Integrating Business Intelligence and Mobile Commerce

Juliet V. Menor
Pangasinan State University, San Carlos Campus
San Carlos City, Pangasinan 2420, Philippines
psujulietmenor@gmail.com

Abstract - *Mobile industry is the ordering and retailing of merchandise, manufactured goods and amenities over wireless digital tools or gadgets like the cellular telephone and computer devices. This paper utilized the descriptive developmental approach of research method in describing the current profile of a local business enterprise in forecasting sales and profits as it implements an existing mobile-commerce system. This paper is aims examine the profile of business in mobile commerce in terms of sales and profit; identify the functional and non-functional requirements of the business intelligence in forecasting sales and profit; and test the level of acceptability of the business intelligence mobile commerce system in terms of learnability, efficiency of use, user satisfaction and reliability. As a result, the level of acceptability of the integrated business intelligence and mobile commerce is highly acceptable, with an overall average weighted mean of 3.83 centered on the criteria such as reliability, user satisfaction, learnability, and efficiency of use. To conclude this study it shows that integrating business intelligence and mobile commerce is highly acceptable to the business communities and to the business enterprises. This study will also serve as a future reference for other researchers who will conduct a similar or comparable study.*

Keywords - Business Intelligence, Forecasting, Sales, Profits, Mobile Commerce

INTRODUCTION

Mobile commerce is a system using electronic technology to organize businesses. Furthermore, with increasing mobile applications overtaking contemporary desktop, it is just a matter of time before mobile commerce does the same [4]. The expansion of the Web is increasing from a manageable gathering of Web sites into systematized marketplaces. Computers have helped workers on businesses perform their jobs more efficiently. Routine functions such as sending memos done through emails. Furthermore, every enterprise integrates information system to maintenance information flows, business processes, data analytics and reporting [1].

In a wide entrepreneurial business, the use of information systems becomes a powerful tool, which is very helpful and beneficial to their business operation. In other words, they need an application that can keep records of their various business transaction and inventory management in order to manage their products and avoid

mishandling of it [2]. One of the major developments in information systems is online advertising, wherein businesses can now advertise their products and services globally with the internet. It has been utilized as one of the marketing strategies used by different businesses all over the world that caught the interest of netizens.

Mobile commerce is the ordering and retailing of goods and amenities over wireless handheld digital devices which is the cellular telephone and computer devices. The next evolution was e-commerce; m-commerce assists the permission through the Internet without requiring finding a place to plug [3]. Electronic Business is the instrumentation using electronic technology to organize businesses. For the past, the period of the electronic market was the greatest motivating and stimulating features of the evolution for the arrival of electronic business or e-business as a popular and maintainable auxiliary to more traditional methods of businesses being directed nowadays [4]. E-

business has become an essential part of business strategies and a dynamic element for economic growth that has grown progressively in the worldwide economy thus, mobile commerce nowadays is essential to the economy of many countries in the world.

Moreover, the file accretion due to competitive pricing of data storages and connectivity has grown problems and issues on how companies organize the interconnections between application data storages, the technology available and analytic methods most effectively. Business Intelligence (BI) can be very facilitative and association of information, methodologies, and analytical tools to be used in decision-making practice [5].

Furthermore, Mobile E-Commerce integrated with Business Intelligence provides alternative information regarding the business' processes and deliver this information in a timely and appropriate manner to company decision makers in order for them to make their tactical and strategic decisions. Business Intelligence for data analysis can serve information systems of the enterprise and complement data from external sources [6].

OBJECTIVES OF THE STUDY

The objectives of this study are: (1) Identify the profile of business in mobile commerce in terms of sales and profit; (2) Identify the functional and non-functional requirements of the business intelligence in forecasting sales and profit; and (3) Test the level of acceptability of the business intelligence in terms of: learnability, efficiency of use, user satisfaction and reliability.

MATERIALS AND METHOD

The descriptive developmental approach of research was used in this study. The descriptive method of research was used in order to obtain and elicit the requirements of the system. The developmental approach, on the other hand, was utilized to create the system based on the elicited requirements. [19]

The descriptive method of research is an approach or technique to describe and explain occurrences, situations, or events based on factual information garnered through direct experiences or observations. Accurate information can be gathered using survey tools such as interview, observation or a survey questionnaire [21].

The researcher utilized the descriptive method of research [20] in order to identify the profile of the present implementation of the mobile-based business application to specify its functional and non-functional requirements along with its fundamental features and components.

