DASHBOARD INFORMATION MODEL FOR SOCIAL RESEARCH NETWORK SITES

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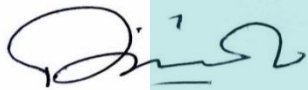
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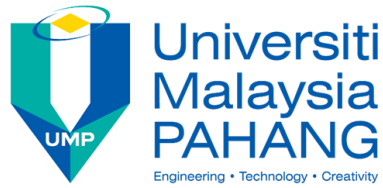
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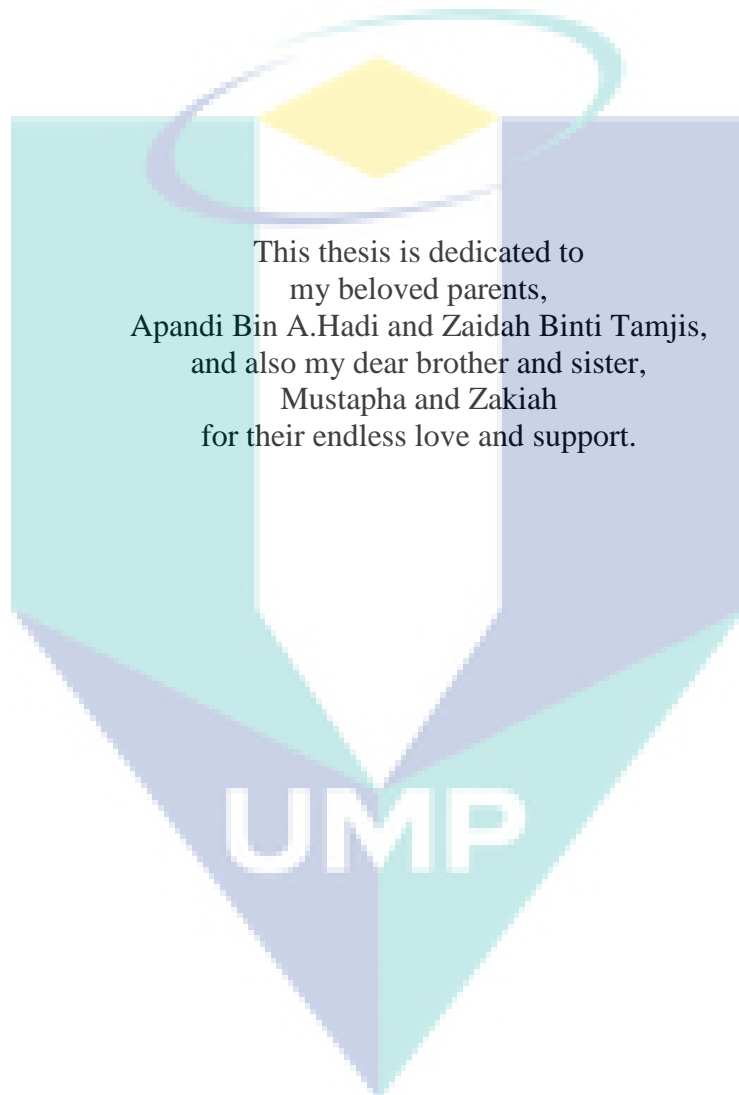Thesis submitted in fulfillment of the requirements
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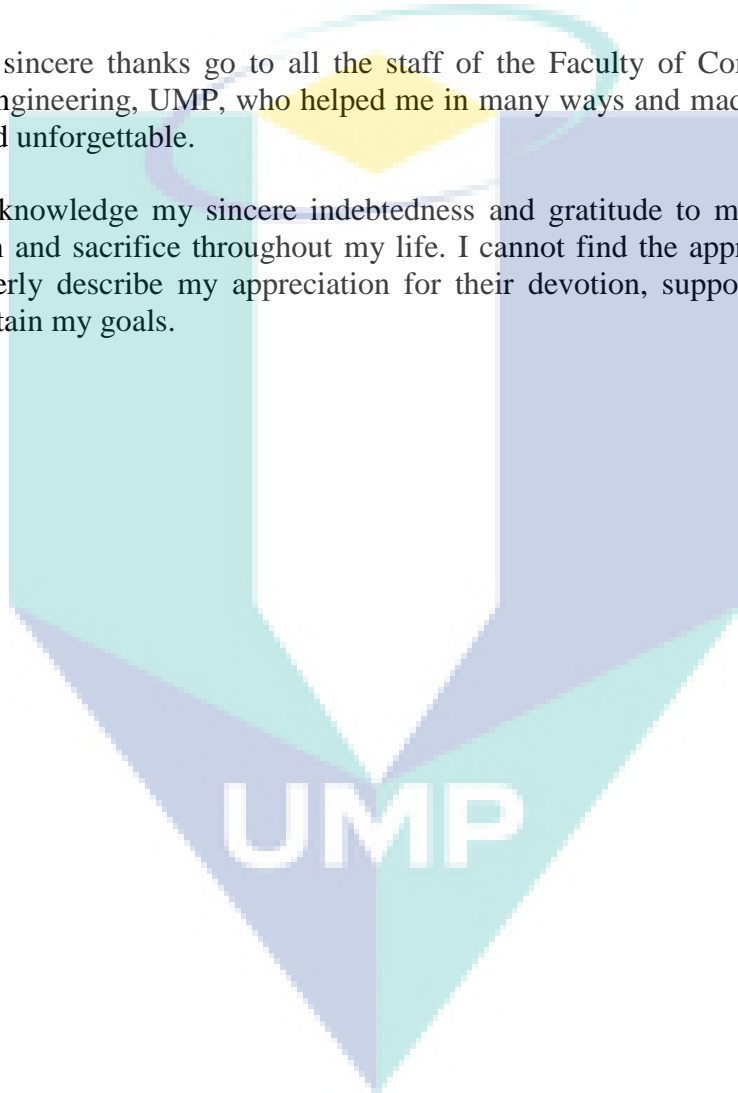UNIVERSITI MALAYSIA PAHANG

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This thesis is dedicated to
my beloved parents,
Apandi Bin A.Hadi and Zaidah Binti Tamjis,
and also my dear brother and sister,
Mustapha and Zakiah
for their endless love and support.

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ABSTRACT

The Social Research Network Sites (SRNS) is an online platform used by researchers for research related activities. Due to huge amounts of information in the current SRNS, sometimes this information overwhelms the researchers. A research-related dashboard information model is proposed to minimize the information overflow in the SRNS and it provides awareness on research-related information. The analysis on the relevance of having a dashboard has been done, and the results shows that it is a significant tool in assisting the researcher needs on monitoring their own research performance, monitoring research trends and alerting them with upcoming events. The proposed dashboard items that are possible to be included in the dashboard information model are identified based on analysis from literature studies and by review on the current SRNS. A survey was conducted in order to validate the dashboard items. Based on the result of factor analysis, the dashboard items can be grouped into three which are publication impact, publication achievements and alert on upcoming events. From the three group of the dashboard items, the dashboard information model is developed that has three dashboard components which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3). Then, we design a mock-up prototyping which represent the dashboard information model. The mock-up prototyping has been used for the dashboard information model verification purpose through interview with selected researchers. The result from the interview has shown that the researchers accepted and intended to use the mock-up prototyping that representing the dashboard information model. A few suggestions for enhancement of the dashboard items to be included in the dashboard information model have been received from the feedbacks. The dashboard information model that has been established is useful to be embedded in SRNS in order to aware the researchers on the research-related information. The embedded of the dashboard information model in the SRNS can attract more users to use the SRNS. The developers of SRNS can utilize the dashboard information model as a guideline in developing a better SRNS for the researchers.

ABSTRAK

Social Research Network Sites (SRNS) adalah platform dalam talian yang digunakan oleh penyelidik untuk aktiviti berkaitan penyelidikan. Disebabkan jumlah maklumat yang besar dalam SRNS, kadang-kadang maklumat ini menyesakkan penyelidik. Sebuah model maklumat *dashboard* berkaitan penyelidikan dicadangkan untuk mengurangkan limpahan maklumat dan ia dapat memberikan kesedaran tentang maklumat berkaitan penyelidikan. Analisis perkaitan mempunyai *dashboard* telah dilakukan, dan keputusan menunjukkan bahawa ia adalah alat yang penting dalam membantu keperluan penyelidik memantau prestasi penyelidikan mereka sendiri, memantau trend penyelidikan dan mengingatkan mereka dengan acara tentang penyelidikan yang akan datang. Cadangan *dashboard items* untuk dimasukkan ke dalam model maklumat *dashboard* dikenal pasti berdasarkan analisis daripada kajian sastera dan kajian pada SRNS. Satu kaji selidik telah dijalankan untuk mengesahkan *dashboard items*. Berdasarkan hasil analisis faktor, *dashboard items* boleh dikumpulkan ke dalam tiga iaitu impak penerbitan, pencapaian penerbitan dan kesedaran tentang acara berkaitan penyelidikan yang akan datang. Daripada tiga kumpulan *dashboard items*, model maklumat *dashboard* dibangunkan yang mempunyai tiga komponen *dashboard* iaitu prestasi penyelidik (M1), impak penerbitan penyelidik (M2) dan kesedaran tentang acara penyelidikan (M3). Kemudian, kami mereka bentuk prototaip *mock-up* untuk mewakili model maklumat *dashboard*. Prototaip mock-up digunakan untuk tujuan pengesahan model maklumat *dashboard* melalui temu bual dengan penyelidik yang dipilih. Hasil daripada temu bual itu telah menunjukkan bahawa para penyelidik dapat menerima dan mahu untuk menggunakan prototaip *mock-up* yang mewakili model maklumat *dashboard*. Terdapat beberapa cadangan tentang penambahan *dashboard item*s untuk dimasukkan ke dalam model maklumat *dashboard* telah diterima daripada maklumbalas para penyelidik. Model maklumat *dashboard* boleh digunakan untuk dimasukkan ke dalam SRNS untuk memastikan para penyelidik sedar tentang maklumat berkenaan penyelidikan. Kemasukan model maklumat *dashboard* dalam SRNS membolehkan menarik lebih ramai pengguna menggunakan SRNS. Pembangun SRNS boleh menggunakan model maklumat *dashboard* sebagai garis panduan dalam membangunkan SRNS yang lebih baik untuk para penyelidik.

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CHAPTER 1

INTRODUCTION

1.1 Research Background

Nowadays with emerge of Internet, social media such as social networking sites, forums and blogs are very popular all over the world. Many people use the social media in their everyday life. The social media allows people to connect with one another from anywhere at any time, does business and socialize in the online world. The growth of social media is also having an impact on the research community (Gruzd et al., 2012). This can be seen based on statistical study on half million researchers that done by Tang et al. (2007), it shows that about 70.6 % of the researchers have at least one homepage or a Web page that introduces their research.

Among various types of the social media, the social networking sites are identified as the most useful tool that supports the phase of a research lifecycle (Cann et al., 2011; Rowlands et al., 2011; Reinhardt et al., 2014). There is a specialized social networking sites for the researchers known as Social Research Network Sites (SRNS) (Bullinger et al., 2010). The researchers use the SRNS in order to fulfill their needs such as to find researchers with similar interests or expertise, to keep in touch with their peers and to share information (Giglia, 2011; Li and Gillet, 2013), while keeping up-to-date on the latest information or trends in their research domain (Masud et al., 2012; Reinhardt et al., 2012b). This relates to awareness concept in Research Network that the "awareness is related to trend-spotting, alerts to research results in a certain domain, changes in the structure of a network, personal changes within a project as well as knowledge about objects that may help carrying out one's task" (Reinhardt et al.,

2012b). From the interviews conducted by Reinhardt et al. (2012b), the interviewees claimed that they need the "awareness functionality to be embedded in their regular workflow". Dashboard can be used to provide awareness facility to the researchers because Reinhardt et al. (2014) describe the dashboard from a user interface perspective as a facility where users may find aggregated information about the system's current state, personal notifications, news as well as other important transactions.

In this study, we would like to investigate how the dashboard can be used to help the researchers aware on the research-related information in the SRNS. The dashboard information model is proposed to develop by including the dashboard items that can display information needed by the researchers. The metrics and alerts information to be presented in the dashboard are referred as the dashboard items.

1.2 Problem Statement

The existing social networking sites are still insufficient for the researchers' needs due to the lack of study that analyzes requirements in the social networking sites especially for researchers (Bullinger et al., 2010). The researchers remain scattered across a range of the social networking sites services in order for them to use different features that are provided in the social networking sites. This phenomena has caused the researchers to consume a lot of time in managing all the different social networking sites that they use (Collins and Hide, 2010; Cann et al., 2011; Masud et al., 2012; Nentwich and König, 2014).

The insufficient of the researchers' needs in the social networking sites can be seen in this scenario. When researchers use the SRNS, they are constantly generating information that an individual researcher might want to know, such as about other researchers and publication papers that are related to their research interests. However, he may fail to do so as the SRNS is clogged with information that is not of his interest or is not related to his field of research (Masud et al., 2012; Reinhardt et al., 2012a; Reinhardt et al., 2014). This is similar with the awareness support in the context of Research Networks that want to make "actors more efficient and effective by making objects (such as people, papers, projects, events, research domains, writings, experts,

social media artifacts) and their relations to each other more noticeable for users" (Reinhardt and Mletzko, 2011; Reinhardt, 2012).

In order to cope with the huge amount of information in the SRNS, researchers need the awareness support to be embedded in their research practice (Reinhardt et al., 2012a; Reinhardt et al., 2012b). By doing this, the effectiveness of how information is spread in communities is improved (Lövstrand, 1991) and positively influences social interactions taking place in those communities (Gross et al., 2005). Hence, they need for a tool that can provide awareness support for the researchers. It is found that the dashboard can be used to provide awareness facility to the researchers because, from a user interface perspective, it is a facility in which users may find aggregated information about the system's current state, personal notifications, news and other important transactions (Reinhardt et al., 2014).

1.3 Research Question

The research question of this study is:

How to produce dashboard information model that can provide effective information for the researchers?

1.4 Research Objectives

The objectives of this study are:

i. To evaluate the dashboard items identified from literature studies and review on the Social Research Network Sites (SRNS).

ii. To develop a dashboard information model in order to construct effective information for the researchers.

iii. To verify the dashboard information model.

1.5   Research Scope

The targets respondents in this study are academic researchers consist of academic staffs (professors, associate professors, senior lecturers, lecturers) and postgraduate students (PhD and Master by research mode) from universities in Malaysia. The dashboard information model is focus on listing the dashboard items that are suitable to be used to satisfy the researcher needs in the dashboard. The dashboard information model does not include functionality of the dashboard.

1.6   Thesis Organization

The thesis is organized in seven chapters. The explanation of each chapter is discussed as follows.

Chapter 1 begins with the introduction of this study that discusses research background on scenario of the researchers using the social networking sites for their research works. The chapter proceeds with the problem statement, discuss on the dashboard that can be used to provide awareness facility to the researchers in the social networking sites. Then, the chapter describes the research questions and research objectives. Next, the scope of this study is clarified.

Chapter 2 discusses literature review related to this study. The chapter begins with discussion on social media and social networking sites, in order to identify which one is the suitable platform for the researchers to support the research activity. How the social networking sites play role in academic research cycle also been discussed, followed by the discussion on the use of social networking sites by the researchers. In order to include dashboard into the social networking sites to provide awareness to for the researchers, we need to understand what the dashboard is. The discussion proceeds into the implementation of dashboard for the researchers, the dashboard development methodology and finished with the literature studies on relevance of dashboard to researcher needs.

Chapter 3 discusses on the methodology used in this study. The chapter begins by discussing the research approach. The chapter continues with the discussion of the research design adopted for this study. The chapter then presents the research operational framework that describes the research phases in this study. The activities, outputs and research objectives achieve in the research phases are discussed.

Chapter 4 discusses on the findings relevancy of dashboard to support the researcher needs. The dashboard items that are suitable to satisfy the researcher needs in the dashboard are identified based on analysis from the literature studies and review on the current SRNS.

In Chapter 5, the survey finding is analyzed using factor analysis to group the dashboard items and it will become basis element to develop the dashboard information model.

Chapter 6 discusses verification result of dashboard information model based on analysis of interview. The mock-up prototyping is designed to represent the dashboard information model and it is shown to the respondents during the interview. Then, the comparison of finalized dashboard information model with the SRNS is discussed.

Finally, Chapter 7 concludes this study by synthesis the findings, describe limitation of this study and also discussing research contribution and recommendation for further research.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

This chapter reviews about the platforms used by the researchers to support the research activity and relation of the dashboard with the social networking sites. The chapter begins with the discussion on the platforms for the researchers (Section 2.2) which are social media (Section 2.2.1) and social networking sites (Section 2.2.2). Then, the difference between those two platforms is discussed in Section 2.2.3. The chapter proceeds with the discussion on the role of social networking sites in academic research cycle as discussed in Section 2.3. The social networking sites used by the researchers can be categorized into two which are general social networking sites and Social Research Network Sites (SRNS) as discussed in Section 2.4. Next, the conceptualization of dashboard is discussed in Section 2.5. Followed by, the discussions on implementation of dashboard for the researchers based on the literature studies and review existing SRNS in Section 2.6. The dashboard development methodology is discussed in Section 2.7. Lastly is discussion about the literature studies on relevance of dashboard to researcher needs in Section 2.8. The framework of literature review in this study is shown in Figure 2.1.

