



INTEGRATED DESIGN APPROACH OF AN ASTRONOMICAL OBSERVATORY

Nur Amalina Binti Alias and Mohamad Saupi Che Awang
Department of Geomatics Engineering
Faculty of Geoinformation and Real Estate
Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia
Email: namalina26@siswa.utm

ABSTRACT

The integrated design approach of an astronomical observatory is an approach in designing and evaluating the performance of an astronomical observatory. There are several factors that need to be considered in the concept of integrated design approach namely sustainability, functionality, productivity, accessibility, cost effectiveness, aestheticism and, security and safety. For this study Kolej Universiti Sultan Zainal Abidin Observatory was taken as studied observatory, so that the factors can be identified clearly. A questionnaire was distributed to users of the Kolej Universiti Sultan Zainal Abidin Observatory, Terengganu for obtaining opinions from the user perspective. The questionnaire was analyzed by using Statistical Package Program for Social Science 16.0 (SPSS16.0). The analysis was performed in order to determine the relationship between all variables. From the result, it has been found that the most critical success factors were sustainability, functionality, accessibility and productivity.

Key words: Astronomical Observatory, Critical Success Factors of an Astronomical Observatory, Integrated Design Approach Elements.

1.0 INTRODUCTION

Development of Islamic Astronomy has contributed to the improvement of the quality of equipments and the accuracy of the observations. However, the quality of equipment could not stand by itself without the presence of a suitable observatory. Tools and observatories should synergize to maximize data quality. With higher accuracy, new information will be found and it will provide an opportunity for the discovery of new theories.

The astronomical observatories aimed at collecting scientific data over long periods of time and this helped to improve understanding of the planetary motions, which included the sun and moon in the geocentric system (Ilyas, 1996). The importance of an observatory can be seen when there is an accumulation of tools and resources that can be used to generate data and theory for the development of astronomy. The observatory is important as it confine the astronomers when the number of professional astronomers dramatically increased in the United States during the first half of the nineteenth century. They recognized that good work required observatories (Arthur L. Norberg, 1976).

In Malaysia, the institution of observatory has grown by the establishment of an astronomical observatory such as Kolej Universiti Sultan Zainal Abidin (KUSZA) Observatory, Terengganu. The development of observatory was contributed to the advancement of *falak syarie* and astronomy in Malaysia.

The concept of integrated design approach consists of several factor such as accessibility, aestheticism, cost effectiveness, functionality, productivity, sustainability and, security and safety (ProwlerD, 2008).

Accessibility factor is related to the building elements, height and clearances that implemented to address the specific needs of disabled people. Aesthetic factor can be relevant to the physical appearance and image of building elements and spaces as well as the integrated design process. Cost-Effective factor involve of selecting a building elements on the basis of life-cycle costs as well as basic cost estimating and budget control. Functionality factor is related to functional programming such as spatial needs and requirements, system performance as well as durability and efficient maintenance of building elements. Productivity is related to well-being of physical and psychological comfort that include building elements such as air distribution, lighting, workspaces, systems, and technology. Sustainability factor is related to environmental performance of building elements and strategies. Security and safety factor is related to the physical protection of occupants and assets from man-made and natural hazards.

The purpose of this paper is to present the results of the study which have two objectives. The first objective is to identify the critical success factors in designing an astronomical observatory and the second objective is correlation with the performance of an astronomical observatory.

2.0 METHODOLOGY

The research methodology involved the process of selection of the title until the completion of the writing. To perform this study, the authors have identified several phases which were:

Phase 1: Preliminary Study

Phase 2: Literature Review

Phase 3: Questionnaire Preparation

Phase 4: Questionnaire Distribution

Phase 5: Data Analysis

2.1 Preliminary Study

Preliminary studies have been done previously to identify the issues and problems arise in the purpose of research, search objectives and data requirements to implement the research. The resource of the issue obtained from the content of *Falak syarie* conference (*Persidangan Hala Tuju Balai Cerap Rasmi Semalaysia*) on 28 June 2010. The topics chosen based on the resources available for reference as evidence that the issues raised are accurate.

This phase describes the problems that exist in realizing the importance of this study. The verification of the study is through data collection and information. Reference is made through the book and journal as well as discussion with supervisor.

