Business Intelligence Dashboard Design:
KPI Reporting Portal through S.M-A.R.T Dashboard (S.M-A.R.T KPI)

by

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CERTIFICATION OF APPROVAL

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Approved by,

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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HAFSAH SYAKIRAH BINTI AHMAD KAMIL

ABSTRACT

Getting the latest basic and critical information that is needed in making effective decision for an organization or a project can be a complex and difficult activity. This is a project that aims to develop an online portal as a solution in designing effective dashboard on the KPIs for Digital Lifestyle Malaysia-Key Performance Indicator (DLM-KPI) project using business intelligence practice in promoting effective decision making. The portal can provide insights and intuitive ways of perceiving a group of data that represent the DLM-KPI elements. The scope of this project is based on five important KPI elements on DLM initiatives in Malaysia, with characteristic of the effective dashboard produced to be Simple, Measurable, Accurate, Reactive and Timely (S.M-A.R.T KPI dashboard). The project begins with the study on the DLM-KPI framework. A number of informal interviews and survey was conducted with a former strategic manager and professional dashboard designer from technological solution company, in identifying the needs and important elements needed in designing an effective dashboard as well as studying its effect in making effective decision. Pitfalls on the dashboard were also identified for preventive measure. A working prototype of the online SMART dashboard system was produced with an effective design and display of DLM-KPI elements as agreed between the users and developer. Then, a research was conducted in studying the effect of effective design dashboard in promoting effective decision making. Reporting dashboard effectiveness is measured by its ability to create situation awareness of the KPI performance, and the effective decision is measured by the ability of the user to make prompt and informed decision. A survey with ten strategic managers was conducted to prove this hypothesis.

ACKNOWLEDGEMENT

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INTRODUCTION

1.0 INTRODUCTION

1.1 Background of the Study

Key Performance Indicator or KPI was first introduced by management gurus and has been widely implemented by many organizations and business entities with an aim of assisting them in defining and measuring organizational or project goals. It became a common occurrence in the organization and team project members as it enables them to monitor their performance towards achieving the intended goals. KPI enables them to evaluate and identify flaws and mishap that require attention and pro-active action in ensuring smooth and continuous process of achieving the set goals.

Online KPI reporting portal through S.M.-A.R.T. dashboard or also can be known as S.M-A.R.T. KPI is a project intended to work as a solution that could solve the problem of inefficient and ineffective reporting system for the DLM-KPI project. The DLM-KPI project is a research collaboration project between UTP (Universiti Teknologi PETRONAS) and SKMM (Suruhanjaya Komunikasi dan Multimedia Malaysia). S.M.-A.R.T. S.M-A.R.T. KPI reporting portal is generated using business intelligence practice

which uses quantitative DLM-KPI element as its back bone. The expected outcome of the transformation is to achieve more effective dashboard design in monitoring and reporting of the latest KPI status which forms a crucial information feeder to the decision makers which will help them to promote effective decision making and subsequently achieving three goals that they have set.

The three goals are:

1.   To provide a better quality of life for all in Malaysia using ICT application

2.   To enable Malaysian to compete internationally by increasing productivity and sustainability through the adoption of intelligent ICT services and Internet of Things application

3.   To make Malaysia as high income nation by 2020 using broadband networks and ICT services

Before the prototype was produced, a number of diagrams and checklist were created as a guideline in developing this online portal of dashboard reporting successfully. The diagrams and checklist include: system context diagram, dataflow diagram and S.M.-A.R.T. KPI dashboard checklist. These diagrams and checklist were created upon research and consultation of experienced dashboard developer/designer and former strategic manager.

The expected impact from the finished system is an effective monitoring and reporting of DLM-KPI data that will help to inform the top decision makers who require constant feedback on the performance of each KPI to make effective decisions. The main feeder of the KPI data for the system is through the pool of data from another survey system. The survey system will be developed by another developer where the system will allow users to fill in a number of survey questions. In the process of designing effective dashboard, the following characteristics are being fulfilled: Simple, Measurable,

Accurate, Reactive and Timely (S.M.A.R.T Dashboard). After the dashboard is produced, its effectiveness is being measured through the feedback from interviews and surveys with ten strategic managers of various industrial backgrounds and companies. The respondent will be asked whether they are able to make prompt and/or informed decision after analysing the dashboard in order analyse the relationship of effective dashboard towards effective decision making.

1.2   PROBLEM STATEMENT

KPI plays a crucial role in enabling measurement of project and organizational performance throughout the entire project towards achieving its set goals. Since KPI elements are unique between projects, a customized reporting system dedicated for effective visual reporting of a project is required, for subsequent crucial decisions. Having realized the need for this, in UTP-SKMM research collaboration project, entitled "The development of a framework for KPI for DLM", is to come up with online DLM-KPI visual reporting system for the decision makers who currently have no proper effective reporting system for the project. In the industry today, this KPI reporting system is a part of Business Intelligence System (BI system) where dashboard is being used to present collections of data into classified information and visual display of ratios and KPI being measured.

The problem statement can be stated this way:
How to design effective online DLM-KPI dashboard with S.M-A.R.T (Simple, Measurable, Accurate, Reactive and Timely) dashboard characteristic for the KPI reporting system in order to promote effective decision making?

Upon approval by the project committee and university, this project is intended to become a template for the other reporting and project management system in the future that the university might be pursuing, should this system successfully being implemented at the DLM-KPI project. It is also intended to introduce the value of business intelligence (in a form of effectively designed dashboard) in facilitating decision makers in the education industry to make effective decision.

AIM & OBJECTIVES

This project is aiming to develop an online reporting system made up of effectively designed dashboard that will use the concept of information visualization and business intelligence in reporting and displaying critical key performance indicator (KPI) elements to the user and decision makers. This is to prove the positive relationship between effective dashboard designs towards effective decision making. Dashboards will be designed and created in communicating the KPI framework on Digital Lifestyle Malaysia in accurate and effective manner. It will be created with these characteristic: Simple, Measurable, Accurate, Reactive and Timely (S.M.-A.R.T.).

The objectives of this project are as follow:

1.   To design effective dashboard on Digital Lifestyle Malaysia KPI data, judged by these characteristics: Simple, Measurable, Accurate, Reactive and Timely.

2.   To provide alternative method of translating raw data into more meaningful figure and graphical representation by using business intelligence that is being made available through easy accessible portal.

3.   To conduct research in examining the effect of effective designed dashboard in promoting effective decision making.

1.3   SCOPE OF STUDY

Since the portal will be the pioneer implementation of an online business intelligence and computerized system dedicated in conducting monitoring and reporting practice of DLM-KPI project, the scope of the S.M.-A.R.T KPI portal will emphasis on the effective visual designing of the KPI dashboard focusing on the outlined DLM-KPI. The outlined DLM-KPI includes:

1.   Number of projects facilitated by SKMM/DLM initiatives (ie: funding, publicity, transaction)

2.   Stakeholders satisfaction index (ie: time, cost, efficiency, productivity)

3.   Number of transaction (application usage from the shared services/products)

4.   Number of applications/products commercialized

5.   Individual satisfaction index (ie: time, cost)

The data organization to be used in the system will represent the real situation in which upon completion of all dashboard reporting agreed between author and SKMM-UTP project decision makers, the system is expected to be launched.

Through this portal, there are two areas of effectiveness being measured: dashboard design effectiveness and effectiveness in decision making as a subsequent effect of the effective dashboard design. The scope in measuring the dashboard design effectiveness is judged by the ability of the dashboard in facilitating the decision maker to monitor the outlined KPIs and maintain the situation awareness. The effective decision making is being measured through the ability of the decision makers to make quick decision and/or informed decision (making decision based on good judgment and knowledge) from the visually classified information presented by the dashboard.

Upon maturity of the portal in achieving all the visual display and reporting of the DLM-KPI report, the portal is expected to become a visual design template for the other future project that the university will pursue. This is because each project will have their own KPI and each project requires project management office or KPI reporting system in monitoring and measuring progress towards achieving the intended goals. The portal also helps in the small preliminary research of identifying the effect of effective dashboard design in promoting effective decision making.

CHAPTER 2

LITERATURE REVIEW

2.0 LITERATURE REVIEW

2.1 Introduction to Strategic Management and Decision

Managers in any organization are divided into three levels mainly: strategic, tactical and operational (Cooke & Slack, 1991). In all managerial level, managers are required to make decision. Strategic managerial level usually consists of top-level managers who spend less time in analyzing raw information for making decision that will give great impact to the organization. Instead, cognitive ability of the managers is used through visualization of the information (Alves, 2010). The process of making strategic decision is unstructured. It is also dependent with information from various parts of the organization and made based on experience (Cooke & Slack, 1991).The competency of a manager to make good strategic decision will determine the manager's effectiveness (Alves, 2010). Focusing on the top-level managers and strategic managerial level, this research will study on the effect of the visual display of data (in this case dashboard) on the strategic level decision will make. Since this research is only preliminary, the strategic level decision is being measured on the manager's ability to understand the information presented, and the ability of the manager to make prompt or/and informed decision.

2.2 Introduction to Flow of Information in Organization

Katz & Kahn (1966) mentioned that there are three methods how the information flows between subordinates and superior (managers): downward (from superior to subordinates), upward (from subordinate towards superior) and lateral (two way direction between manager and colleagues. Information requirement of subordinate and superior are different and sometimes superior faces the inability of gaining information that they need. Similar to different level of manager, Ballard (2006) mentioned that information also comes in the form of: operational, tactical and strategic. Strategic information is presented in the form of analytic, dashboard, queries and report. The information is more summarized, and designed in fulfilling the information requirement for specific type of analysis and application. In this project and research, only strategic information is being presented in order to feed the need of the strategic managers and decision makers in monitoring and viewing the progress report of the five DLM-KPI elements.

2.3 Introduction to KPI

Key Performance Indicator (KPI) is a measuring tool used in management practice to measure the performance of an organization in its pursuit to achieve its set goals and objectives. KPI does not limited to progressive towards the organizational goals, but it is also used to measure the progress of any type of project. In defining and measuring progress towards the organizational goals, numeric metrics like KPI is used (LCG System, 2010). Bernard Marr, defined KPI in simpler terms, as communicating information of the performance of the organization to the stakeholders in deciding whether the organization is on track or not towards their set strategic goals and objectives. Through KPI, there are three things that organization can achieve. Firsly, the organization or project team members can learn and improve as the information provided can help them to make better and informed decision that can lead to improvement. Secondly, it can be used to report externally to the external stakeholders, and demonstrate compliance towards external reporting regulations and information

required. Thirdly, through KPI, controlling and monitoring people's behaviour and action is made possible, as it can objectively access the achievement of these goal and provide feedback on any unwanted variance between achievements and goal. This is to eliminate variance and improve conformity (Marr, 2012).

2.4 Introduction to Business Intelligence and its relation to KPI

Today, KPI monitoring and reporting system has been part of Business Intelligence System that are made up of different platforms offered by many big players in the industry which currently dominated by Oracle, IBM Cognos and Microsoft (Kelly, 2010). Business Intelligence is where the process of gathering, storing, accessing and analyzing data is being performed using broad category of applications, technologis and processes that facilitate the business user to make better decision (Watson, 2009). Gangadharan and Swami, defined the usage of business intelligence system as a system that support both business analysis and decision making activities of an organization in facilitating them to understand their operation and compete in the workplace (Gangadharan & Swami, 2004)**.**

Mouhib Alnoukari, outlined the importance of business intelligence as an assistance for the organization in becoming more flexible, possesing sustainable competitive advantage and having differentiation for the organization (Alnoukari, 2009). He also explained the common architecture being implemented for business intelligence, which consist of data warehousing, business analytics, business performance management and data mining. BI solution contained three important layers: data layer, logic layer and access layer. At the data layer, all of the data which includes structured, unstructured and semi-structured data are being stored, while the logic layer provide the functionality to analyze data and communcite knowledge through database query reporting, data mining tools, data analysis tools such as Online Analytical Processing (OLAP), extract-transform-load (ETL) and visualization tools like dashboard (Dayal, Castellanos, Simitsis, & Wilkinson, 2009). The last layer for BI solution is the access layer where it consist of the Business Intelligence portal or the Software portal.

2.5 Information visualization: dashaboard, dashboard design in reporting and effective decision making

Most of the time, decision is made based on historical and current data that is produced in a report format from the latest tools that store, retrieve and analyze the data. The report produced will assist the higher level management to decide on the strategic implementation and planning that will utilize the resources available (Ta'a, Abu Bakar, & Saleh, 2008). Initally, decision support used off line analysis of historical data, but the evolvement of technological advances allow organization to use the real time data in improving the current operation and decision to be made (Watson, 2009). The process of analyzing large amount of data can be conducted and easily understood through information visualization. Data or information visualization is described as converting abstract, non-spatial or behavioural data into visual images (VDI, 1997), but it is also refer to computer generated interactive graphical representation of information where the scope includes the design, development and application (Chen, 2010). In the Dictionary of Computer Graphics and Virtual Reality, visualization is "the process of representing data as a visual image". Depending on the properties of the data, visual analog like pie chart or line graph is required for abstract data (Latham, 1995). He also noted that visualization in the form table, outlines, pie charts, line graphs and bar charts has been available for sometimes. Tegarden cites that information visualization technology uses human visual/spatial ability to extract information provided by pool of data to assist in solving business problems (Tegarden, 1999). This is supported by Vessey that say in cognitive fit theory, if the information presented is able to assist in problem-solving task, better decision making can be made (Vessey, 1991). The problem with todays' decision maker is too much information is relayed to them and causes critical information to be overlooked. At time, prompt decision and responds is required but the current Decision Support System tools constrain their productivity (VDI, 1997). This is one of the aims of the proposed project as the author would want to produce an online dashboard reporting portal that could facilitate decision makers in making effective decisions. The effectiveness of the dashboards is assessed by its ability to help

decision maker monitor the progress and aware of the project situation based on the status of the KPIs shown by the reporting dashboard, and whether the five major characteristics of the dashboard outlined by author is accomplished or not. While the effective decision is being judged by the decision maker ability to make prompt decision based on the informed situation relayed by the dashboard generated.

In the case of data visualization, the common term used to describe it in business intelligence and KPI monitoring system is called dashboard. Dashboard is defined as "Visual display of the most important information needed, to achieve one or more objectives consolidated and arranged on a single screen so that information can be monitored at a glance" (Few, 2006). Stephen Few in his writing on the common pitfall in dashboard design, compliment the existence of dashboard in communicating information effectively, only if the information is being transmitted with effective visual design. Effectiveness of the dashboard is judged by the clearness, speed and accuracy of the information being transmitted. Only then, the dashboard usability can be increased. Since dashboard deals with visual display, proper visual presentation of the information can be easily interpreted by the observer compare to the same information presented in the form of text. Characteristics of an effective dashboard are when it is able to communicate the KPI indicator in meaningful context, and present the KPI that allow user to understand the significance of the information instantly. Through the dashboard observation, it allow user to evaluate the choices that they have in making decision and give them confidence in making decision when it is being supported by facts (Pureshare, 2006). Pureshare also provide a checklist of designing effective dashboard solution, which includes:

1. Use standard, culturally accepted colors and symbols

2. Employ thresholds and show meaningful comparison and trends

3. Identify clearly units of measurement and provide actual values

4. Show clearly targets, norms and design displays that show progress towards these

5. Provide date and timestamp for each metric

6. Provide drill-down links to groups with detailed information

7. Provide links to roll-up and overview dashboards

8. Place data in context and suggest advisable action based on the metric

9. Provide date and time when metric will be updated, when business need warrant, allow ad-hoc update

10. Ready to develop new dashboard

Despite the checklist provided, in the effort of developing effective dashboard, Stephen Few warned the challenged and failure dashboard designer would encounter. He outlined 13 failures in dashboard designing which includes:

1. Exceeding the boundaries of a single screen

2. Supplying inadequate context for the data

3. Displaying excessive detail or precision

4. Expressing measures indirectly

5. Choosing inappropriate media of display

6. Introducing meaningless variety

7. Using poorly designed display media

8. Encoding quantitative data inaccurately

9. Arranging the data poorly

10. Ineffectively highlighting what's important

11. Cluttering the screen with useless decoration

12. Misusing or overusing color

13. Designing an unappealing visual display

In relation to this project, providing the importance and the need of an effective dashboard for reporting and the possible failure in designing it summarized the five major characteristics of the dashboard to be created. The usage of S.M.-A.R.T characteristic that stand for Simple, Measurable, Accurate, Reactive and Timely proposed in this project's aim, is suitable in designing the proposed solution as it is enough to address the intended problem and the time factor. Simple define the dashboard to be created based on the users' requirement on the data and adequate information that should be communicated to them, without excessive details and accessories, while Measurable define the dashboard to provide meaningful information in measuring the performance towards achieving the intended goals through the KPIs. Units of measurement will clearly be identified and actual values will be used. In terms of Accurate, only the latest and the most updated data will be used after the process of data cleansing and encoding the data accurately. Reactive on the other hand is where the chart will be updated and react to the new data updated or modified, while Timely characteristic will allow the dashboard to have their own date and timestamp each, in communicating the time the dashboard was generated. Despite the S.M.-A.R.T. dashboard characteristic needed to be fulfilled, effective dashboard reporting outlined by Stephen Few will be translated only to some certain extend, while the pitfall will become a notable guideline in developing an effective DLM-KPI dashboard reporting.