Platform for researchers **(Section 2.2)**	
Social media **(Section 2.2.1)**	Social networking sites **(Section 2.2.2)**
Differences between social media and social networking sites **(Section 2.2.3)**	

Role in academic research cycle **(Section 2.3)**

Social networking sites used by researchers **(Section 2.4)**	
General social networking sites	Social Research Network Sites (SRNS)
Differences between general social networking sites and SRNS	

Conceptualization of dashboard **(Section 2.5)**
Implementation of dashboard for researchers **(Section 2.6)**
Dashboard development methodology **(Section 2.7)**
Literature studies on relevance of dashboard to researcher needs **(Section 2.8)**

Figure 2.1. Framework of literature review in this study.

2.2   Platform for Researchers to Support Research Activity

The growths of social media such as social networking sites and blogs have attracted the researchers to use it for their research activity. It is found that the social networking sites as the most useful tool that supports the phase of a research lifecycle (Cann et al., 2011; Rowlands et al., 2011; Reinhardt et al., 2014). Figure 2.2 shows the relation of social media and social networking sites. It shows that the social networking site is one type of social media. The social media is discussed in Section 2.2.1 and the

social networking sites in Section 2.2.2. Within these two online platforms, the suitable platform for the researchers needs to be identified in order to support the research activity as discussed in Section 2.2.3. The social networking sites used by the researchers can be divided into two categories which are general social networking sites and Social Research Network Sites (SRNS), and also the differences between those sites is discussed in Section 2.4. The focus of discussion is on the specialized social networking for the researchers which is the SRNS.
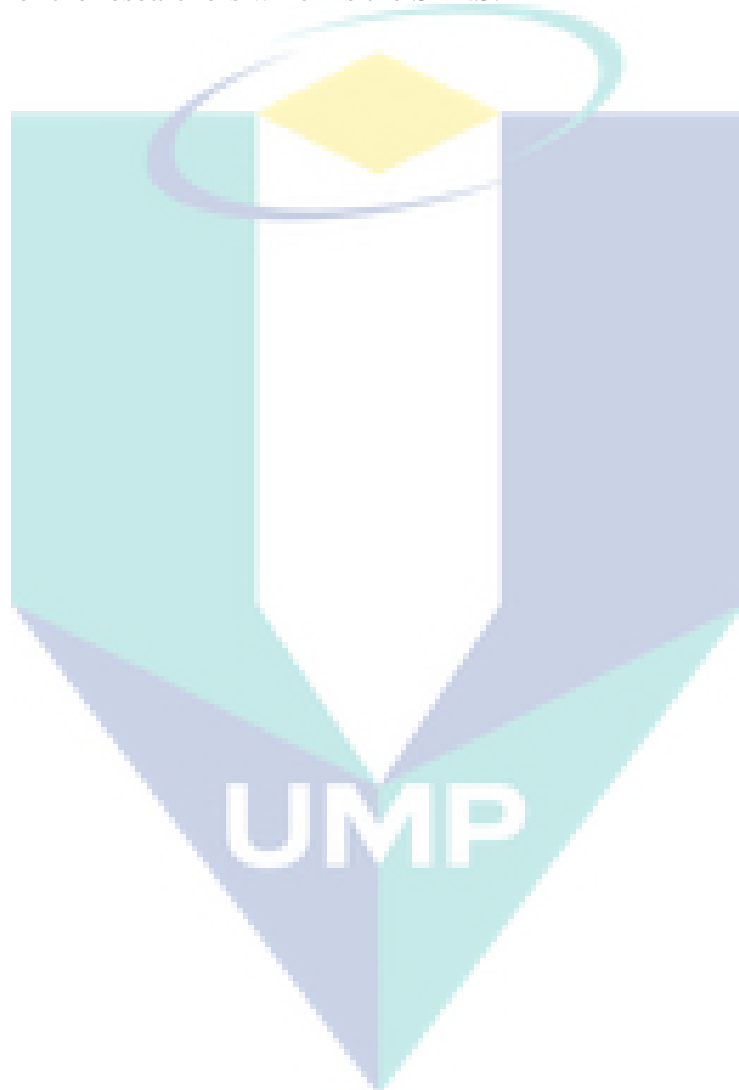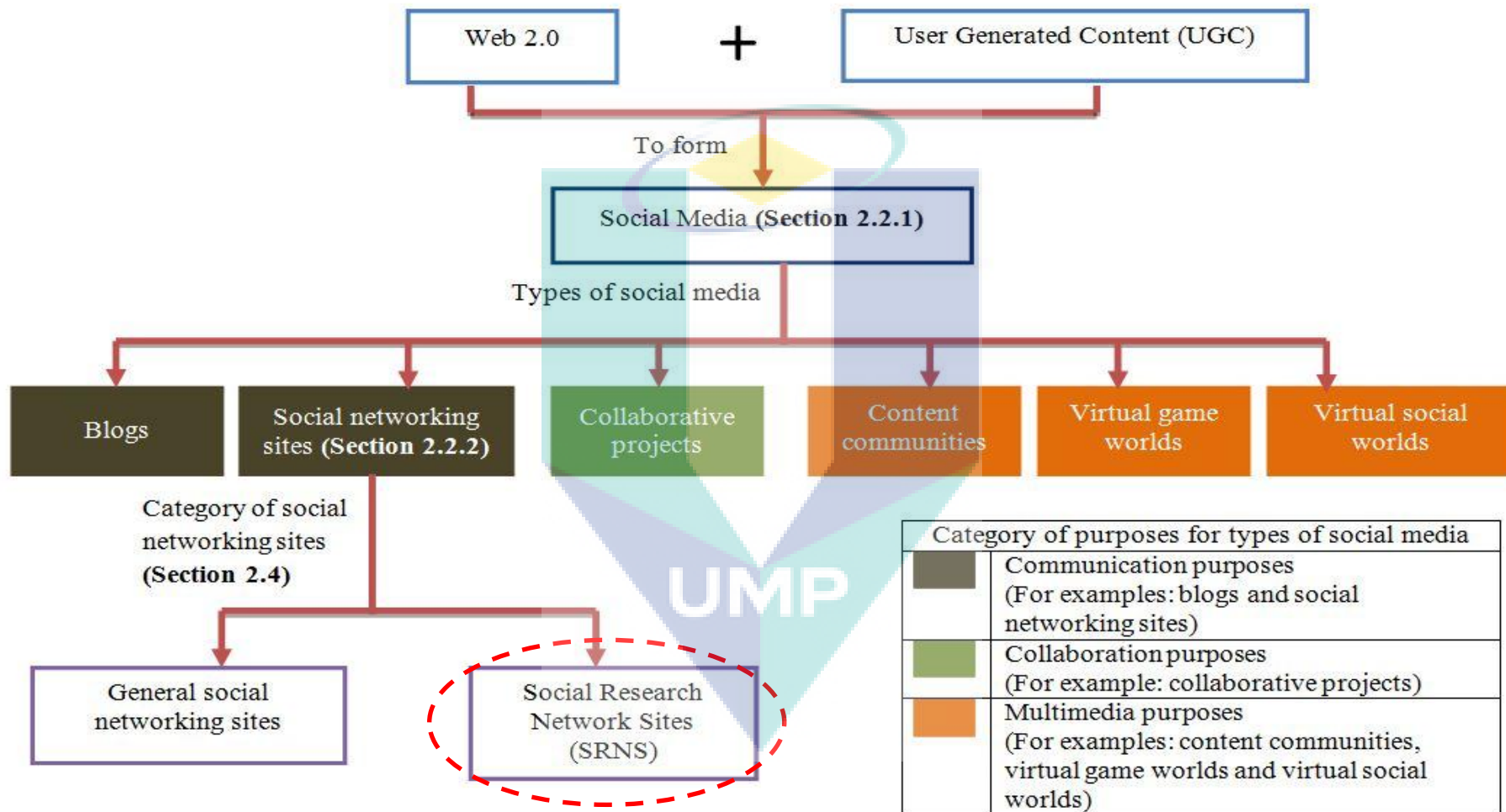
Figure 2.2. Relation of social media and social networking sites.

2.2.1   The Conceptualization of Social Media

The emergence of social media or also referred to as consumer-generated media has shift into how people discover, read and share information. The social media is a web based applications associated with web 2.0 technologies that allow for creation/exchange of user-generated content and enable interaction between the users (Kaplan and Haenlein, 2010; Procter et al., 2010; Taprial and Kanwar, 2012; Nández and Borrego, 2013). Based on this statement, there are two fundamental concepts to form the social media which are Web 2.0 and User Generated Content (UGC) as shown in Figure 2.2 (Section 2.2). Web 2.0 and UGC can be described as the followings:

i. Web 2.0

The term Web 2.0 was first popularized in 2004 to describe a new way to utilize the World Wide Web. Web 2.0 added the idea of people putting their own data on the Web and interacting with the data of others using web browsers (Smith, 2010). With the appearance of Web 2.0, content in the Internet are continuously modified by all users in a participatory and collaborative fashion (Kaplan and Haenlein, 2010). There are three basic functionalities that are required for Web 2.0 which are Adobe Flash, RSS stands for Really Simple Syndication and AJAX stands for Asynchronous Java Script (Kaplan and Haenlein, 2010).

a. Adobe Flash

A method to add animation, interactivity and audio/video streams to web pages.

b. Really Simple Syndication (RSS)

A family of web feed formats used to publish frequently updated content.

c. Asynchronous Java Script (AJAX)

A technique to retrieve data from web servers asynchronously, allowing the update of web content without interfering with the display and behavior of the whole page.

ii.   User Generated Content (UGC)

The term User Generated Content (UGC) was commonly used in 2005 that describe the various types of media content that are publicly available and created by end-users (Kaplan and Haenlein, 2010) which consists of text, photos, music and video (Vickery and Wunsch-Vincent, 2007). Based on Vickery and Wunsch-Vincent (2007), there are three basic requirements in UGC.

a.   It needs to be published either on a publicly accessible websites or on a social networking site accessible to a selected group of people.

b.   It needs to show a certain amount of creative effort, thus it is more than simply posting a newspaper article on a personal blog without editing or comments.

c.   It is consumer-generated by an individual outside of a professional organization, without a commercial market in mind.

There is a broad range of tools in social media. Kaplan and Haenlein (2010) classified the social media into six different types: collaborative projects, blogs, content communities, social networking sites, virtual game worlds and virtual social worlds as shown in Figure 2.2 (Section 2.2). The classification is made based on two factors which are media richness and self-disclosure (Kaplan and Haenlein, 2010). Cann et al. (2011) have divide the social media into three categories of purposes which are communication purposes for examples blogs and social networking sites; collaboration purposes for example collaborative projects; and multimedia purposes for examples content communities, virtual game worlds and virtual social worlds (Figure 2.2 in Section 2.2). The description for each types of the social media are given below (Kaplan and Haenlein, 2010):

i.   Blogs

The earliest form of social media is blogs, a website that display order of entries in reverse chronological date-stamped. The blogs provide the possibility of interaction with others through the addition of comments. The researchers can use the blogs as a platform to share information regarding their research. The other researchers with similar interest can visit the blogs

and gather their research ideas. This demonstrates the ability of the blogs to provide collaborative spaces and connecting the other researchers. However, this platform is less likely to be used by the researchers because it consumes time to maintain the blogs (Gruzd and Goertzen, 2013). For most researchers, they do not prefer information from the blogs, due to unreliability of the information (Collins and Hide, 2010).

ii. Social networking sites

The most popular types of social media is social networking sites, which enable users to connect by creating personal information profiles, inviting friends and colleagues to have access to those profiles, and sending messages between each other. It is discussed more in Section 2.2.2.

iii. Collaborative projects

The collaborative projects enable many end-users to joint and simultaneous creation of content. For example of applications under the collaborative projects are the Wikipedia and the social bookmarking web service such as Delicious that allows the user to store and share the web bookmarks.

iv. Content communities

The content communities are a place to share media content between users. The media content consists of different media types, includes text, photos, videos and power point presentations. Photo-sharing site such as Flickr, presentation sharing site such as SlideShare and video-sharing site such as YouTube are examples of the content communities. The adoption of this platform, such as SlideShare allows the researchers to disseminate and share information with the others. For example, the researchers can share their presentation slides presented at conferences by posting in the SlideShare (Gruzd and Goertzen, 2013).

v. Virtual game worlds

The virtual game worlds are one of the forms in virtual worlds. The virtual worlds are platforms that replicate a three dimensional environment. Users

can appear in the form of personalized avatars and interact with each other like in a real life. In the virtual game worlds, the users need to behave according to strict rules in the context of a massively multiplayer online role playing game (MMORPG). The examples of the virtual game worlds are World of Warcraft.

vi.   Virtual social worlds

The virtual social worlds are another one of the forms in virtual worlds and it enable inhabitants to choose their behavior more freely and essentially live a virtual life similar to their real life. Users appear in the form of avatars and interact in a three dimensional virtual environment. Second Life application is the example of virtual social worlds.

2.2.2   The Conceptualization of Social Networking Sites

The social networking sites are identified as the most fastest growing type of the social media (Vickery and Wunsch-Vincent, 2007; Smith, 2010). The term social networking sites was being used as early 1998 in order to describe the way in which websites could be used to allow people to interact with each others who shared the same interests. Madhusudhan (2012) explain the social networking sites based on definition by boyd and Ellison (2008) as an "Internet-based systems and services that allow individuals to create multiple public or semi-public profiles either within or between different social networks, build a list of other users with whom they share a connection, often referred to as friends, and view and communicate with their list of friends and other social networking sites users". Some examples of the well-known social networking sites are Twitter, Facebook and Google+. The most popular social networking sites, "Facebook now has more than 800 million active users and growing at a rate of around 83 % per year on average over the last five years" (Masud et al., 2012). The foundation for the social networking sites is relationships or connecting people (Richter and Koch, 2008; Cann et al., 2011). One of the important features in the social networking sites in establishing connections is creating user profiles to represent themselves so that can it can be viewed by others (boyd and Ellison, 2008; Othman et al., 2012; Taprial and Kanwar, 2012). Madhusudhan (2012) stated that "the key aspect

of the social networking sites is that it involves wider participation in the creation of information which is shared and collaborated in educational, social, and business contexts". From the above mentioned of previous works, it can be concluded that the social networking sites have three major functionalities which are to manage personal identity, to manage communication and to provide information of certain interest to the users.

2.2.3   Differences between Social Media and Social Networking Sites

The terms of the social media and social networking sites are always been used interchangeably, but actually there seems to have different meaning between these two terms. The social media refers to online media that enable user to publish the media content with large audience (Hogan and Quan-Haase, 2010). The social networking sites are more related to communication with peoples through online. There are three functionalities in the social networking sites which are to: manage personal identity, manage communication and provide information; while the social media has a functionality which is to provide information. The social media is a one-to-many communication while the social networking sites are a two or many-to-many communications. Some examples of the social media are Youtube, Slideshare and blog; while Twitter, Facebook and Google+ are some examples of the social networking sites. The difference between these two online platforms is shown in Table 2.1.

Table 2.1
Difference between social media and social networking sites

	Social media	Social networking sites
Purpose	Transmit information with a large audience	Build relationships and interacting with people
Functionalities	• To provide information	• To manage personal identity • To manage communication • To provide information
Way of communication	One-to-many communication	Two or many-to-many communications
Examples	Youtube, Slideshare and blogs	Twitter, Facebook and Google+

The social networking sites are identified to give an effect to research lifecycle because it is most useful to support phase of the research lifecycle especially in phase of identifying research opportunities, find collaborators and disseminate findings (Rowlands et al., 2011). It can be concluded that the social networking sites is more suitable to be platform for the researchers to support the research activity because these sites are able to gather researchers that shared common interests. Thus, opportunity for the researchers to find and communicate with other researchers in their area of interest can be highly valuable (Cann et al., 2011).

