Winter 12-1-2013

How To Introduce On-Line Agricultural Products Navigation System On Google Earth Success

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ABSTRACT

In the agriculture industry many brokers exploit the benefits between farmers and customers and decrease farmers' income. As technology has developed, the internet has become the best advertising medium for many industries. In light of this, this study based on Google Earth, has designed an on-line Agricultural Products Navigation System operated by mobile devices which can easily exclude brokers, and build the bridge between farmers and customers in order to increase farmers income and customer benefits. Moreover, based on the IS success model of DeLone and McLean, by using qualitative methodology we expect this model will be able to provide system developers with the knowledge to improve the success of their systems.

Keywords: Electronic Commerce, Agricultural Products, IS Success Model

INTRODUCTION

The managerial tasks in agriculture are currently shifting to a new paradigm, requiring more attention to interaction with surroundings, namely environmental impact, terms of delivery, and documentation of quality and growing conditions (Sigrimis et al., 1999; Dalgaard et al., 2006). The increasing use of computers and the dramatic increase in the use of the Internet have improved and eased the task of handling and processing of internal information as well as acquisition of external information which may be produced from many sources and may be located over many sites (Sørensena et al., 2010). The potential of using these data will reach its full extent when suitable information systems are developed to achieve beneficial management practices (Fountas et al., 2006). For this reason, designing an information system should emphasize what farmers do and how they act (McCown, 2002). Although computer adoption on farms has been studied by many researchers (Amponsah, 1995; Ortmann et al., 1994; Huffman & Mercier, 1991), current studies do not present rigorous analyses of farm management information system (FMIS) success factors combined with geographic information systems and Google Earth.

In addition, most farmers do not yet sell their agricultural products using the technology and concept of Internet marketing. Many benefits are therefore exploited by brokers in the market. Therefore, this study focuses on the actual needs of the farmers and customers, combining geographic information systems (GIS) (Bansal & Pal 2009), Google Earth (2012), Internet and databases in order to design an on-line Agricultural Products Navigation System, which provides a means of managing information between farmers and customers (Wu & Lin 2010). This not only helps the farmers to lower the prime cost and to improve efficiency in management, but also to provide a simple surfing platform for customers. The customers will be able to order and pick up the product easily through handheld devices (e.g., tablet computer, smart phones, PDA etc.) while choosing the freshest and most reasonable item at the nearest location.

However, improving the system for successful use by farmers and customers is also a critical issue. In light of this, this study is based on the updated IS success model of Delone and McLean (2003) using a qualitative research method to explore how to improve the on-line Agricultural Products Navigation System and implement it successfully.

In fact, Delone and Mclean (2004) found that the success of on-line book stores and electronics e-commerce need different kinds of characteristics in the system and use an approach between these two kinds of industries. In light of this, we can infer that the on-line Agricultural Products Navigation System needs different characteristics to achieve success. Therefore, in order to design a successful on-line Agricultural Products Navigation System which can operate by mobile devices, this study expects to resolve two research questions: (1) What kinds of characteristics should be included in this system? (2) How can farmers and customers use this system and what characteristics are required for success of the system?

The updated D&M IS Success Model and its six success dimensions as follows:

(1) System quality: in the Internet environment, measures the desired characteristics of an e-commerce system. Usability, availability, reliability, adaptability, and response time (e.g., download time) are examples of qualities that are valued by users of an e-commerce system.

(2) Information quality: captures the e-commerce content issue. Web content should be personalized, complete, relevant, easy to understand, and secure if we expect prospective buyers or suppliers to initiate transactions via the Internet and return to our site on a regular basis.

(3) Service quality: the overall support delivered by the service provider applies regardless of whether this support is delivered by the IS department, a new organizational unit, or outsourced to an Internet service provider (ISP). Its importance is most likely greater than previously since the users are now our customers and poor user support will translate into lost customers and lost sales. Therefore, assurance, empathy and responsiveness are critical elements in this dimension.

(4) Usage: measures everything from a visit to a Web site (number of site visits), to navigation within the site (navigation patterns), to information retrieval (nature of use), to execution of a transaction (number of transactions executed).