2.6 Current Technology realted to Business Intelligence, KPI and dashboard reporting

Tools like Oracle Exadata v2, Oracle Database 11g, IBM Cognos 8, Microsoft Excel, Microsoft SQL Server and Microsoft SharePoint are among the current technologies used in fulfilling the demand and complexity of BI system through the utilization of the organization's data warehouses. These technologies can generate dynamic and flexible dashboard depending on the demand by the user in visualizing the KPI elements and other elements required in the BI system which are unique depending on the organization. The selling point for each of these large vendors is their flexibility of the tools in fulfilling the customer's needs and preferences, and other software qualities such as low maintenance cost (cheaper), scalability and quick deployment (Kelly, 2010). Today, the KPI system has become a part of the larger Business Intelligence system, where the existence of the advance function called predictive analytic is able to provide projected model of the future trends through the usage of information pool of historical and real time data (Stackpole, 2010).

Majority of the tools offered by the leading vendors are all patented in nature, and will cause many organization and companies to reconsider on the decision in investing on such technology. The primary concerned would be the initial cost that will be incurred for the implementation which is leveraged with the returned promised by the system and the risk of the system failure provided by the chosen vendor. There are however the open source solutions which also provide flexibility and freedom in the development in the market such as SpagoBI, Pentaho, OpenBI and JasperSoft to name some. However, for these open source solution, security issues has become the major concern in constructing an effective BI system, as only with the existence of IT infrastructures expertise that this issue can be resolved. Regardless of the patented tools or open source, each of the system has their own architecture and procedure in translating the KPI element that has been customized by user into a visualized form of KPI monitoring and reporting system. Each systems has their limitation and strong features that should be

outlined before deciding on the type of system the organization wish to pursue, in order to fulfill their specific needs. In this case, the needs of a team of experts in IT solution and technical item should be able to work well with the solution chosen in order to start the system development.

In relation to this project, the tools available in the market was initially rather advance and to some extent can fulfill what is beyond the scope of this project which is considered as a foundation level in terms of the data repository technology and the intended problem wanted to be solved. However, the availability of the chosen tools of Microsoft Sharepoint in developing the dashboard and KPI reporting portal at author's hardware has become an advantage to the author in solving the intended problem. This availability provides an opportunity of in house development of KPI monitoring and reporting system through the development of effective visual dashboard design based on the definitions and requirements specified by the outlined DLM-KPI elements, users and effective dashboard design guideline/checklist. The ability to efficiently be able to monitor and performs reporting of its KPI status forms a crucial management advantage to better facilitate the project's aim in achieving its set goals.

CHAPTER 3

METHODOLOGY

3.0 METHODOLOGY

In the process of solving the intended problem outlined, which is to provide an effective visual reporting dashboard of the DLM-KPI elements through online KPI reporting portal in promoting effective decision making, this project is divided into two parts.

The first part revolves around the development of the S.M.-A.R.T. DLM-KPI reporting portal. Author is required to deal with a pool of data that will make up dashboards reside at the portal. These data consist of historical and real time data. Since the SKMM DLM-KPI project is still in its preliminary stage, the data populated is only sample data for the intended reporting portal. The development of the reporting dashboard and portal from the data pooled will act as a sample dashboard report that will allow users to constantly monitor and obtain reporting of the current progress of their outlined KPIs towards their set goals.

The second part is the study conducted to measure the effectiveness of the dashboard created. This is being judged based on its ability to help users to monitor and maintain their situation awareness of the current progress of the KPIs. Then, cascading study on effect of the dashboard effectiveness towards promoting effective decision is also being conducted through interviews and surveys with ten strategic managers of various backgrounds and companies. The respondent will be asked whether they are able to make prompt and/or informed decision after analyzing the dashboard.

3.1   [Part 1] S.M.-A.R.T. DLM KPI Reporting Portal Development

In terms of portal development methodology adopted, online DLM-KPI reporting portal implement agile development method. Within the time constraint given in developing the project and the number of developer in developing the system, Agile system development is a suitable methodology that is used in developing the dashboard and the portal at a fast pace without sacrificing its quality. This method of development is iterative which means the entire system was developed iteratively by parts, where in the portal, the dashboards developed were created and designed one by one based on the S.M.A.R.T dashboard characteristics, until all five DLM-KPIs has been translated into graphical display. Initial prototype of the dashboard was produced and iteratively presented to the user in a form of versioned dashboard prototype. Once the users are satisfied, portal development and dashboard coding activities were conducted and followed by system testing. Research study was conducted to study the effect of effective design dashboard towards effective decision making through a survey with ten managers and finally, the portal and the dashboard is delivered to the user. Flow chart below summarizes the development process of the portal in providing effective dashboard with S.M.-A.R.T. characteristic as the solution to the problem that this project is trying to solve.
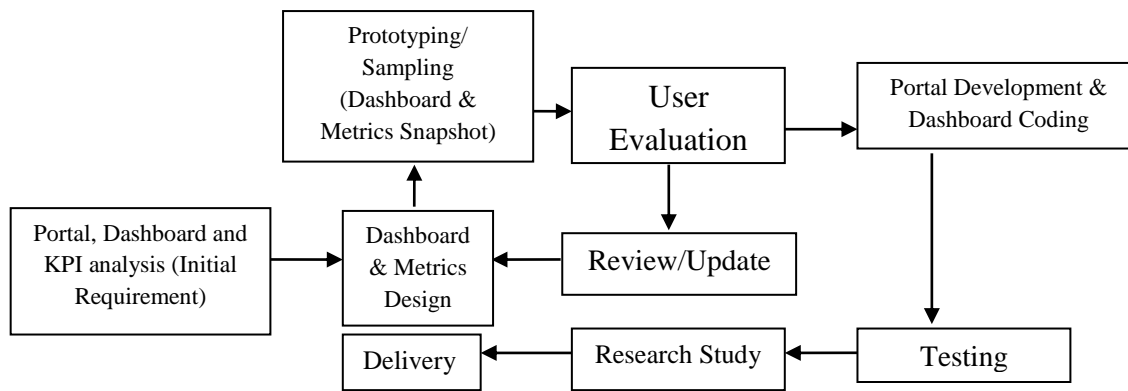
Figure 1: Agile Methodology adopted by S.M-A.R.T KPI Reporting System

3.1.1 Requirement Gathering: Interviews, Portal and KPI analysis

This phase establishes a high-level view of the intended project and determines the framework of the project goal. The aim of this phase is to perform preliminary investigation on the current and effective dashboard design, framework and building block of a reporting portal and the analysis on the method of generating the KPIs. In order to achieve these aims, a number of requirement gathering methods were selected, namely: Interviews, Document analysis and Previous portal analysis

For the preliminary process of data collection, two interviewee categories were questioned: ex-strategic managers and senior dashboard designer with more than two years of experience in the industry. For the first category, former Chief Executive Officer of a technological company was interviewed in order to suggest some plausible characteristic of an effective dashboard design in reporting key performance indicator through the perspective of big corporation and strategic managers. A number of essential characteristic of a dashboard were verbally specified which was noted through the interview at his office. For the second category, a professional dashboard designer at another technological company with MSC status was interviewed in providing guideline of the dos and don'ts in designing dashboard. The interview was conducted online, and eventually inclined towards dashboard designing tutorial.

Succeeding in the process of data collection, document analysis of the DLM-KPI framework was conducted. This is done in the process of understanding the characteristic and behavior of the data to be measured and the method of collection, consolidation and process of the data. Former portal analysis was also being conducted, since author was previously involved in similar project throughout the industrial working experience. Both analysis methods function as a tool to understand effective KPI reporting environment and best practice in KPI online reporting portal and dashboard design.

S.M-A.R.T. KPI is principally focus on designing effective visual display of DLM-KPI elements in a form of dashboard that will reside in KPI reporting portal. Hence, data collection phase was mainly intended to fulfill the aforementioned.

The analysis process performed in this phase will facilitate in refining the project goal into defined functional and operation of the intended dashboard and portal. Through analysis, it is aimed to analyze and map the problem intended to be solved by providing the solution through the new system and the system architecture. From the information gathered, further analysis and translation of data into functional and operational requirement of the system was performed. The requirements were modeled in providing high level view of the system in creating the conceptual system design which will become useful in later specific technical design.

For S.M-A.R.T KPI, system context diagram was developed to illustrate the interaction of the system with the user and external user based on the results obtained from the KPI analysis and interviews. Data flow diagram was also being developed in order to illustrate the process flow of the KPI data. This includes the method the KPI data input is obtained, processed and the output expected to be produced. In designing effective reporting dashboards, a list of checklist on the S.M-A.R.T KPI dashboard characteristic was created in providing a guideline and framework of the intended dashboard to be produced.

3.**1.2**   **Design and Prototyping**

For the design and prototyping phase, the aim is to transform the modeled requirements that have been produced in a form of diagrams into detailed function, operation and graphical form which make up the looks, input, process and output of the actual portal and dashboard. In the support of designing and prototyping work, development tools used in this project will be Adobe Dreamweaver C3s, Microsoft Visual Studio, Microsoft Sharepoint Designer and Microsoft SQL server. All of the software is readily available at the author's hardware and laptop, ready to be used. The prototypes produced will be presented to the user in a form of snapshot view. The reason is because the initial prototyping of the dashboards are configured and created through author's local host in order to facilitate faster designing and development activities.

Since this project is implementing Agile System Development, there has been alternating activities between designing the dashboard and performing user evaluation in order to fulfill the main goal of the project which is to design an effective dashboard in monitoring and reporting the KPIs for the users.

3.1.3   Portal Development and Dashboard Coding

Upon the agreement of the intended requirement and design of the dashboard to produce in monitoring and reporting the KPIs, development of the portal was conducted and dashboard coding was performed. The tools used are similar during the design phase with additional software of Adobe Photoshop C3S, WampServer 2.1e-x32, PhpMyAdmin 3.3.9 and Filezilla 3.5. These tools further facilitate the development, testing and implementation of the portal and dashboard to the actual server.

3.1.4   Implementation and delivery

Upon maturity of the portal development, this phase require the author to ensure the running of the system in the actual users' environment. S.M.-A.R.T KPI is currently working as intended and able to achieve the goal and the portal has expected to be accepted by users as template of reporting system. However, further continuous improvement must be made for more detail reporting once the real data is collected.

3.2 [Part 2] Study on the effect of effective dashboard in making effective decision

This part of the project is designed and developed with intention to investigate the effectiveness of the reporting dashboard produced and the effect that it has in promoting effective decision. Ten strategic managers are chosen for an interview and engagement session. The subjects will act as project manager for the SKMM DLM-KPI project that requires constant timely and accurate reporting of the current KPI progress of the project. The reporting dashboard will be the subject being evaluated and the respond from the managers will be the outcome in determining the effectiveness of the dashboard and deciding whether or not the dashboard helps them to make prompt decision if needed. In preparing for the interview, a list of questions and survey questions (see in Appendix) is produced in order to obtain the following objectives:

1. To measure the effectiveness of the dashboard based on its ability in facilitating the user to monitor and aware of the situation and progress of the KPIs.
2. To measure the effectiveness of the dashboard design as a whole and specific part of the dashboard.

3. To measure the ability of the respondent in making initial prompt decision based on the dashboard analyzed.

CHAPTER 4

RESULT & DISCUSSION

4.0   RESULTS & DISCUSSIONS

4.1   Requirement Gathering: Pre-Implementation Interviews, Portal and KPI analysis

Requirement gathering is the first phase of the project, where this phase is aimed to perform preliminary investigation on the current and effective dashboard design, framework and building block of a reporting portal and the analysis on the method of generating the KPIs. To achieve these aims, a number of requirement gathering methods were selected, namely: Interviews, Document analysis and previous portal analysis

Interview

The aim of the interview is to understand the characteristics of designing and developing effective dashboard from the view of strategic managers and expert developer. Strategic managers are those who are always in need of critical and latest progress of the KPIs towards their set goals. In the interview with the former CEO of a technological company in Perak, the result shows that there has always been a problem for strategic managers to obtain the latest information about the organization's performance; especially when they need particular information before making the decision. Even though the information is available, it will takes time to obtain it as the information may come in a form of excel and power point presentation. If there is delay in obtaining the information, the data may be obsolete and irrelevant in making the

decision based on the information. It has been found that, presentation of the data may not be very effective in communicating good information. There are times where the charts did not display the information that they need, and sometimes the colours and shapes has become a challenge in figuring out the information. He pointed out that good decision can be facilitated by proper construction of charts and dashboard, which can communicate the information that they need effectively.

Another interview was conducted with a professional dashboard designer, from a technological company located in Shah Alam, in obtaining the method in creating effective dashboard for KPI reporting system. The result shows that the information that need to be displayed at the KPI dashboard will always depend on the user. Working closely with the user and understand their working environment will help to generate the intended dashboard that will become useful for them. In terms of designing, she outlined a number of dos and don'ts practice which mostly similar to what Stephen Few in Pitfall in Dashboard Designing, and Pureshare in Metrics Dashboard Design: Designing Effective Metrics Management Dashboard article. Checklist below shows the improved guideline that has been formed by author for S.M.-A.R.T dashboard features based on the advice by the dashboard designer.