Meanwhile, in order to create and develop the actual business intelligence application that will be integrated with the mobile commerce application system, the researcher employed the developmental method of research along with the use of Iterative Waterfall Model as a method of System Development Life Cycle (SDLC). The developmental method of research is the gradual adjustments being made to the system as development occurs over an extended period of time. [22]

CONCEPTUAL FRAMEWORK

The Iterative Waterfall Model was used to identify and form the context of the proposed business intelligence application. The Iterative Waterfall Model is a methodology comprehensively employed in analyzing and contextualizing the overall development of an information software processing. In this model, the researcher gathered all the pertinent data required to develop an effective and efficient system [8]. The researcher undertook several interviews, survey, and research, to gather relevant information. The researcher also looked for all the possible functional and non-functional requirements that will suit for the project development. The development relates to the methods used by the researcher, which include descriptive and developmental methods of research and Iterative Waterfall Model, which includes the phases, namely: requirements, design, implementation, verification and validation and operational and maintenance. During the requirement phase, pertinent business

process transactions were carefully observed to elicit the requirements. In the design phase, the researcher and developer created a blueprint that will satisfy all documented requirements. After the requirement and design phase, implementation comes next.

In this phase, each unit of the system was tested to ensure its function. Once the system has been implemented, the stakeholder to ensure the developed system meets their requirement as shown in Figure 1 tested verification and validation.
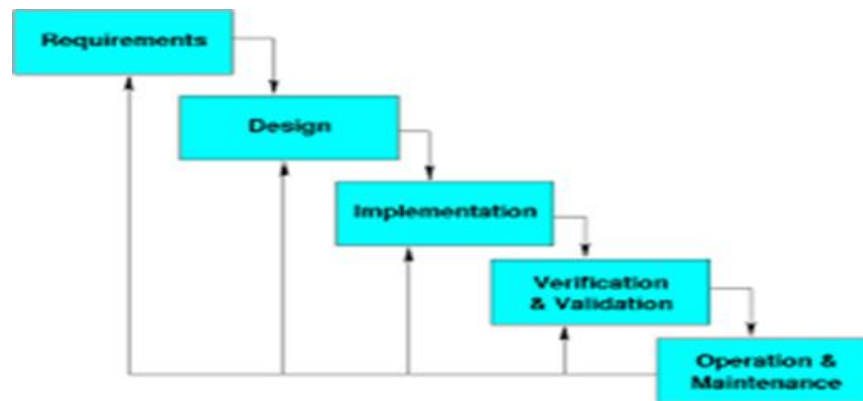

Figure 2. Waterfall Model

The researcher utilized the developmental method of research. The sales and profits forecast results served as the key requirement of developing the BI application [23]. The system requirements such as sales and profits information stored in the system's database were identified to be requisites of the proposed system as it will be the main basis for computing the forecast. Forecast sales and forecast profits were identified as the required input parameters of each BI application.

The user interface (UI) was designed according to the visual requirements of the application. Forecast table and bar graph were chosen to present data visually. While designing the UI, procedures and functions were coded and developed [23]. The user interface was designed according to visual requirements of the application to forecasting the sales and profit. In addition, the functional and non-functional requirement were also integrated into the system [24].

Meanwhile, the outcome relates to the forecasting results of the proposed BI application and the integration and acceptability test results,

while the details of how the researchers applied the Iterative Model are discussed in the methodology section of this research [7].

Research Population and Sample. The research is conducted with the business application at a local business enterprise who is presently implementing a mobile-based business system. The respondents of this research are the business managers, the business owners, and the managing directors. The respondents served as the key persons who provided priceless first-hand information on the profile of the company regarding how sales and profits forecasts are being manually computed based on the data available from the mobile commerce in their business application system presently being implemented. The respondents provided important information such as daily and monthly transactions which are and in the decision making needs of the management [26]. Each respondent has also participated in the final User Acceptance Test (UAT).

Table 1. Research Population Distribution

Category	Enterprise Category		Total
	Small	**Medium**	
Trading Store	10	10	20
Furniture Shop	10	10	20
Footwear Store	10	10	20
Computer Shop	10	10	20
Bamboo Store	10	10	20
Total	**50**	**50**	**100**

The distribution of the respondents in their respective stores and shops categories is shown in Table 1.

The research was conducted in 50 Stores and Shops enterprises implementing Mobile Commerce Business Application System composed of trading, furniture, and footwear, computer, and bamboo shops. The research population of the study comprised of Fifty (50) business owners and Fifty (50) managing directors for a total of 100 respondents.