(5) User satisfaction: remains an important means of measuring our customers' opinions of our e-commerce system and should cover the entire customer experience cycle from information retrieval through purchase, payment, receipt, and service. Therefore, repeat purchases, repeat visits and user surveys are critical elements in this dimension.
(6) Net benefits: are the most important success measures as they capture the balance of positive and negative impacts of the e-commerce on our customers, suppliers, employees, organizations, markets, industries, economies, and even our societies. Therefore, cost savings, expanded markets, incremental additional sales, reduced search costs and time savings are critical elements in this dimension.
Moreover, according to the study of Delone and Mclean (2004), they believe that different kinds of industries will have different characteristics to use and make the system a success. Therefore, the on-line Agricultural Products Navigation System should include some different kinds of characteristics to make it successful, especially that it can be operated by mobile devices. In light of this, based on the updated D&M IS success model (2003), this study proposes the following two propositions:

P_1: In the on-line Agricultural Products Navigation System, information and service quality should include some characteristics which will improve the system success.

P_2: To compare with other industries, the usage of the on-line Agricultural Products Navigation System will differ according to users (farmers and customers) to ensure the success of the system.

RESEARCH METHOD

In order to resolve the two questions of this study, this study presents a design for an on-line Agricultural Products Navigation System in the first stage, then adopts a qualitative research approach to interview the farmers and customers who have used the system in the second stage.

First Stage: Design an On-line Agricultural Products Navigation System

This study uses Dream Weaver, SQL Server 2005, Google Earth (2012) and Google Map API (2012) as the developing tools: This study uses Dream Weaver (2012), SQL Server 2005(2012), Google Earth (2012) and Google Map API (2012) as the developing tools: **(1) Dream Weaver:** Overall professional tool sets, used to set up and subordinate the Internet and the Internet application programs. It provides an integrated encoding environment and powerful standard WYSIWYG design platform; for the main program language used by the system, all program designers need to know how to design modularization, windows and Object-Oriented Programming to work in different divisions (Chiang 2006; Laboratory of Ming-Wei Shih 2008; Studio of Ruei Deh 2007; Tsai 2006). **(2) Microsoft SQL Server 2005** (2012)**:** a well functioned database platform, using the integrated business intellectual (BI) tools to provide data management function for business. In addition, SQL Server 2005 database also provides a safer, more stable storage environment for relational and structural data, in which the team members may set and manage a more useful and efficient application for company. **(3)Google Earth** (2012)**:** the visual tellurium software of Google Company sets all satellite photos, aviation photos and Earth information system on a 3D Earth Model. **(4)Google Map API** (2012)**:** tools to produce, to view and edit 2D diagrams; it is simple and has various functions to work easily and efficiently (Chiang & Gong 2008).
The platform of each function is also designed according to the needs of users, so that the users encounter fewer problems while working with the system. The system constantly interacts with the farmers and potential customers during the analysis and designing process, receives suggestions from different sides, continuously edits and renews its functions, in order to achieve satisfaction for the users.

Second Stage: Qualitative Research Approach

There is an absence of extant literature on building an on-line Agricultural Products Navigation System used by farmers and customers, but organizational employees. Therefore, the next two questions are critical for this study: (1) What kinds of characteristics should be included in this system? (2) How will farmers and customers use this system and what characteristics are needed to achieve a successful system? In order to resolve the above two research questions, it is impossible to analyze the interactive relationship using the Cross-Section Positivism, since the user feedback of farmers and customers is a process (Pettigrew 1985). For this reason, the study adopted a case study approach to collect and analyze data (Paré 2004; Strauss & Corbin 1990). This paper adopts a multiple case study approach, collecting qualitative data from farmers and customers who have used the on-line Agricultural Products Navigation System, then analyzing data based on the Updated D&M IS Success Model (DeLone & McLean 2003) (Strauss and Corbin 1990; Yin 1994; Paré 2004). In light of this, this study was driven by Eisenhardt's (1989) suggested eight steps of theory (model) testing (building), consisting of: get started, select the cases, craft the instruments and protocols, enter the field, analyze data, shape propositions, enfold the literature, and reach closure.
Firstly, two farmers have used the on-line Agricultural Products Navigation System to sell their agricultural products. Case # 1 is a pineapple farmer, and Case # 2 is a mango farmer. All of them believe that their agricultural products sales will be increased through this system. Secondly, five customers have bought agricultural products with this system. They also believe that the success of this system will be different from other systems. In light of this, for collecting the qualitative data, the primary data sources were semi-structured interviews (Myers, 1997). The interview teams consisted of two of the four authors. Interview protocols were developed and refined several times. The interviews were taped, with agreement from participants. The semi-structured interviews lasted on average 2 hours. The taped interviews were transcribed verbatim into

text files. To understand the systems success factors, the following represent a sample of the questions that guided the interview process (follow-up questions in parentheses):