Simple
- Use simple design (without excessive detail & accessories) and be consistent
- use appropriate color/indicator
- adequate information must be communicated

Measurable
- create related dashboard in one page
- identify & display clearly units of measurement for all data wanted to be displayed

Accurate
- ensure only data that has been cleansed is used
- proper arrangement of data & ensure clear label display - avoid overlapping information

Reactive
- ensure all charts are updated when data are updated or modified

Timely
- code timestamp on every dashboard created
- chart will automatically generated upon clicking the link, based on the data pooled at the database

Figure 2: S.M.-A.R.T. KPI Dashboard Features Checklist

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Subsequent analysis on the KPI documents and previous portal that has been generated was also being conducted. The result shows the development of the DLM-KPI framework was based on iterative steps of generating KPIs from a set of goals. Once the outlined KPI has been generated, sample data was populated in a structured table form in the database since the real data for the KPI is yet to be produced by SKMM. The data that has been collected are required to be reported in an effective form to facilitate the users in monitoring the KPI progress. There are five important KPIs that must be monitored and produced by the reporting system. They are:

1. No. of projects facilitated by SKMM/DLM Initiative (eg. funding, publicity, transactions)
2. Stakeholder satisfaction index (eg. time, cost, efficiency, productivity)
3. No. of transactions (application usages) from the shared services/products
4. No. of applications/products commercialized
5. Individual satisfaction index (eg. time, cost)

In the effort of reporting these KPI effectively, analysis of previous portal that author has been involved in was also being conducted. This is to facilitate author in effectively construct S.M.-A.R.T. KPI reporting portal and the dashboard required. Based on the document analysis and former portal analysis, context system diagram, use case diagram and data flow diagram were constructed, as shown below, to facilitate author in understanding the flow of data and the interaction of the users and designer with S.M.-A.R.T. KPI reporting portal.
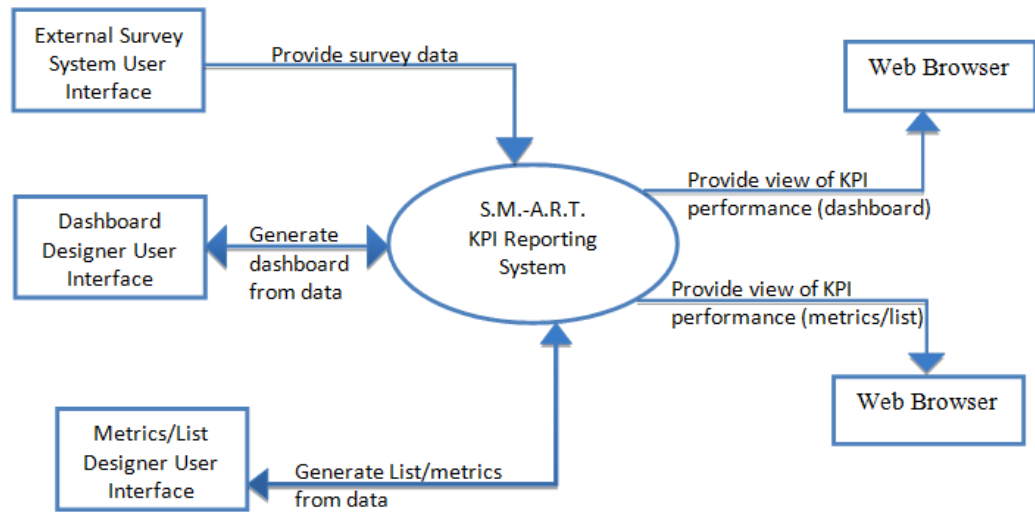
Figure   Figure 3: System Context Diagram for S.M.-A.R.T. KPI Reporting System
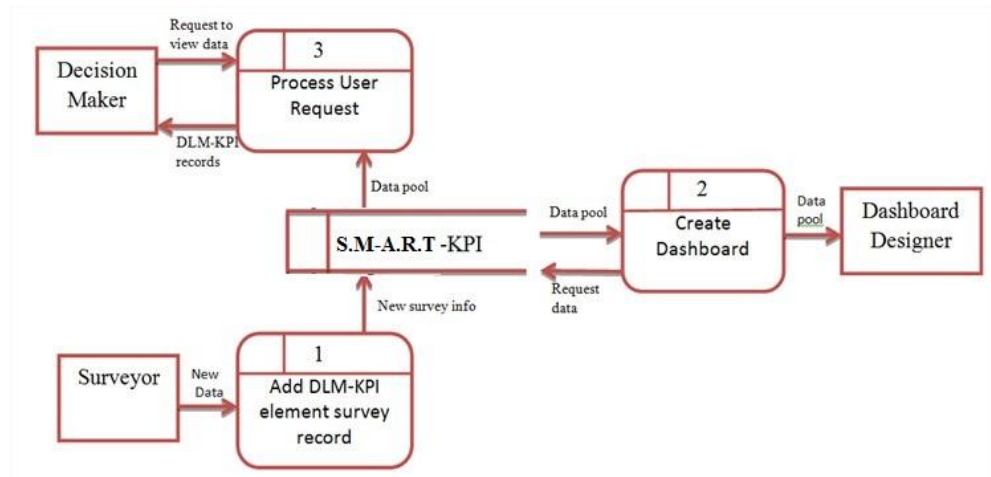
Figure 4: Data Flow Diagram for S.M.-A.R.T. KPI Reporting System

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The use case diagram illustrates the functionalities available in the reporting system and illustrates how the system interacts with each other.
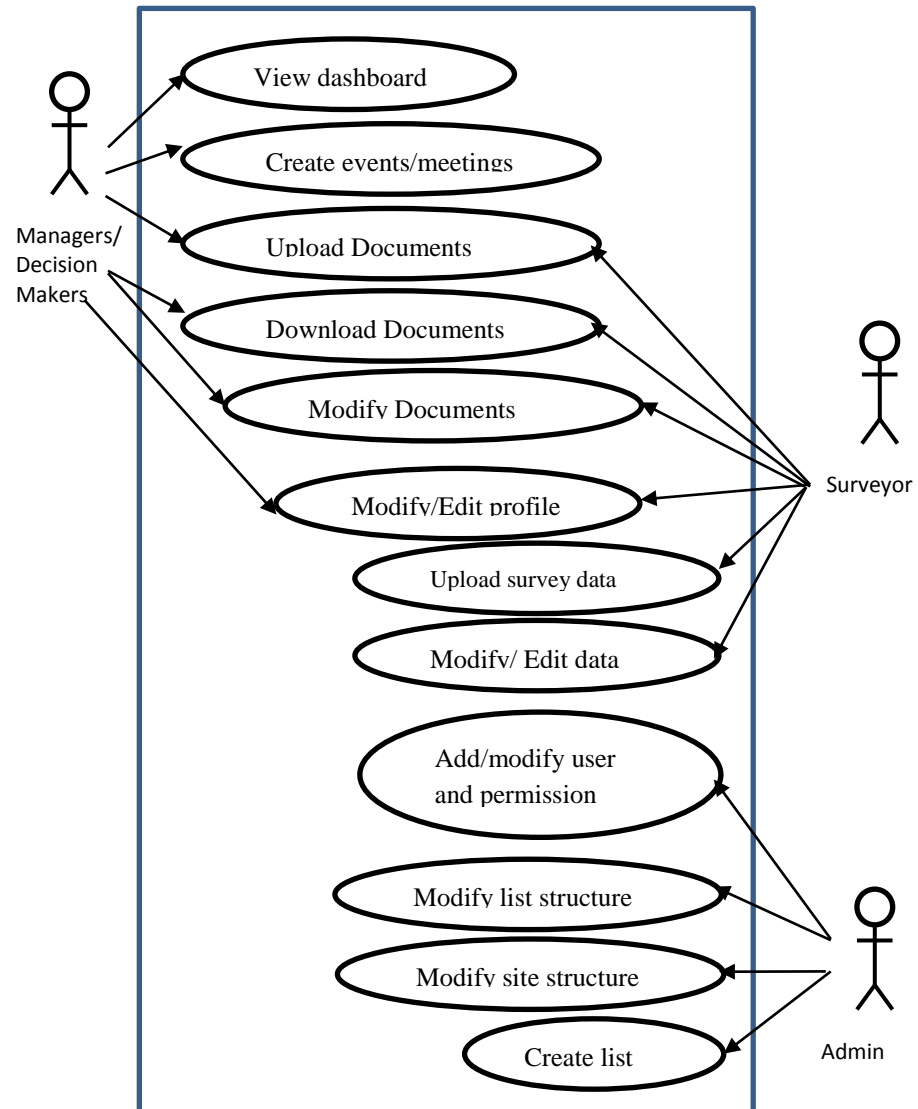
Figure 5: S.M.-A.R.T. KPI Use case diagram

4. 1 Dashboard Design & Prototype development

During the course of the first part of the project, the initial snapshots of the intended dashboards were able to be developed. The prototype produced illustrates the S.M.-A.R.T. dashboard design features that the DLM-KPI element should be presented. The dashboard developed for this particular prototype covers all five KPIs which include:

1. No. of projects facilitated by SKMM/DLM Initiative (eg. funding, publicity, transactions)
2. Stakeholder satisfaction index (eg. time, cost, efficiency, productivity)
3. No. of transactions (application usages) from the shared services/products
4. No. of applications/products commercialized
5. Individual satisfaction index (eg. time, cost)

For the first KPI, in measuring the number of project facilitated by SKMM/DLM initiative (eg. Funding, publicity, transactions), a metrics in populating the data, two pie charts in communicating the data populated were produced. For the chart, among the important features added in Reactive and Timely characteristic of S.M.-A.R.T. is the timestamp and fast update that the chart will produce whenever dashboard link is clicked or the dashboard is refreshed.
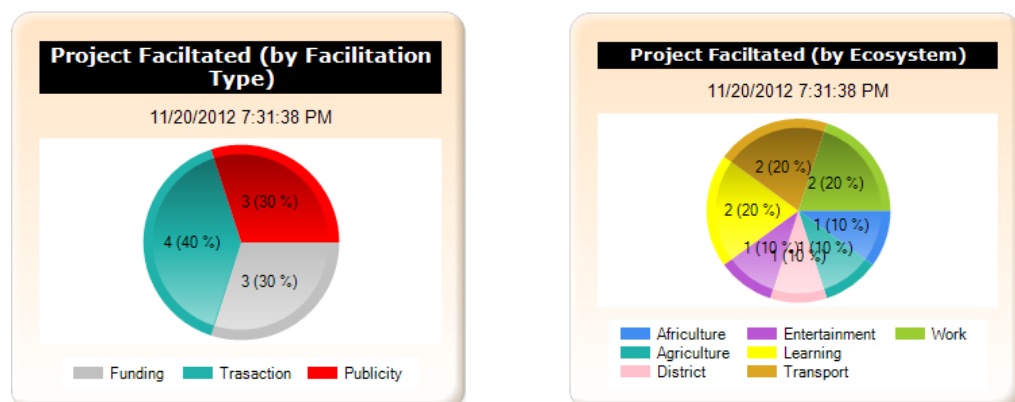
Figure 6: Dashboard Reporting for KPI (1): No. of projects facilitated by SKMM/DLM Initiative (eg. funding, publicity, transactions)

Figure 7: Lists for KPI (1): No. of projects facilitated by SKMM/DLM Initiative (eg. funding, publicity, transactions) - Filtered by "Funding" Facilitation Type

For the second KPI, a metric, two pie charts and a bar chart were produce in displaying the summary of the number of application/product commercialized were produced. The pie chart was measured and labeled with numbers, percentage and divided according to ecosystem and year.
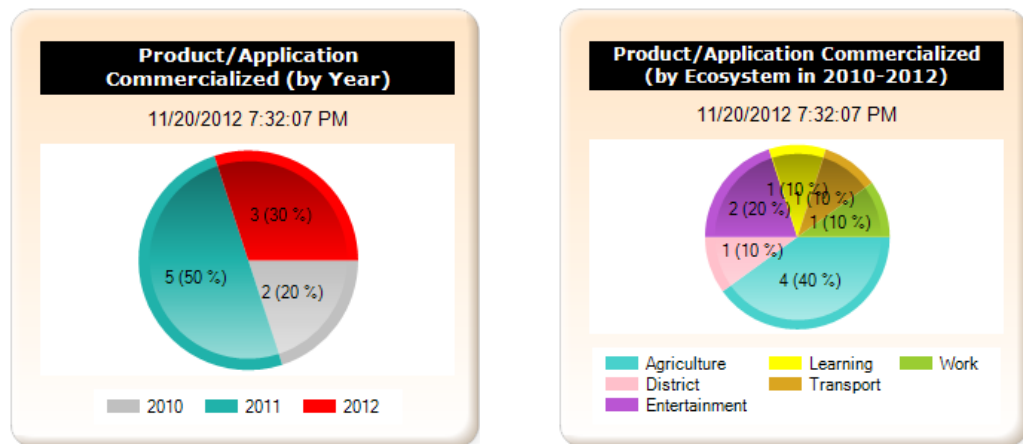
Figure 8: Dashboard Reporting for KPI (2): No. of applications/products commercialized
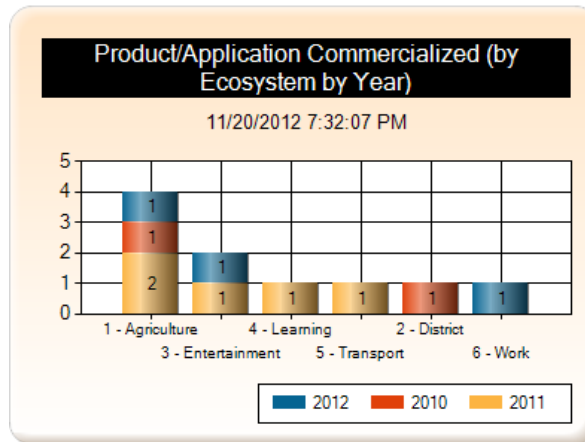
Figure 9: Dashboard Reporting for KPI (2): No. of applications/products commercialized (grouped by ecosystem by year)

Figure 10: Lists for KPI (2): No. of applications/products commercialized (grouped by year)

For the third KPI, in measuring the stakeholder satisfaction index on the website produced under DLM initiatives, a metrics, six pie charts and two bar charts were produced in comparing the satisfaction index of the previous year and satisfaction index of this year.
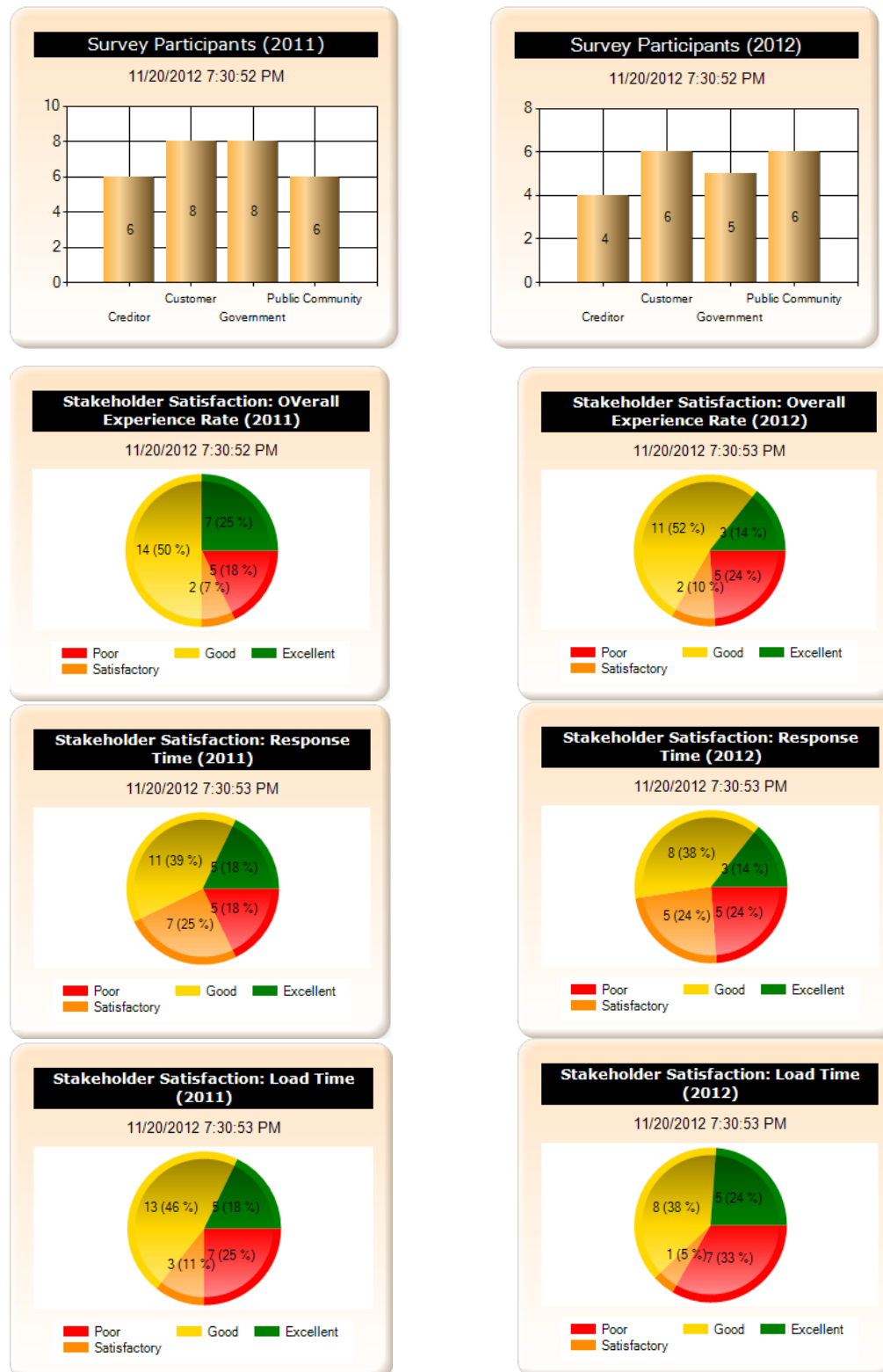
Figure 11: Dashboard Reporting for KPI (3 & 4): Stakeholder satisfaction index (eg. time, cost, efficiency, productivity) & Individual satisfaction index (eg. time, cost)