Instrumentation and Data Collection. The researcher employed numerous instruments and techniques to achieve the objectives of this research by using questionnaires, personal interviews, observations, and analysis of pertinent documents to develop the business intelligence application for the mobile commerce business application system and complete the study [27].

Observation. The researcher applied the observation method in acquiring data related to the study. Observation is the process of allowing researchers to fully understand the relevant actions and responses of individuals who are engrossed on a system in their natural environment or workplace through deep observation and action involvement [28].

In this method, the researcher organized an interview with the respondents in their respective places and observed the processes made in the developed business application. The flow of information concerned in completing the manual process is evaluated, observed, examined and noted [29]. The techniques, disadvantages, limitations, and conflicts concerning the execution of the manual business processes of the business were acknowledged by the researcher.

Interview. Another method used by the researcher in collecting data and information is the interview method.

Using this method, the researcher prepared an organized set of important questions enquired to stakeholder-respondents who provide a detailed description of circumstances, measures, procedures, answers, outcomes, or events [30].

A requirement is classified either as functional or non-functional. Functional requirements pertain to the requisites that a system must basically comprise of such as sales and profits forecast to be updated after each sale dated taking into account the future and current prices, planned promotions, costs and products as well as artifact varieties changes. These requirements govern how the system would perform and what sorts of effects it will produce once installed and run [33].

In this method, the researcher request for a schedule with the respondents to personally ask the questions structured in the interview questionnaire. This is to identify the functional and non-functional requirements appropriate to the creation and development of business intelligence application suited for their developed mobile commerce system. Important answers were noted while unclear answers were fully clarified and discussed with the respondents [31].

The researcher also prepared sets of survey questionnaires which were used and distributed as follows:

Planning and Design Phase. The researcher prepared a separate questionnaire concerning the planning and design phase. This was floated to the Huang Ming Zhu business owners to identify the common business forecasting and analytics problems that were encountered in their company such as non-repeatable and non-comparable methods, lack of quantitative analysis, no simple way to include bottom-up inputs from sales, and lack of tools to analyzed historical trends [32].

Final User Acceptance Test. The respondents were provided with another questionnaire to evaluate the business intelligence application for the mobile commerce system. They were invited to evaluate the result of BI application and were also given a set of computer system evaluation form to evaluate the software modules and in terms of presentation, information, economic, control and security, efficiency, and delivery aspects [34].

Relative frequency distribution was the statistical tool used by the researchers in order to produce a frequency distribution among the respondents. The relative frequency formula is as follows:

$$= \Sigma \quad 100\%$$

where:

= Relative Frequency rate in %
= Frequency result
Σ = Sum of frequencies

All the respondents were properly oriented as to the purpose of the survey and were assured that their individual answers and individual information will be private. Clarifications raised by respondents during the survey were accommodated accordingly and secured that confusing matters were clarified.

The results of the table answers of the respondents were integrated into the design and development of the business intelligence for the mobile commerce system.

Analysis of Documents. Document analysis is also employed by the researchers for data collection. It is the process of gathering documents and other forms connected to actual business functions where documents gathered were analyzed to identify the goals and the flow of the business functions. Documents may include written protocols and guidelines. [35]

The relevant business forms gathered include sales and profits reports forecast. These documents served as guides for the developer in identifying the data and its flow for every phase of the business purposes.

RESULTS AND DISCUSSION

This study used survey type of descriptive and developmental research where respondents answer the questions administered through interviews or questionnaires [36] such as evaluation form to evaluate the software modules in terms of presentation, information, economic, control and security, efficiency, and delivery aspects. This study developed an integrated business intelligence using mobile commerce system based on the standards of an online business site and conducted a test to determine the acceptability of the system to small and medium enterprises. The descriptive survey method was employed because it provides an accurate portrayal or account of the characteristics of the present profile such as behaviors, opinions, beliefs, abilities, and knowledge of a particular individual, situation or group. This method is chosen to determine the acceptability of applying the business intelligence application.

The User Acceptance Testing (UAT) is used for analyzing the functionality of an adapted scheme once the improvement stage has been finished. The researchers made use of the standardized Website Analysis and Measurement Inventory test in accomplishing the acceptability of the system [37]. The themes imposed in the Website Analysis and Measurement Inventory (WAMMI) are based on a data using statistical methods known as latent variable analysis and have a reliability data rating of between 0.90 and

0.93. User Acceptance Testing (UAT) is identical and vital for the effective execution of any changed scheme. Monsuwe and Ruyter (2004) [38]. In order to test the acceptability of the system, a ready-made WAMMI structured questionnaire was used to the intended users such as the customers, buyers, shoppers and other individuals using mobile.