2.2 Literature Review

Literature review is a continuous process to give ideas and inspiration for this study. The pre-understanding of this research is done by searching information from reading material such as books, journals, articles, internet and also from previous thesis that are related to the research.

From the literature review, author found that the most important thing in designing an astronomical observatory is in knowing what the purposes of the observatory want to be built. When the goals have been identified, the design of an observatory can be determined. The design of an astronomical observatory is very important in order to minimize the error in the observation. To build an astronomical observatory, there is such element that need to be considered where the integrated design approach were applied. There has an integrated design approach that consists of several factors in order to design an astronomical observatory. All the factors are related to each other and need to be applied to ensure the successfulness in designing an astronomical observatory and its performance.

2.3 Questionnaire Preparation

Questionnaire design is a long process that demands careful attention. Design begins with an understanding of the capabilities of a questionnaire. It is designed in order to achieve the objective and to evaluate the suitability of the question to the target group. The questions in the questionnaire include the matters to be investigated that are to identify the critical success factors in designing an astronomical observatory and its correlation with the performance of an astronomical observatory.

In this study, the questionnaire was prepared and the structured of questionnaire were divided into four parts that are:

Part 1: Background of the Respondent

Part 1 is a questionnaire relating to personal information of respondent. Among the items to be loaded to get the respondents' personal data are sex, occupation, educational level and information about the observatory that was visited by the respondents. The background of the respondent is important so that authors can identify who is answering the questionnaire.

Part 2: Astronomical Observatory in General View

Part 2 is the question that consist the opinion about an astronomical observatory in general view. This question is important in order to get the feedback from users about the integrated design approach that consist of critical success factors in designing an astronomical observatory.

Part 3: Correlation of Integrated Design Approach towards Performance of an Astronomical Observatory.

Part 3 is a question concerning users' point of view in correlation of integrated design approach towards performance of an astronomical observatory. It's approaching users' knowledge and experienced in using an astronomical observatory.

Part 4: KUSZA Observatory as a Studied Observatory.

Part 4 are concerning about KUSZA Observatory as a studied observatory. It consists apart of the opinion about the critical success factor that has been achieved by KUSZA observatory and how these factors correlated with the performance of KUSZA Observatory itself. This part is very important in order to identify the real issue of integrated design approach of an astronomical observatory.

2.4 Questionnaire Distribution

The questionnaire was distributed among 35 respondents. Among of that, 54% (19respondents) are male and 46% (16respondents) are female. The respondents are from the users of an astronomical observatory especially from KUSZA Observatory, Terengganu.

The questionnaire was distributed to the target groups which are the users of an astronomical observatory that consist the student and lecturer of astronomy and *Falak Syarie*, officers and staff of the observatory and *Mufti*.

The selection of respondents from different backgrounds is necessary in order to get results from different perspective of users. As a result, there is no bias to be obtained later.

2.5 Data Analysis

Data obtained from the questionnaires has to be reviewed to ensure that all answers have been filled. Data obtained from the questionnaires are analyzed by using Statistical Package Program for Social Science 16.0 (SPSS16.0). This analysis is performed in order to determine the relationship between all variables.

After all analysis has been done by using Statistical Program for Social Science 16.0 (SPSS 16.0), the analyses are used to generate a graph and pie chart by using Microsoft Excel 2007. All the analyses are shown in graph and pie chart to ensure that it is easy to understand and it can explain all the result in a simple way.

3.0 RESULTS AND ANALYSIS

From the analysis, results were present in graph and pie chart in order to show the relationship between all variable.

3.1 Critical Success Factor in Designing an Astronomical Observatory

Based on users feedback about determination of 7 critical success factor in designing an astronomical observatory, the result as shown in **Figure 1**