Year	Stakeholder Type	Response Time	Load Time	Overall Experience Rate
Stakeholder Type : Creditor (6)				
2011	Creditor	2 - Satisfactory	2 - Satisfactory	3 - Good
2011	Creditor	3 - Good	4 - Excellent	3 - Good
2011	Creditor	2 - Satisfactory	3 - Good	3 - Good
2011	Creditor	3 - Good	4 - Excellent	3 - Good
2011	Creditor	4 - Excellent	4 - Excellent	4 - Excellent
2011	Creditor	2 - Satisfactory	2 - Satisfactory	3 - Good

Figure 12: Lists for KPI (3 & 4): Stakeholder satisfaction index (eg. time, cost, efficiency, productivity) & Individual satisfaction index (eg. time, cost) - Filtered by Stakeholder Type "Creditor"

Year	Stakeholder Type	Response Time	Load Time	Overall Experience Rate
Stakeholder Type : Customer (8)				
2011	Customer	3 - Good	3 - Good	4 - Excellent
2011	Customer	1 - Poor	1 - Poor	1 - Poor
2011	Customer	1 - Poor	1 - Poor	1 - Poor
2011	Customer	2 - Satisfactory	1 - Poor	2 - Satisfactory
2011	Customer	3 - Good	3 - Good	3 - Good
2011	Customer	2 - Satisfactory	1 - Poor	2 - Satisfactory
2011	Customer	3 - Good	3 - Good	3 - Good
2011	Customer	3 - Good	3 - Good	4 - Excellent

Figure 13: Lists for KPI (3 & 4): Stakeholder satisfaction index (eg. time, cost, efficiency, productivity) & Individual satisfaction index (eg. time, cost) - Filtered by Stakeholder Type "Customer"

For the final KPI, in measuring the number of transaction (application usages) from the shared services/products, a metrics and a line graph were generated in measuring the number of site access, hit counter, and number of application downloaded.
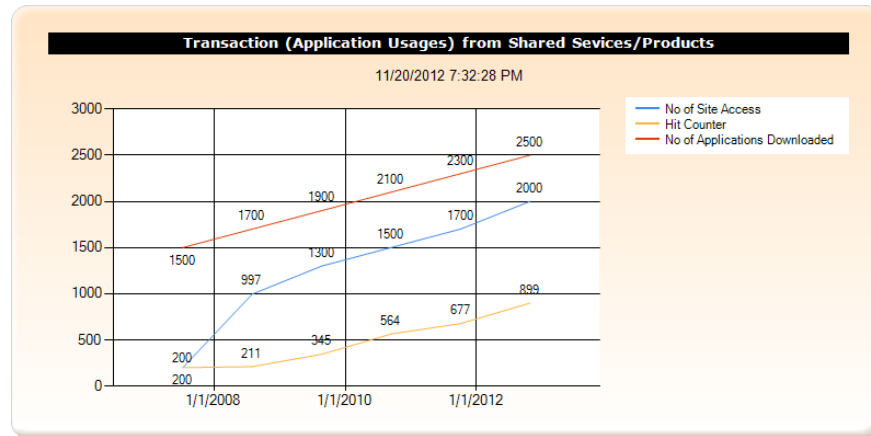
41

Figure 14: Dashboard Reporting for KPI (5): No. of transactions (application usages) from the shared services/products

Figure 15: Lists for KPI (5): No. of transactions (application usages) from the shared services/products

Following the dashboard prototype, the actual prototype of the portal for the reporting system was developed as a platform that will reside the dashboard created and the populated lists that make up the dashboard. The process of the dashboard creation at the portal require careful coding work and technical integration between the portal and its respective database resides at the current local server.

4.2 Pre-Implementation Dashboard Design User Evaluation

One of the most crucial parts in implementing this project is the user evaluation on the dashboard and portal prototype, so that the refined requirements and S.M.-A.R.T. design features intended to be implemented are fulfilled.

For the initial snapshot of the dashboard, positive feedback has been received upon an engagement session with the SKMM representative, in terms of the design and suitability of the dashboard in monitoring the DLM-KPI performance. Upon receiving green light from the SKMM representative, portal for the reporting system was designed and configured, with all the features and characteristic outlined from the system context diagram, data flow diagram and use case diagram.

4.3 Portal Design & Prototype development

During the second part of the project, a portal was developed with the guideline from context system diagram, use case diagram and data flow diagram. Below is the snapshot of the portal developed.

1. User login
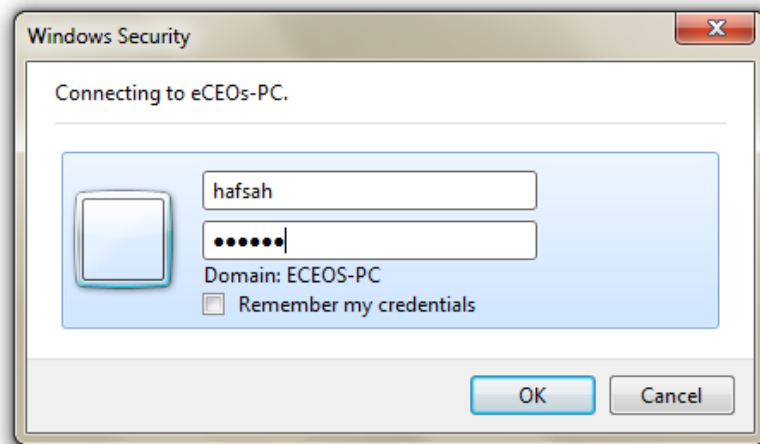
Figure 16: Login Window

Any user will be prompted with the login window that require the insertion of username and password that is unique for each user. The username and password will be given to each user upon request.

2. Personal profile details
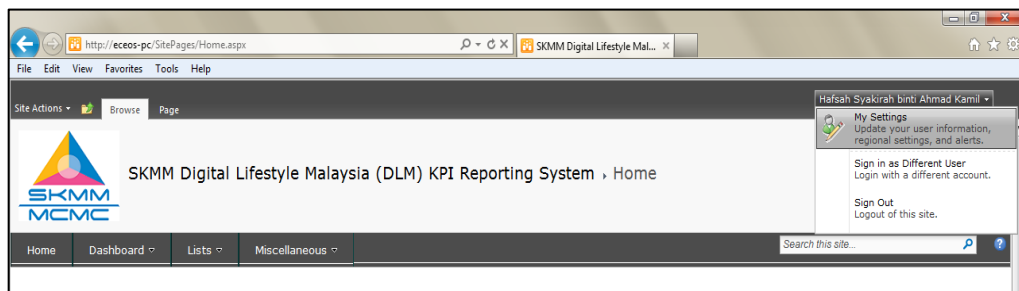
Figure 17: Personal Profile

44
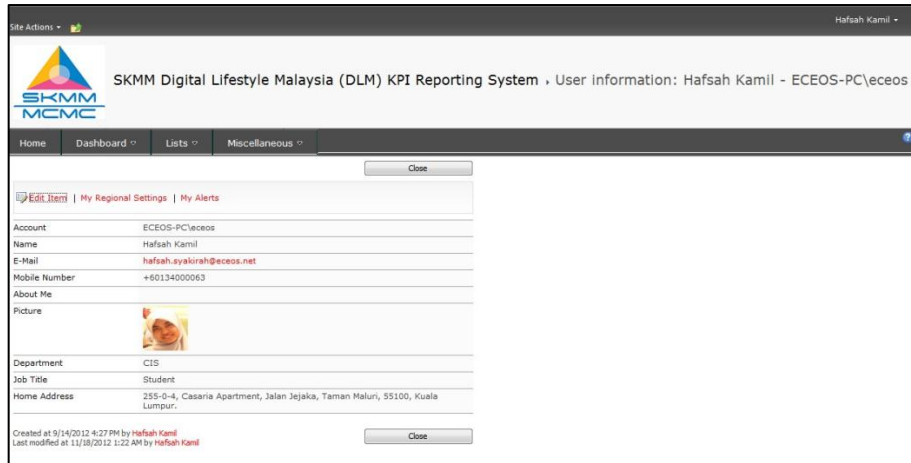
Figure 18: Personal Profile Page

Each user will be provided with profile page complete with all the data regarding the user. User can edit their data upon clicking "Edit Profile" link. A form will be prompted that allows user to edit or modify their personal information at the portal. This feature helps identifying the user clearly on the any modifying and editing action that they perform during their visit at the

3. Portal Front Page
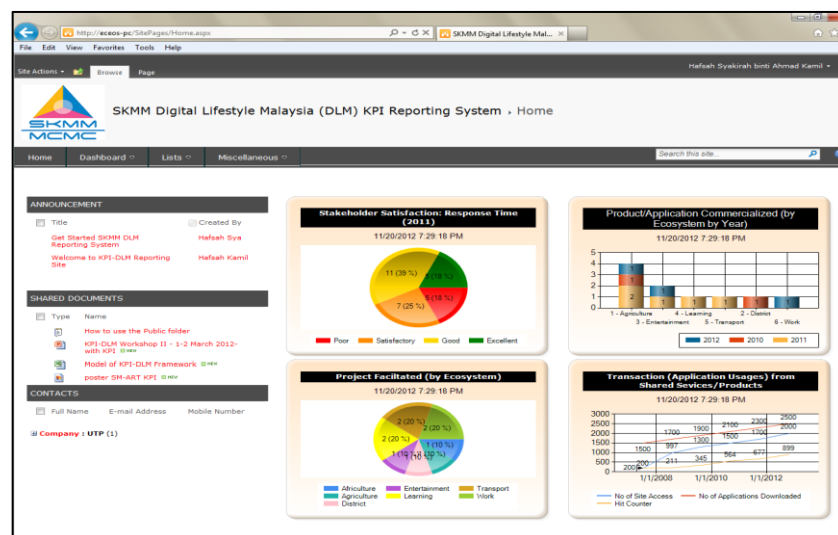
Figure 19: Portal's Front Page

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Upon logging into the portal, user will be navigated to the portal's front page that is equipped with a dashboard consisting of four charts that shows the overall performance of the SKMM DLM-KPI performance. On the left column of the portal, located an announcement section, shared document and team contacts. The announcement section can be used to broadcast important news or updates that require everyone's attention. The shared document feature is created with the purpose of facilitating the managers and users to download and upload public document that can be easily retrieved. Lastly, the team contact section was created to assist in reaching the other user easily via other means beside the portal.

4. S.M.-A.R.T. KPI Dashboards

For each of the KPI, a detailed dashboard was produced that will facilitate the strategic managers to monitor the current performance of each KPI. A drop down menu for all the dashboard pages was created to ease the user's navigation.
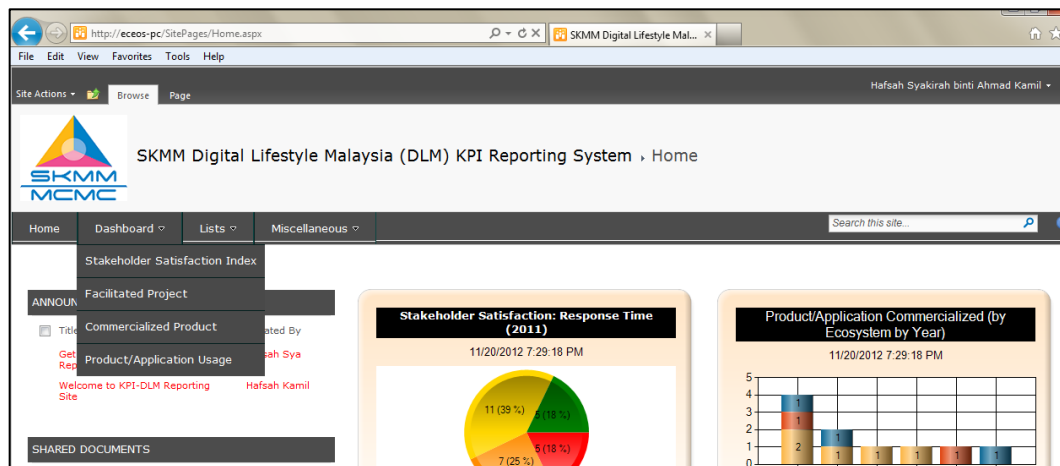
Figure 20: Navigation for Detail Dashboard Page

Upon clicking "Stakeholder Satisfaction Index" submenu, located under "Dashboard" menu, managers and users will be navigated to the Stakeholder Satisfaction Index dashboard. There will be a total of eight charts produced and displayed, that will assist the managers to monitor the current performance of the satisfaction index against the previous performance. Appropriate colors are used, accurate labeling and numbers are shown, and suitable title is uniquely placed for each chart in identifying the area of KPI performance being monitored.
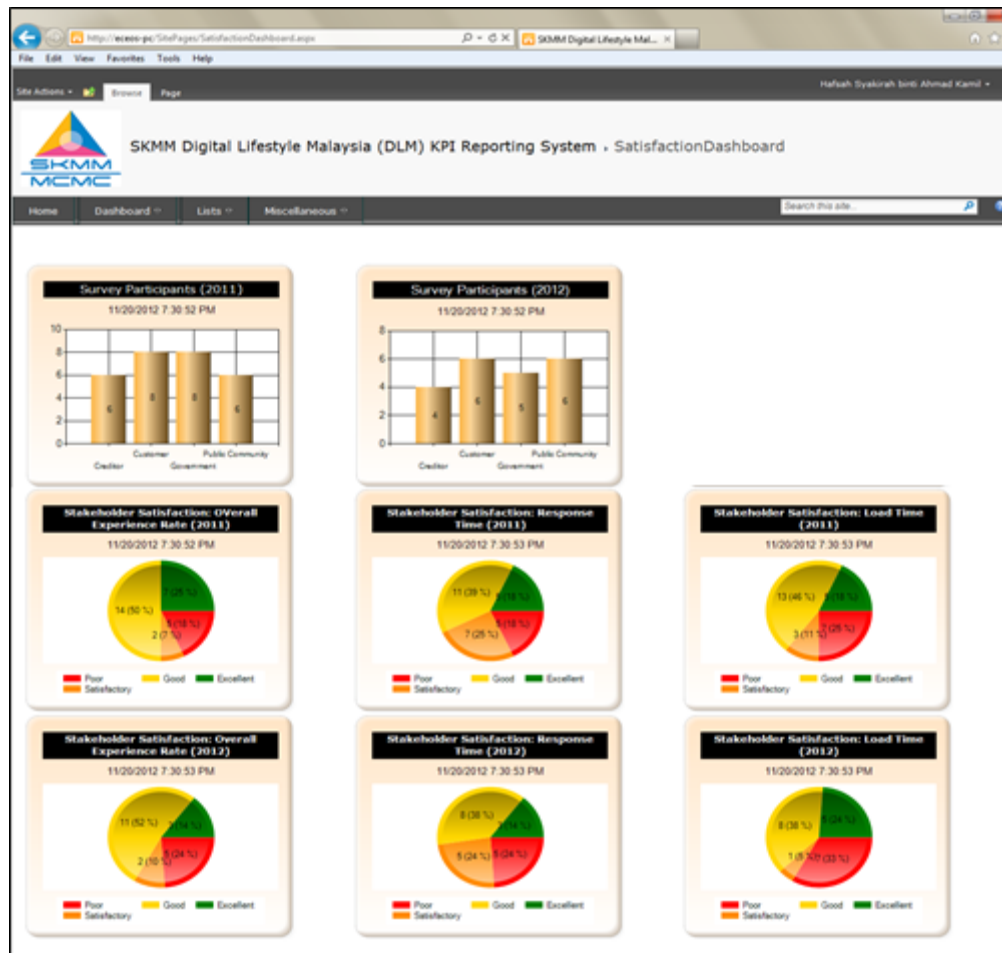
Figure 21: Dashboard Reporting page for KPI: Stakeholder satisfaction index (eg. time, cost, efficiency, productivity)