Table 2 shows the feedback of the identified users in terms of learnability, efficiency of use, user satisfaction, and reliability. To give relevant meaning to the organized numerical data, a Likert Rating Scale of one to five was used. The Likert Rating has the rate of 1 for strongly disagree which means that the

respondents strongly does not favor the concept, 2 for disagree which means that the respondents somewhat not in favor of the concept, 3 for undecided, 4 for agree, and 5 for strongly agree.

Learnability. Learnability is an idea accurate in the design and improvement of products, software, and user interfaces. The learnability (the ease with which a software application understood by users), is essential because the better the learnability of an application, the less training and time it will take for a person to use it [39].

Table 2. System Evaluation According to Learnability

Learnability	Mean	Description
1. The business in website doesn't need More introductory explanations	3.80	Agree
2. Learning to find my way around this Website is not a problem.	3.75	Agree
3. Using this website for the first time is Easy.	3.70	Agree
4. Remembering where I am on this website is not difficult.	4.05	Agree
Weighted Mean	**3.83**	**Agree**

Legend: (SD); Strongly Disagree, (D); Disagree, (U); Undecided, (A); Agree, (SA); Strongly Agree.

The above table shows the system evaluation criteria for the learnability of the system. The criteria used to evaluate the system. Learnability is the pace at which users become familiar with the website.

The table is clearly indicative that highest rate of learnability are from remembering where I am on this website is not, with 4.05 weighted mean and the lowest rate from using this website for the first time is easy, with 3.70 weighted means.

The result of Table 2 shows the average weighted mean of 3.83 reveals that majority of respondents agree that the system is not complicated, and it can easily use because it is user-friendly.

Table 3. System Evaluation Criteria for the Efficiency of Use

Efficiency of Use	Mean	Description
1. It is not difficult to move around this website.	3.70	Agree
2. I can quickly find what I want on this website.	3.80	Agree
3. This website seems illogical to me.	3.85	Agree

4. This website helps me find what I am looking for.	4.20	Agree
5. The website is fast.	3.85	Agree
6. I can easily contact the people I want on this website.	3.65	Agree
7. I feel efficient when I'm using this website	3.70	Agree
8. It is not difficult to tell if this website has what I want.	3.55	Agree
9. Using this website for the first time is easy.	3.85	Agree
10. Everything on this website is easy to understand.	3.85	Agree
Weighted Mean	**3.80**	**Agree**

Legend: (SD); Strongly Disagree, (D); Disagree, (U); Undecided, (A); Agree, (SA); Strongly Agree.

The efficiency of use of the system refers to the features which are easy to locate, quick to load the navigation within the system, and difficulties in searching. As shown in Table 3, the data showed that the highest rate of efficiency of use is "this website helps me find what I am looking for", with 4.20 weighted mean and the lowest rate is "it is not difficult to tell if this website has what I want", with 3.55 weighted mean.

Table 3 reveals that most of the respondents say that the system was efficient in terms of quick access having a weighted average mean of 3.80.

Table 4. System Evaluation According for User Satisfaction

User Satisfaction	Mean	Description
1. The website has much that is of interest to me.	4.20	Agree
2. The page on this website are very attractive.	4.30	Agree
3. I feel in control when I'm using this website.	3.75	Agree
4. I don't like using this website.	4.20	Agree
5. I can easily contact the people I want on his website.	4.20	Agree
6. It is not difficult to tell if this website has what I want.	3.95	Agree
7. This website has favorable features.	4.25	Agree
8. Using this website is not waste of time.	3.90	Agree
9. I get what I expect when I click on things on this website.	4.10	Agree
10. Everything on this website is easy to understand	3.95	Agree
Weighted Mean	**4.08**	**Agree**

Legend: (SD); Strongly Disagree, (D); Disagree, (U); Undecided, (A); Agree, (SA); Strongly Agree.

It is shown in Table 4 the criteria for the evaluation of the system based on the user's satisfaction. User satisfaction refers to the users' feeling of using the system comfortably. It is frequently dignified as distinct of the best vital appraisal aspects which are typically careful as an average organization achievement and usefulness [40]. Based on the evaluation, the customer

satisfaction was independently adaptable which can be inclined by more than few features such as user effectiveness, user characteristics, effort, opportunities, and organizational effectiveness [41].