- What kinds of “system quality” will influence you have willing to use this system? Does it will affect your satisfaction for this system? Why or why not?
- What kinds of “information quality” will influence you have willing to use this system? Does it will affect your satisfaction for this system? Why or why not?
- What kinds of “service quality” will influence you have willing to use this system? Does it will affect your satisfaction for this system? Why or why not?
- Will you use this system in what way? Why or why not?
- Do you think the use (intention to use) and user satisfaction will impact each other? Why or why not?
- Do you think the use (intention to use), user satisfaction will perceived net benefit? Why or why not?
- Do you think the net benefits will feedback influence the use (intention to use) and user satisfaction? Why or why not?

We also observed users’ physical environments to be certain their use approach matches the interviewees’ description. Based on key constructs of the updated D&M IS success model (2003), we developed an initial list of coding categories. This list was refined after the first interviews, and refined again after interviews were completed to reflect both the information gained from the interviews and the additional information of published research (Strauss & Corbin, 1990; Paré, 2004). Once the research team agreed on the list of categories, each member separately coded the same interview file. We compared results and discussed differences until agreement was reached on the categories, meanings, and future coding procedures (Paré, 2004). One researcher then coded the interview files using the revised coding scheme, which provided not only structure but also flexibility for coding new or unexpected findings (Strauss & Corbin, 1990).

After these files were coded, further discussions were held until the coders achieved complete agreement on content categories and descriptors within the categories. Agreement was achieved through open discussion. Each case was then recoded.

RESULTS

On-line Agricultural Products Navigation System

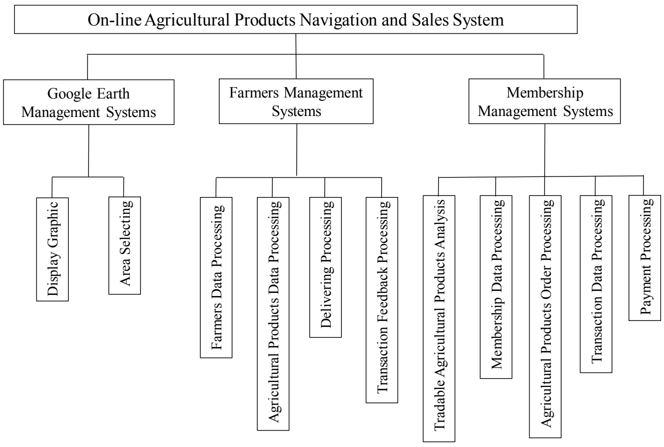

Figure 1: System Structure

On-line Agricultural Products Navigation System (http://mapshopping.wholeway-gis.com.tw:8080) includes three management systems and eleven sub-systems (Figure 1). They are described as below:

(1)Google Earth management system: **(A) display graphic system:** combine all display information graphic systems in Google Earth; **(B) area selecting system:** a system to combine cartographic data of Google Earth and display the information from different areas.

(2) Farmers management system: **(A) farmers data processing system:** to manage the information of the farmers; **(B) agricultural products data processing system:** to manage the renewed and edited information of the agricultural products; **(C) Delivering processing system:** to manage the delivery of the farmers **(D) Transaction feedback processing system:** to manage the customer’s feedback (e.g., after the customer has completed the payment).

(3) Membership management system: **(A) Tradable agricultural products analysis system:** to search for the analysis information of tradable agricultural products and areas; **(B) Membership data processing system:** to manage the members’ information; **(C) Agricultural products order processing system:** to deal with the orders of agricultural products; **(D) Transaction data processing system:** according to the situation of member orders, it reports immediately the information of the trade; **(E) Payment processing system:** to manage the payment information from members.