2.3 Role of Social Networking Sites in Academic Research Cycle

A researcher can be defined as a person who is conducting a research. The research involves an activity that explores the work of previous researchers by reading their relevant published papers in order to add new knowledge and thereby fill a void in existing knowledge (Kalb et al., 2009; Cann et al., 2011; Creswell, 2012). Figure 2.3 shows an academic research cycle that consists of four stages which are identification, creation, quality assurance and dissemination of knowledge (Cann et al., 2011). Collaboration is at the center of academic research cycle in order to show that the collaboration between the researchers is involved at every stages of the academic research cycle.
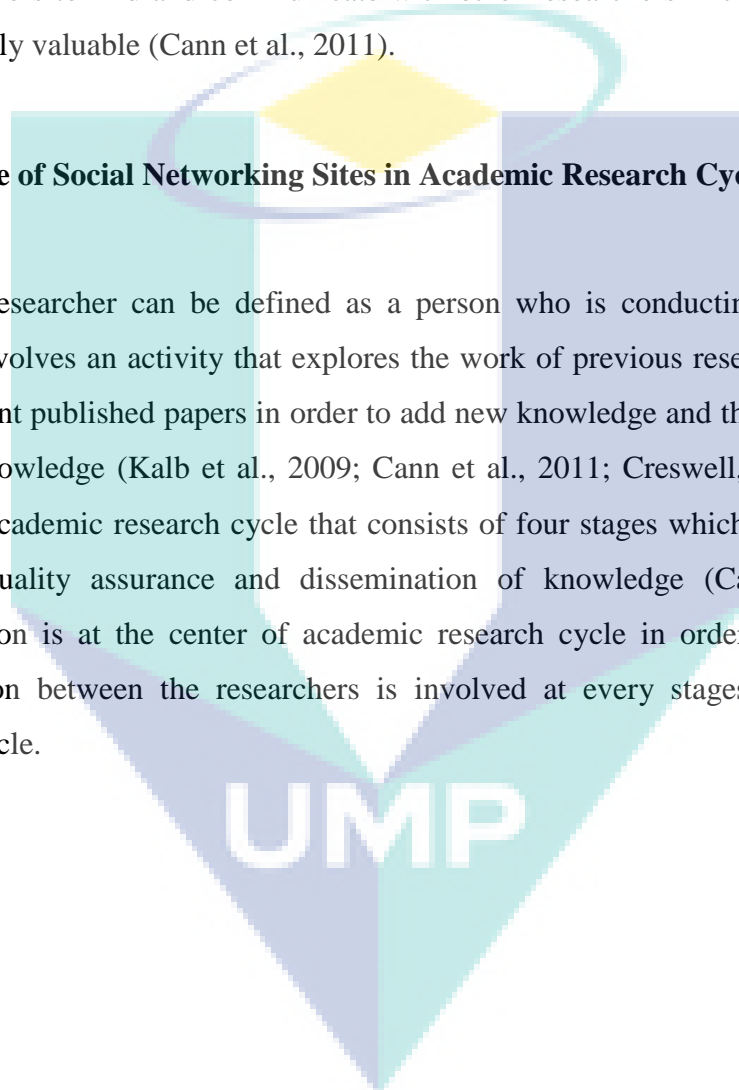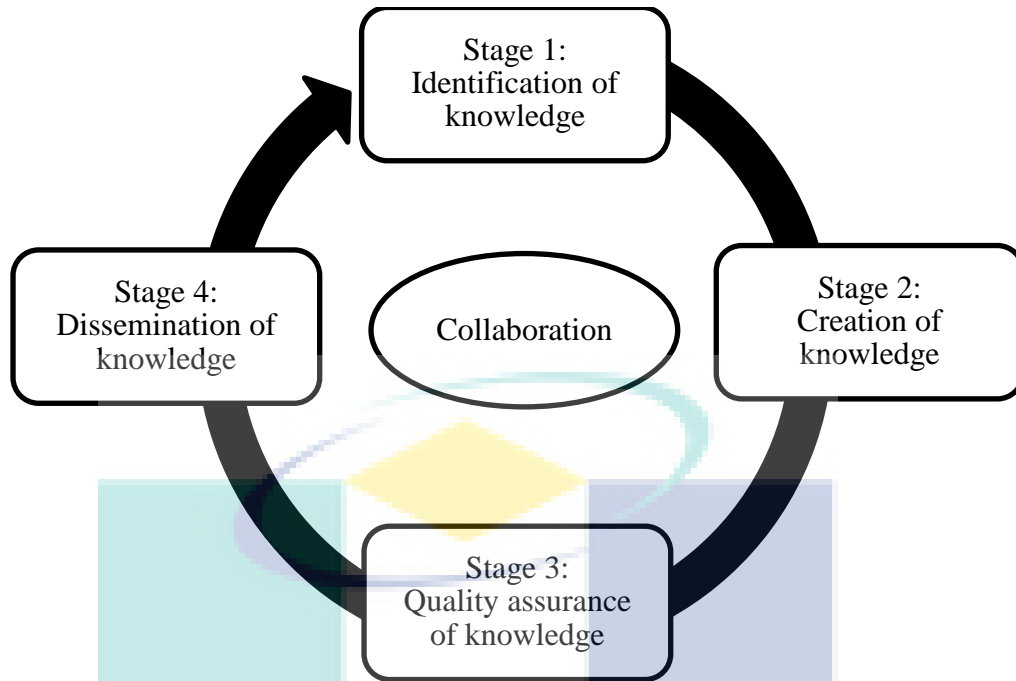
Figure 2.3. Academic research cycle.

Source: Cann et al. (2011)

The emergence of the social networking sites has attracted the researchers to use it for collaboration purpose. The social networking sites extends the researchers ability to collaborate with other researchers without constrained by time and place (Cann et al., 2011; Rowlands et al., 2011). The four stages of the academic research cycle and how the social networking sites play role in those stages are discussed as the following:

i. Stage 1: Identification of knowledge

This is a beginning stage in the academic research cycle where the researchers find information by doing literature review (Kalb et al., 2009; Cann et al., 2011; Creswell, 2012). The literature review means find information on a topic from books, journals and publications paper. In a digital world, the process to find articles are simplified by using a database which is a collection of articles from different journals that are indexed into an electronic database that can then be searched electronically using keywords, author or title of articles. There are also articles that can be retrieved in the social networking sites that have been shared by the researchers.

ii.   Stage 2: Creation of knowledge

The researchers can use the social networking sites as a platform to share ideas, ask advice and discussion on research with the other researchers in the social networking sites (Cann et al., 2011). The benefits of using the social networking sites in this stage are:

   a. opportunities to forge new collaborations with the other researchers
   b. drawing in expertise to help with research processes such as use of techniques, methods and analysis
   c. receiving feedback as the researchers go rather than waiting until the researchers reach high stakes moments like submitting to journals and presenting conference papers

iii. Stage 3: Quality assurance of knowledge

The researchers write a scholarly article to publish their research results. The scholarly article typically be published in scientific journals, books or presented on conferences (Kalb et al., 2009). Before the scholarly article is published, it will going peer review process to assess quality of the scholarly article (Cann et al., 2011). The peer review means the scholarly article will be read and reviewed by the qualified experts in the particular field. The researchers rely on peer review of their scholarly article in order to validate and inform their research. With emergence of web technologies, some journal publishers added functionality for readers to add comments and rating to individual articles, that provide useful supplement to traditional peer review.

iv.   Stage 4: Dissemination of knowledge

The researchers want their publication paper to be read and cited by the other researchers. Thus, the researchers need a platform to promote their publication paper. The growth of technology likes the social networking sites are particularly useful in disseminating information such as to make the publication paper publicly available to the other researchers (Kalb et al., 2009; Cann et al., 2011; Gruzd et al., 2012).

In this section, the relation of the social networking sites and academic research cycle can be seen. The social networking sites are useful to support the researchers to do the research activity.

2.4   Use of Social Networking Sites by Researchers

The researchers can be categorized into senior and junior researchers. The senior researchers are those who already in possession of a doctoral degree and has more than five years in doing the research (Abrizah et al., 2014; Department of Materials Science & Metallurgy, n.d.) such as professors and associate professors (Gruzd et al., 2012; Abrizah et al., 2014). Ge's and Jamali and Nicholas's studies as cited in Mohammadi et al. (2014) found that the junior researchers are large users of the social networking sites. The junior researchers are more familiar using the social networking sites in their personal lives. Thus, they are aware of the social networking sites potential as a platform to develop their professional networks (Collins and Hide, 2010; Gruzd et al., 2012; Nández and Borrego, 2013; Mohammadi et al., 2014). There is also a group of the researchers who do not have any purpose in mind when they join the social networking sites and they just follow their colleagues to use the social networking sites (Nández and Borrego, 2013). On the other hand, Tang et al. (2007) found that from those who have use the social media, the percentage of researchers from universities' faculty members (85.6 %) is higher than researchers from company research centers (14.4 %).

Use of the social networking sites for research has become essential parts of research practices (Cann et al., 2011; Rowlands et al., 2011; Reinhardt et al., 2014). The social networking sites are useful to support the researchers for identifying research opportunities, find collaborators and disseminate findings (Rowlands et al., 2011). Many of today's researchers adopted more than one tool of social networking sites for research-related activities (Tang et al., 2007; Collins and Hide, 2010; Gruzd et al., 2012). There are two categories of the social networking sites being used by the researchers which are general social networking sites and Social Research Network Sites (SRNS) as shown in Figure 2.2 (Section 2.2).

Firstly, the general social networking site is discussed. Facebook and Twitter are some examples of the general social networking sites that most being used by the researchers (Madhusudhan, 2012; Gruzd and Goertzen, 2013; Kumar and Kumar, 2013). Usually the general social networking sites are used for public purpose such as to keep in touch with other people, share information and also for entertainment and business use. The general social networking sites also can facilitate research activities such as for making connection and communication with the other researchers, and also share research information (Gruzd et al., 2012; Nández and Borrego, 2013; Reinhardt et al., 2014). There are three basic functionalities in the general social networking sites which are functionality of identity and network management to present the user profile, functionality of information management to share information, and functionality of communication to interact with the other users. These functionalities are needed by the researchers to collaborate with the other researchers (Bullinger et al., 2010). Research collaboration means any research activity that is carried out by multiple individuals overcoming institutional, disciplinary, and geographic boundaries (Masud et al., 2012). Most researchers collaborate with different reasons such as: share and expand knowledge, make new connections, increase possibility of getting funds, motivation, speedup the work or publish more (Alhoori and Furuta, 2011). However, the researchers encounter a problem when they use the general social networking sites for their research work which they feel difficult to manage personal and professional identities (Gruzd et al., 2012; Gruzd and Goertzen, 2013). The researchers also feel distracted by status updates appeared in news feeds of the general social networking sites as not every user use it to post status that related to the research work (Masud et al., 2012).

As an alternative, the researchers use platforms that are specifically designed for the research communities. There are two categories of platforms to support the research activities which are Research Information Management Tools and Social Research Network Sites, also known as SRNS (Bullinger et al., 2010; Masud et al., 2012). In the Research Information Management Tools, the researchers can find information for publications based on keywords, authors, conferences, and journals. This platform satisfies the researchers' need of information regarding publication, events or researchers. Example of this platform are Google Scholar, CiteSeerX, Pubzone, ArXiv, IEEE and ACM (Masud et al., 2012).

The other platform that are specifically design for the research communities which is the Social Research Network Sites (SRNS) can be categorized as one of the social networking sites based on the functionalities provided. The SRNS have been defined as a web-based service that allows individual researchers to: 1) construct a public or semi-public profile within a bounded system for identity purpose, 2) articulate a list of other researchers with whom they share a connection and communicate for communication purpose, 3) share information with other researchers within the system for information purpose and 4) collaborate with other researchers within the system for collaboration purpose (Bullinger et al., 2010). There are four functionalities in the SRNS which are identity and network management, information management, communication and collaboration. The SRNS provide collaboration functionality, which is not included in the general social networking sites. By having these four functionalities, the SRNS allows collaboration and interaction between the researchers. Further, the researchers can update and share information about their work and interests (Bullinger et al., 2010; Masud et al., 2012). Examples of the SRNS that mostly used by the researchers are Academia.edu, ResearchGate and Mendeley (Gruzd et al., 2012; Reinhardt et al., 2012a; Nentwich and König, 2014).

According to Gruzd and Goertzen (2013), there are three categories of researchers benefits on using the SRNS which are information gathering, collaboration and a combination of social and information dissemination.

i. Information gathering
    Following other researchers' work, keeping up to date with topic, discovering new ideas or publications, and discovering new funding opportunities

ii. Collaboration
    Collaborating with other researchers and get advice from peers

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iii.   Combination of social and information dissemination

The researchers that use the SRNS to promote their research works are also likely to make new research contacts that are shared same research interest

Both information gathering and combination of social and information dissemination are identified as the most important benefits when the researchers use the SRNS. These two categories of benefits can improve discoverability of information and help the researchers hold more effective conversations (Collins and Hide, 2010).

The SRNS still have issues in supporting research activities where the researchers still explore many sites in order for them to use different features provided and this could be time consuming for the researchers to manage those sites (Collins and Hide, 2010; Cann et al., 2011; Masud et al., 2012; Nentwich and König, 2014). The researchers want to be alerted on latest information in research field or looks for events on a specific topic but fail to do because they are huge amounts of information in the SRNS and it would overwhelm them (Masud et al., 2012; Reinhardt et al., 2012a; Reinhardt et al., 2014). The researchers need the awareness support to be embedded in their research practice in order to handle the huge amount of information in the SRNS (Reinhardt et al., 2012a; Reinhardt et al., 2012b). The awareness support can improves the effectiveness of how information is spread in communities (Lövstrand, 1991) and positively influences social interactions taking place in those communities (Gross et al., 2005). The dashboard can be used as a tool to provide awareness facility to the researchers because, from a user interface perspective, it is a facility in which users may find aggregated information about the system's current state, personal notifications, news and other important transactions (Reinhardt et al., 2014).

Based on the discussion above, Table 2.2 shows the difference between general social networking sites and SRNS.

Table 2.2

Difference between general social networking sites and Social Research Network Sites

	General social networking sites	Social Research Network Sites (SRNS)
Type of users	Wide range of users such as kids, teenagers and adult people	Users consist of people who are involved in research projects
Purpose	Used to keep in touch with other people, socialize and entertainment	Used to share research work and also keep in touch and collaborate with other researchers
Functionalities	• Identity and network management • Information management • Communication	• Identity and network management • Information management • Communication • Collaboration
Examples	Facebook and Twitter	Academia.edu, ResearchGate and Mendeley
Problems	• Difficult to manage personal and professional identities (Gruzd et al., 2012; Gruzd and Goertzen, 2013) • Distracted by status updates appeared in news feeds as not every user use it to post status that related to the research work (Masud et al., 2012)	• Lack in supporting research activities where the researchers explore many sites in order to use different features provided and this could be time consuming to manage those sites (Collins and Hide, 2010; Cann et al., 2011; Masud et al., 2012; Nentwich and König, 2014) • The researchers overwhelm with the huge amounts of information in the SRNS (Masud et al., 2012; Reinhardt et al., 2012a; Reinhardt et al., 2014)

2.5 The Conceptualization of Dashboard

In order to include dashboard as a tool to provide awareness to the researchers in the SRNS, the dashboard need to be understand in term of definition and characteristics of the dashboard. The term dashboard is always associated with the dashboard used in vehicles (Malik, 2005; Pauwels et al., 2009; Yigitbasioglu and Velcu, 2012; Maheshwari and Janssen, 2013). As an example, a car dashboard displays a set of key performance indicators (KPIs) to describe condition of the car such as amount of fuel, speed and temperature. The car dashboard brings together all the important information

to the driver in order to make sure that the car is in good condition to be used for driving (Orts, 2004; Malik, 2005).

There are several dashboard definitions in the field of information management. Malik (2005) has define the dashboard as "a computer interface with charts, reports, visual indicators and alert mechanisms that are consolidated into dynamic and relevant information platform". Few (2006) has define the dashboard as "a visual display of the most important information needed to achieve one or more objectives, consolidated and arranged on a single screen so the information can be monitored at a glance". Bose (2006) has define the dashboard as "a software application that provides a single-screen display of relevant and critical business metrics and analytics to enable faster and more effective decision making". Orts (2004) describe the dashboard as a tool to monitor the daily health of the organization. The decision makers could access KPIs, which is actionable information used to guide business performance, that is displayed in a single interface. It has also been stated that the dashboard can be serve as an executive intranet, which is a site in which all important information is displayed in logical groupings.

Based on the dashboard definitions, there are some vital points about the dashboard which are:

i.   Display information needed to achieve specific objectives

The information display in dashboard can be information that is needed by anyone who has objectives to meet. For example, to indicate performance status, the right key metrics should be included in the dashboard to achieve that objective (Few, 2006; Pauwels et al., 2009; West, 2012).

ii. Graphical presentation

The information should be presented in a form of graphical presentation such as gauges, charts, and tables, often color-coded for easy summarization (Malik, 2005). It is the best way to present the information in order to caught human attention and human can easily interpret the

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information (Few, 2006; Suryatiningsih et al., 2011; Yigitbasioglu and Velcu, 2012).

iii.   Fits on a single screen

The information in the dashboard must fit on a single screen so that it is easy for the user to view the information at a glance (Few, 2006; Morton-Owens and Hanson, 2012). If the information needs to be scroll, it has surpassed limitless of the dashboard (Few, 2006; Mahendrawathi et al., 2010).

Malik (2005) has establish the basic characteristics of the dashboard. "SMART IMPACT" is an acronyms for the dashboard characteristics. "SMART" stands for (Synergetic, Monitor, Accurate, Responsive, Timely) and "IMPACT" stands for (Interactive, More data history, Personalized, Analytical, Collaborative, Trackability). Table 2.3 shows the description of dashboard characteristics. Then, it follows with the discussion on the dashboard characteristics.

Table 2.3
Description of dashboard characteristics

Dashboard characteristics	Description
S – Synergetic	Must be ergonomically and visually effective for a user to synergize information about different aspects within a single screen view
M – Monitor	Must display critical KPIs required for effective decision making for the domain to which a dashboard caters
A – Accurate	Information being presented must be entirely accurate in order to gain full user confidence in the dashboard. The supporting dashboard data must have been well tested and validated
R – Responsive	Must respond to predefined thresholds by creating user alerts in addition to the visual presentation on the dashboard (such as sound alarms, e-mails, pagers, blinkers) to draw immediate user attention to critical matters
T – Timely	Must display the most current information possible for effective decision making. The information must be real-time and right-time
I – Interactive	It should allow the user to drill down and get to details, root causes, and more

Source: Malik (2005)

Table 2.3 Continued.