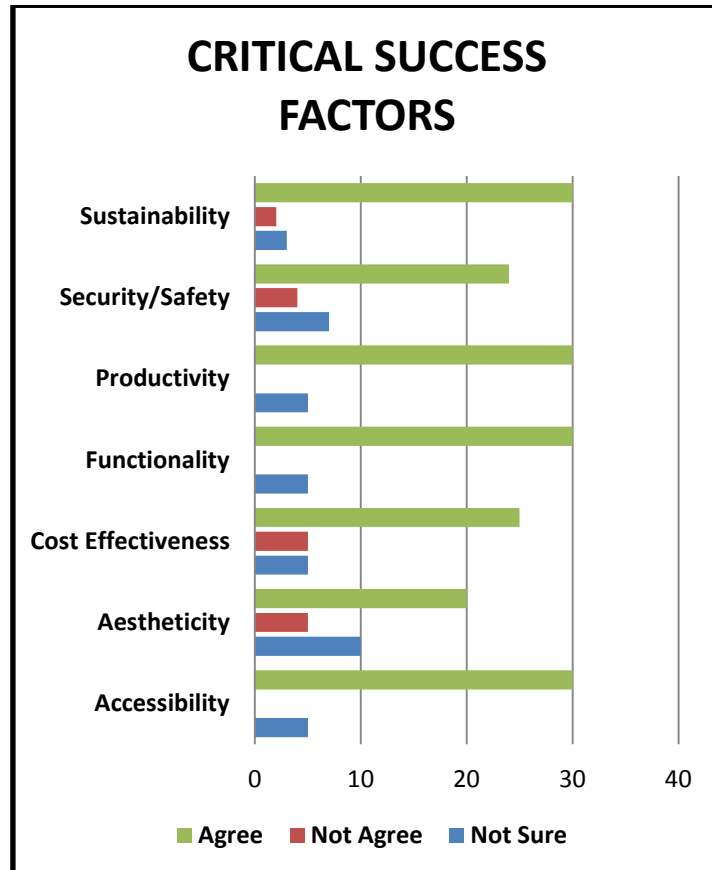


Figure 1: Critical Success Factors in Designing an Astronomical Observatory

Based on **Figure 1**, the level of critical success factors in designing an astronomical observatory is shown. The factors were divided into 7 elements that are sustainability, security and safety, productivity, functionality, cost effectiveness, aesthetics and accessibility.

In the assessment scale, there has three levels that are agree, not agree and not sure. From the analysis, the most critical factors in designing an observatory are sustainability, productive, functional and accessible where 30 respondents are agree with it. Apart from that 25 respondent are agree with cost effectiveness 24 respondent agree with safety and security and 20 respondent agree with aesthetic as a critical success factor in designing an astronomical observatory. Only several respondents are not agreeing and not sure with the factors that has been listed.

The sustainability, productivity, functionality and accessibility become the most critical factors because of their own reason. All of the aspects have a relation between each other. The sustainability factor is important because its shows on how long the astronomical observatory will be operate. The successfulness of an astronomical observatory can be seen when it can be operate to the maximum period of time with higher productivity. The higher productivity of an astronomical observatory is where it can provide higher quality of observation data and other performance such as the technology and equipment. By this way it's able to enhance the functionality of the observatory. The function of astronomical observatory are rely on the purpose of astronomical observatory itself such as, for the purpose of astronomical observation, research and education of astronomy and also for the astronomical tourism. In accessibility factor, it is the way the observatory will connect to users. It shows on how users can get along with the astronomical observatory and how users can access to there. Other

than that, security and safety, cost effectiveness and aestheticity become not so critical from a users perspective. However, it's still need to be considered.

3.2 Critical Success Factors Achieve by KUSZA Observatory

Based on users feedback about the critical success factors that have been achieve by KUSZA Observatory, the result as shown in **Figure 2**