For the second submenu entitle "Facilitated Project", managers and users will be navigated to the Facilitated Project dashboard where there are two charts produced. The KPI being monitored here is "No. of projects facilitated by SKMM/DLM Initiative (eg. funding, publicity, transactions)". In displaying the division of the type of facilitation and year of the project facilitated, data are being grouped accordingly and appropriate colors are used to differentiate between each division.
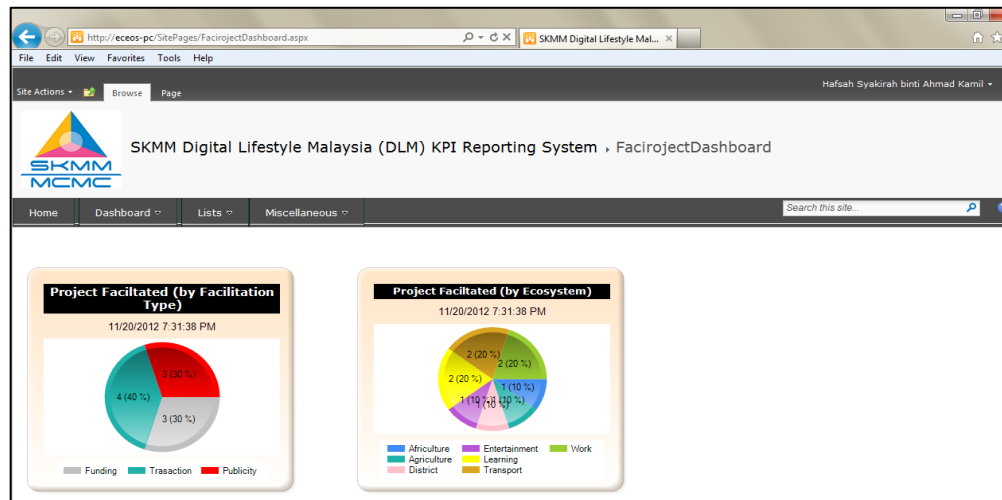
Figure 22: Dashboard Reporting page for KPI: No. of projects facilitated by SKMM/DLM Initiative (eg. funding, publicity, transactions)

Submenu entitles "Commercialized Product" will navigate managers and user to the Commercialized Product dashboard. Three charts are produced to monitor yearly product commercialization under SKMM DLM, and the ecosystem involved in producing the product. Two of the charts are shown in a form of pie chart while the last one is shown in the form of bar chart.
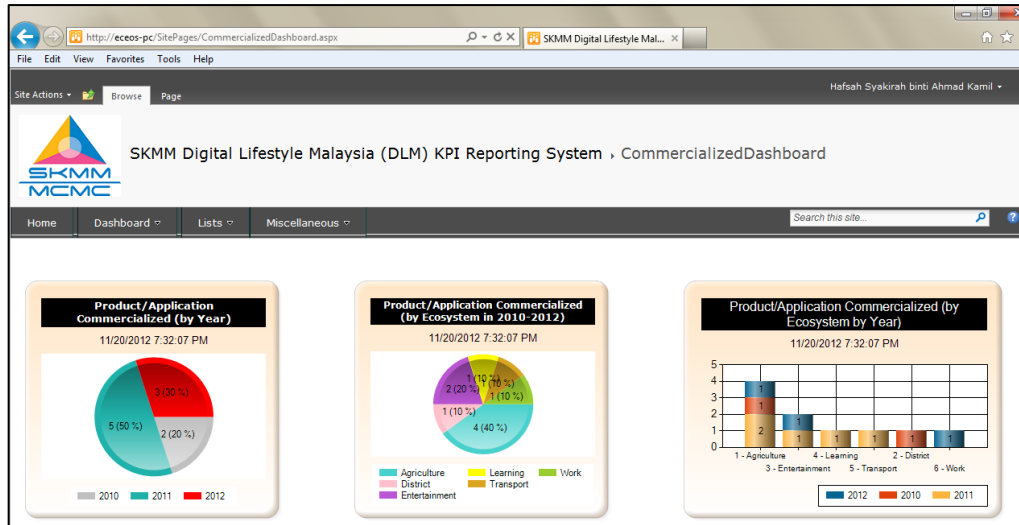
Figure 23: Dashboard page for KPI: No. of applications/products commercialized

The last KPI being monitored is "No. of transactions (application usages) from the shared services/products", where the submenu entitle "Product/Application Usage" will navigate managers and users to the dashboard. A line chart is produced to show the three parameters being monitored: Hit counter, No of Site Access and No of Applications Downloaded. This line graph will help managers and users to see the trends and usage of the application / product, from one date to another.
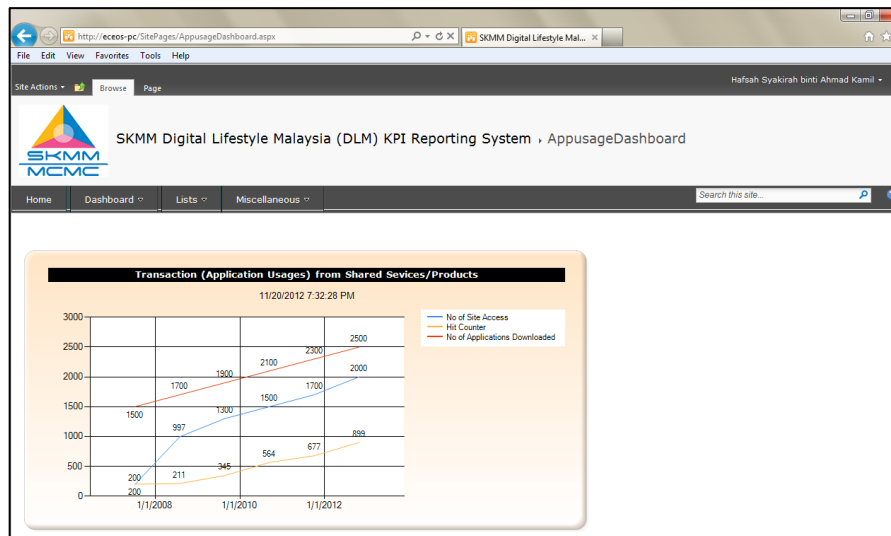
Figure 24: Dashboard Reporting for KPI: No. of transactions (application usages) from the shared services/products

5. KPI data

All of the data used in producing the charts is managed into lists. Surveyors will upload all of the data collected, and the dashboard will adjust automatically to reflect the changes made on the data and the data population.

Figure 25: Sample lists for Shareholder Satisfaction Index KPI

To add new data, users just have to click on "New" menu located at the very top left of the list, or, user can just click "Add new item" link located at the very bottom of the list. A window form will popped up that requests user for insertion of new data details.

Figure 26: Prompted Form when inserting a new data/item into the lists

In the case of large number of data is required to be inserted into the list, "Edit in Datasheet" feature is used, that facilitate this action. Similar to excel, the list will allow user to copy and paste the data details from another source into the list, as shown in the figure 28.
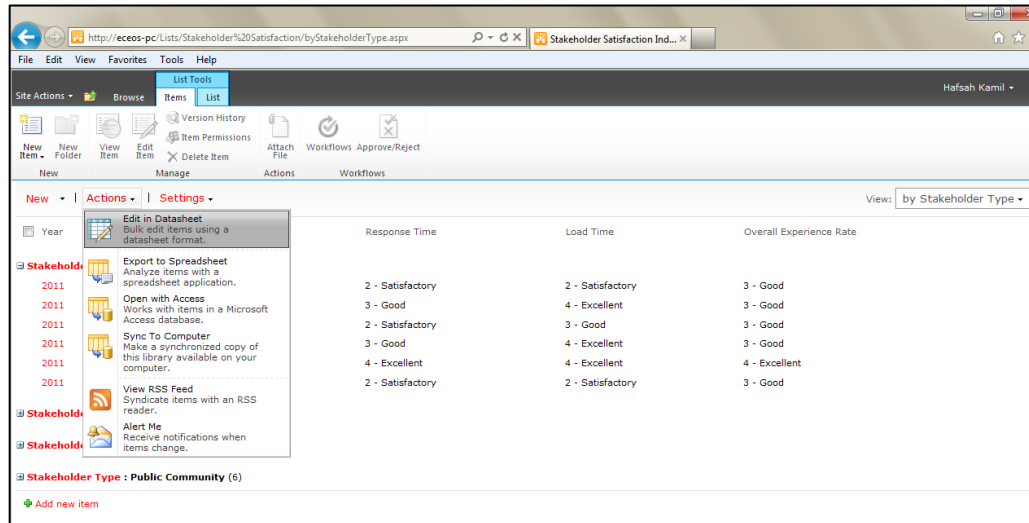

Figure 27: "Edit in Datasheet" menu (Another option of editing or adding new data)
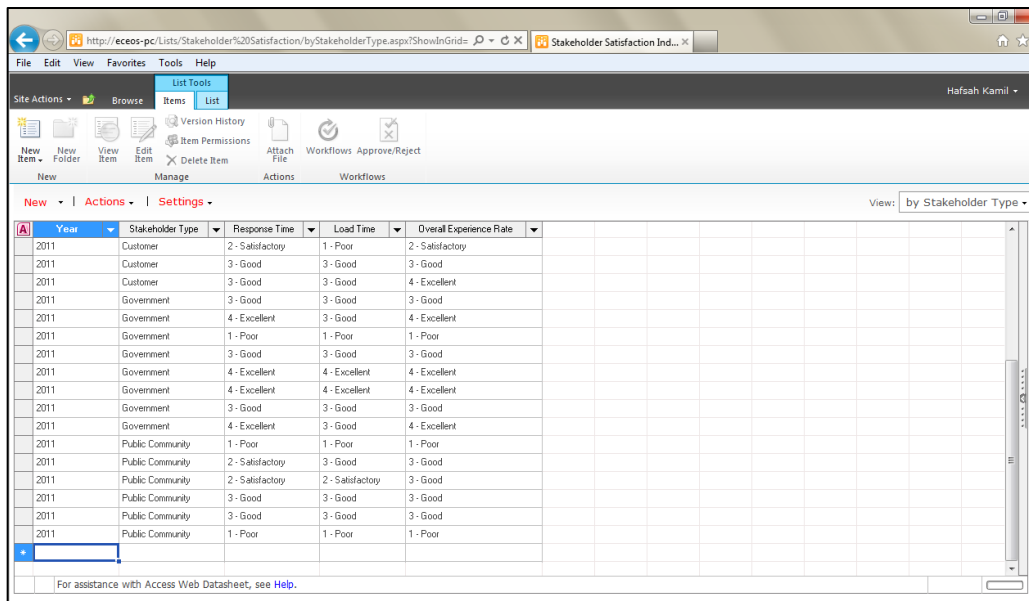

Figure 28: Edit in Datasheet view (used to perform multiple data upload and data editing)

The list can also be viewed according to user's preference. The column order can be changed and any column can be shown or hidden. Menu located at the very right of the list displays different choice of default views user can choose in viewing the list. New view can also be created by choosing "Create View" and user will be navigated to a simple straight forward interface.
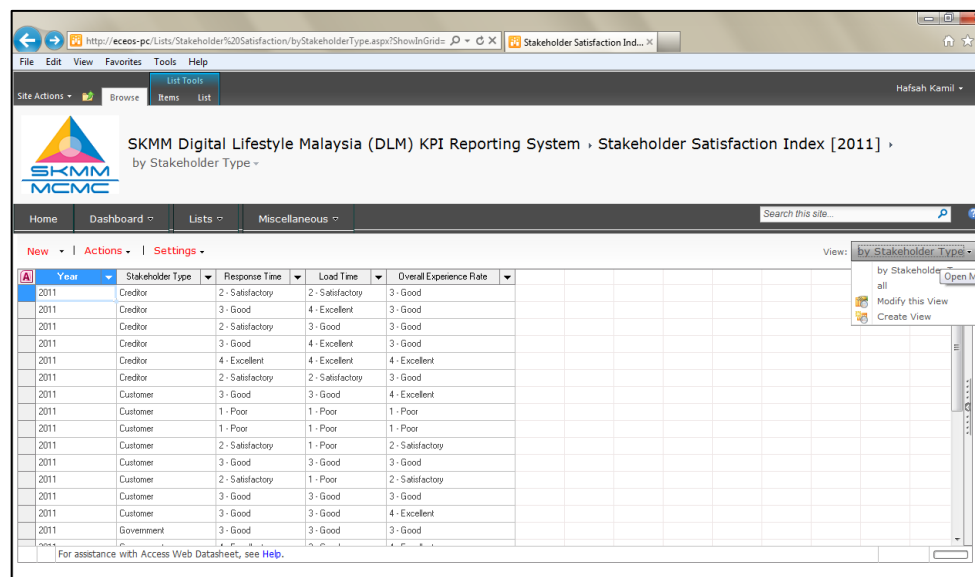

Figure 29: More option in viewing the lists, modifying current list view and creating new list view

6. Additional Functionalities

Additional functionalities added into the portal that can facilitate the user to perform collaborative team work includes: Calendar (with create event and meetings functionalities), Shared Document Library, Team Discussion and Team Contact
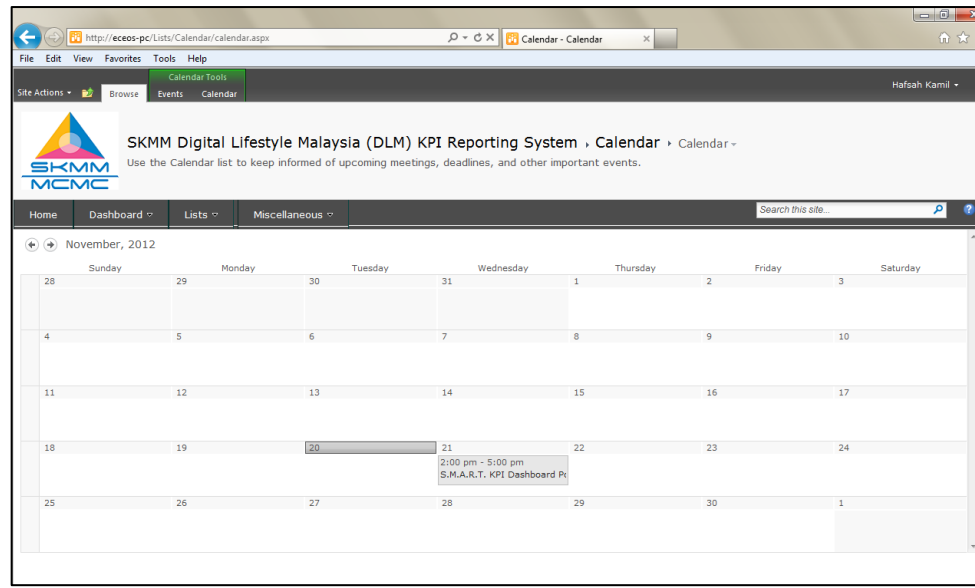
.