Dashboard characteristics	Description
M - More data history	The dashboard should allow users to review the historical trend for a given KPI
P – Personalized	The dashboard presentation should be specific to each user's domain of responsibility, privileges, data restrictions
A – Analytical	It should allow users to perform guided analysis such as what if analysis. The dashboard should make it effortless for a user to visually navigate through drill-down paths, compare, contrast, and make analytical inferences
C – Collaborative	The dashboard should facilitate users' ability to exchange notes regarding specific observations on their dashboards that serve as a communication platform for task management and compliance control.
T – Trackability	It should allow each user to customize the metrics he or she would like to track

Source: Malik (2005)

Figure 2.4 shows an example of dashboard interface from Oracle Corporation. It uses different type of charts to display the information of market analysis for product by category. The dashboard is used to analyze product performance by category (Few, 2006). The dashboard characteristics from Table 2.3 that related to this dashboard are synergetic and monitor, where the dashboard helps the user to monitor the sales KPIs for product such as cost of sales in the single screen.

Figure 2.4. Example of dashboard interface.

Source: Few (2006)

Figure 2.5 shows an example of dashboard interface from Business Objects that displays a series of performance measures using graphical presentation (such as gauges and charts) and also a list of alerts (Few, 2006). This figure wants to focus on the alert mechanism that is highlighted with a yellow box. The alert mechanism serves as a warning system when any relevant metrics are out of acceptable boundaries. In order to attract user attention, the alert mechanisms accompanied by attention-capturing actions such as automatic e-mails and/or visual indication such as blinking or animation on the dashboard. With the ever growing information load, the alert mechanism assures that any important information is not overlooked by the user. The idea of alert mechanism is inspired from where there is alarm appear on the car dashboard when the car is running low on gas. Figure 2.6 shows the interface for alert mechanism. The bold text in Figure 2.6 shows the alert descriptions that have not been clicked yet (Malik, 2005). The

dashboard characteristic from Table 2.3 that related to the alert mechanism is responsive.
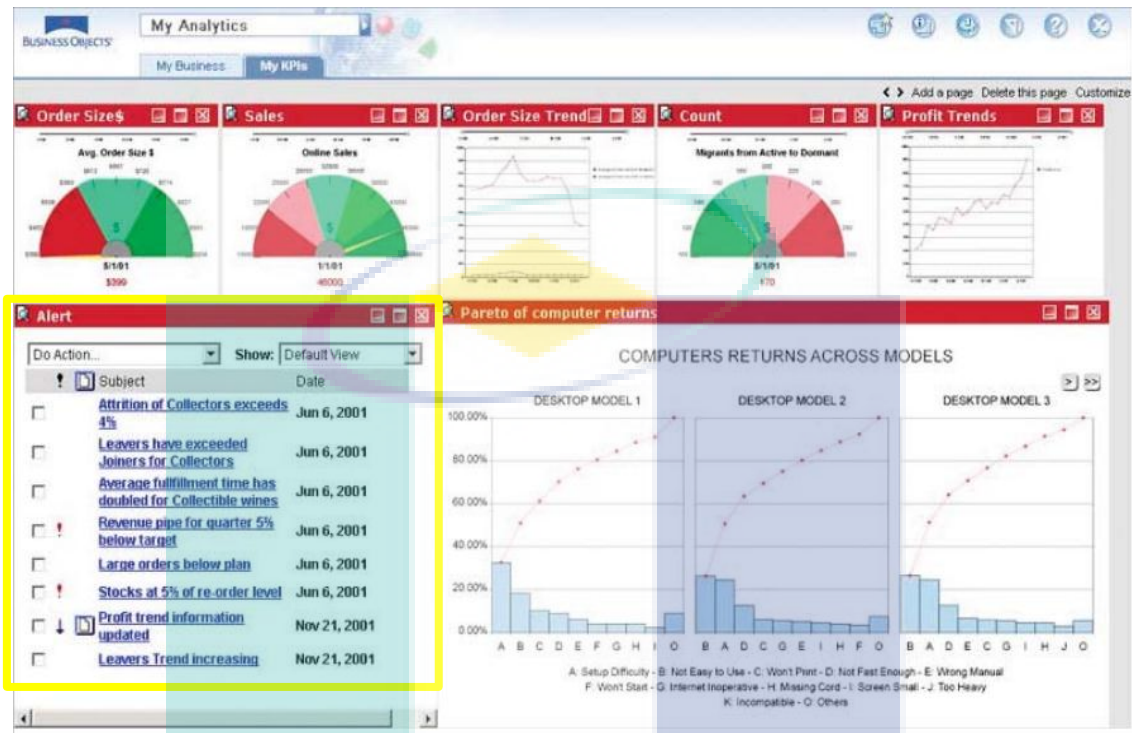
Figure 2.5. Example of dashboard interface with alert mechanisms.

Source: Few (2006)

Figure 2.6. Interface of alerts.

Source: Malik (2005)

The real-time feature means the dashboard should present current data from data source. If there is a change of data values in the data source, it should also reflect the changes of data values in the dashboard. Figure 2.7 shows the example of dashboard with the real-time feature to monitor the result of an Internet campaign (Malik, 2005). The dashboard characteristic from Table 2.3 that related to the real-time feature is timely.
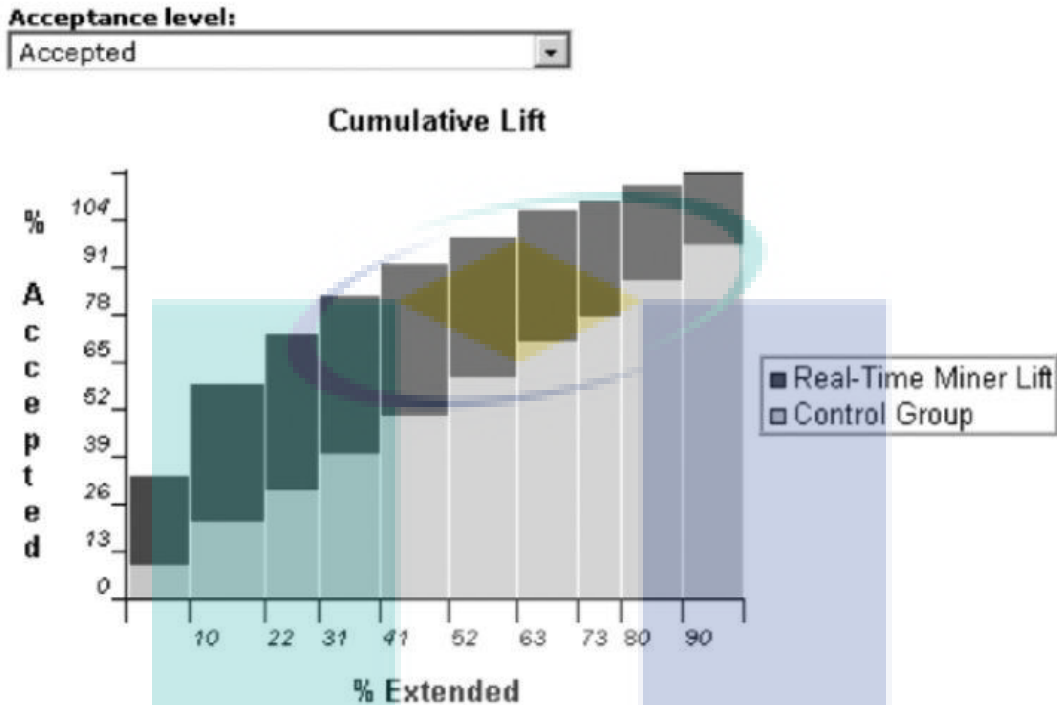
Figure 2.7. Real-time feature to monitor the results of an Internet marketing campaign.

Source: Malik (2005)

The drill-down feature is an essential in the dashboard that it helps the user perform self-guided analysis. With the drill-down, a more detailed level of information that explains the visual indicator will appear when the user clicks on the visual indicator. For example, Figure 2.8 shows the drill-down feature. When the user clicking on a slice of the Category Sales pie chart could lead to a trend line for the past six to 12 months of sales (units and dollars) for that category (Malik, 2005). The dashboard characteristics from Table 2.3 that related to the drill-down feature are interactive, more data history and analytical.
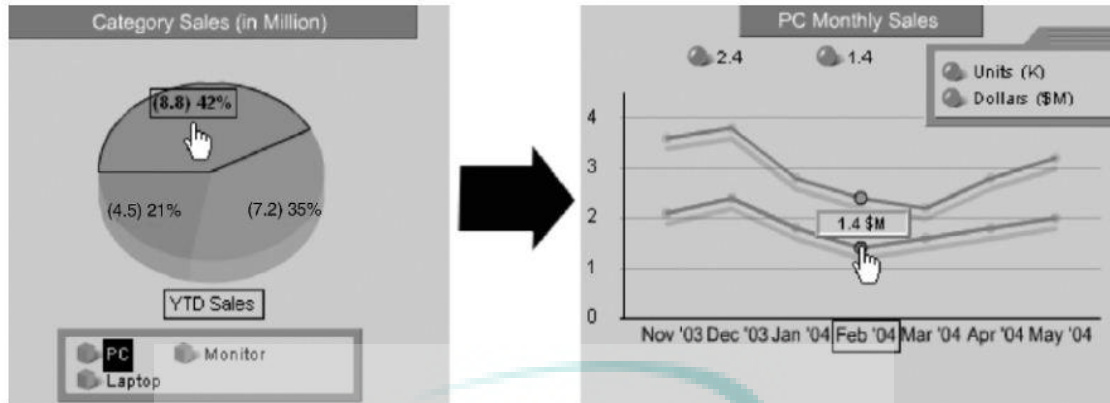
Figure 2.8. Drill-down feature on category sales to view monthly sales trend.

Source: Malik (2005)

The dashboard personalization feature presents the metrics and alerts that are relevant to a given user and within the user's domain of privilege. There are two types of dashboard personalization which are user driven and template driven. Firstly, the user-driven dashboard personalization means that each user should have the capacity to exercise limited control over the layout of the dashboard and help determine the metrics and alerts that will be displayed to him or her. Lastly, the template-driven dashboard personalization refers to the capacity of the dashboard to filter the data based on the user's profile (Malik, 2005). The dashboard characteristics from Table 2.3 that related to the user-driven dashboard personalization is trackability, while for template-driven dashboard personalization is personalized.

The collaboration feature extends the dashboard's role from a passive information interface to an active enterprise management console. The alert mechanism is integrated with the collaboration feature that allows all those receiving the alerts to participate in a relevant discussion regarding each alert in the discussion forum. For example, if an alert for sales below target for a specific territory is created, the territory representative and corresponding regional manager may communicate on the subject. For future reference, all communication regarding that alert may be tracked through the discussion forum linked to that alert (Malik, 2005). The dashboard characteristic from Table 2.3 that related to the collaboration feature is collaborative.

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2.6   Implementation of Dashboard for Researchers

The study about dashboard should deserve ample research attention but it is hardly investigated by researchers (Maheshwari and Janssen, 2013). There are limited studies concerning on the implementation of the dashboard for the researchers and it is discussed as follows:

i.   Supporting Scholarly Awareness in Publications and Social Networks (PUSHPIN) application (Reinhardt et al., 2012a)

Many types of SRNS provided have caused the scattered network of potentially relevant information. The researchers need of awareness support tools that provide detailed recommendations and hints for possible collaborators. The PUSHPIN application is a new social networking site built that aims provide researchers' awareness of publications, peers and research trends. Figure 2.9 shows the interface of PUSHPIN application. In PUSHPIN, there is a visualization features that support awareness of data related to researchers, affiliations and publications which are:

a.   Usage and statistical visualizations to show the development of followers, co-authors and publications. For example, a chart to show the number of citations for a publication.

b.   Trend-based visualizations to show trending citations, authors, topics and keywords.

c.   Map-based visualizations to show the geographical location of researchers and institutions. From this visualizations, the researchers can see the widely spread co-authorship networks and the associations of different institutions.

d.   Co-authorship visualizations to show the co-authors of the researchers.

Those visualizations features can be consider as the dashboard items because it is used to monitor the researcher performance.
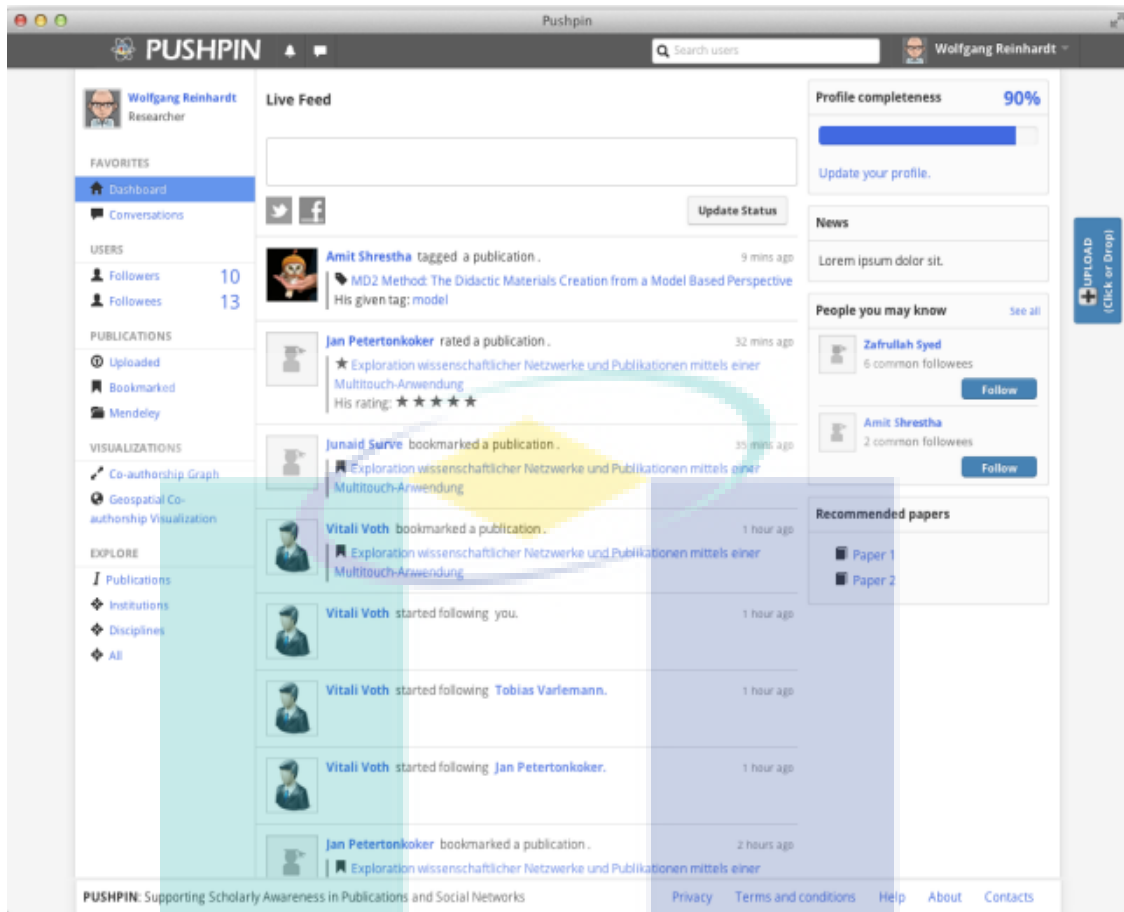
Figure 2.9. Interface of PUSHPIN application.

Source: Reinhardt et al. (2012a)

ii. A widget-based Awareness Dashboard for Research Communities (AWESOME) (Reinhardt et al., 2014)

There is an issues in the researcher's daily work practice which are collaboratively working on a document, inviting co-authors and meeting a given format requirement; finding experts for a given topic; and get detailed information about a researcher in one's own Research Network. A paper prototype of a widget-based dashboard (AWESOME) is introduced to enhance the researchers' awareness of fellows, of entire research domains and of relations between several information objects. Figure 2.10 shows the interface of widget-based dashboard (AWESOME). In AWESOME, the researchers can personalized their own dashboard by add widgets and freely arranged the widgets in the

dashboard. However, there is an issue in AWESOME where the researchers' lack of knowledge to personalized their dashboard and using the widget facility.
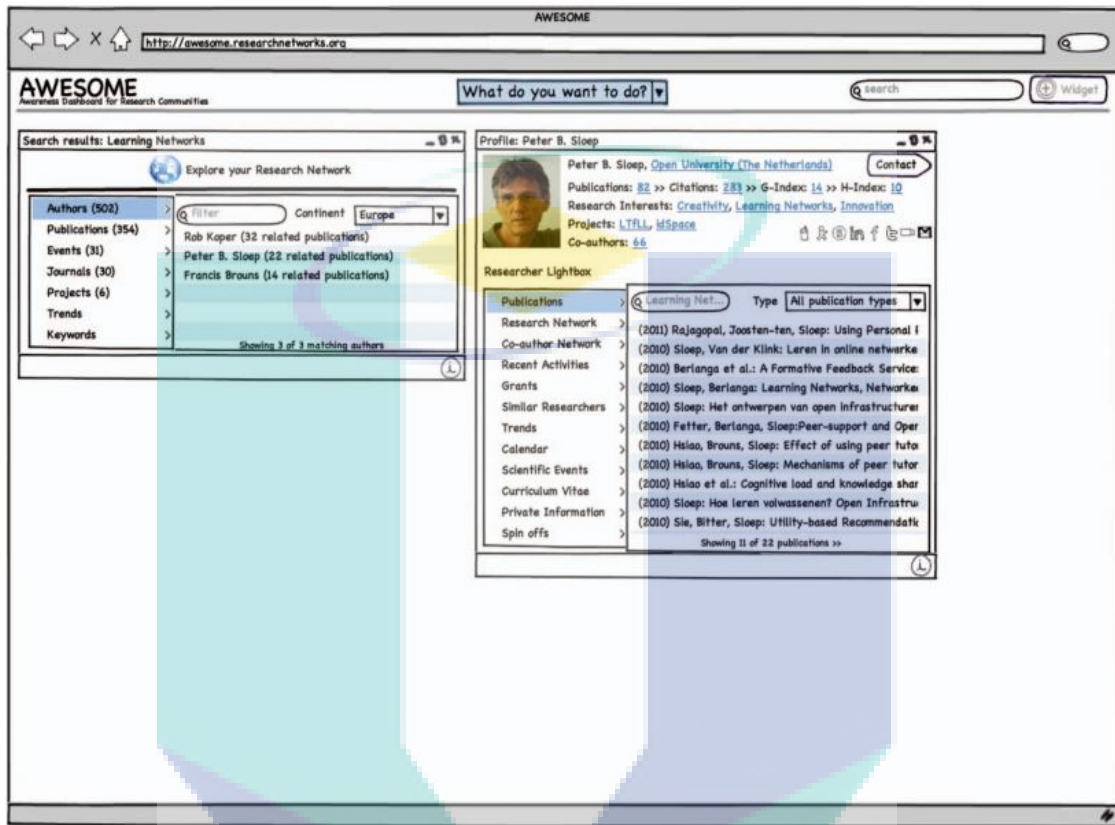
Figure 2.10. Interface of widget-based dashboard (AWESOME).

