
DESIGN AND DEVELOPMENT OF GIS-ENABLED TOOL FOR HUMAN ASSETS MAPPING

DENNIS C. TENERIFE
ERNESTO E. EMPIG
CENIE M. VILELA-MALABANAN
ADRIAN P. GALIDO

ABSTRACT

For economic survival, an individual must have human capital and social capital, both comprise the human assets. This study is a design and development of a GIS-enabled human assets mapping (GIS-HAM) tool. It is aimed at mapping-out human assets to easily identify the different skills of the community members which are needed for future employment by various job sectors. The study used the waterfall model as Software Development Life Cycle in designing and developing the GIS-HAM prototype. The GIS-HAM tool was tested in Barangay Manlin, Buug, Zamboanga Sibugay, among randomly selected household heads ($n=176$) who answered the researcher-made questionnaire and were subjected to focus group discussions and interview. Research has shown that unemployment due to skills and educational qualification mismatch in the labor market is one of the causes of poverty. Majority of the respondents and key informants (82%) were high school level, acquired skills by experience (66%), and had skills in farming (37%). The system has the improved interoperability functions of the Google API, such as Google Map and Visual Analytics, which map and locate the addresses of skilled persons while showing their individual educational attainment, skills, occupation and contact number. Both employer (skills searcher) and employee (job seeker) can match skills to job types. Respondents' evaluation yielded the system being overall functional in terms of content, user-friendliness, and performance. Study recommended that the GIS-HAM be implemented in mobile apps for accessibility of data at any time and be developed using multimedia software to enhance its user interface design.

KEYWORDS: *Human Assets Mapping, Geographic Information System, Human Capital, Social Capital*

INTRODUCTION

Background of the Study

According to [1], about one in every ten or ten percent of the total ninety million Filipinos survives on just \$1.25 per day, highlighting the poverty situation in the Philippines for decades now.

In 2009, the Philippines was one of the Asian countries with the highest levels of income inequality in Asia. The income of thirty out of one hundred Filipinos falls far short of the minimum cost of satisfying the basic requirements and live below the poverty threshold [2]. For the past four decades, the proportion of households living below the official poverty line has declined slowly and unevenly. Poverty and inequality in the Philippines have remained a challenge to the government [3].

One undeniable cause of poverty is the steady rise of unemployment due to skills mismatch in the labor market. Educational qualification and skills mismatch in the labor market could have serious effects on wages and are associated with negative labor market outcomes [4]. The basic idea is that, although higher education raises productivity in general, the actual level of productivity realized is also determined by the match between educational and job level. Job mismatch is when a person's job does not match with its educational attainment level [5].

Human capital and social capital as components of human assets are considered the influencing factors to the household income and the poverty threshold. Poverty is just one of the socio-economic issues this paper is trying to address.

In line with this, the study sought to map-out the human assets consisting of human capital and social capital to identify easily the different skills of the community members needed by the industry for future employment. A Geographic Information System (GIS)-enabled tools could be used for mapping people with different skills and assets. With this tool, it would easier for the employer to find people with specific skills needed for the job and their location.

Statement of the Problem

This study seeks to map out the human assets consisting of human capital and social capital. Explicitly, the study intends to answer the following questions:

1. What factors must be considered in designing a GIS-enabled human assets mapping model?
2. What are the perception of the respondents and the key informants to the developed GIS-enabled human assets mapping tools?

Objectives of the Study

The study intends to design and develop a prototype of a GIS-enabled tool for human assets mapping. This study specifically aims to:

1. Design a model for human assets mapping.
2. Develop a GIS-enabled prototype for human assets mapping.
3. Assess the acceptability and perceived usefulness of the developed prototype.