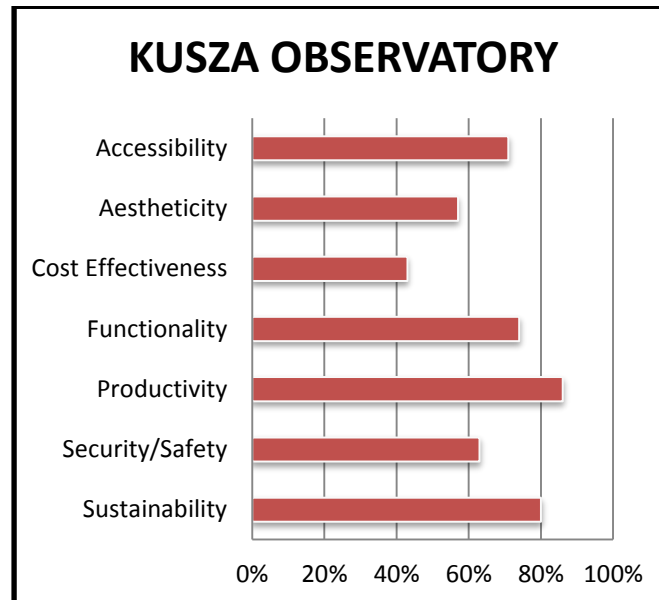


Figure 2: Critical Success Factors Achieve by KUSZA Observatory

Based on **Figure 2**, 86% respondent agree that productivity factor of integrated design approach have been achieved in KUSZA Observatory. Apart from that, 80% respondents are agreeing with sustainability, 74% are agreeing with functionality, 63% are agreeing with security and safety, 57% are agreeing with aestheticity and 43% are agreeing with cost effectiveness.

Productivity factor can be seen as most critical factor that have been achieve in KUSZA observatory when there has a good records of usage and the high quality of observation data.

KUSZA Observatory provides road network for users to access the observatory by any transportation such as motorcar and motorcycle. Other than that, KUSZA Observatory also has own webpage. As a consequence, it shows how KUSZA Observatory achieved the accessibility factor.

Sustainability is taking the right of future generation towards today astronomical observatory. It's affected from the development of economy and social. It's defined whether the observatory is still relevant to be used in the future. For KUSZA Observatory, 80% of respondent are agree that it achieved the sustainability factor. It can be seen where KUSZA Observatory are located in the strategic location on top of Bukit Merang, Setiu, Terengganu. The sky view in that area is less polluted. The obstruction at the horizontal view of KUSZA observatory is small and not interfere the observation.

KUSZA Observatory is to be functioning as an observatory for astronomical observation such as new moon. It's also for education purpose where it has been used by different student and

researcher around Malaysia especially student from Universiti Sultan Zainal Abidin, Terengganu. However, only 74% of respondent are agreeing that KUSZA Observatory has achieved the functionality factor. It is a consequence of the lack of facilities so that it can't achieve their functionality successfully.

Based on **Figure 2**, the less choice of factor that have been achieved by KUSZA observatory from users' perspective are security and safety, aestheticity and cost effectiveness. It's related to the critical success factor in designing an astronomical observatory where security and safety, aestheticity and cost effectiveness become not so important.

As a conclusion, KUSZA Observatory has achieved some of the critical success factor such as productivity and sustainability. There's a thing that need to be improve in order to become a successful observatory so that it will become as an attraction to users.

3.3 The Correlation of Critical Success Factors towards Performance of KUSZA Observatory

Based on users feedback about the correlation of critical success factors towards performance of KUSZA Observatory, the result as shown in **Figure 3**