Source: Reinhardt et al. (2014)

There is also a dashboard implemented in the SRNS. There are four SRNS that mostly used by the researchers which are ResearchGate, Academia.edu, Mendeley and Google Scholar Citations (Gruzd et al., 2012; Nentwich and König, 2014). These SRNS are being reviewed in order to identify the dashboard items in the SRNS by circled it with red color.

i.   ResearchGate

ResearchGate is an online platform which aimed at researchers from all disciplines that allow access specific topics and conversations of researchers from around the world that shared similar interests (Rohani and

Ow, 2011; Madhusudhan, 2012). In 2008, the ResearchGate was founded (Giglia, 2011) and currently this site has reached over three million users. In the ResearchGate, the researchers can create their own profiles, list their publications, ask and answer questions and also find collaborators (Thelwall and Kousha, 2015). Figure 2.11 shows screenshot of the researcher profile in the ResearchGate. The identified dashboard items in Figure 2.11 are used to monitor the researcher performance such as number of publications and also number of views, downloads and citations of an article.
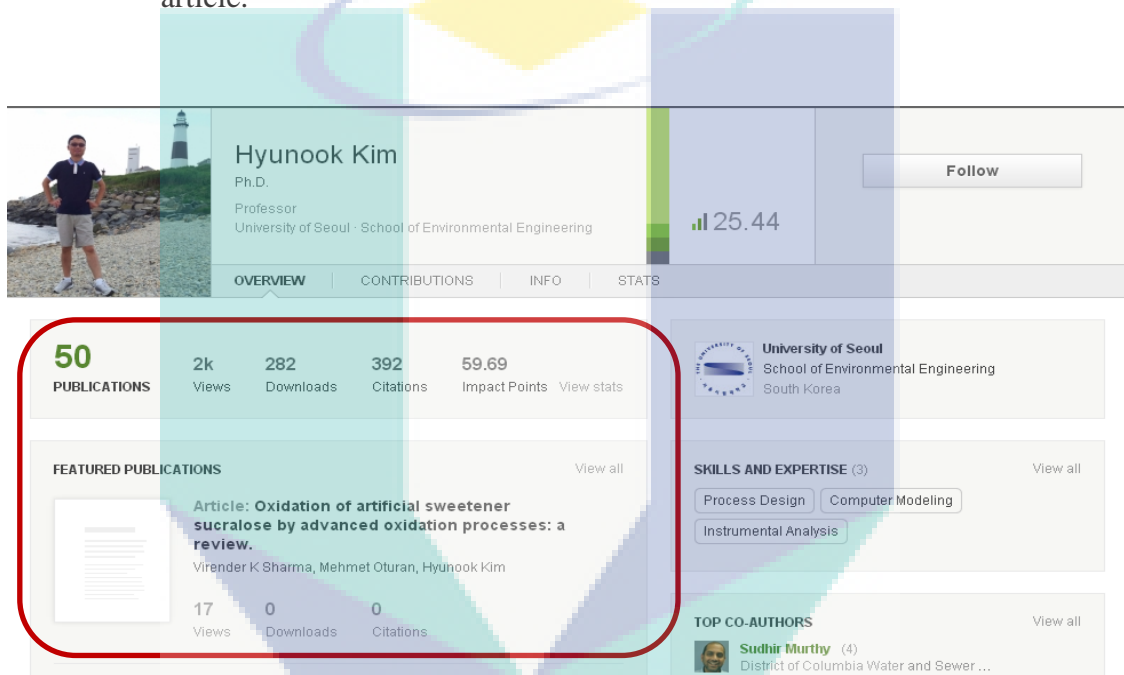
Figure 2.11. Screenshot of researcher profile in ResearchGate.

ii. Academia.edu

Academia.edu is a social networking site that built specialized for the researchers to upload and share their publications, follow the other researchers and receive notifications about publication papers and other research updates (Nández and Borrego, 2013). The Academia.edu was founded by Richard Price. In September 2008, the Academia.edu was launched and the registered users have over eight million. Figure 2.12 shows screenshot of Analytics feature in the Academia.edu. The Analytics feature such as number of profile view and document views and also top

keywords can be identified as the dashboard items because the researcher can see the real-time impact of the researchers work.

Figure 2.12. Screenshot of Analytics feature in Academia.edu.

iii. Mendeley

Mendeley has two platforms which are in desktop and web. Users can organize their collection of research articles and citations in Mendeley Desktop (Rohani and Ow, 2011; Masud et al., 2012). The Mendeley can automatically extracts references from documents, generate bibliographies from users PDFs and turns them into a searchable full-text database (Rohani and Ow, 2011; Masud et al., 2012). It also syncs continuously with other reference managers like Zotero or CiteULike (Rohani and Ow, 2011;

Masud et al., 2012). In Mendeley Web, the researcher can create online profiles, access research paper library from anywhere, share documents in closed groups, and make collaboration (Masud et al., 2012; Mohammadi et al., 2014). Figure 2.13 shows the screenshots of Mendeley readership statistics of an article. The readership statistics consists of discipline, academic status and country of readers that used to measure impact of the article can be identified as the dashboard items.
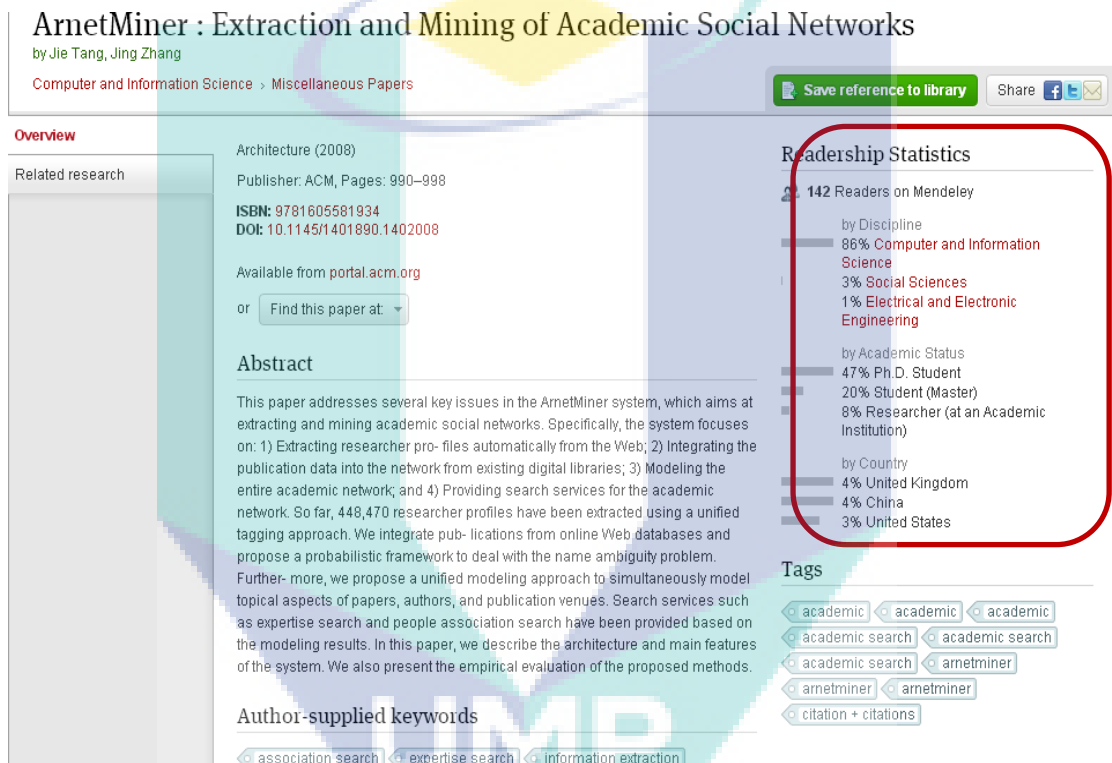
Figure 2.13. Screenshot of Mendeley readership statistics of an article.

iv.   Google Scholar Citations

In the Google Scholar Citations, the researchers can create profile and list their publications. It also can track citations of researchers' publications. Figure 2.14 shows screenshot of the researcher profile in the Google Scholar Citations. The identified dashboard items in Figure 2.14 are used to measure the researcher performance such as a graph showing citation of the researcher articles and number of citation in each article.
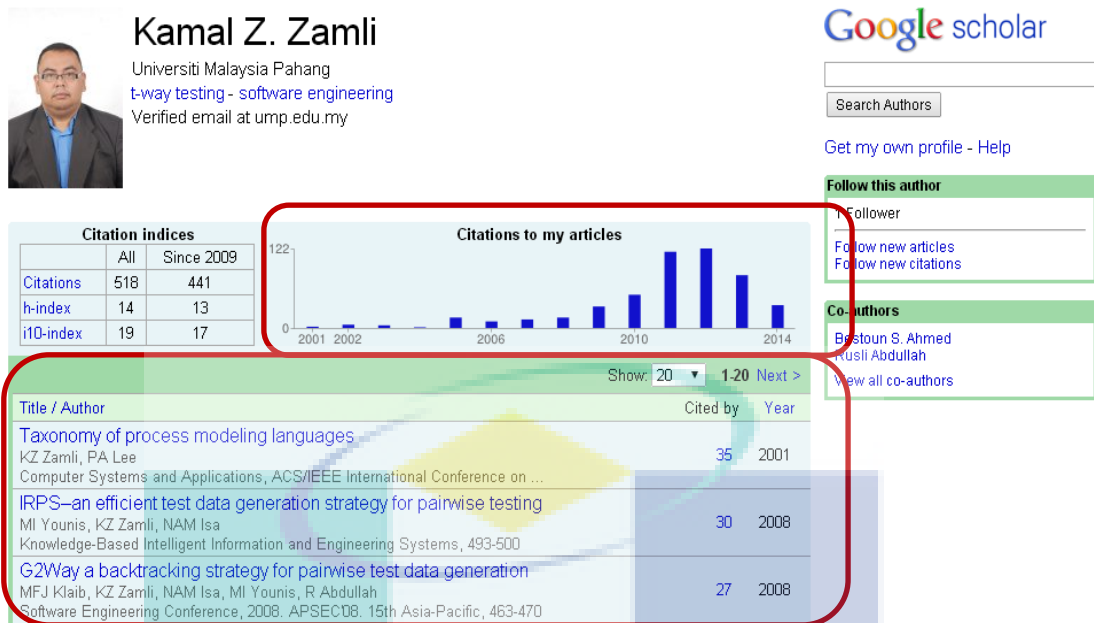
Figure 2.14. Screenshot of researcher profile in Google Scholar Citations.

Based on the above discussion regarding the implementation of dashboard, it was found that there is much type of visualizations and metrics are used to monitor the researcher performance. We can consider these visualizations and metrics to be dashboard items included in the dashboard information model. In this study, we can gather and analyze all the dashboard items identified from the literature studies and SRNS; and then combined it into the dashboard information model. The proposed dashboard information model is not intended to be isolated from existing SRNS, but this dashboard information model can be embedded in the existing SRNS to enriching the researchers' awareness on the research-related information.

2.7   Dashboard Development Methodology

There are a few steps need to be taken in order to develop the dashboard. Two type of dashboard development methodology are being reviewed in this study. The first dashboard development methodology has four phases which are requirement identification, plan process, prototype design and review prototype phases. In this study, we focus on the requirement identification phase in the dashboard development methodology as shown in Figure 2.15.
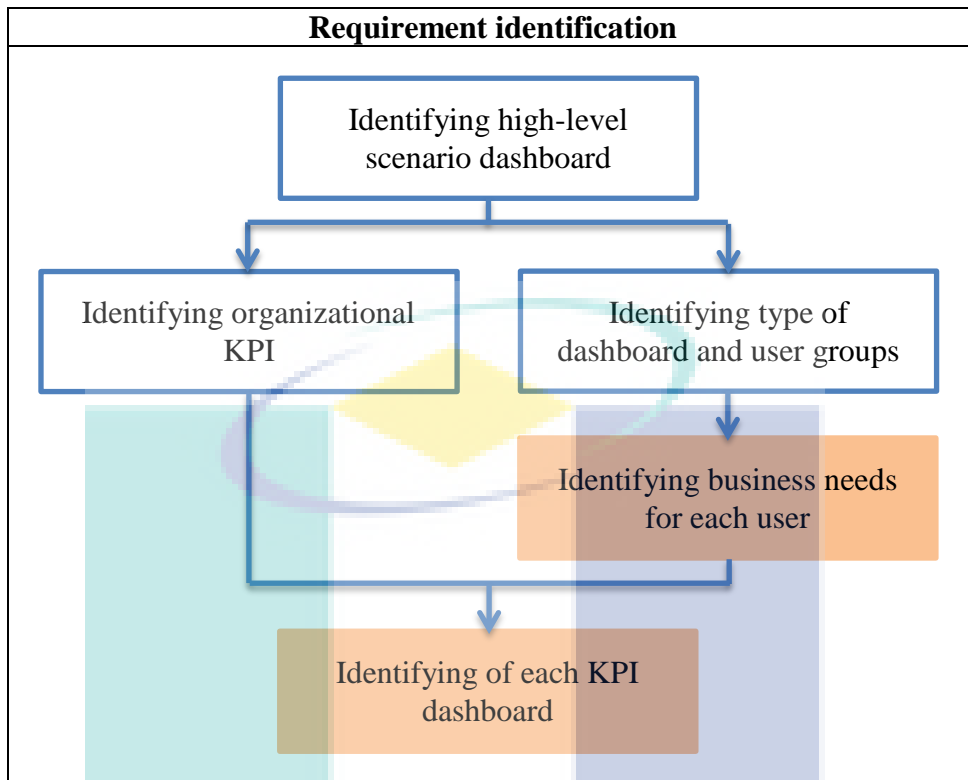
Figure 2.15. Requirement identification phase in dashboard development methodology.

Source: Hariyanti (2008)

Next, the dashboard development methodology has three phases which are intelligence, design and implementation phase as shown in Figure 2.16. In this study, we focus on the intelligence phase in the dashboard development methodology.
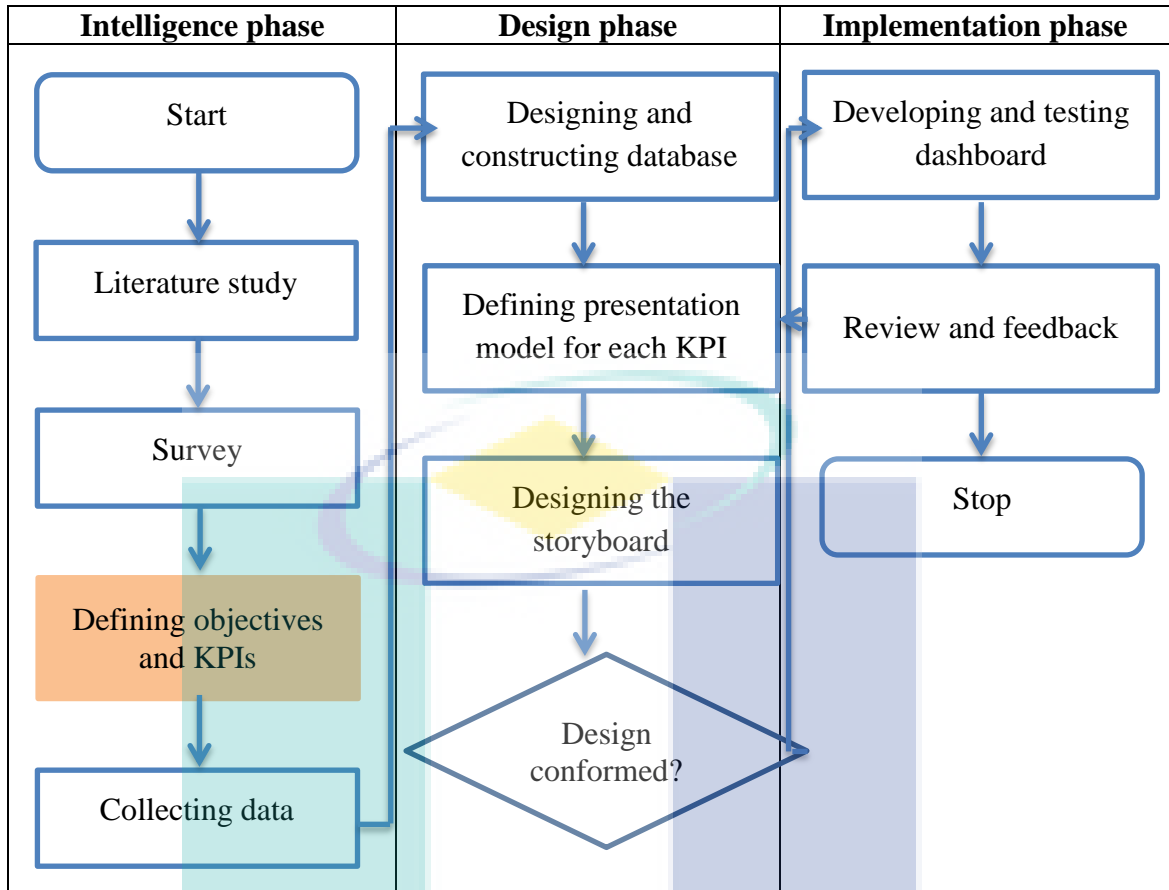
Figure 2.16. Intelligence phase in dashboard development methodology.