Figure 30: Calendar Function

New event and meeting can be created by clicking "Event" highlighted in green at the top left of the page. A pop up window will be displayed as shown by the figure below. Fill up the details and click save.

Figure 31: New Event/Function

Shared document library is a feature that will help managers and users to upload and download important public document shared by the other users.
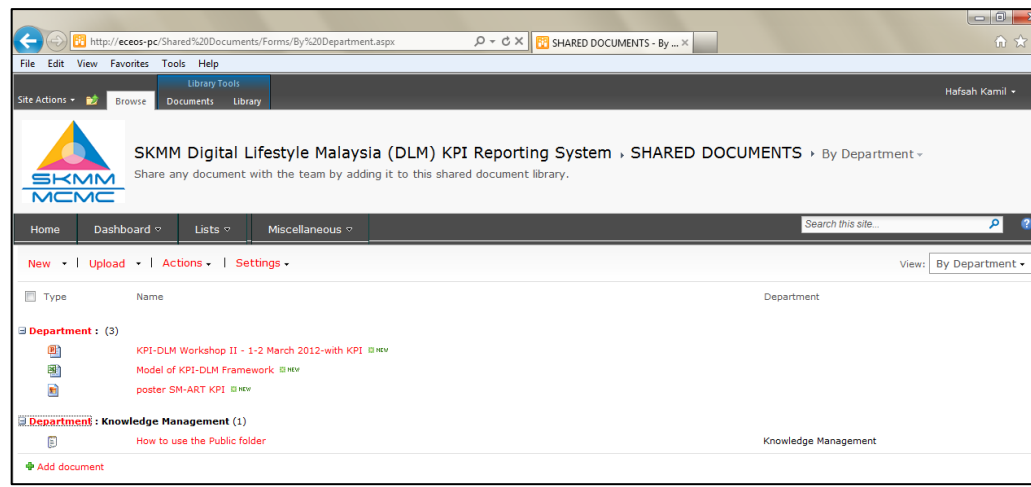

Figure 32: Shared Document Library

To download the document, user can just simply click on the document, and the download will start automatically. To upload new document, user must click "New" located at the top left of the document library. A pop up window will be displayed as shown in the figure below.
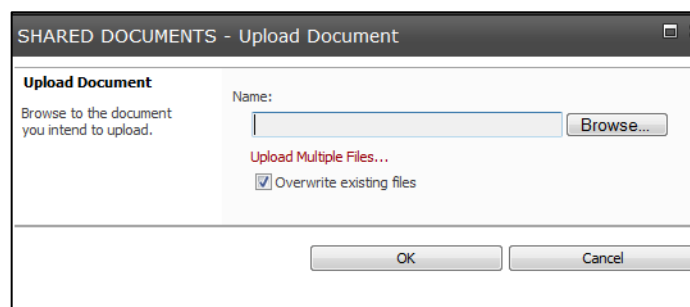

Figure 33: Uploading Document(s) at Shared Document Library

Team discussion page is another functionality created to facilitate discussion between the portal users. Through this, sers can easily reach the other user for new opinion, knowledge and information.
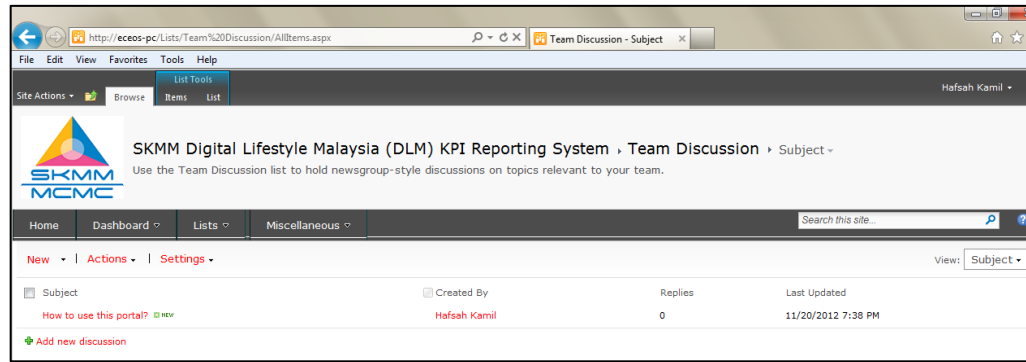

Figure 34: Team Discussion page

To add new topic, click "New" menu located at the top left of the Team Discussion and a pop up window will be displayed that require user to fill in the details, as shown by the figure below.
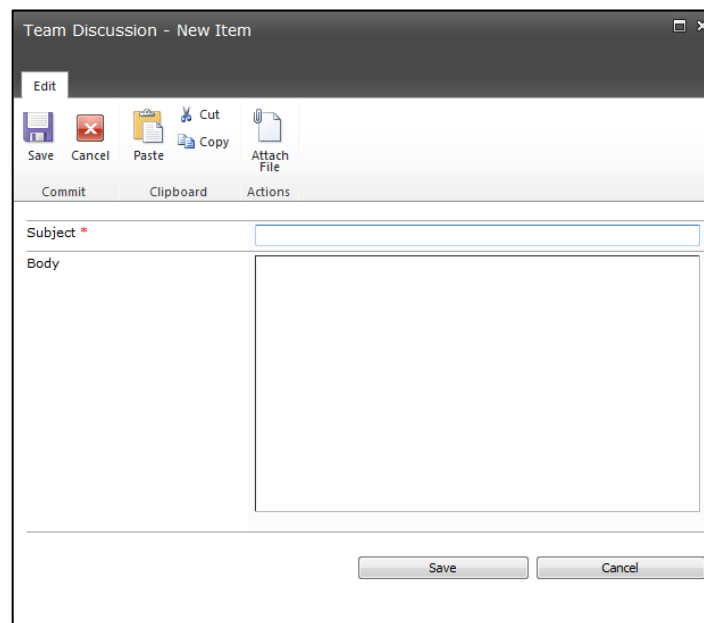

Figure 35: Team Discussion "New Item"

For each main stream of discussion, any user can post a reply by clicking on the "Reply" button located at the right side of the reply posted by the other user, as shown by the figure below. A pop up window will appear as shown by figure 37.
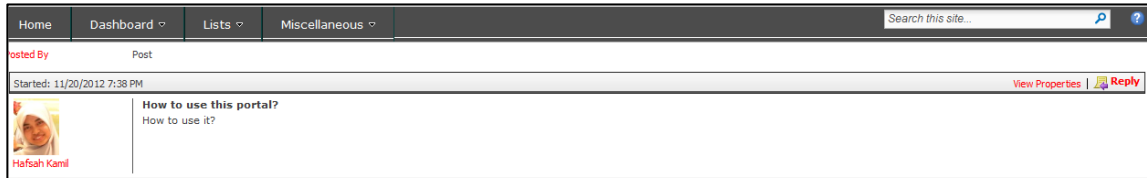

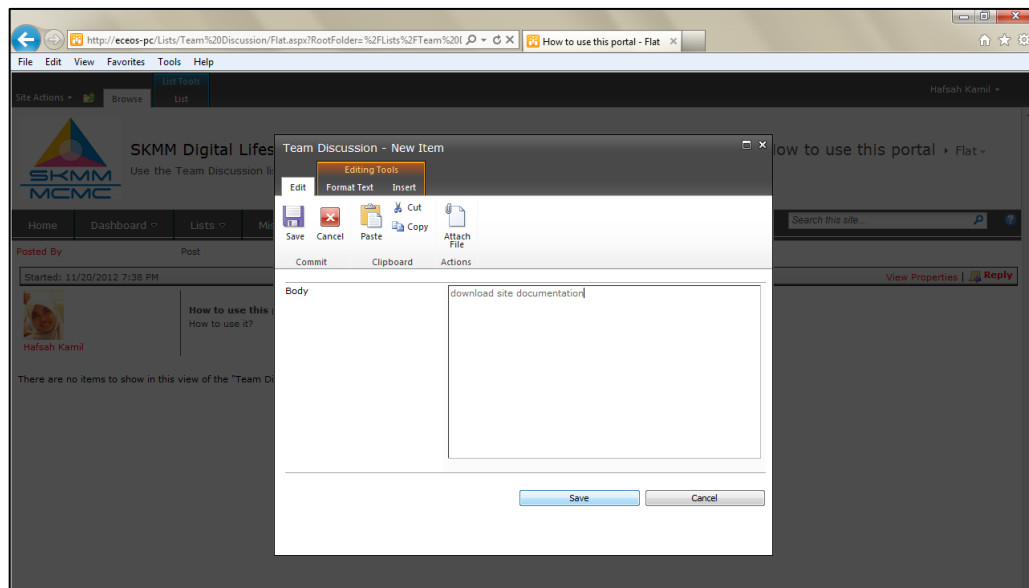Figure 36: Other user reply at Team Discussion page

Figure 37: Windows Prompted for in replying to the thread / add new topic to the Team Discussion page
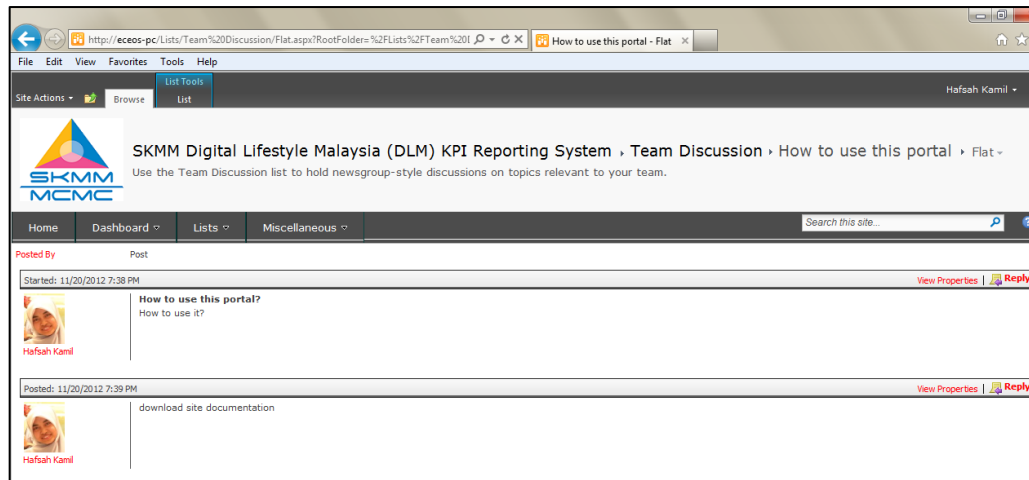
Figure 38: Team Discussion on one of the Topic rose

Team Contact library is a feature that facilitate portal user to save their contact details and enable them to retrieve the other user's contact details.

Figure 39: Team Contact Library

To add new contact details, user can click "New" menu located at the top left of the page or "Add new Item" link located at the bottom left of the library. New Item pop up window will be displayed that allow user to fill in their contact details to be saved.

Figure 40: Windows Prompted Form - Adding New Contact

4.4 Study on the effect of effective dashboard in making effective decision: Data Gathering Analysis

4.4.1 Survey Analysis

Survey Objective

The purpose of the survey/questionnaire is to evaluate the effectiveness of the dashboard (as a whole and specific part of the dashboard) based on its ability in facilitating the respondent in monitoring and aware of the situations of the outlined KPIs. The survey is also intended to measure the ability of the respondent in making initial prompt decision based on the dashboard analyzed.

Data Collection Process

The survey has been distributed to ten strategic managers that came from different industry backgrounds, which includes education industry, technology industry, construction consultant industry and medical industry. An appointment was made to meet the strategic managers individually, however, in the survey, names and details were omitted to protect the identity of the participants and their companies. Some of the managers interviewed asked that their identity remained hidden since they have not request any authorization to give the interview. For uniformity, all identities were not exposed.

Findings

14 questions were asked and all of the questions are close ended where respondents were required to rate the question from strongly disagree scale until strongly agree scale.

Part 1: Evaluating the effectiveness of the dashboard as a whole

The objective of this part of the survey is to evaluate the effectiveness of the dashboard for each KPI as a whole. There are 6 questions asked in this part. Below are the results gathered from the survey:

1. 80% of the Strategic managers strongly agree that they find it easy to identify items that require the most attention, with additional 20% also support it.
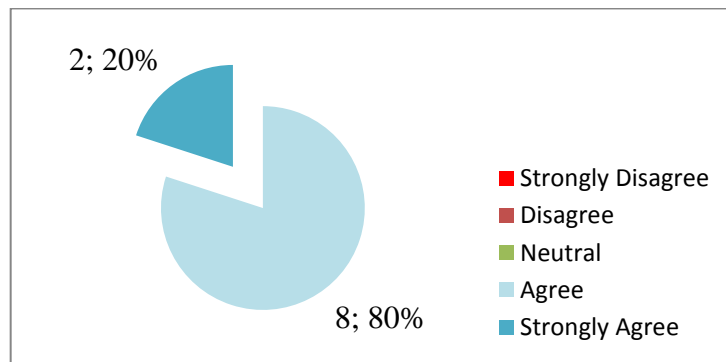
Figure 41: Survey Result - Part 1, Question 1

2. 90% of the strategic managers says that the information that they considered important are being featured prominently at the dashboard, while only 10% says it may feature prominently.
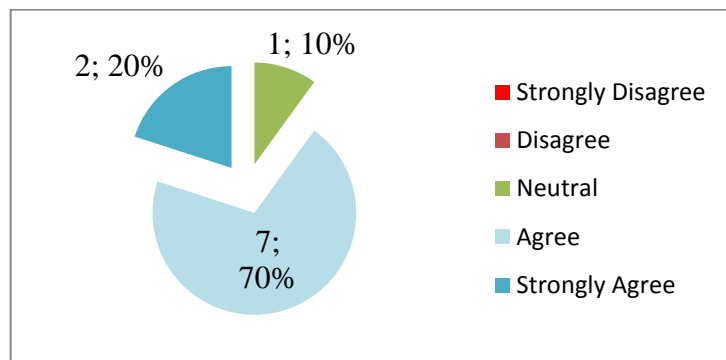
Figure 42: Survey Result - Part 1, Question 2

3. All of strategic managers think that the dashboard draw their attention to the information needed, proved by 70% saying strongly agree and another 30% agree.
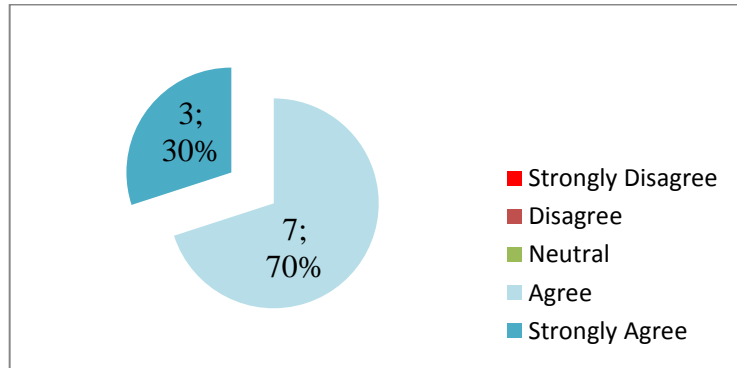
Figure 43: Survey Result - Part 1, Question 3

