12	14	4	7	6	12	9	16
	Total	Count	81	78	82	40	69	65	73	60	87

Percentages and totals are based on respondents.

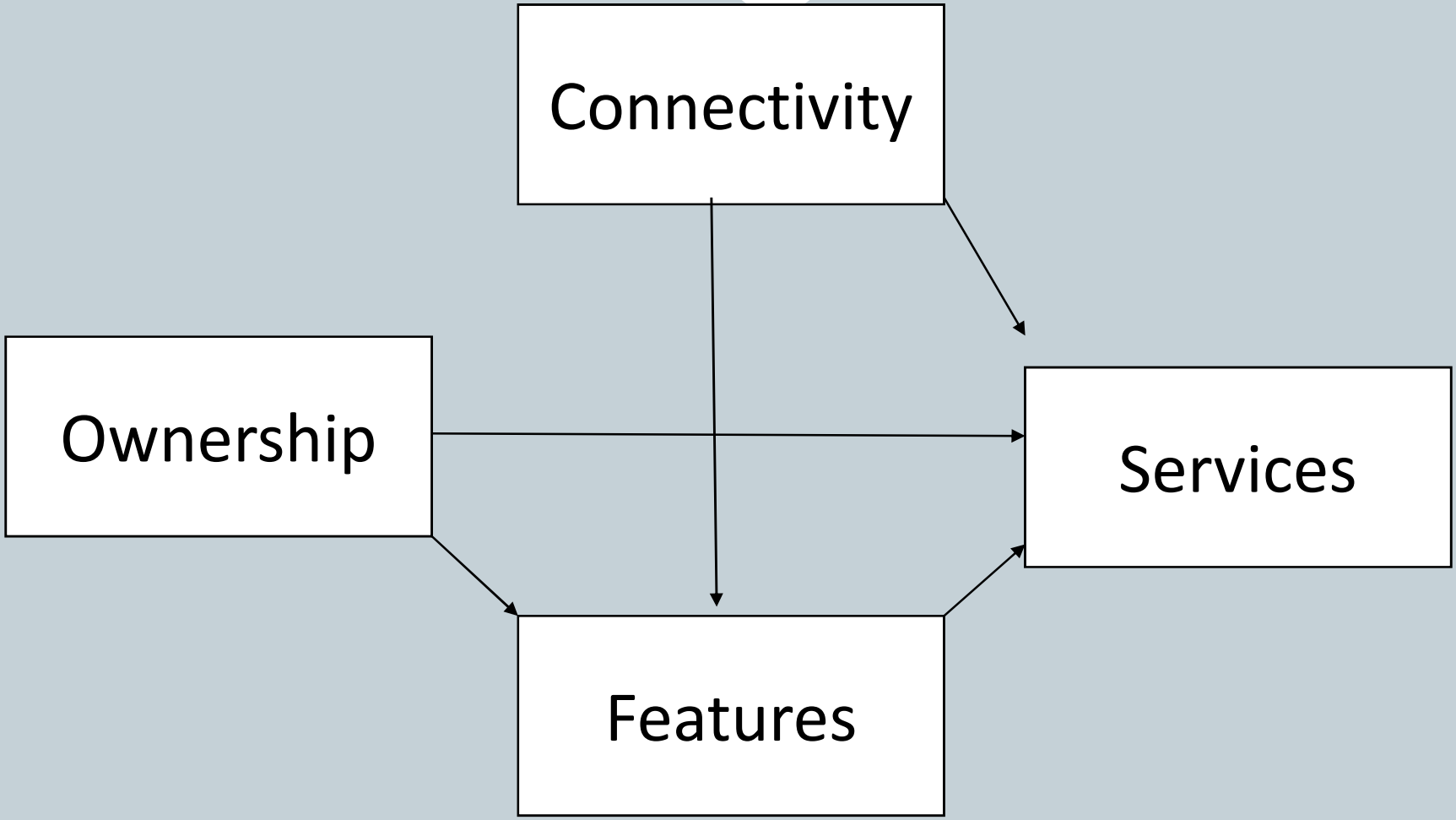
Hypothesis 6: The services accessible to a mobile device will depend on the type of connectivity available.

Access to University network * Services accessed Crosstabulation

			Services Accessed								
			University Intranet	Internet	E-Learning Site	Academic Management System	University Email	Other University Servers	Library Services	University Website	Total
access the university network while out of the University	Yes	Count	14	19	38	5	5	4	15	12	44
		% within q40	31.80%	43.20%	86.40%	11.40%	11.40%	9.10%	34.10%	27.30%	
	No	Count	1	1	3	1	0	0	2	1	4
		% within q40	25.00%	25.00%	75.00%	25.00%	0.00%	0.00%	50.00%	25.00%	
	Total	Count	15	20	41	6	5	4	17	13	48
Percentages and totals are based on respondents.											