Source: Mahendrawathi et al. (2010)

Based on Figure 2.15 and Figure 2.16, there are some relevant steps can be adopted in this study. The relevant steps from those figures are highlighted. In Figure 2.15, the relevant steps are 'Identifying business needs for each user' and 'Identifying of each KPI dashboard'. While in Figure 2.16, the relevant step is 'Defining objectives and KPIs'. From those relevant steps, we know that the objectives of dashboard and needs of dashboard user need to be identified first in order to identify the suitable KPI for the dashboard. It would apply in methodology used in this study which is 'Phase 1: Relevance of dashboard to researcher needs' and 'Phase 2: Identification of dashboard items' as shown in Figure 2.17. The implementation of phase 1 and phase 2 of methodology in this study is discussed in Section 3.3.1 and Section 3.3.2, respectively.
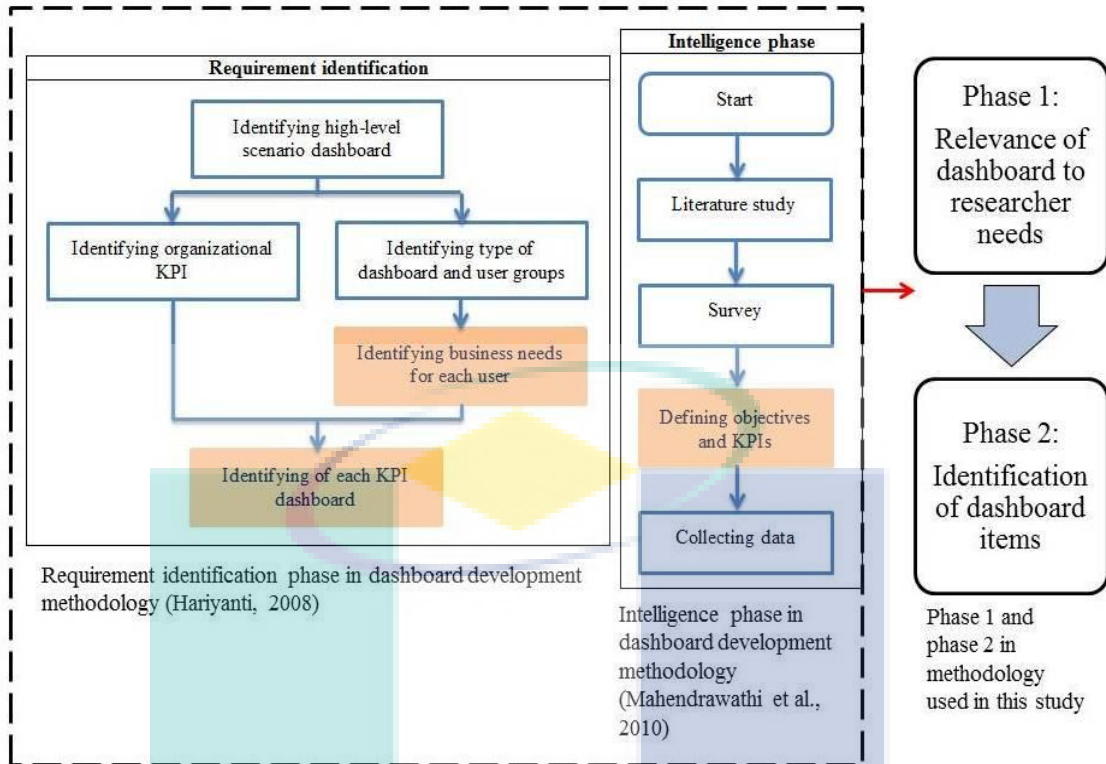
Figure 2.17. Formation of phase 1 and phase 2 in methodology used in this study.

2.8   Literature Studies on Relevance of Dashboard to Researcher Needs

In order to include the dashboard in the SRNS as a tool to provide awareness on research-related information, we need to seek the relevance of dashboard to support the researcher needs. There are few steps need to be done. Firstly, we need to search relevant papers that discuss on the researchers' reasons on using social networking sites in order to find the researcher needs. Next, we need to search relevant papers that discuss on the dashboard usage in order to find the dashboard purposes. Then, we need to analyze the researcher needs and dashboard purposes in order to find relevance of the dashboard to researcher needs. The details of these steps are discussed in Section 3.3.1.

First of all, we explore on the relevant papers that discuss on the researchers' reasons on using social networking sites in order to find the researcher needs. The discussions on the findings of the researcher needs are as follows. Most of the researchers use the social networking sites as a platform to publicize their research

outputs (Rowlands et al., 2011; Gruzd et al., 2012; Nentwich and König, 2014; Thelwall and Kousha, 2014). They want their publication papers to be read and cite by the other researchers. Metrics are needed to measure their research impact such as number of citation and download of the publication paper. A performance of the researcher can be monitored (RN1) (Giglia, 2011; Rohani and Ow, 2011; Masud et al., 2012; Li and Gillet, 2013; Osborne et al., 2013; Nentwich and König, 2014; Thelwall and Kousha, 2014) in order for them be recognized by the other researchers. The social networking sites have ability to support the researcher needs to find information about other researchers (RN2) and publication papers (RN3) (Giglia, 2011; Chakraborty, 2012; Gruzd et al., 2012; Masud et al., 2012) but they encounter a problem where the researchers could not noticed about these information since there are huge amounts of information in the social networking sites (Reinhardt et al., 2012a). Next, the researchers also want to be alerts on upcoming events likes seminar and conferences (RN4) (Chakraborty, 2012; Gruzd et al., 2012; Madhusudhan, 2012; Masud et al., 2012) to enable they plan to the event they interested to submit the publication paper. Lastly, there is a need to monitor research trends in order to know which research fields are growing and shrinking (RN5) (Masud et al., 2012; Osborne et al., 2013) as the social networking sites involve all researchers from diverse research fields. We have summarize five points regarding the researcher needs which are to monitor performance of researcher (RN1), to know information about the other researchers (RN2) and publication papers (RN3), alerts on upcoming events likes seminar and conferences (RN4) and to monitor research trends (RN5).

Then, we explore on the relevant papers that discuss on the dashboard usage in order to find the dashboard purposes. The discussions on the findings of the dashboard purposes are as follows. Firstly, most previous works state that the dashboard been used for performance measurement (DP1) (Phippen et al., 2004; Bose, 2006; Pauwels et al., 2009; Mahendrawathi et al., 2010; Morton-Owens and Hanson, 2012; Yigitbasioglu and Velcu, 2012; Maheshwari and Janssen, 2013). For example, Phippen et al. (2004) describes the dashboard used to report monthly and weekly performance of multinational airline company's website such as visits, visitors, registrations and visits to bookings information. Secondly, the dashboard used to guide decision making (DP2) (Bose, 2006; Pauwels et al., 2009; Mahendrawathi et al., 2010; Morton-Owens and

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Hanson, 2012; Yigitbasioglu and Velcu, 2012). For example, manager use dashboard in marketing to guide on decisions, such as, promotion activities and sales force allocation (Pauwels et al., 2009). Thirdly, the dashboard has been used to provide awareness support (DP3) (Bose, 2006; Treude and Storey, 2010; Reinhardt et al., 2012a; Reinhardt et al., 2014). The awareness means "an understanding of the activities of others, which provides a context for your own activity" (Dourish and Bellotti, 1992). These are some examples of the dashboard used to provide awareness support. The software development teams has used the dashboard to provide awareness for project status (Treude and Storey, 2010). The dashboard had been implemented for the researchers to provide the awareness support in the context of Research Networks that want to make the researchers noticed information about the other researchers and publication papers that they might be interested (Reinhardt and Mletzko, 2011; Reinhardt, 2012; Reinhardt et al., 2012a; Reinhardt et al., 2014). Bose (2006) state alert messages can be used to make the user aware of the information needed. Lastly, the dashboard also can be used to monitor trend over time (DP4) (Phippen et al., 2004; Morton-Owens and Hanson, 2012; Maheshwari and Janssen, 2013). By comparing current and past information, the dashboard can identify what trending up or down. We have identified four points regarding the dashboard purposes; namely performance measurement (DP1), guide decision making (DP2), provide awareness support (DP3) and monitor trend over period of time (DP4).

After we find the researcher needs and dashboard purposes from the previous works, we need to analyze the researcher needs and dashboard purposes in order to find relevance of the dashboard to researcher needs. The findings on the relevance of dashboard to support the researcher needs is discussed in Section 4.2.

2.9   Conclusion

This chapter has discussed the framework of literature review in this study. The chapter begins with discussion on social media and social networking sites, and based on the comparison of those platforms, it is found that the social networking sites are more suitable platform for the researchers to support the research activity. The social networking sites are useful to play role in the academic research cycle. The social

networking sites used by the researchers can be categorized into two which are the general social networking sites and SRNS. When they use the general social networking sites, they face a problem where they have difficulty in managing personal and professional identities, and distracted by updates status that appeared in news feeds that related to the research work. As an alternative, the researchers can use the SRNS which is a specialized social networking site for the researchers. However, there is an issue for the researcher to be alerted with latest information in research field since current SRNS are overwhelmed with huge amounts of information. The dashboard can be used to provide awareness to the researchers. The discussion on the conceptualization of dashboard has provided definition and characteristics of dashboard. The implementation of dashboard for the researchers has reviewed based on literature studies and review existing SRNS. The dashboard development methodology based on the previous studies is reviewed in order to get an idea of the steps to be implemented in the methodology used in this study. Lastly, the literature studies on relevance of dashboard to researcher needs are discussed.
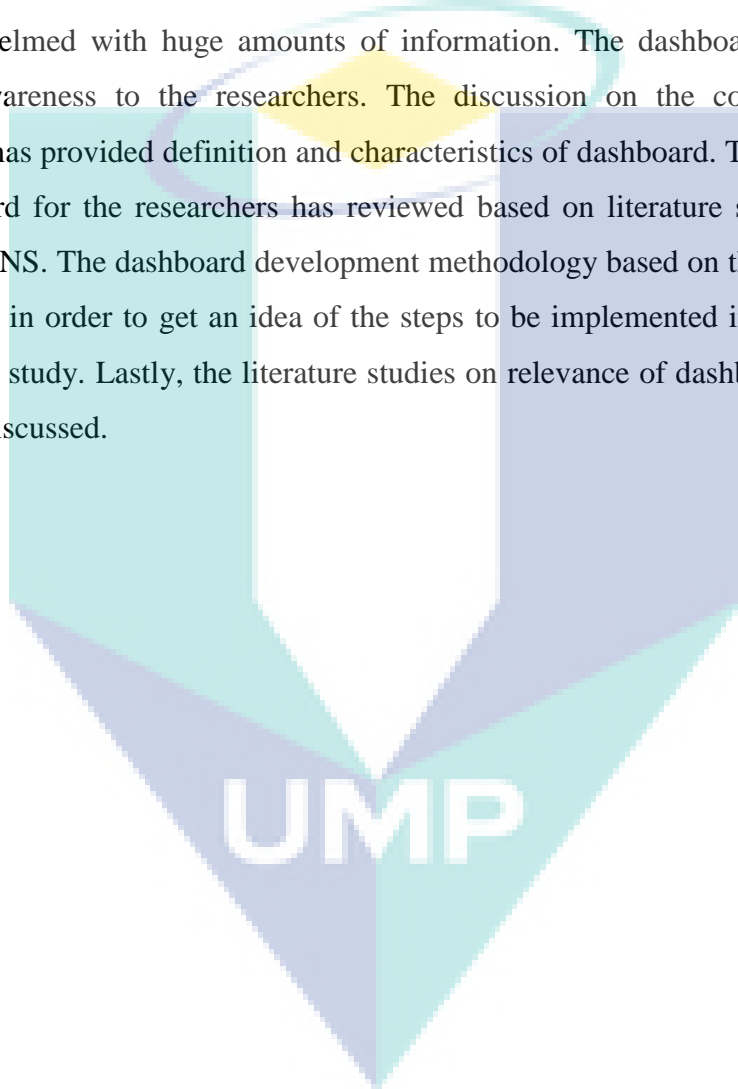
CHAPTER 3

METHODOLOGY

3.1   Introduction

This chapter begins with discussion on the three type research approaches which are qualitative, quantitative and mixed methods. The research approach selected in this study lead to choice of the research design adopted. Then, this chapter describes the research operational framework in this study, followed by discussion on the activities conducted, outputs and research objectives achieved.

3.2   Research Approaches

There are three types of research approaches which are qualitative, quantitative and mixed methods. Creswell (2013) gives a brief definitions of these three research approach as follows:

i.   Qualitative research

Qualitative research is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. The process of research involves emerging questions and procedures, data typically collected in the participant's setting, data analysis inductively building from particulars to general themes and the researcher making interpretations of the meaning of the data.

ii.   Quantitative research

Quantitative research is an approach for testing objective theories by examining the relationship among variables. The variables can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures.

iii.   Mixed methods research

Mixed methods research is an approach to inquiry involving collecting both quantitative and qualitative data. The core assumption of this form of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem.

The three types of research approaches can be differentiate based on philosophical assumptions, research designs and research methods as shown in Table 3.1.

Table 3.1
Comparison of research approaches

	Qualitative approach	**Quantitative approach**	**Mixed methods approach**
Philosophical assumptions	- Constructivist - Transformative	- Post-positivist	- Pragmatic
Research designs	- Narrative research - Phenomenology - Grounded theory - Ethnography - Case study	- Survey research - Experimental research	- Convergent parallel - Explanatory sequential - Explanatory sequential - Transformative
Research methods	- Open-ended questions - Text analysis	- Closed-ended questions - Statistical analysis	- Open- and closed-ended questions - Statistical and text analysis

Source: Creswell (2013)

In this study, in order to collect perceptions of the researchers towards the identified dashboard items that will be used to develop the dashboard information model, the quantitative approach is used by conducting a survey. In addition, for verification of the dashboard information model, the qualitative approach is used by conducting an interview in order to gain feedback from the researchers about the dashboard information model.

3.3   Research Design

The research design adopted in this study is survey research that considered as quantitative approach as shown in Table 3.1 (Section 3.2). The survey research is used because it can provide a quantitative description of perceptions of the researchers towards the identified dashboard items.

The research operational framework in this study is shown in Table 3.2. The first column as presented in the table shows the research objectives in this study. The next column in the table shows the phases conducted in order to achieve the research objectives. There are five phases in this study which are to seek the relevance of dashboard to researcher needs, to identify the dashboard items, to develop the dashboard information model based on the analysis of survey result, to design the mock-up prototyping of dashboard information model, and to verify the dashboard information model. The activities and outputs in each phases is also shown in the table.

Table 3.2
The research operational framework in this study

Research objectives	Phases	Activities	Outputs
• Objective 1: To evaluate the dashboard items identified from literature studies and review on the SRNS • Objective 2: To develop a dashboard information model in order to construct effective information for the researchers	1. Relevance of dashboard to researcher needs	• Review articles that discuss about: i. use of social networking sites by researchers to find the researcher needs ii. dashboard usage to find the dashboard purposes	The researcher needs that can be supported by the dashboard
	2. Identification of the dashboard items	• Two approaches used to identify possible dashboard items: i. from literature studies ii. by review existing Social Research Network Sites (SRNS)	Possible dashboard items that can satisfy the researcher needs that we have identified in phase 1
	3. Development of the dashboard information model based on the analysis of survey result	• Design survey questionnaire • Conduct pretesting • Analyze pretesting result • Conduct survey • Analyze survey result • Develop dashboard information model based on survey result	• The dashboard items are validated • The dashboard information model is designed

Table 3.2 Continued.