4. 90% of the strategic managers strongly agree and another 10% agree that they find it easy to recognize how the information and KPIs are organized at the dashboard.
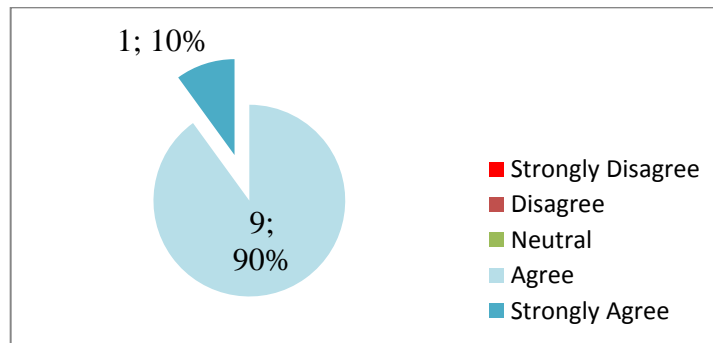
Figure 44: Survey Result - Part 1, Question 4

5. Strategic managers can in fact perform quick skim through of the dashboard in order to gain understanding of what re the current progress and the current situation, as 80% strongly agree with the question and additional 20% agree.
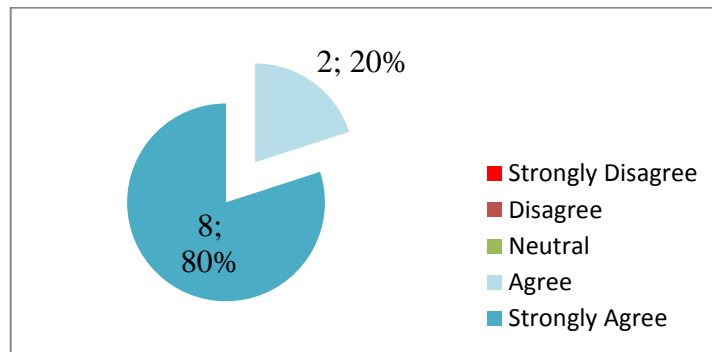
Figure 45: Survey Result - Part 1, Question 5

6. 80% of the strategic managers agree that the dashboard does inform them about everything that they need in order to create the big picture of what is currently going on, while only 20% chooses that the dashboard may and may not inform them about everything.
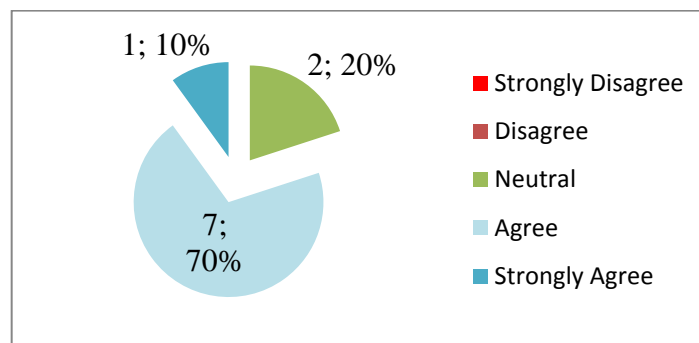
Figure 46: Survey Result - Part 1, Question 6

7. The mode of each KPI being displayed express the information that directly supports the strategic managers' need with the need of them to perform conversion or calculation in their head, as all of the strategic managers agree to this.
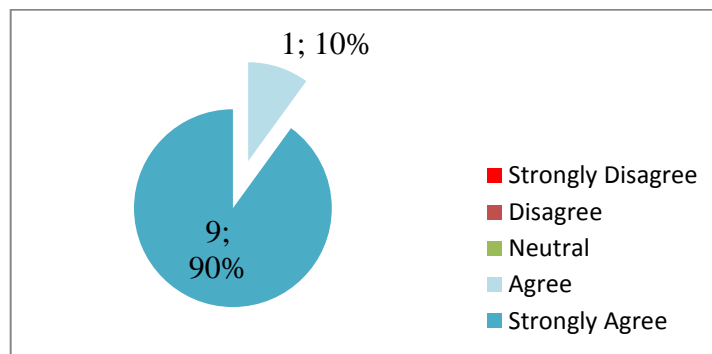
Figure 47: Survey Result - Part 2, Question 7

8.

    a. All of the strategic managers can rapidly recognize the value being shown in measuring the performance of the KPIs.
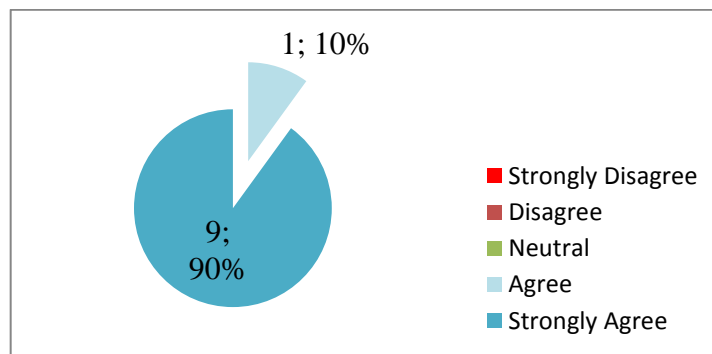
Figure 48: Survey Result - Part 2, Question 8 a

b. The strategic managers cannot determine whether the KPI performance is above target, meet target, and below target (and require attention). 70% of the respondent disagree to the question, with 50% chose disagree with additional 20% chose strongly disagree. This is because all of the dashboards created do not portray this information. The available data does not provide the information of the targeted KPI performance, thus, the evaluation of the KPI performance in meeting the target, performing above target or performing below the target cannot be performed.
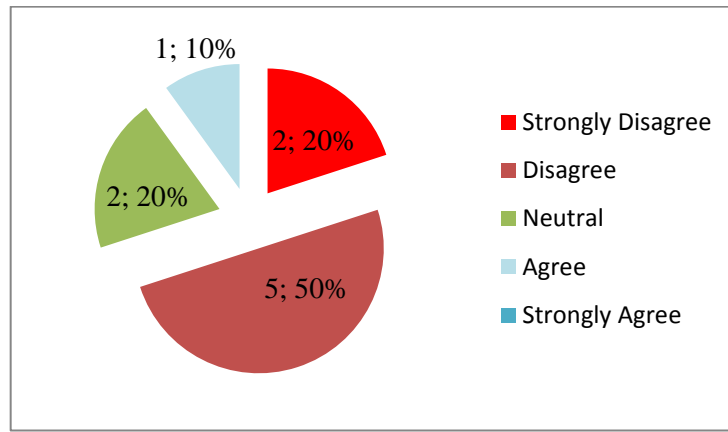
Figure 49: Survey Result - Part 2, Question 8 b

9. The strategic managers is able to make prompt decision involving a particular KPI, and all of them agree that they have actually enough information of each item that allows them to respond in the same way, as 60% agree to this and additional 40% strongly agree.
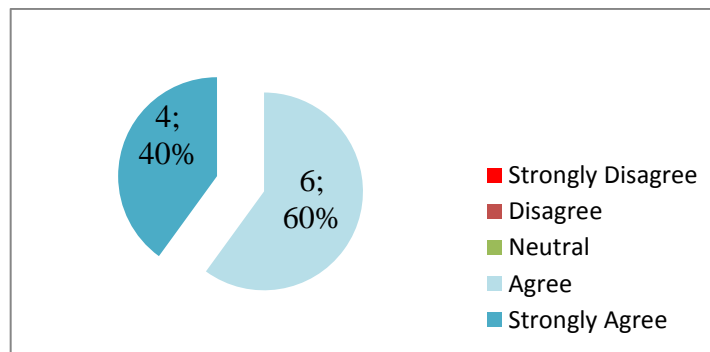
Figure 50: Survey Result - Part 2, Question 9

10. If the strategic managers need to make decision, they find it easy to obtain additional important and accurate information that is needed in determining how they make their decision.
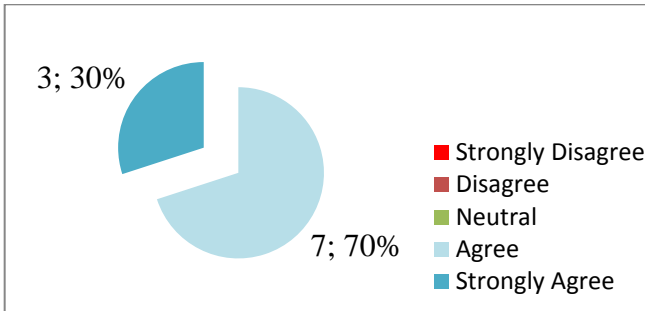
Figure 51: Survey Result - Part 2, Question 10

11. They can also distinguish each measure exactly as they need to.
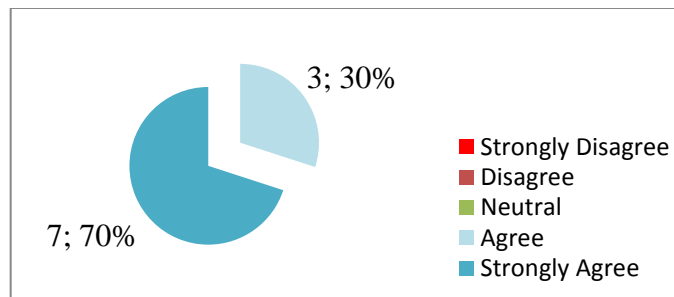
Figure 52: Survey Result - Part 2, Question 11

12. For each KPI being measured, strategic managers are able to identify if the performance and the progress is improving, getting worst or performing steadily.
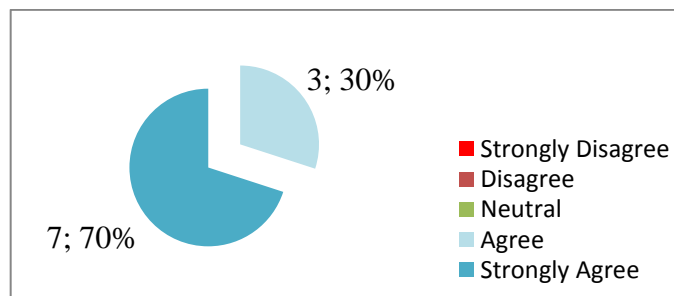
Figure 53: Survey Result - Part 2, Question 12

13. Strategic mangers also find it easy to compare the items and see the relationship between items in each dashboard.
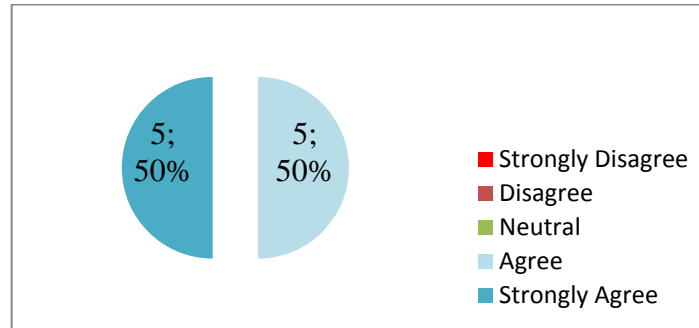
Figure 54: Survey Result - Part 2, Question 13

14. Strategic managers are also informed of the date or time of which the data conveyed is effective.
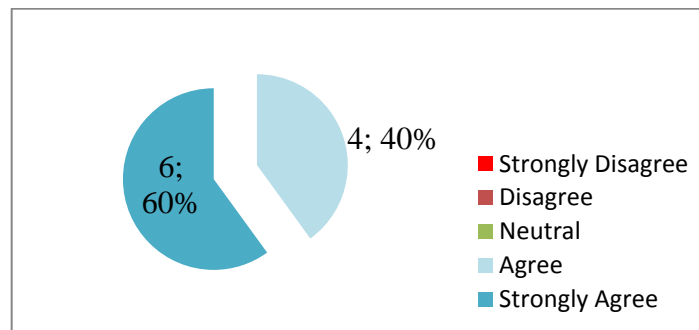
Figure 55: Survey Result - Part 2, Question 14

In conclusion, based from the feedback received from all the strategic managers, it can be seen that S.M.-A.R.T. KPI dashboard has been effectively designed both as a whole and as individual / specific part. All of the strategic managers agreed that the dashboard is able to facilitate them in monitoring and aware of the situations of the outlined KPIs. Besides that, the dashboard is also has the capability in facilitating the strategic managers to make an informed prompt decision and allows them to use it in making any decisions that require additional important and accurate information involving the KPIs being monitored.

CHAPTER 5

CONCLUSION & RECOMMENDATION

5.0 CONCLUSION & RECOMMENDATION

5.1 Project Summary

The emergence of S.M.-A.R.T. KPI in designing effective dashboard for reporting and monitoring of KPIs for DLM-KPI project started upon a request. The request came from the research collaboration work between UTP and SKMM. Through the development of S.M.-A.R.T. KPI, it helps to provide an alternative method of translating raw data into more meaningful and effective figure and graphical representation by using business intelligence practice, which resides at an easy accessible portal. It also to offer insights and intuitive way of perceiving a group of data that made up the DLM-KPI elements. The project is called S.M.-A.R.T. KPI due to the five characteristic ruled out by author which the dashboard will acquire in effectively communicate information to the user. The five characteristics are: Simple, Measurable, Accurate, Reactive and Timely.

S.M.-A.R.T. KPI dashboard has been taken to the industry user to test its design effectiveness and its contribution towards effective decision making. It is proven that design wise, S.M.-A.R.T. KPI is able to provide accurate and summarized form of information that could facilitate the managers to make decision especially at strategic

level. The effectiveness of the decision in this research is being measured through the ability of the manager to make prompt decision and any future decision that rely on the information relayed by the dashboard.

5.2   Recommendation and Future Work

This project is planned to reach its deployment stage in the research collaboration between UTP and SKMM for their reporting and monitoring system of the DLM-KPI project. Should there is more opportunity for other project, this system is aimed to become a template for future reporting system, or as an introduction of the usage of business intelligence system in facilitating decision makers in any industry to make effective and better decision. Besides that, additional dashboard functions should also be enhanced in the portal in order to provide strategic managers with enough and useful information that could facilitate them in making any decision in the organization or in individual projects.

Since this research is still in its preliminary level, further research work should also be conducted in measuring effective decision made by strategic managers upon the usage of the effective dashboard created. The number of outlier for the survey should also be increased in order to improve the conclusion made for the outlined hypothesis.

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APPENDIX (I): Survey Questions

S.M.-A.R.T. KPI Dashboard Effectiveness and Its Effect on Decisions Survey

The purpose of this survey is to evaluate the effectiveness of the dashboard (as a whole and specific part of the dashboard) based on its ability in facilitating the respondent in monitoring and aware of the situations of the outlined KPIs. This survey is also intended to measure the ability of the respondent in making initial prompt decision based on the dashboard analyzed.