All the sub-systems mentioned above are written with Dream Weaver (2012), Microsoft SQL Server 2005 (2012) and Google Earth into the guiding forms as an online trading platform. It combines the function of item searching from Google Earth and builds an on-line Agricultural Products Navigation System on Google Earth. This not only provides the customers with a convenient and efficient online platform, avoids the previous complicated process, such as personal consultations for agricultural product trade, but also avoids exploitation by brokers. Whether for clients or farmers, this system creates low-cost access for greatest benefit and efficiency.

The system provides several ways for searching: **(1) Single condition search:** according to the name of the agricultural products, areas, customers and search for the needed products individually. **(2) Multiple conditions search:** choose several areas and products; choose a combination of multiple areas and products at the same time for searching products (Figure 2).

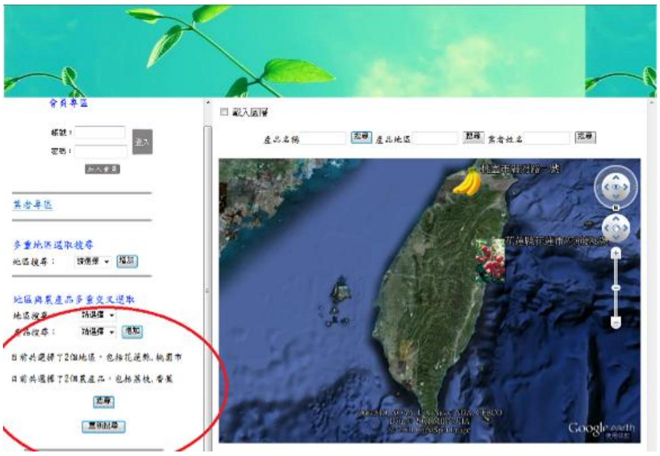

Figure 2: Customers' Multiple Areas and Products Search Form

Figure 3: Smart Phone: Multiple Conditions Search

After the customers have chosen their area and agricultural products and farmers according to their needs, they will confirm on the front page of the system, enter their member information, and order the products at the relative sub-system for members. The system has the advantage that it can be operated through handheld devices (e.g., tablet computer, smart phones, PDA etc.) in order to order the products online at anytime (Figure 3).

Result of Qualitative Data

(1) System quality: the updated D&M IS success model (2003) suggests that the desired characteristics of an e-commerce system should be measured in the Internet environment. These are: usability, availability, reliability, adaptability, and response time (e.g., download time), which are examples of qualities that are valued by users of an e-commerce system. However, so that farmers can sell their agricultural products through the on-line Agricultural Products Navigation System in this study, it is necessary inter-exchange system data with the distributors' system at the same time. For this reason, the $\mathbf{P_1}$ cannot satisfy the data of this study, therefore, we extend $\mathbf{P_1}$ and revise it to the following proposition:

New_$\mathbf{P_{1\text{-}1}}$: The system should provide an inter-exchange data function with the distributors' system to improve the system quality.

(2) Information quality: the updated D&M IS success model (2003) suggests that for capturing the e-commerce content issue, web content should be personalized, complete, relevant, easy to understand, and secure if we expect prospective buyers or suppliers to initiate transactions via the Internet and return to our site on a regular basis.

(3) Service quality: the updated D&M IS success model (2003) believes that the overall support delivered by the service provider, applies regardless of whether this support is delivered by the IS department, a new organizational unit, or outsourced to an Internet service provider (ISP). Its importance is most likely greater than previously since the users are now our customers and poor user support will translate into lost customers and lost sales. Therefore, assurance, empathy and responsiveness are critical elements in this dimension. But, due to the most of farmers who have adopt the on-line Agricultural Products Navigation System do not have the ability to resolve the system's problems, therefore, 24 hours service of the system maintenance will be necessary. In light of this, $\mathbf{P_1}$ was extended and revised to the following proposition:

New_$\mathbf{P_{1\text{-}2}}$: The system should provide 24 hours service to improve service quality.

(4) Usage: the updated D&M IS success model (2003) believes that everything from a visit to a Web site (number of site visits), to navigation within the site (navigation patterns), to information retrieval (nature of use), to execution of a transaction (number of transactions executed) should be measured.