Research objectives	Phases	Activities	Outputs
• Objective 3: To verify the dashboard information model	4. Design the mock-up prototyping of dashboard information model	• Design the mock-up prototyping to represent dashboard information model	The mock-up prototyping of dashboard information model is designed
	5. Verification of the dashboard information model	• Design interview protocol • Conduct interview • Analyze interview result	The dashboard information model is verified

3.3.1 Phase 1: Relevance of Dashboard to Researcher Needs

The dashboard can be used as a tool to provide awareness on research-related information for the researchers in the SRNS. In order to include the dashboard in the SRNS, we need to find significance of dashboard for the researchers. Firstly, we analyze previous works regarding the researchers' reasons on using social networking sites in order to understand the researcher needs. Then, we have to investigate the dashboard usage to find its purposes. Further, we have to analyze the relevancy of the dashboard purposes with relation to the researcher needs. From the relationship relevancy, we can provide the justification on the significance of the dashboard for the researchers needs. Figure 3.1 shows the steps taken in the first phase.
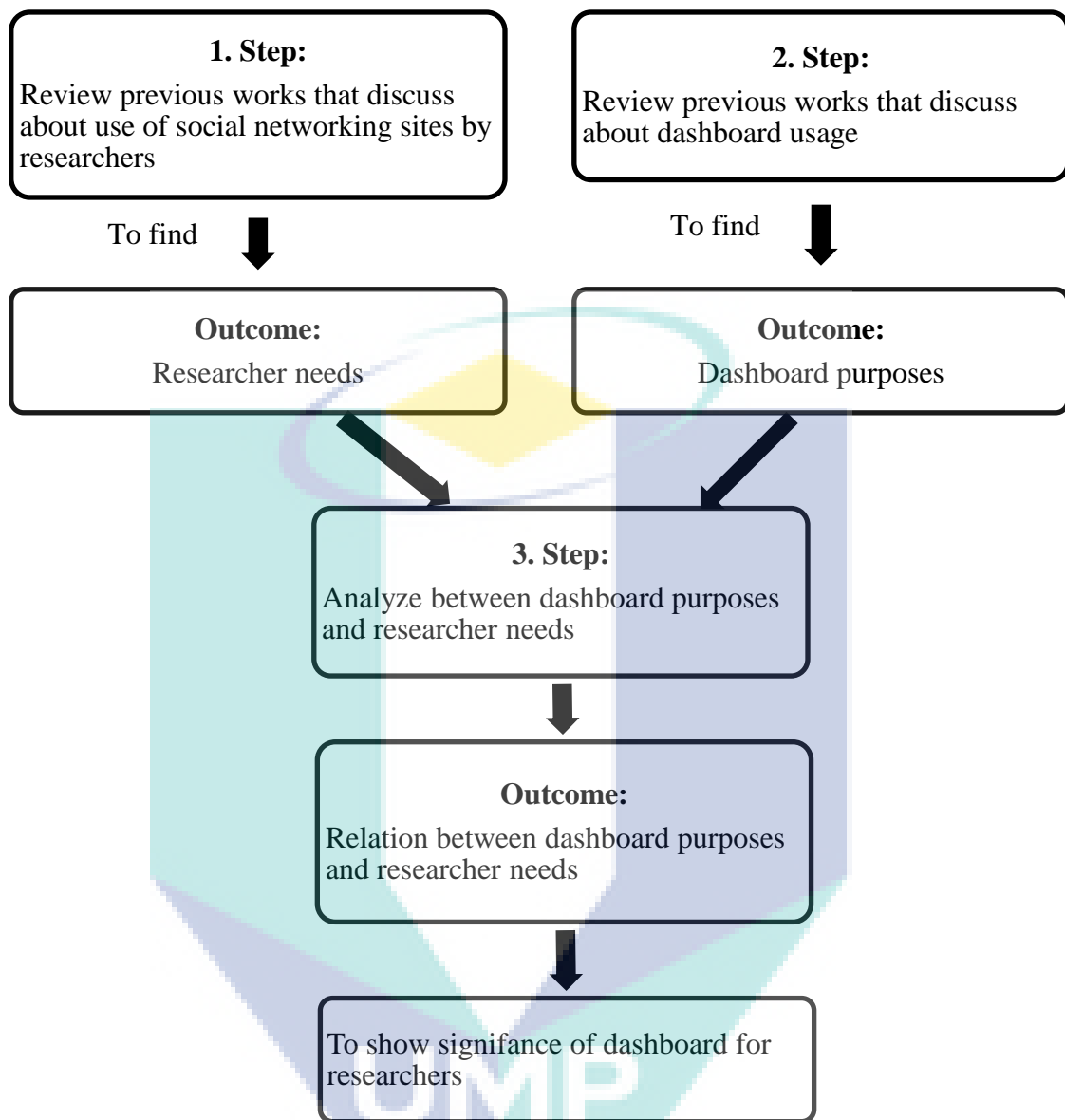
Figure 3.1. Steps taken in the first phase.

We used most widely academic search engine, Google Scholar (Baez et al., 2011; Osborne et al., 2013) to find previous works that discuss about the researchers use of social networking sites and also the usage of the dashboard. The keywords that we used to find the previous works are "social networking sites", "researchers", "dashboard", "performance measurement" and "awareness". We filtered the articles that relevance to our study. This approach of review previous works also had been used in Yigitbasioglu and Velcu (2012). We used a concept matrix to extract important points

from the previous works (Webster and Watson, 2002). The findings on the relevance of dashboard to support the researcher needs is discussed in Section 4.2.

3.3.2   Phase 2: Identification of Dashboard Items

We need to identify possible dashboard items that can satisfy the researcher needs identified in phase 1. In order to do that, we used two approaches to identify the dashboard items which are from literature studies and review on the SRNS. The following activities were carried out as a process to identify the proposed dashboard items:

i.   Identify dashboard items from literature studies

The academic search engine, Google Scholar is used to search relevant papers that discuss the researchers' use of the SRNS. The keywords that we used to find the relevant papers are "social media", "scholars", "academic social network sites", "altmetrics", "metrics for academic impact" and "research impact". The title of the papers is considered to identify the relevant papers. Consequently, 17 relevant papers are selected consist of 12 journal papers, four conference papers and one book section. Those relevant papers are reviewed to identify the dashboard items that can satisfy the researcher needs identified in phase 1. The dashboard items identified from those relevant papers are listed with the reason regarding selection of the dashboard items. The finding on the identification of dashboard items from literature studies is discussed in Section 4.3.1.

ii.   Identify dashboard items from review on the SRNS

Select the SRNS that are mostly used by the researchers based on reading on relevant papers that discuss use of the SRNS by the researchers. We review the features in the SRNS and identify which features can be used as the dashboard items to satisfy the researcher needs identified in phase 1. Make a comparison on the identified dashboard items to know frequency appearance of the dashboard items in the SRNS. The finding on the

identification of dashboard items from review on the SRNS is discussed in Section 4.3.2.

iii. Compare the findings

Compare the findings between identified dashboard items based on analysis from literature studies and review on the current SRNS in order to propose dashboard items to be used as basis element to develop the dashboard information model. The finding on the proposed dashboard items is discussed in Section 4.3.3.

3.3.3 Phase 3: Development of Dashboard Information Model Based On the Analysis of Survey Result

The proposed dashboard items identified based on analysis from literature studies and review on the current SRNS is validate using empirical study via quantitative approach by conducting a survey. Then, the analysis of survey result which is factor analysis to group the dashboard items will be used to develop the dashboard information model. Before the survey is distributed for the real data collection, the pretesting is conducted as discussed in Section 3.3.3.1. The discussion on the survey is described in Section 3.3.3.2.

In this study, the target populations are academic researchers which consist of academic staffs and postgraduate students that have been involved in doing the research and come from universities in Malaysia. These target populations are selected in this study because they are large users of the social media with 85.6 % of the researchers are faculty members in universities based on statistics of randomly selected 1 K researchers that have using the social media (Tang et al., 2007).

3.3.3.1 Pretesting of the survey

Before the survey is distributed for the real data collection, the pretesting is conducted in order to detect misunderstandings, ambiguities, or other difficulties the

respondents may encounter with the survey (Perneger et al., 2015). Failure to conduct pretesting could cause sampling errors because of nonresponse to the questions and nonsampling errors because of misunderstanding the questions, incorrect or unclear skip patterns, or any number of other reasons (Grimm, 2010). The pretesting can be done on a small number of the respondents who resemble the target population (Litwin, 1995; Grimm, 2010). Recommended number of sample sizes for the pretesting is about 30 (Grimm, 2010; Perneger et al., 2015). However, the less formal pretesting can be conducted with a smaller convenience sample which are at least five to ten respondents (Grimm, 2010; tools4dev, n.d.).

The survey consists of two parts which are the respondent details and the respondent preference about the dashboard items. A feedback form is accompanied with the survey in order to ask the respondents feedback about the content of the survey. The questions in the feedback form are measured by using five-point scales (question number 1 – 3 as shown in Table 3.3). An open-ended question is also included in the feedback form in order to ask recommendation from the respondents to improve the survey (question number 4 as shown in Table 3.3).

Table 3.3
List of questions in feedback form of the survey

1. Are the questions in the instrument self-explanatory to the target respondents?				
	(1) No	(2) Yes to only a few	(3) Yes to some	(4) Yes to majority	(5) Yes to all
2. The suitability of questions to the target respondents?				
	(1) Not suitable	(2) Suitable for a few questions	(3) Suitable for some questions	(4) Suitable for majority questions	(5) Suitable for all questions
3. Do you think the instrument is a valid instrument to be used to investigate perception of researchers towards dashboard items in Social Research Network Sites (SRNS)?				
	(1) No	(2) Yes to certain extent only	(3) Yes to some extent	(4) Yes to most extent	(5) Yes
4. Do you have recommendation to improve the survey?				

Sample design used in this study is a nonprobability sampling approach, where the researchers are selected because they are available, convenient and represent some characteristic that need to be studied (Creswell, 2012). There are two popular

approaches in the nonprobability sampling which are convenience and snowball sampling approaches (Creswell, 2012). In convenience sampling, the respondents are selected because they are willing and available to be studied. While in snowball sampling, the respondents are asked to identify others to become members of the sample.

The academic staffs (lecturers, senior lecturers, associate professors and professors) and postgraduate students (PhD students and Master students by research mode) come from different faculties in Universiti Malaysia Pahang (UMP) are invited to participate in the pretesting. The samples of academic staffs are collected by getting their email address through staff directory in the UMP website. The samples of postgraduate students are collected by getting the list of their email address with the help from the staff of Institute of Postgraduate Studies, UMP. The approach to get samples of academic staffs and postgraduate students is known as the convenience sampling because they are available to be studied. The pretesting is conducted by distribute the link of online survey accompanied with feedback form through email to 105 researchers consist of academic staffs and postgraduate students in UMP. The pretesting finding is discussed in Section 5.2.

3.3.3.2   The survey

The survey in this study is developed in order to validate the proposed dashboard items that are identified based on analysis from literature studies and review on the current SRNS as discussed in Section 3.3.2. The survey has been checked through pretesting as discussed in Section 3.3.3.1, before it is used for real data collection. There are two parts in the survey as shown in Table 3.4. The survey form is shown in Appendix A.

Table 3.4
Parts in the survey

Part	Item
A. Respondent details	Question number 1 – 9
B. Respondent preferences about dashboard items	Question number 10 – 27

Explanations about each part of the survey are as follows:

i.   Part A: Respondent details

This part contains questions about the respondents detail such as gender, age group, position, years involvement in research, email and university name. This part also contains questions whether the respondents have used the SRNS for the research work. The question give options of the four most popular SRNS (ResearchGate, Academia.edu, Mendeley and Google Scholar Citations) or the respondents can state the other SRNS that they have used. There is also a question to ask whether the respondents know about the dashboard.

ii.   Part B: Respondent preferences about dashboard items

In order to know perception of the respondents towards the dashboard items, the respondents are asked to answer the questions by selecting one Likert scale between the 7-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree or disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree). As cited in Lietz (2010), the seven-point Likert scale is used in the survey because it has been shown to be more reliable (Cronbach, 1951) as it allows for greater differentiation of responses than the 5-point Likert scale (Finn, 1972; Masters, 1974; Alwin, 1992).

In this study, the target population is academic researchers which consist of academic staffs (lecturers, senior lecturers, associate professors and professors) and postgraduate students (PhD students and Master students by research mode) that have been involved in doing the research and come from universities in Malaysia. We need to determine the size of sample needed in this study. The following formula as shown in Eq. (3.1) is used to determine the sample size for infinite population which is more than 50 000 (KENPRO, 2012).

$$n = \frac{Z^2 X \, p \, X \, (1 - p)}{M^2}$$ (3.1)

Where:

n = sample size for unknown population

Z = Z value (for example 1.96 for 95 % confidence level)

p = population proportion (assumed to be 0.5)

M = margin of error at 5 % (0.05)

$$n = \frac{1.96^2 \, X \, 0.5 \, X \, (1 - 0.5)}{0.05^2} = 384.16 \sim 385$$

Thus, the required number of sample size in this study is 385.

Sample design used in this study is a nonprobability sampling approach, that has two approaches which are convenience and snowball sampling approaches (Creswell, 2012). The samples of academic staffs are collected through staff directory in the university website by getting their email address. This approach is known as the convenience sampling because they are willing and available to be studied. The samples of postgraduate students are collected by asking the identified respondents to identify the other postgraduate students to become members of the sample. This approach is known as the snowball sampling.

The survey in this study is distributed using two approaches which are manually distributed hardcopy survey and link of online survey sent via email address of the respondents. Before distributing the survey, a letter of student confirmation is obtained from Institute of Postgraduate Studies, UMP to support the research. Then, a cover letter, student confirmation letter and the survey are distributed to 4 800 academic researchers consist of academic staffs and postgraduate students come from universities in Malaysia.

The statistical program, Statistical Package for the Social Sciences (SPSS) is used to analyze the survey data. Four types of data analysis conducted using the survey

data which are descriptive statistic to discuss on the respondents background, factor analysis to group the dashboard items, calculating a Cronbach's coefficient alpha to check the internal consistency reliability of the survey and independent sample t-test to analyze differences in perceptions of dashboard items between senior and junior researchers. The survey analysis and result is discussed in Section 5.3. The dashboard information model is developed based on the result of factor analysis to group the dashboard items. The further discussion on the development of dashboard information model is explained in Section 5.3.3.

3.3.4 Phase 4: Design the Mock-up Prototyping of Dashboard Information Model

The mock-up prototyping, which is the interface design, is designed to represent the dashboard information model. The study by Vonk, as cited in Lindland (1993), stated that the focus of the mock-up prototyping is on the external appearance, such as the screen of the system but without including functionality. The purpose of the mock-up prototyping is to evaluate the respondents' reactions to the appearance of the dashboard information model in a web browser. A software called Adobe Dreamweaver is used to design the mock-up prototyping for the dashboard information model. The mock-up prototyping designed to represent the dashboard information model can be seen in Appendix B (Section C).

3.3.5 Phase 5: Verification of Dashboard Information Model

The dashboard information model is verified by conducting an interview with the researchers. The advantage of adopting the interview is that it can provide additional perspectives in terms of how the researchers feel towards the dashboard information model. Previous study has shown the interview has been used as a tool to validate proposed research model (Wang et al., 2014). An interview protocol is prepared for the interview session. It is a form that contains an instructions for the process of the interview, the questions to be asked and space to take notes of the researchers' responses (Creswell, 2012). The interview protocol used in this study consists of five

sections as shown in Appendix B. Explanations about each section of the interview protocol are described as follows:

i. A brief introduction about this study is shown in Appendix B (Section A).

ii. The design of dashboard model with its description is shown in Appendix B (Section B).

iii. The mock-up prototyping of dashboard information model is shown in Appendix B (Section C).

iv. The interview questions as shown in Appendix B (Section D) are asked to the respondents in order to gauge their satisfaction regarding the dashboard information model and their intention to use mock-up prototyping that are used to represent the dashboard information model. The interview questions is designed based on End-User Computing Satisfaction (EUCS) instrument (Doll and Torkzadeh, 1988). The EUCS instrument model has been used as a standardized instrument for measuring user satisfaction of an information system (Xiao and Dasgupta, 2002; Day, 2007), consists of five factors and 12 questions, as shown in Figure 3.2. Table 3.5 shows a description of the five factors of EUCS, which are content, accuracy, format, ease of use and timeliness. The content factor is selected to be included in the interview questions in this study because it measures the ability of a system to provide the information without having the user to actively interact with the system. It is related with the dashboard concept in which the dashboard is used to display information without user interaction. There are four questions in the content factor (questions of C1 – C4) as shown in Figure 3.2. Questions of C2 and C4 are selected to be included in the interview questions because C2 is used to measure whether or not the dashboard information model meets the needs of the researchers, while C4 is used to measure whether or not the dashboard information model provide sufficient information. Besides, the format factor is also selected to be included in the interview questions. There are two questions in the format factor (questions of F1 and F2) as shown in Figure 3.2. Question of F2 is selected to be

included in the interview questions because it checks whether the researchers satisfy with the output information presented in the mock-up prototyping. If the researchers feel satisfy, then it has meet researchers needs. The other factors of EUCS which are accuracy, ease of use and timeliness are not included in the interview questions. Table 3.6 shows some of the interview questions designed in this study based on the questions in the content and format factor of EUCS.