Please look at the dashboard and rate (/) the questions below (1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree)

KPI being monitored:
1) No. of transactions (application usages) from the shared services/products
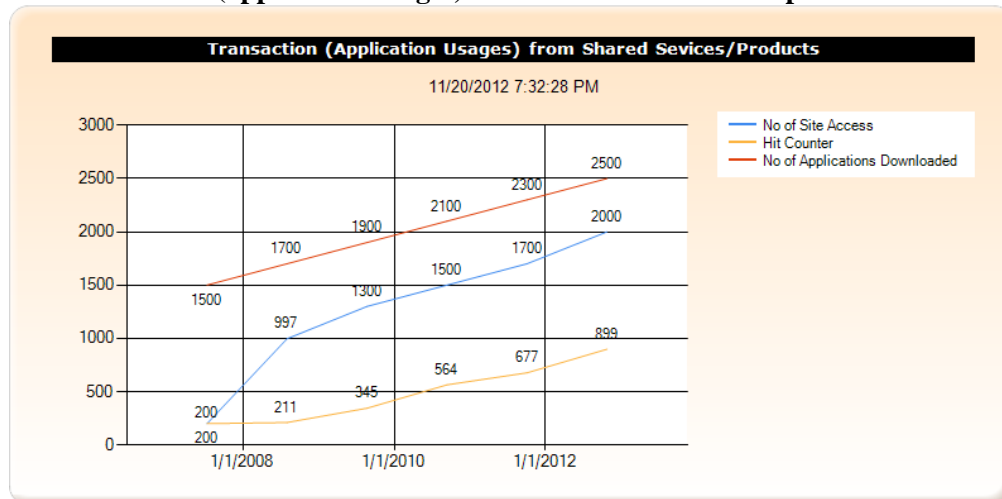
2) Stakeholder satisfaction index (based on the survey on website's load time &response time)
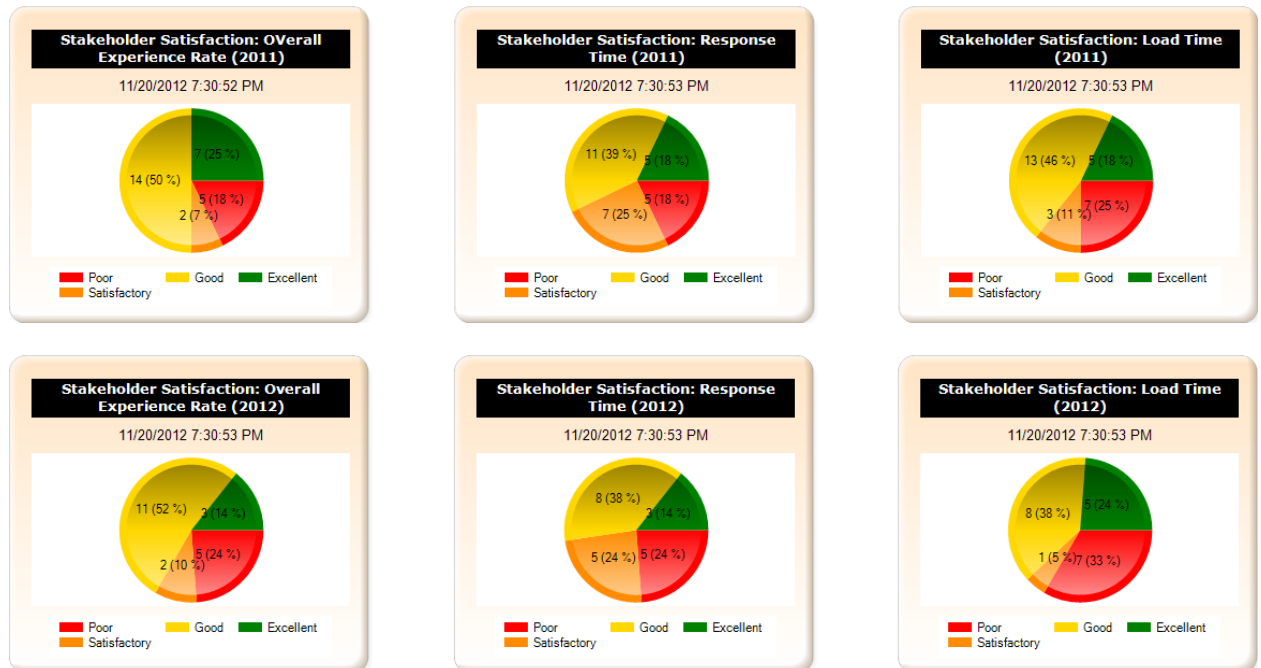
3) No. of projects facilitated by SKMM/DLM Initiative (eg. funding, publicity, transactions)
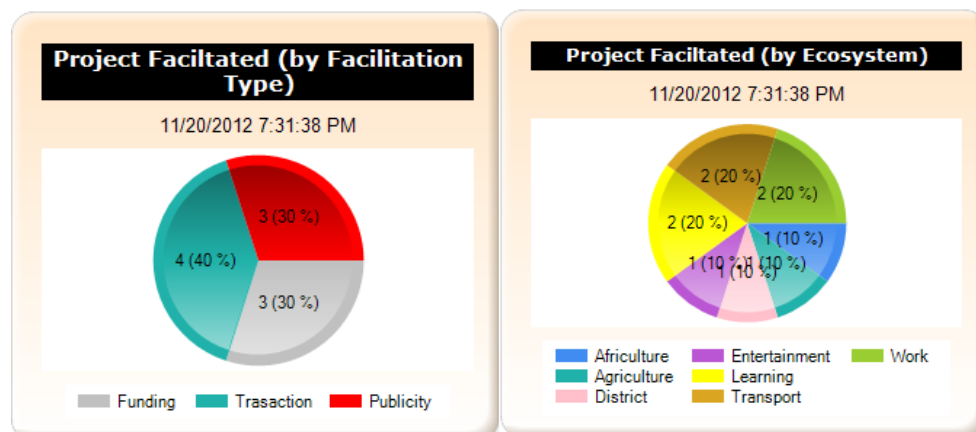
4) No. of applications/products commercialized
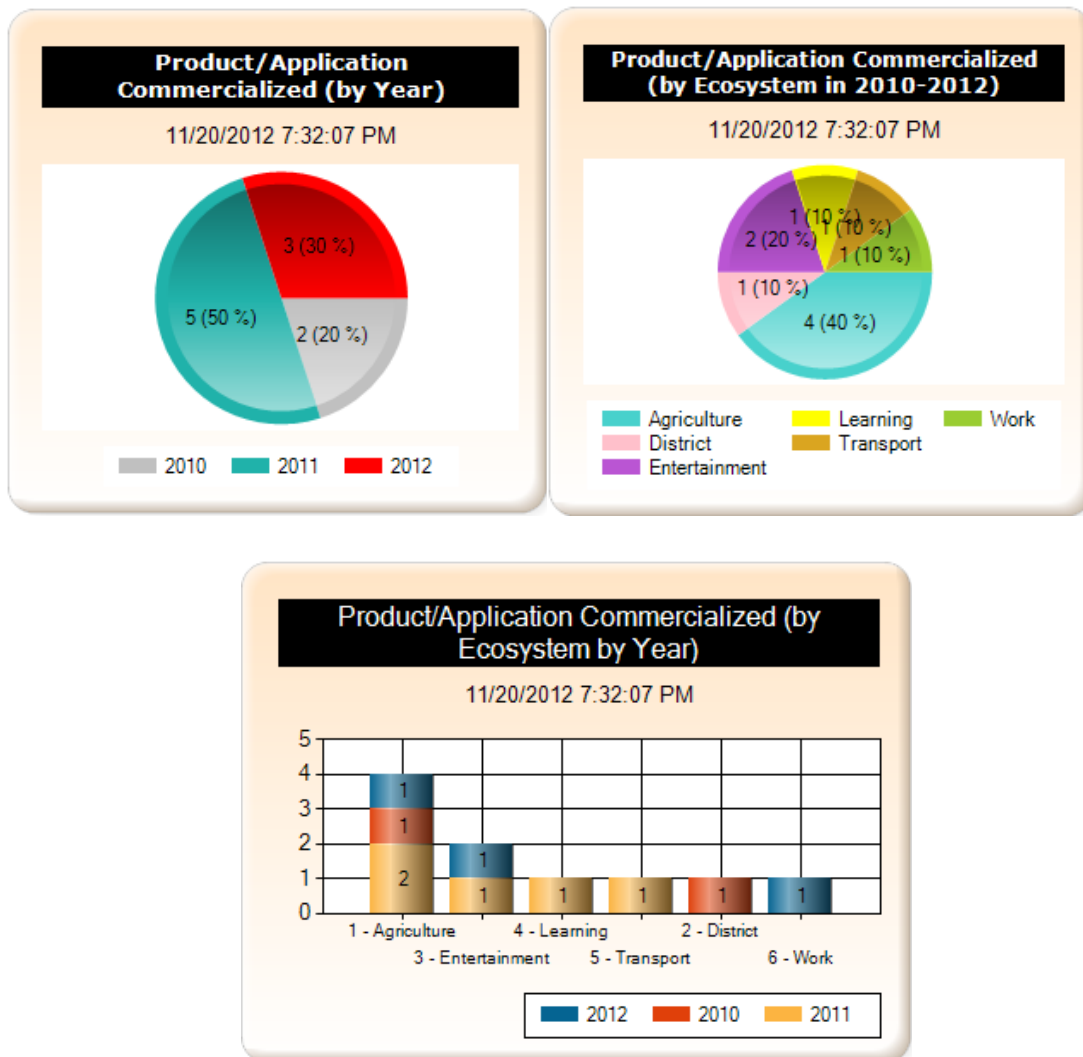
Evaluating effectiveness of the dashboard as a whole

1. Can you easily identify the items that require most attention?

    Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree
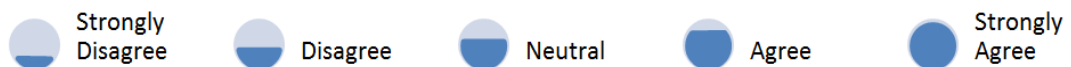
2. Does the information that you considered important are being featured prominently at the dashboard?

    Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

3. Does the dashboard draw your attention to the information needed?

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree
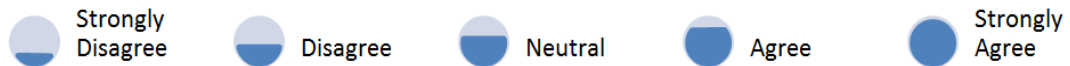
4. Can you easily recognize how the information and KPIs are organized at the dashboard?

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree
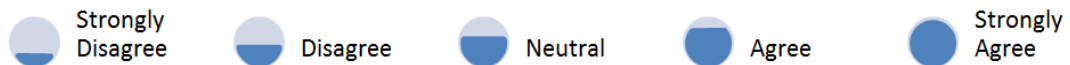
5. Can you perform quick skim through the dashboard in order to gain understanding of what are the current progress and the current situation?

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

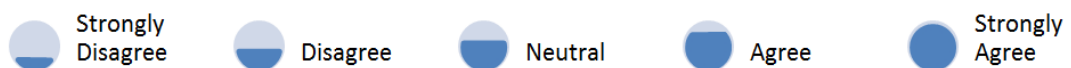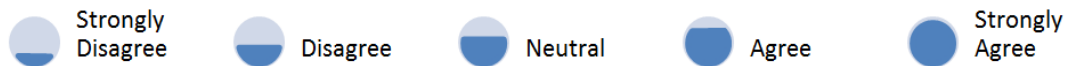6. Does the dashboard informed about everything that you need in order to create the big picture of what is currently going on?

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree
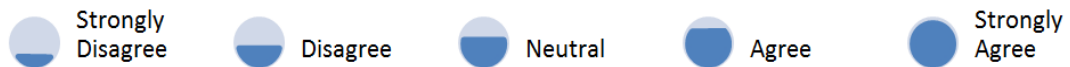
Evaluating effectiveness of specific dashboard & effective decision

7. Does the mode of each KPI being displayed express the information that directly supports your need without the needs of you to perform conversion or calculation in your head?

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree
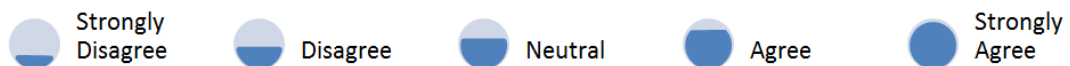
8. Can you rapidly:

    a. Recognize the value being shown in measuring the performance of the KPIs.
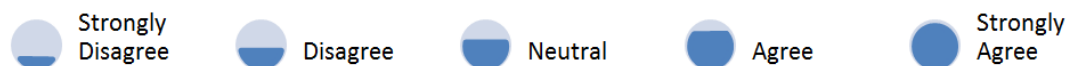
Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

b. Determine whether the KPI performance is above target, meet target and below target (and require attention).

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree
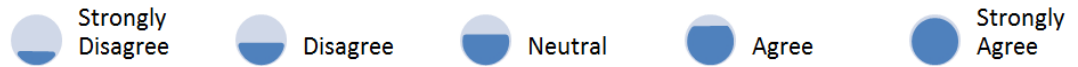
9. If you need to make prompt decision involving a particular KPI, do you have enough information of each item that allows you to respond in some way?

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree
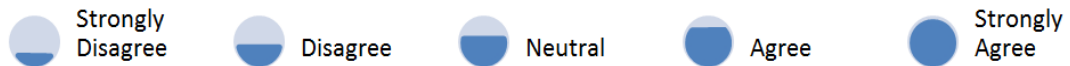
10. If you need to make decision, can you easily obtain additional important and accurate information that is needed to determine how you will make your decision?

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree
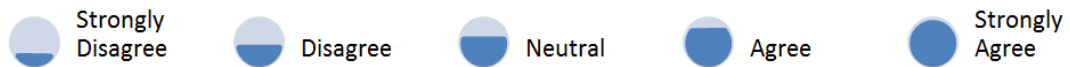
11. Can you distinguish each measure exactly as you need to?

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree
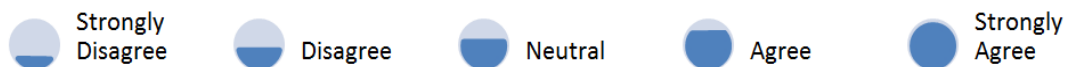
12. For each KPI being measured, can you identify if the performance and the progress is improving, getting worst or performing steadily?

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree
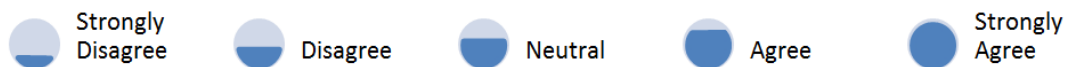
13. Can you easily compare items and see the relationship between items?

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree
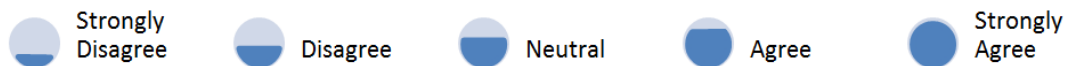
14. Are you informed of the date or time of which the data conveyed is effective? (ie: as of yesterday)

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

PROJECT ACTIVITIES		WEEK														
Preliminary Research Work		1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Selection of Project Topic	🟧	🟧												
	Identify & clarify research element, system objectives		🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧		
	Read research works, journals, papers, articles etc.			🟧	🟧										
Requirement Gathering & Analysis	Identify research methodology to be used					🟦	🟦								
	Phase 1.1: Data collection & Requirement Gathering (Interviews)						🟦	🟦	🟦						
	Phase 1.2: Document/KPI analysis & Existing Portal Analysis								🟦	🟦					
	Phase 1.3: Development of High-level view of portal & dashboard									🟦					
Design & Prototyping	Phase 1.4: Identification of development tools										🟩	🟩	🟩	🟩	🟩
Important Dates	Phase 2: Portal and Dashboard Designing & Prototyping	🟥	🟥⭐												
	Submission of selected project topic & preliminary proposal						🟥⭐								
	Submission of Extended Proposal									🟥⭐					
	Proposal Defense													🟥	
	Submission of Interim Report													🟥⭐	

(Column between weeks 7 and 8: MID-SEMESTER BREAK)

Figure 56: Part 1 (FYP 1) Gantt Chart

PROJECT ACTIVITIES		WEEK							MID-SEMESTER BREAK							
		1	2	3	4	5	6	7		8	9	10	11	12	13	14
Design & Prototyping & Evaluation	Continue Prototyping	■	■													
	User Evaluation		■													
Portal Development & Dashboard Coding	Portal Configuration & Development			■	■	■	■									
	Dashboard Coding					■	■	■		■						
Implementation & Delivery	Portal Implementation & Testing & Research Study										■	■	■			
	Portal Delivery													■		
Important Dates	Submission of Progress Report 1				★											
	Poster Exhibition									★						
	Submission of Dissertation (soft bound)												★			
	Oral Presentation (VIVA)													★		
	Submission of Project Dissertation (Hard Bound) & Technical Report submission															★

Figure 57: Part 2 (FYP 2) Gantt Chart