(5) User satisfaction: the updated D&M IS success model (2003) provides an important means of measuring our customers' opinions of our e-commerce system and should cover the entire customer experience cycle from information retrieval through purchase, payment, receipt, and service. Therefore, repeat purchases, repeat visits and user surveys are critical elements in this dimension. However, users' satisfaction will be produced after they have used (intention to use) the on-line Agricultural Products Navigation System. For this reason, this study extends $\mathbf{P_2}$ and revises it to the following proposition: **(3)**

New_$\mathbf{P_{2\text{-}1}}$: Farmers will check users request frequencies, but customers will query all kinds of agricultural products which they need.

New_$\mathbf{P_{2\text{-}2}}$: Use (Intention to use) the system will influence user satisfaction.

(6) Net benefits: the updated D&M IS success model (2003) believes it is most important to balance positive and negative impacts of e-commerce on customers, suppliers, employees, organizations, markets, industries, economies, and even our societies. Therefore, cost savings, expanded markets, incremental additional sales, reduced search costs and time savings are critical elements in this dimension.

In sum, as the "on-line Agricultural Products Navigation System" has characteristics which could differ from other information systems. For this reason, this study has extended the updated D&M IS success model (2003) with four modified new propositions.

RESEARCH CONTRIBUTIONS

Academic Contributions

Although the system has a number of advantages as described above, however, Google Earth could not access remote map data on the Android platform and this is the first contribution of this study. Therefore, we have resolved this by the following method: (1) transferring database data to the KML format, which can R/W by Google Earth on Android platform; (2) although a default is declared with UTF-8 code format in the file, it still needs to declare UTF-8 in the program, before saving data to KML to resolve the Chinese Mojibake problem; (3) addition of exhibit figure KML function and helping users to download KML to exhibit the agricultural products figures problem with Android platform; and (4) changing users' connection to the outside IP address of server to capture and exhibit the figures on Android platform. In light of this, all the Android platform smart phone users can now perform the transaction of agricultural products through their smart phone at any time or place very easily.

This study found that the "on-line Agricultural Products Navigation System" indeed needs some system, information and service quality different from other industries' systems; and users (farmers and customers) also have different kinds of use. Therefore, this study proposed **New_P$_{1\text{-}1}$**, **New_P$_{1\text{-}2}$**, **New_P$_{2\text{-}1}$** and **New_P$_{2\text{-}2}$** to revise and extend the perspective of Delone and Mclean (2004) for adapting it for the agricultural system.

Contributions for Practice

The system provides both farmers and customers a powerful dynamic map, which facilitates the trade of agricultural products. First of all, the farmers can easily use the system to manage their agricultural products and display them on the Internet in 3D platform. Secondly, the consumers can easily use computers or handheld devices (e.g., tablet computer, smart phones, PDA etc.) to search both the spatial and attribute information of the nearest farmers and products on this platform and order the agricultural products they want. After the consumers complete the purchase, they can view their orders online at anytime. The farmers can meanwhile obtain basic information about the consumers and their orders, manage and sell products accordingly in a more convenient and efficient way, sell products and create profits later on. Not only can farmers promote products without using any commercials, the users can also save their search time and consume agricultural products from the nearest distance and at the lowest-cost, but also the most convenient method, facilitating the pick-up procedure and saving the transport cost. It also reduces carbon footprint and accomplishes the purpose of energy saving and carbon reduction. It reduces the time and spatial problems of both sides during trading and avoids exploitation by brokers.

CONCLUSION

The system provides both farmers and customers a powerful dynamic map, which facilitates the trade in between and achieve the goals below: the first step is to upload the pictures on the Internet. Users can search the spatial information simply through computer's browser or Android smart phones and enlarge or reduce the size of pictures. Then, when the users are surfing the website of the system, they can collect the relative information and the geographic location of the farmers. Not only the farmers can promote its products without using any commercials, the users can also save their time of searching and consume the wanting products from the nearest distance and with the lowest-cost but the most convenient way, which saves energy and reduce carbon. Moreover, besides viewing the location and the farmers' information, the system also provides farmers and customers an online platform for agricultural products trade. It reduces the time and spatial troubles of both sides during trades and avoids the exploit of the brokers. Lastly, the system also provides farmers effective product management functions and an efficient searching platform for the relative information of agricultural products.

REFERENCES

[1] Amponsah, W. A. (1995). Computer adoption and use of information services by North Carolina commercial farmers. *Journal of Agricultural and Applied Economics*, 27(2), 565–576.