Conceptual Framework

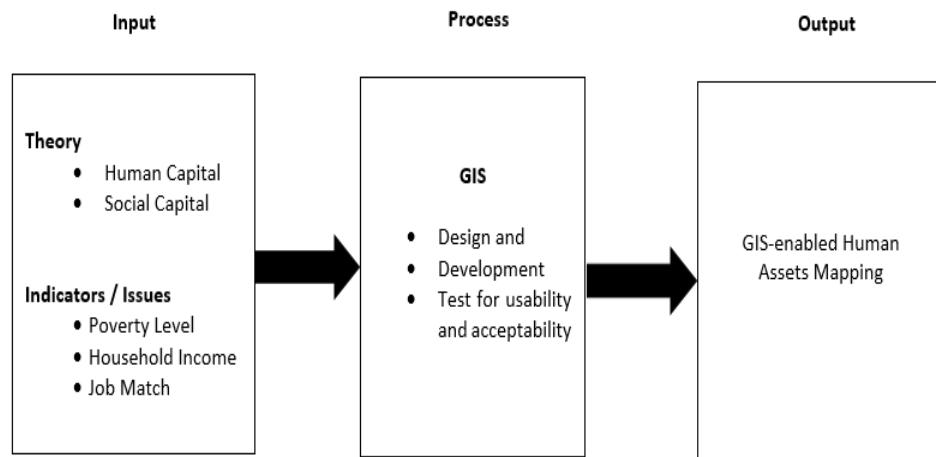


Figure 1: Conceptual Framework

Figure 1 shows that the human capital theory [15] compose of the human capital [13] and social capital [18]. The indicators concerning the socio-economic status of a person are the poverty level [1], household income [4] and job mismatch [5]. These are the independent variables of the study and serves as an input to the GIS which leads to the development of the GIS technology. The GIS-enabled Human Assets Mapping is a newly developed tool that helps mapping the individual assets of the respondents and serves as the dependent variable of the study.

METHODOLOGY

Research Design

Research designs are guides or procedures that researchers follow when collecting, analyzing, interpreting, and reporting data in research studies [21]. The study was descriptive by nature in terms of data gathering but the

approach in analyzing data used was a mixed method. Mixed method that combines quantitative and qualitative approach [22]. This study utilized the Research Design and Development type of research which is summarized in Figure 3.1:

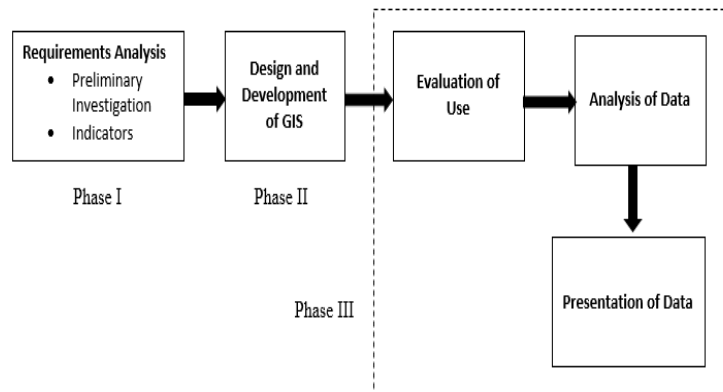


Figure 3.1: Research Flow

Development of GIS-HAM Prototype

In this section, the researcher considered Waterfall as the Software Development Life Cycle (SDLC) model in developing the system prototype as shown Figure 3.2.

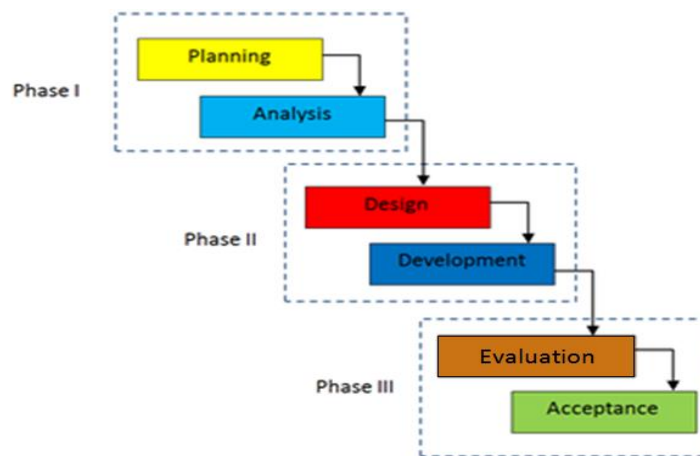


Figure 3.2: The Waterfall Model (adopted from Dennis et al, 2002)