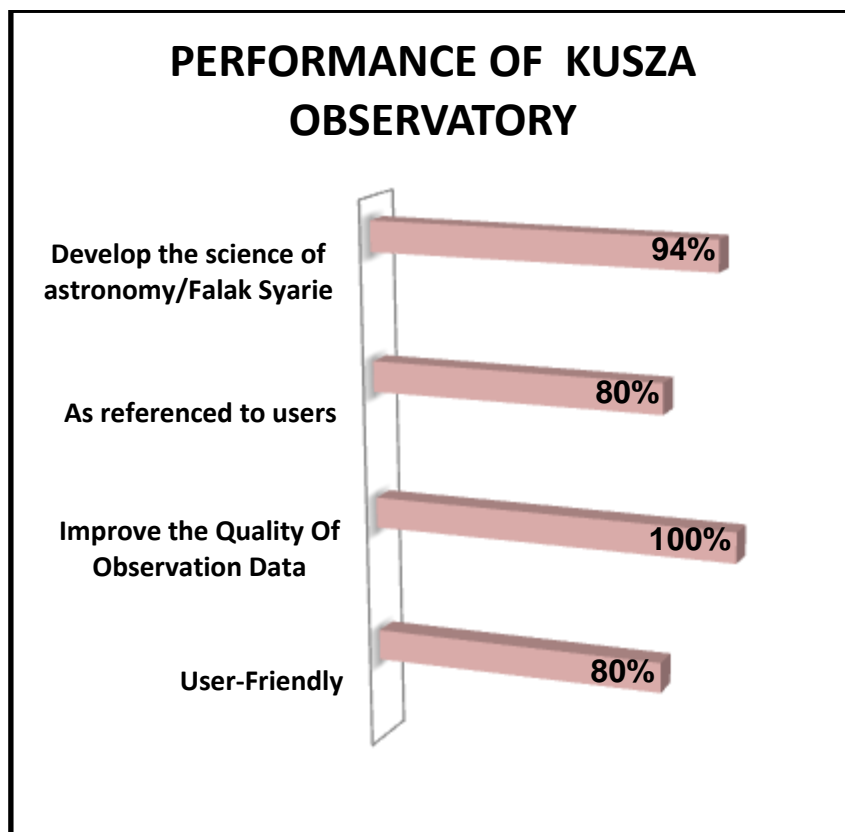


Figure 3: The Correlation of Critical Success Factors towards Performance of Kolej University Sultan Zainal Abidin Observatory

Based on **Figure 3**, 100% respondent agree that critical success factor influence the performance of KUSZA observatory in aspect of improvement the quality of observation data. 94% respondents agree that critical success factor that has been achieved by KUSZA Observatory has developed the science of *falak syarie* and astronomy in Malaysia. Other

than that, only 80% respondent agree KUSZA Observatoryl become as referenced to users and users-friendly when the critical success factor are applied.

3.4 The Needs of an Astronomical Observatory for Each State in Malaysia

Based on users feedback about the needs of an astronomical observatory for each state in Malaysia, the result as shown in **Figure 4**

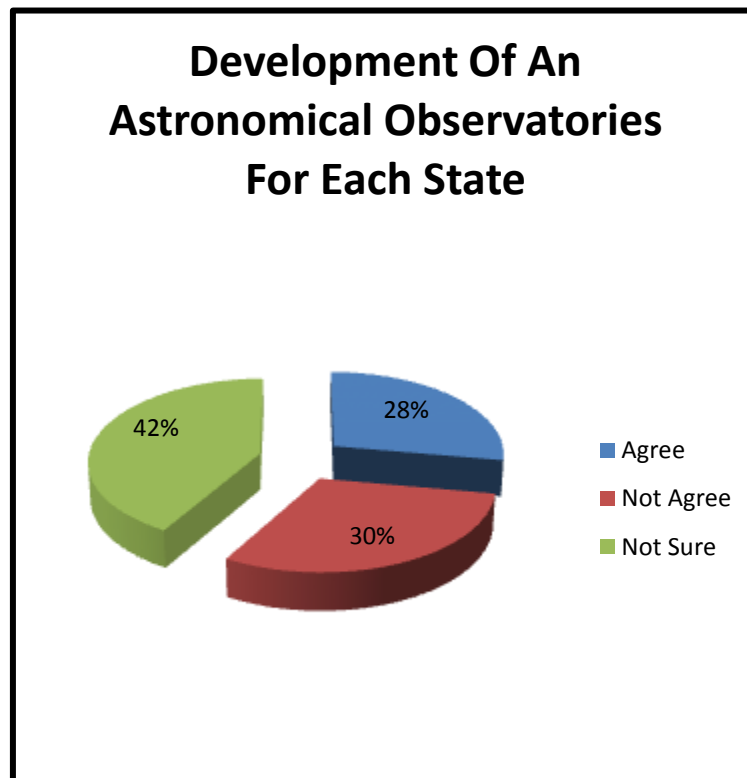


Figure 4: The Needs of an Astronomical Observatory for Each State in Malaysia

Based on **Figure 4**, there has a different perspective of users about the needs of an astronomical observatory around Malaysia. 42% respondents are not sure whether an astronomical observatory needs to be build for every state around Malaysia or not. 30% of them are not agreed and only 28% are agreed.

The desires of an astronomical observatory are depend on the purpose of an observatory that wants to be built. It's also depending on the necessity of the community of users that consist of student, researchers, *Falak Syarie* Members, and Astronomers.

From users' feedback, they have a reason why they choose to be not sure, not agree and agree about the needs of an astronomical observatory in Malaysia. It's is because they have their own perspective about the importance of an astronomical observatory. **Figure 5** shows user feedback about their perspective about the significance of establishment of an astronomical observatory in Malaysia.