The table is clearly indicative that highest rate of user satisfaction is from the page on this website are very attractive, with 4.30 weighted

mean and the lowest rate from I feel in control when I'm using this website, with 3.75 weighted means. Based on the analysis of data gathered, where Table 4 shows a weighted average mean of 4.08, which signifies that most of the users agree that system is very user-friendly. Reliability refers to consistently perform and based on its specifications which refer to the website being available and complete. It has long been considered one of the related attributes that must be considered when creating system software. The consistency of the possibility that the method will accomplish its future purpose is shown underneath scheme restrictions.

Table 5. System Evaluation According to the Reliability of Use

Reliability	Mean	Description
1. This website is very fast.	3.60	Agree
2. I get what I expected when I click on this website.	3.63	Agree
Weighted Mean	**3.62**	**Agree**

Legend: (SD); Strongly Disagree, (D); Disagree, (U); Undecided, (A); Agree, (SA); Strongly Agree.

Table 5 above noted the System Evaluation According to the Reliability of Use information. Reliability states that the system is available and given complete all the time.

The table is clearly indicative that highest rate of reliability is from "I get what I expect when I click on this," with 3.630 weighted means and the lowest rate from "this website is very fast," with 3.60 weighted means. The analysis reveals a weighted average mean of 3.62 which explains that the system is reliable, available and all links are indicated and functions are active.

Table 6. General Weighted Mean for Acceptability of the Integrating BI Mobile Commerce

Description	Mean	Description
1. Learnability	3.83	Agree
2. Efficiency of Use	3.80	Agree
3. User Satisfaction	4.08	Agree
4. Reliability	3.62	
Weighted Mean	**3.83**	**Agree**

Legend: (SD); Strongly Disagree, (D); Disagree, (U); Undecided, (A); Agree, (SA); Strongly Agree.
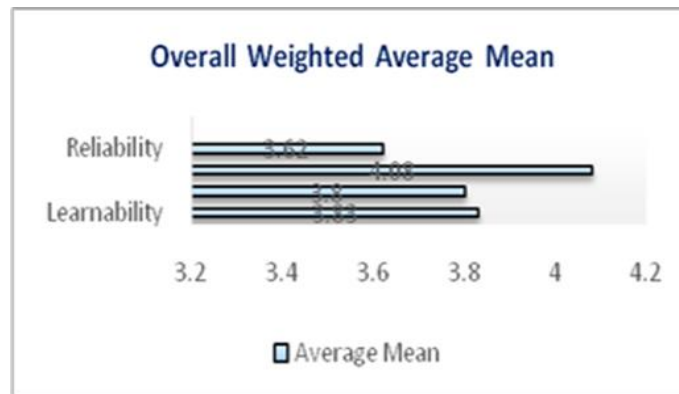
Figure 2. The Overall Weighted Average Mean of Integrating BI Mobile Commerce

Table 6 and figure 2 show the general weighted mean for acceptability of integrating business intelligence with mobile commerce, the acceptability of which is highly acceptable with an overall weighted average mean of 3.83 based on the criteria such as learnability, the efficiency of use, user satisfaction, and reliability. The study shows the BI mobile commerce using the iterative waterfall model process was effective in a business application. The study proved that the use of the BI mobile commerce website contributes to the effective development of a business application that is highly appraised by prospective users.

The study proved that the developed Integrating Business Intelligence Mobile Commerce is efficient, easy to navigate, satisfies the users and reliable as shown by the weighted average of 3.83. Therefore, it is concluded that strategy that adds excellence to customer service and a dynamic social media presented into the mix can spell higher traffic and better sales for the business. This study shows that mobile commerce is highly acceptable to the business community and to the users. The result of this study will serve as a future reference for other researchers who will conduct the similar or comparable study.

CONCLUSION AND RECOMMENDATION

The acceptability of integrating business intelligence with mobile commerce is highly acceptable, as shown by the overall weighted average mean of 3.83 based on the criteria of learnability, efficiency of use, user satisfaction, and reliability. The use of the Iterative Waterfall Model process was effective in the development of the Integrated Business Intelligence and Mobile Commerce business application system. This website model contributes to the effective development of a business application that is highly accepted by prospective users. With the existing manual forecasting processes identified, the functional and non-functional requirements of business intelligence modules to be integrated with the mobile-based Huang Ming Zhu Marketing system were determined and were incorporated in the development of the said B.I. modules in computing sales and profits during the creation and development.