- the following hypothesis were found to be true.
  - **Hypothesis 1**: The ownership of a mobile device is influenced by the features of the device.
  - **Hypothesis 2**: The ownership of a mobile device will be dependent on the services available to the user.
  - **Hypothesis 4**: The features of a mobile device directly influences the services that users can access.
  - **Hypothesis 5**: The available connectivity will affect the features of the mobile devices used.
  - **Hypothesis 6**: The services accessible to a mobile device will depend on the type of connectivity available.
- The following hypothesis could not be proved as true:
  - **Hypothesis 3**: The ownership of a mobile device will be dependent on the connectivity options available to the user.

Proposed Model



Mobile Services Important to Students

- Timetable information
- Exam results checking
- Subscription and enrolment services
- Student voting
- Fees balance information
- Online library reservation
- Download of e-materials
- Instant messaging

Conclusion

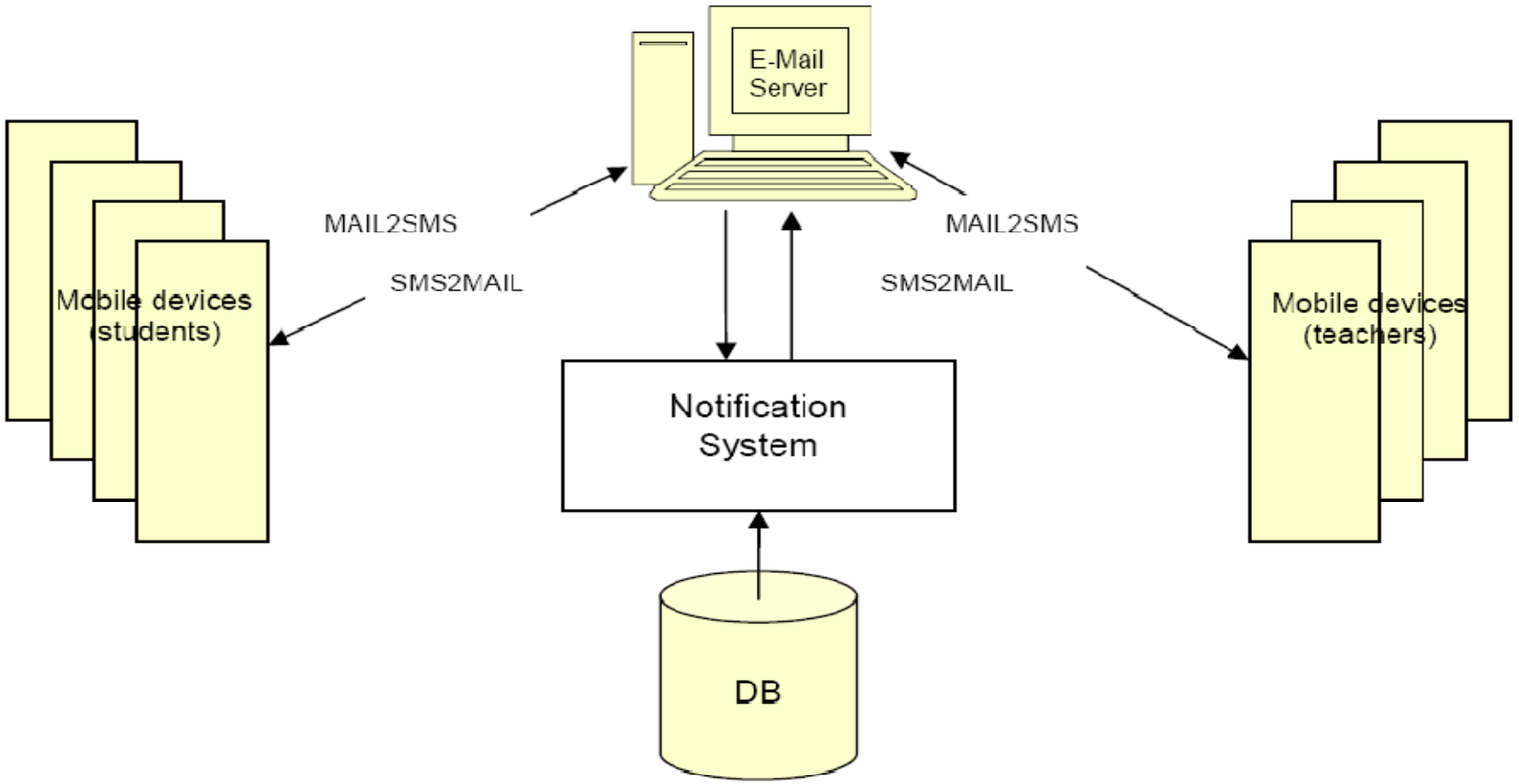
- The researcher's interest is in specifically looking at the role the university establishment can play in taking advantage of available mobile computing technologies in the university campus.
- The value of this research lies in a better understanding of how mobile computing technologies can be used to extend both teaching and learning services in universities.
- It is evident that there is availability of powerful mobile computing devices in universities.
- The development of services and systems requires careful consideration of the needs of the users (services desired) and the type of devices that they own.