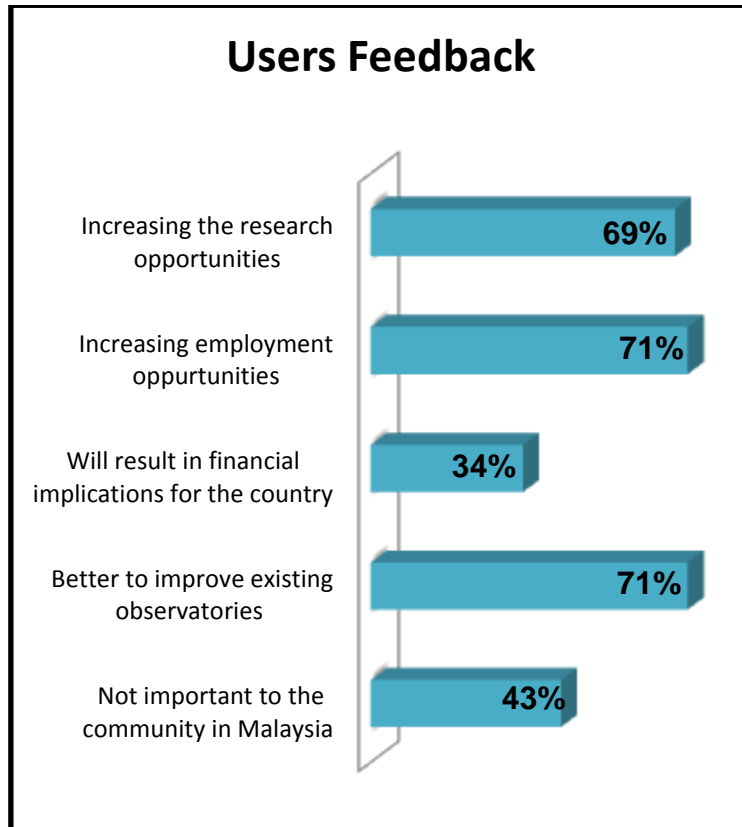


Figure 5: Perspective of Users about the Significance of Establishment of an Astronomical Observatory for Each State

Based on **figure 5**, it shows the different feedback from users about the significance of establishment of an astronomical observatory for every state in Malaysia. 71% of respondent give a perception that it is better to improve existing observatory rather than to build a new one. Besides that, 71% give a response the establishment of observatory will increase the employment opportunities and 69% of them give a response that it will increase the research opportunities. Then, 43% and 34% respondent responses that the astronomical observatory is not important to the community in Malaysia and it will result in financial implications for the country.

4.0 CONCLUSION

Generally, this research has already fulfilled the objective that has been outline. From this research, the most critical success factors have been identified which are accessibility, functionality, accessibility and also sustainability.

From this research, it has shown that the critical success factor has a high correlation with a performance of an astronomical observatory in aspect of improvement of observation data. Other than that it will develop the science of astronomy and *falak syarie* in Malaysia as well as to become a reference and attract users.

As a conclusion, the development of astronomy and *falak syarie* is parallel with the success of observatories. There is no observation without an observatory and there is no development without an observation.

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AUTHORS



Nur Amalina Binti Alias is a final year undergraduate student who undertaking Bachelor in Engineering (Geomatic) at Faculty of Geoinformation and Real Estate, Universiti Teknologi Malaysia.



Sr Mohamad Saupi bin Che Awang is a senior lecturer at the Department of Geomatic Engineering, Faculty of Geoinformation and Real Estate, Universiti Teknologi Malaysia. He holds a B.Sc (Hons) in Surveying and Mapping Science (University of East London, UK, 1986) and a M.Sc in Geodetic Science and Surveying (Ohio State University, USA, 1991). Since 1992, he has involved with the making and implementing of policies and guidelines for Islamic Astronomy Research and Development through the appointment as a member for the National Islamic Calendar Technical Committee of Department Of Islamic Development, Malaysia (JAKIM), Putrajaya. He has also committed with the development of Islamic Astronomy education and training by giving lectures at the Institute of Islamic Training (ILIM), Bangi and several religious and Mufti departments. His research interests lie in the areas of Islamic Astronomy, GNSS and Atmospheric Studies. Currently he is a member of Royal Institution of Surveyors Malaysia.