RESULTS AND DISCUSSIONS

Demographic Profile of the Community

Barangay Manlin was created on March 14, 1967, under RA 3590 and it was taken from Barangay Guminta. It is bounded on the east by Barangay Guminta; on the west by Barangay Poblacion; on the North by Lantawan and on the South by Barangay Basalem. Barangay Manlin has the total land area of 928,361.70 square hectares and a total population of 1,198 with 285 households [23]. To reach the Barangay vicinity, a 15-minute motorcycle ride is needed from the town proper of Buug.

Demographic Profile of Persons Residing in the Community

The study was conducted in Barangay Manlin, Buug, Zamboanga Sibugay, among randomly selected household heads ($n=176$) who answered the researcher-made questionnaire and were subjected to focus group discussions and interview. Data revealed that majority of the respondents and key informants (82%) were high school level, acquired skills by experience (66%), and had skills in farming (37%). Aside from that, it also shows that most (77%) of the respondents are currently employed and are receiving a daily wage income.

Perception of the Community on the developed GIS-HAM System

Figure 4.1 shows the total of 28 system evaluators who participated in the system evaluation. The respondents were given a chance to navigate features and functionality of the system. Afterwards, they were given an evaluation form for evaluation of the system. There are 5 criteria for the system evaluation which includes presentation of contents, user friendliness, system functionality, look and feel and system performance.

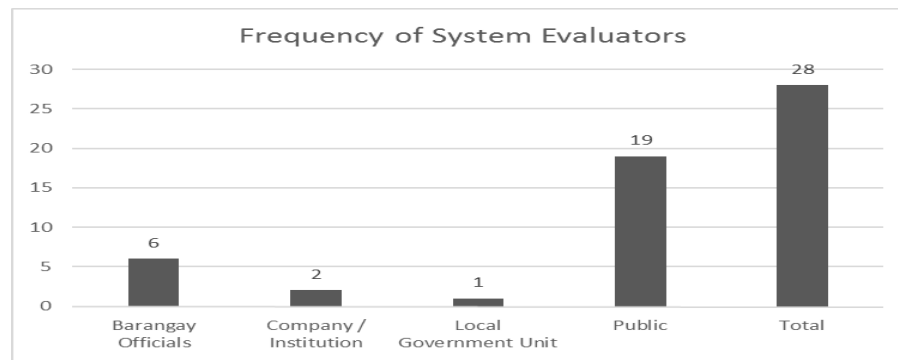


Figure 4.1: Respondents of the System Evaluation

Summary of System Evaluation

Figure 4.2 shows that 59% of the respondents “Agree” on the overall functionality of the system based on the five (5) identified categories. It indicates that the system overall functionality is acceptable and useful.