The developed BI application was accepted in the use and integration tests having no faults or errors found during functional, integration tests and during the user acceptance test. The developed business intelligence modules were unanimously recommended to be implemented by the UAT participants during the user acceptance test conducted resulting in an overall average weighted mean rating of 3.83.

The study was conducted as a prelude to a comprehensive study on Integrating Business Intelligence and Mobile Commerce. It is recommended further study should be conducted focusing on the following variables namely: learnability, efficiency of use, user satisfaction and reliability.

REFERENCES

[1] Hossein Bidgoli, Computers: *The Machines behind Computing.* https://www.ndsu.edu/pubweb/~latimer/.../bidgoli.../9781111533960_PPT_ch02.ppt (2012).

[2] David T. Bourgeois, *Information Systems for Business and Beyond,* Retrieved from https://www.saylor.org/site/textbooks/Information%20Systems%20for%20Business%20and%20Beyond.pdf (2014).

[3] Rouse, M., *What Is Value Innovation? Tech Target* .Available at: http://searchcio.techtarget.com/definition/value-innovation (2015).

[4] Moss, B., Beimborn, D., Wagner, H. T. Weitzel, T., "*The role of innovation governance and knowledge management for innovation success*", in the 44th Annual Hawaii International Conference on System Science proceedings, Kohala: IEEE 1-10., (2011).

[5] Turban, E.; Sharda, R., & Delen, D., *Decision Support and Business Intelligence Systems,* 9th ed., Prentice Hall Press, Upper Saddle River NJ. (2010).

[6] Marketa Horakova, Hana Skalska, *Business Intelligence and Implementation in a Small Enterprise.* (2013).

[7] Books, LC, Software Development Process: *Waterfall Model, Computer Programming, Extreme Programming, Capability Maturity Model, Software Testing, Software Architecture, Code and Fix, Revision Control, Spiral Model, Iterative and Incremental Development,*(2011).

[8] Ana Azevedo, Manuel Filipe Santos, *Integration of Data Mining in Business Intelligence System*, A volume in the Advance in Business Strategy and Competitive Advantage (ABSCA) Books Series, ISSN: 2327-3429: ISSN: 2327-3437. (2015).

[9] VOŘÍŠEK, J., et al.. *Principe a model řízení podnikové information*. Oeconomica. ISBN 978-80-245-1440-6. (2018).

[10] GARTNER.. *Gartner Predic Three Business Intelligence Trends*, (2012).

[11] ROE, D., *Gartner Predicts Business Intelligence Will Go Mobile and Social*, (2011).

[12] Techaisle, *Cloud & Mobility Driving Business Intelligence Adoption*. White Paper, (2011).

[13] KOTLYAR, M., *6 Predictions for Business Intelligence* in (2012).

[15] Xiaping Zheng, Mengting Liu, *An Overview of Accident forecasting Methodologies.* (2009).

[16] Hyndman, Rob J. and Athanasopoulos, George. *Forecasting: Principles and Practice.* OTexts Publishing. ISBN: 0987507109/9780987507105. (2014).

[17] Rob J Hyndman, George Athanasopoulos, Forecasting: principles and practice, (2014).

[18] Nancy Nelson, Knupfer (n.d), *Descriptive Research Methodologies,* (2012).

[19] Nancy Nelson Knupfer and Hilary McLellan (n.d), *Descriptive Research Methodologies*, Software Development Life Cycle, (2012).

[20] Rai Technology University: Engineering Minds (n.d), *Management Information System*, (2009).

[21] Rick Still, SAS Institute Inc., Cary, NC, Fast Dashboards Anywhere with SAS® **Visual Analytics**, (2013).

[22] Lawrence Chung (n.d), Functional and Non-Functional Requirement , (2009).

[23] Jennifer Biewer, Value of a Partnership *Approach to User Acceptance Testing,* (2017).

[24] C. Carlsson; P. Walden; J. Veijalainen, *Mobile Commerce: core business technology and intelligent support* Jessica Iacono1, Ann Brown, and Clive Holtham (n.d), Research Methods – a Case Example of Participant Observation, (2004).

[25] Myers, M.D. and Avison, D. (Eds.) *Qualitative Research in Information Systems* London: Sage.(2002).

[26] Chrsna Jooste, Judy Van Biljon, and Jan Mentz (n.d), Usability Evaluation Guidelines For Business Intelligence Applications, (2012).