- For universities of the future using new technologies, the systems must be applied with intuitive, ease-to-use systems for learning, and these systems will gain their acceptance.
- After developing mobile systems,. It is necessary to promote and point out how useful the system is to users. We also need to educate learners or students' learning habits and prove that they could obtain more services through mobile computing devices.
- In the end, it is always a human who chooses to accept or reject a particular technology.

Future research

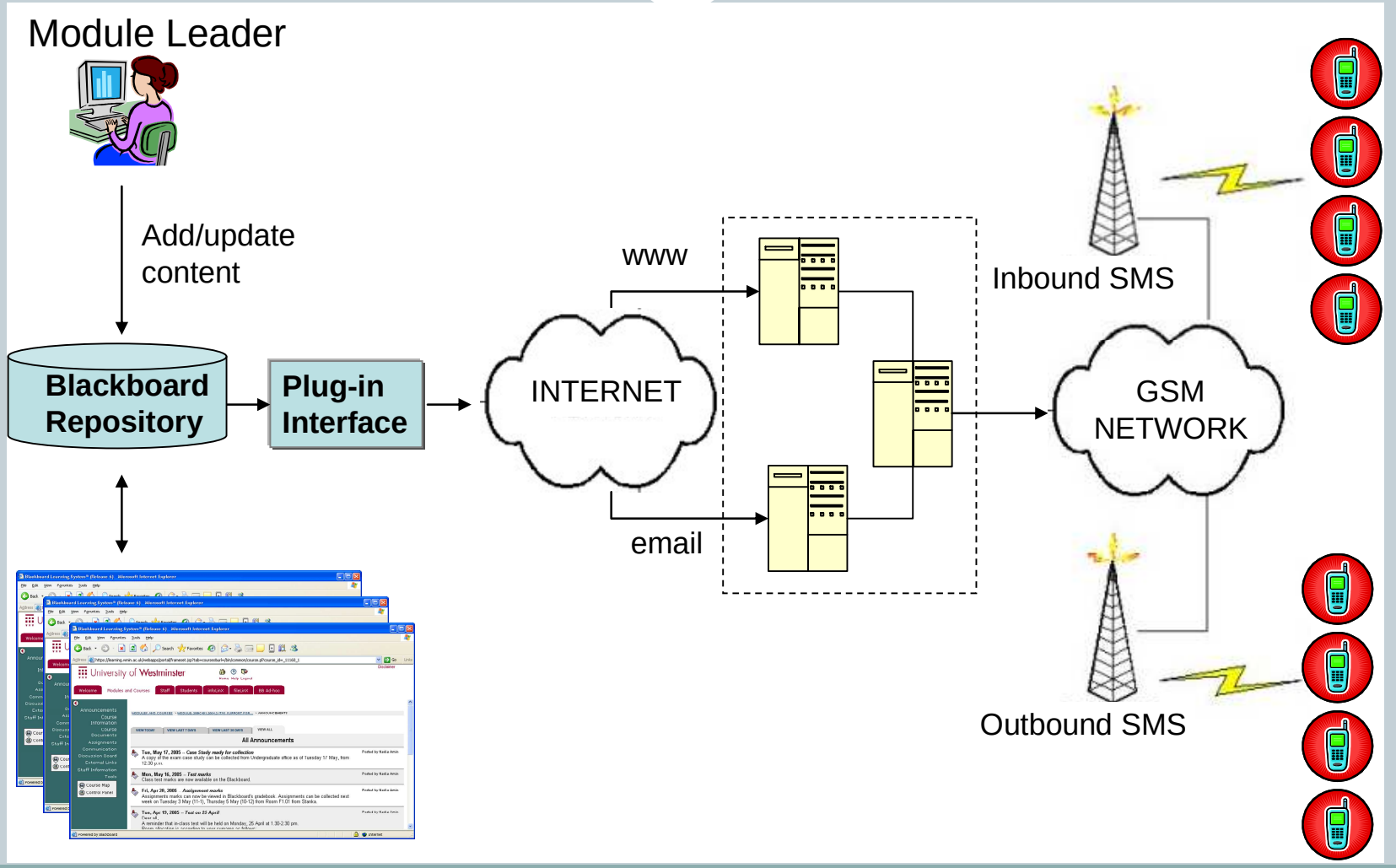
- The research should be extended to cover a public university which has a higher population of users and different environment compared to Strathmore University which is a private university.
- There are universities that have deployed mobile based systems. Further studies should be done to test the model proposed against these.
- Their effectiveness and acceptability should also be investigated.
- Further studies should also be carried out to find out which services are deemed important by university communities. These can then be given priorities during roll-out.

Example Of Application - 1



Organizational scheme of "Notification/ Information" m-service (Doneva,Kasakliev, and Totkov 2006.)

Example Of Application - 2



Integrating SMS with Blackboard (Vassell, 2006)

Parting Shot.....

Each second around the world, four people are born……and 36 mobile phones are sold.

(Mehul B. Patel, 2008)