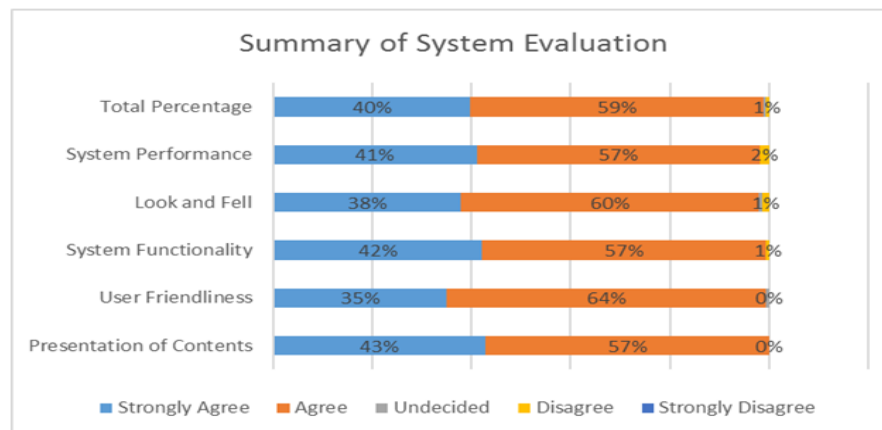


Figure 4.2: Summary of System Evaluation Results

Figure 4.3 also shows that 11 out of 28 (or 39%) of the evaluators recommended that the system should be implemented using mobile apps, followed by 8 (or 28%) of them who recommended that the system be applied online, and 21% said there is a need to improve the user interfaces.

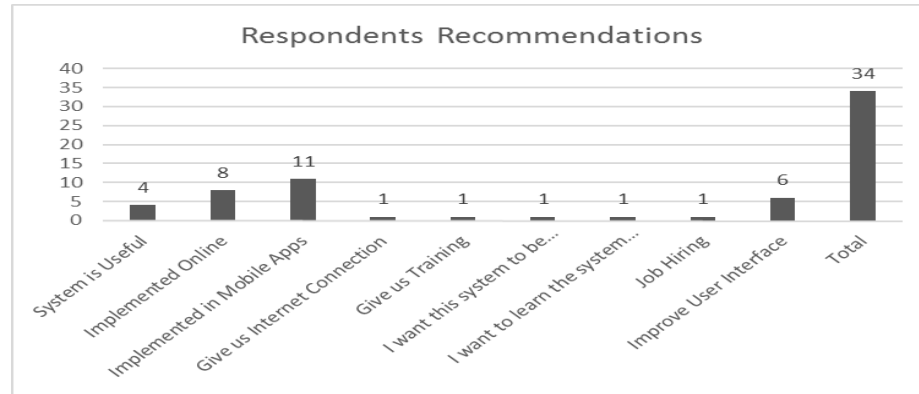


Figure 4.3: Summary of Respondents Recommendations

The GIS-HAM Model

Figure 4.4 shows the GIS-enabled human assets mapping model. The model consists of three inputs such as scope definition, development tools and system models. Scope definition defines the human assets such as skills, educational attainment, occupations and the organization where they belong. Google API services were also utilized for displaying Google analytics and maps in the system. Moreover, development tools such as notepad++, adobe photoshop and Xampp server were also used in developing the prototype. Furthermore, the researcher used system models to model the different functionality of the system such as use case diagram, activity diagram and sequence diagrams. Use case diagram shows the overview of all the functional requirements of the system. Activity diagram and sequence diagram also show the flow of event during a user performing every scenario. However, the GIS-HAM model will be used as a reference in the development of a system prototype.