[2] Bansal, V. K. and Pal, M. (2009). Construction schedule review in GIS with a navigable 3D animation of project activities. *International Journal of Project Management*, 27(5), 532-542.

[3] Chiang, K. J. (2006). Personal Book of Dream Weaver 8. Tpi Publishing, Taipei.

[4] Chiang, K. and Gong, S.P. (2008). *Google API Development Resolution: Google Map and Google Earth Double Stalwarts*. TPi Publishing, Taipei.

[5] Dalgaard, R., Halberg, N., Kristensen, I.S., Larsen, I., 2006. Modelling representative and coherent Danish farm types based on farm accountancy data for use in environmental assessments. *Agriculture, Ecosystems and Environment*, 117(4), 223–237.

[6] DeLone, W.H. and McLean, E.R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, 3(1), 60-95.
[7] DeLone, W.H. and McLean, E.R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems,* 19(3), 9-30.
[8] Delone, W. H., & Mclean, E. R. (2004). Measuring e-commerce success: Applying the DeLone & McLean information systems success model. *International Journal of Electronic Commerce*, 9(1), 31-47.
[9] Eisenhardt, K.M. (1989). Building theories from case study research. *The Academy of Management Review*, 14(4), 532-550.
[10] Fountas, S., Wulfsohn, D., Blackmore, B.S., Jacobsen, H.L., Pedersen, S.M., 2006. A model of decision-making and information flows for information-intensive agriculture. *Agricultural Systems*, 87(2), 192–210.
[11] Google Earth. (2012). available online at http://code.google.com/intl/zh-TW/apis/earth/
[12] Google Map API. (2012). available online at http://code.google.com/intl/zh-TW/apis/maps/
[13] Huffman, W. E., & Mercier, S. (1991). Joint adoption of microcomputer technologies: an analysis of farmers' decisions. *Review of Economics and Statistics*, 73(3), 541–546.
[14] Laboratory of Ming-Wei Shih. (2008). The Sixteen Courses of Correct Learning Dream Weaver CS3. Flag Publishing, Taipei.
[15] McCown, R.L., 2002. Changing systems for supporting farmers decisions: problems, paradigms and prospects. *Agricultural Systems*, 74(1), 179–220.
[16] Microsoft SQL Server. (2012). The Evolution of Microsoft SQL Server: 1989 to 2005.
[17] Myers, M.D. (1997). Qualitative research in information systems. *MIS Quarterly Discovery* (available online at http://www.qual.auckland.ac.nz/).
[18] Ortmann, G. F., Patrick, G. F., & Musser, W. N. (1994). Use and rating of computers by large scale U.S. cornbelt farmers. *Computers and Electronics in Agriculture*, 10(1), 31–43.
[19] Paré, G. (2004). Investigating information systems with positivist case study research. *Communications of the Association for Information Systems*, 13(1), 233-264.
[20] Pettigrew, A.M. (1985). Contextualist research and the study of organizational change processes. In Research Methods Information Systems (Mumford, E. Hirshheim, R. Fitzgerald, G., & Harper, T.W. (Eds), pp. 53-72, North-Holland.
[21] Sigrimis, N., Hashimoto, Y., Munack, A., De Baerdemaeker, J., 1999. Prospects in agricultural engineering in the information age: technological developments for the producer and the consumer. CIGR E-Journal 1, 1–20.
[22] Sørensena, G.C., Fountasb, S., Nashf, E., Pesonend, L., Bochtisa, D., & Pedersene, S.M. (2010). Conceptual model of a future farm management information system, *Computers and* Electronics *in Agriculture*, 72(1), 37-47.
[23] Strauss, A. and Corbin, J. (1990). Basics of Qualitative Research: Grounded Theory, Procedures, and Techniques. Newbury Park, CA.: Sage Publications.
[24] Studio of Deh Ruei. (2007). Dream Weaver & ASP.NET Web Database Design Practices. TPi Publishing, Taipei.
[25] Tsai, Z.M. (2006). Dream Weaver 8 for Dynamic Web Database Design Practices. TPi Publishing, Taipei.
[26] Wu, R.H. and Lin, H.H. (2010). Information System Analysis and Design. Tze-Sung Publication.
[27] Yin, R.K. (1994). Case Study Research: Design and Methods (2nd edition). Sage Publication.