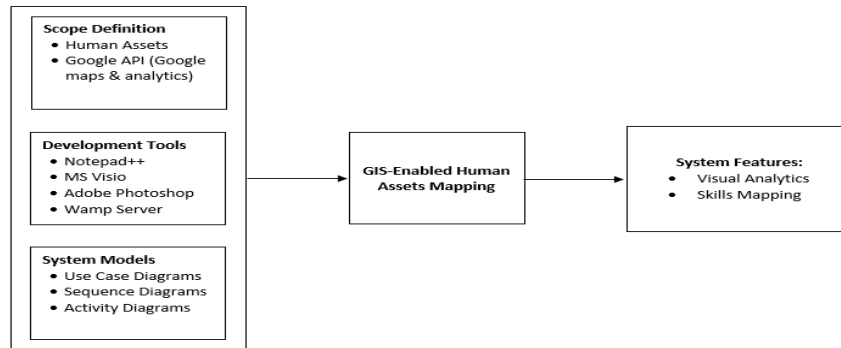


Figure 4.4: GIS-enabled Human Assets Mapping Model

The GIS-HAM System Prototype

The GIS-enabled human assets mapping prototype is a tool in mapping human assets. It helps the organization or institution in finding specific skills needed for the job or project. The prototype was developed using PHP as the front-end and MySQL as the back-end. The researcher used Notepad++ as the development environment of the system. Cascading style sheet (CSS) and Javascript were also utilized to make the prototype more interactive. Xamp server was used to serve as a local server of the prototype. The prototype also utilized the Google API that handles the Google map and analytics. It helps in displaying the visual analytics of the system such as percentages of the job mismatch, livelihood, occupation, educational attainments and a network of organizations. The system was tested and debugged using a web browser such as Google Chrome and Mozilla Firefox.

The GIS-HAM System Features

The features of the GIS-enabled Human Assets Mapping system are the following: (1) Visual Analytics; (2) Search Skills; (3) Register; and (4) Login. Each of these will be discussed in the subsequent sections.

Visual Analytics

This section discusses the job matching, livelihood, educational attainments and network mapping to the organization. Accumulation of data in the visual analytics is done during registration. It uses Google API to display the Google Analytics using a pie chart.

Job Matching Analytics

The job matching analytics which gave the respondents information on match and mismatch of jobs. Match and mismatch were calculated based on their skills and occupation. A match means that the current occupation of the respondents is related to their skills. For example, a respondent registers in the system and selects carpentry as skills and the current occupation selected also is a carpenter. Otherwise, if the current occupation of the respondents is not related to their skills, this means a mismatch.

Livelihood Analytics

Shows the list of current occupations of the respondents who are registered in the system. It gives an information on what are the current livelihood of the community.

Skills Analytics

This feature shows the skills analytics of the respondents who are registered in the system. It shows the list of skills of every respondents' and how many respondents have these skills.

Educational Attainments Analytics

These analytics displays the educational attainment of the respondents who are registered in the system. It shows the list of educational attainment of every respondent and how many respondents have these educational levels.

Social Capital Analytics

This feature shows the Network Analytics User Interface. It also shows the networks mapping of the organization. It displays the list of organizations where the respondents are involved with.

Search Skills

The Search skills function helps the user to identify the specific skills needed from that specific location of the person by specifying either a street number or purok number, barangay name, city/municipality and province. Searching of skills without specifying the location will display a marker on the map of all the locations of persons having that particular skills. Clicking the marker on the map will display the information of the respondents such as pseudonyms, educational attainment, skills, occupation and contact number. A list of names is also displayed beside the GIS map as an alternative measure if multiple outputs will display the same location.

CONCLUSION

The study was conducted in Barangay Manlin, Buug, Zamboanga Sibugay with a total of 176 residents who participated. The human assets such as human capital and social capital were considered as determinants of the socio-economic status of the respondents. Data revealed that job mismatch and unemployment are contributory factors to poverty. Second, majority of the respondents did not match with their skills and occupation. Lastly, human

assets such as human capital and social capital were not fully maximized to help alleviate poverty, hence, there is a job mismatch. However, information gathered were used as indicators in the development of the GIS-enabled human assets model. The developed GIS-enabled model can be used as a tool in mapping individual human assets of the community. This model could be effectively used as a reference in the development of the system prototype. Moreover, the developed GIS-HAM prototype helps the employer and employee match the specific occupation and skills of a person by locating the address using the Google map and decision making using the visual analytics. On the other hand, results from the system evaluation shows that 59% of the respondents agreed on the developed prototype indicating that the overall functionality of the system is acceptable and useful. It was also revealed that 32% of the evaluators recommended that the GIS-enabled human assets mapping system be implemented in mobile apps.

RECOMMENDATIONS

Based from the findings and conclusion of this study, the following recommendations were formulated:

1. Replicate this study but may expand research locale to include more barangays and different regions.
2. For future researchers, to conduct complementary study to evaluate the effectiveness of GIS-enabled human assets mapping model.
3. The developed GIS-enabled human assets mapping prototype could be implemented online by subscribing a web domain. Aside from that, the system prototype could also be developed using multimedia software to enhance its user interface design and become more interactive and finally, to be implemented also in mobile apps.

REFERENCES

- World Bank (2013). *The World Bank Annual Report 2013*. Washington, DC. Retrieve from <https://openknowledge.worldbank.org/handle/10986/20093> License: CC BY-NC-ND 3.0 IGO
- Suriin ang Kahirapan. (2009). *KASAMA* Vol. 23 No. 3, July-August-September-October 2009, Solidarity Philippines Australia Network.
- Asian Development Bank (ADB). (2009). *Poverty in the Philippines: Causes, Constraints and Opportunities*. Retrieved from <http://www.adb.org>. October 2015.
- J. Allen, & R. Van der Velden. (2001). Educational mismatches versus skill mismatches: effects on wages, job satisfaction, and on-the-job search. *Oxford economic papers*, 53(3), 434-452.
- UNHCR (2004). *The UN Refugee Agency*. Retrieved from <http://www.unhcr.org/> on May 2015.
- D. Makoka, & M. Kaplan. (2005). *"Poverty and Vulnerability"*. ZEF Center for Development Research. University of Bonn.
- T. Gabe. (2015). *Poverty in the United States: 2013*. Congressional Research Service.
- M. J. Handel. (2003). *Skills mismatch in the labor market*. *Annual Review of Sociology*, 135-165.
- US Bureau of Labor Statistics, Department of Labor. (2014).
- N. R. Goodwin. (2003). *Five Kinds of Capital: Useful Concepts for Sustainable Development*. Global Development and Environment Institute. Working Paper No. 03 -07. Tufts University.
- C. Saunders, Kaye W. Blake, & R. Campbell. (2010). Capital based sustainability indicators as a possible way for measuring agricultural sustainability.
- L. Almendarez. (2010). *Human capital theory: Implications for educational development*. Belize Country Conference. Retrieved from <http://www.open.uwi.edu>. January 2016.

-
- H. H. Son. (2008). Explaining growth and inequality in factor income: The Philippines case. ERD working paper series.
- D. A. Olaniyan, & T. Okemakinde. (2008). Human Capital Theory: Implications for Educational Development. European Journal of Scientific Research. Retrieved from <http://www.eurojournals.com>.
- M. Levels., R. van der Velden, & V. Di Stasio. (2014). From school to fitting work How education-to-job matching of European school leavers is related to educational system characteristics. *Acta Sociologica*, 57(4), 341-361.
- G. Psacharopoulos, & M. Woodhall. (1997). *Education for Development: An Analysis of Investment Choice*. New York: Oxford University Press.
- J. D. Montgomery. (2000). *Social Capital as a Policy Resource*. Springer Publisher. Volume 33, Issue 3-4, pp 227-243.
- C. Campbell, R. Wood, & M. K. Kelly. (1999). *Social Capital and Health*. Health Education Authority. London.
- M. Rusko, R. Chovanec, & R. Dana. (2010). An Overview of GIS and its Role and Applicability in Environmental Monitoring and Process Modeling. DOI: 10.2478/v10186-010-0031-1.
- J. Creswell, & V. Plano Clark. (2011). *Designing and Constructing Mixed Methods Research*. SAGE Publications, Inc. 4th Edition.
- J. W. Creswell. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage Publications Inc.
- Barangay Manlin Annual Implementation Plan. (2016).
- R. Putnam, R. Leonardi, & R. Nanetti. (1993). *Making Democratic Work: Civic Traditions in Modern Italy*. Princeton University Press, Princeton, New Jersey.
-