v. The questions about the respondents' information are shown in Appendix B (Section E).
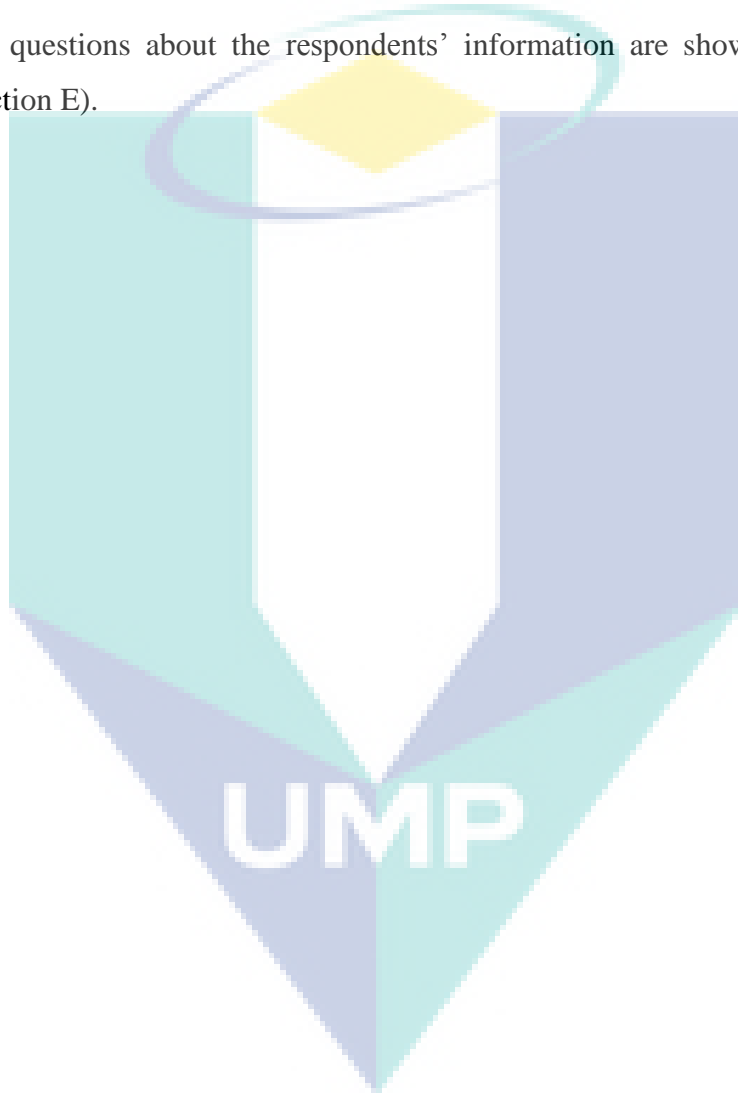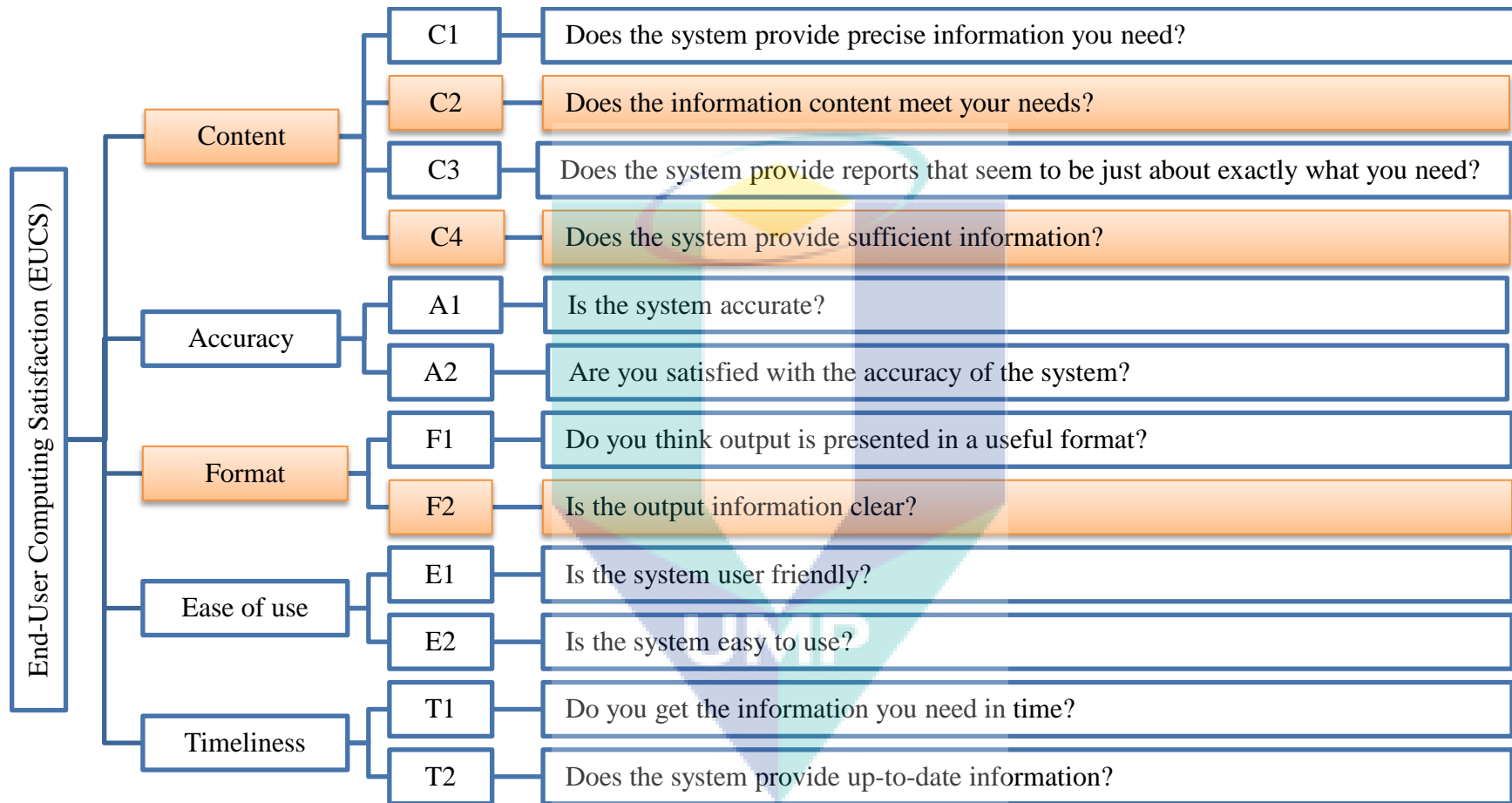
Figure 3.2. A model of End-User Computing Satisfaction instrument.

Source: Doll and Torkzadeh (1988)

Table 3.5
Description of factors of End-User Computing Satisfaction

Factor of EUCS	Description
Content	The content factor is related to the ability of the system to provide the information that meets the user's needs. The system should provide the information without waiting for user interaction with the system (Keinonen, n.d.).
Accuracy	The accuracy factor is related to the precision of the information provided in the system (Day, 2007; Zainal and Hussin, 2013).
Format	The format factor related to the information is in a useful and easy to understand format (Zainal and Hussin, 2013).
Ease of use	The ease of use factor is based on impression of the user when using the system, whether it is user friendly and easy to use (Day, 2007; Zainal and Hussin, 2013; Keinonen, n.d.).
Timeliness	Day (2007) states that the timeliness factor can be separated into two components: efficiency (the number of steps taken to complete a task) and speed (the length of time taken to complete a task). It involves user active interaction with the system. It is also related to up-to-date information (Zainal and Hussin, 2013).

Table 3.6
Some of the interview questions designed in this study based on the questions in the content and format factor of EUCS

Questions in the content and format factor of EUCS (as shown in Figure 3.2)	Interview questions (as shown in Appendix B – Section D)
C2 - Does the information content meet your needs?	Question 1 (Qu1) Does the dashboard items (DC1a, DC1b and DC1c) in the dashboard component researcher performance (M1) meet researcher needs to monitor the performance of the researchers based on their own publication achievements (P1)?
F2 - Is the output information clear?	
C4 - Does the system provide sufficient information?	Question 2 (Qu2) Does the dashboard component researcher performance (M1) provide sufficient information?

The researchers who are invited to participate in the interview consist of academic staffs and postgraduate students that have been involved in doing the research and come from selected university in Malaysia. They are selected using a snowball sampling approach which is a form of purposeful sampling, in which the identified respondents were asked to recommend other respondents to be interviewed in order to

verify the dashboard information model. The verification result of dashboard information model based on analysis of interview is discussed in Section 6.2.

3.4   Conclusion

This chapter has discussed the methodology used in this study. It begins with the comparison of the research approaches which are qualitative, quantitative and mixed methods. The quantitative approach is used by conducting survey in order to collect perceptions of the researchers towards the identified dashboard items and the qualitative approach is used by conducting interview in order to verify the dashboard information model. This study has come up with five phases for the research which are: to seek the relevance of dashboard to researcher needs, to identify the dashboard items, to develop the dashboard information model based on the analysis of survey result, to design the mock-up prototyping of dashboard information model, and to verify the dashboard information model. Those phases have the research objectives to be achieved, supported by activities which are used to produce outputs.

CHAPTER 4

DASHBOARD ITEMS FOR DASHBOARD INFORMATION MODEL

4.1   Introduction

This chapter begins with the discussion on the relevancy of dashboard to support the researcher needs. Then, this chapter discusses the identification of the dashboard items that are selected based on its suitability to satisfy the researcher needs in the dashboard.

4.2   Findings on the Relevance of Dashboard to Support the Researcher Needs

When the researchers use the SRNS for the research activity, they face a problem where there are huge amounts of information in the SRNS and it would overwhelm the researchers. Thus, the dashboard is introduced to provide awareness on the research-related information for the researchers. In order to include the dashboard in the SRNS, the dashboard relevancy in supporting the researcher needs need to be explored.

There are few steps taken to seek the relevance of dashboard to support the researcher needs. Firstly, we analyze previous works regarding the researchers' reasons on using social networking sites in order to find the researcher needs. Then, we have to investigate the dashboard usage in order to find the dashboard purposes. Further, we have to analyze the relevancy of the dashboard purposes with relation to the researcher needs. From the relationship relevancy, we can provide the justification on the significance of the dashboard for the researchers needs. The explanation about those

steps taken to seek the relevance of dashboard to support the researcher needs is discussed in Section 3.3.1.

Table 4.1 shows the five conference papers and five journal papers that discuss about the use of social networking sites by the researchers that are being reviewed in order to find the researcher needs. The details discussion of the researcher needs has been describe in Section 2.8. We have summarize five points regarding the researcher needs which are to monitor performance of researcher (RN1), to know information about the other researchers (RN2) and publication papers (RN3), alerts on upcoming events likes seminar and conferences (RN4) and to monitor research trends (RN5) as shown in Table 4.1.

Table 4.1
Researcher needs

Type of paper	Author	Researcher needs				
		Monitor performance of researcher (RN1)	Information about other researchers (RN2)	Information about publication papers (RN3)	Alerts on upcoming events likes seminar and conferences (RN4)	Monitor research trends (RN5)
Journal paper	Giglia (2011)	/	/	/		
Conference paper	Rohani and Ow (2011)	/				
Conference paper	Chakraborty (2012)		/	/	/	
Journal paper	Gruzd et al. (2012)		/	/	/	
Journal paper	Madhusudhan (2012)				/	
Journal paper	Masud et al. (2012)	/	/	/	/	/
Conference paper	Li and Gillet (2013)	/				
Conference paper	Osborne et al. (2013)	/				/

Table 4.1 Continued.

Type of paper	Author	Researcher needs				
		Monitor performance of researcher (RN1)	Information about other researchers (RN2)	Information about publication papers (RN3)	Alerts on upcoming events likes seminar and conferences (RN4)	Monitor research trends (RN5)
Conference paper	Nentwich and König (2014)	/				
Journal paper	Thelwall and Kousha (2014)	/				

Table 4.2 shows the three conference papers and seven journal articles that discuss about dashboard usage that are being reviewed in order to find the dashboard purposes. The details discussion of the dashboard purposes has been describe in Section 2.8. Based on previous works of the dashboard usage, we have identified four points regarding the dashboard purposes; namely performance measurement (DP1), guide decision making (DP2), provide awareness support (DP3) and monitor trend over period of time (DP4) as shown in Table 4.2.

Table 4.2
Dashboard purposes

Type of paper	Author	Dashboard purposes			
		Performance measurement (DP1)	Guide decision making (DP2)	Provide awareness support (DP3)	Monitor trend over period of time (DP4)
Journal paper	Phippen et al. (2004)	/			/
Journal paper	Bose (2006)	/	/	/	
Journal paper	Pauwels et al. (2009)	/	/		
Conference paper	Mahendrawathi et al. (2010)	/	/		
Conference paper	Treude and Storey (2010)			/	

Table 4.2 Continued.

Type of paper	Author	Dashboard purposes			
		Performance measurement (DP1)	Guide decision making (DP2)	Provide awareness support (DP3)	Monitor trend over period of time (DP4)
Journal paper	Morton-Owens and Hanson (2012)	/	/		/
Journal paper	Reinhardt et al. (2014)			/	
Conference paper	Reinhardt et al. (2012a)			/	
Journal paper	Yigitbasioglu and Velcu (2012)	/	/		
Journal paper	Maheshwari and Janssen (2013)	/			/

The purposes of the dashboard (DP1 - DP4) are then analyzed to seek whether these purposes can satisfy the needs of researcher (RN1 - RN5) in their research works. From the analysis, we can see what researcher needs that can be supported by the dashboard.

Every day, each research field gets deeper with increasing number of publication papers. Thus, a research trends can be generated (RN5) such as by making comparison number of publication papers in various research fields versus years. From that, we can see which research fields are growing and shrinking. The dashboard can be used to monitor trend over period of time (DP4).

The information about the researcher and publication are related with one another. For instance, impact factor of the publication paper can influence the researcher reputation (Li and Gillet, 2013). The impact factor can be example of the metric to measure the researcher performance which might help them to know their ranking in the research community. As stated by Rohani and Ow (Rohani and Ow, 2011), "ranking mechanism can create an enthusiasm for users to increase their rank and enhance their position in their university or colleges". The dashboard can be used to monitor

performance of researcher (RN1) as the dashboard has been used by the company to measure their business performance (DP1).

Besides, the researchers want to be alerts on upcoming events likes seminar and conferences on a specific topic (RN4). Thus, the researchers can submit their publication paper to the event that related to their research interests (Tang et al., 2008; Chakraborty, 2012). The dashboard has ability to provide awareness support (DP3) (Treude and Storey, 2010; Reinhardt et al., 2012a; Reinhardt et al., 2014) to make the researchers noticed events related to their research interest.

Table 4.3 shows the relationship between the need of researchers with the dashboard purposes. From here, we can see relevance of the dashboard purposes to cater the researcher needs. Based on the analysis, the dashboard is identified as a significant tool in assisting the researcher needs on monitoring their own research performance, monitoring research trends and alerting them with upcoming events.

Table 4.3
Relationship between dashboard purposes and researcher needs

Dashboard purposes	Researcher needs
Monitor trend over period of time (DP4)	Monitor research trends (RN5)
Performance measurement (DP1)	Monitor performance of researcher (RN1)
Provide awareness support (DP3)	Alerts on upcoming events likes seminar and conferences (RN4)

4.3 Findings on the Identification of Dashboard Items

The possible dashboard items that can be used to satisfy the researcher needs which are to monitor performance of researcher (RN1), alerts on upcoming events likes seminar and conferences (RN4) and to monitor research trends (RN5) as shown in Table 4.3, need to be identified. There are two approaches used to identify the dashboard items which are based on analysis from the literature studies and review on the current SRNS. The explanation about the activities to identify the dashboard items is discussed in Section 3.3.2.

4.3.1   Dashboard Items Identified from Literature Studies

The list of the dashboard items identified from literature studies with the reason regarding the selection of the dashboard items are shown in Table 4.4.

Table 4.4
List of dashboard items identified from literature studies

	Dashboard items	Reason	References	Type of paper
1.	Total number of publications	To measure researcher productivity	Stvilia et al.'s study as cited in Gruzd et al. (2012)	Journal paper
			(Ramsden, 1994)	Journal paper
2.	Publications category	To know the category of publications that the researcher has been publish	Niu and Hemminger's study as cited in Mohammadi et al. (2014)	Journal paper
3.	Number of downloads	To measure impact of research	(O'Leary, 2008)	Journal paper
			(Thelwall and Kousha, 2015)	Journal paper
4.	Number of citations	To measure impact of research	(Ramsden, 1994)	Journal paper
			(O'Leary, 2008)	Journal paper
			(Priem et al., 2012)	Journal paper
			(Yan and Ding, 2012)	Conference paper
		Merton's study as cited in Thelwall and Kousha (2014) found that citations confer recognition. Moed and Reinhardt et al.'s study as cited in Thelwall and Kousha (2014) state that this recognition is important for academic careers and evaluations of researchers' work.	(Thelwall and Kousha, 2014)	Journal paper

Table 4.4 Continued.

	Dashboard items	Reason	References	Type of paper
5.	Top publication papers	To give individual authors feedback about which of their articles are proving to be the most popular	(Thelwall and Kousha, 2015)	Journal paper
6.	Impact factor	An author is rated based on the impact factor of his publications	(Masud et al., 2012)	Journal paper
			(Li and Gillet, 2013)	Conference paper
		Impact factor is now being used to measure as an index of quality and prestige and is being increasingly used for ranking and evaluating the journals and judging the academic performance and the quality and importance of an individual research publication	(Jones, 2003)	Journal paper
		Although impact factor is not an ideal method to measure the quality of the articles but there is nothing better and it has the advantage of already being in existence and is therefore a good technique for scientific evaluation	(Mathur and Sharma, 2009)	Journal paper
7.	Co-authors list	To detect research communities and identify collaboration patterns	(Yan and Ding, 2012)	Conference paper
			(Reinhardt et al., 2012b)	Conference paper
		To show academic influence. Top influencers tend to have many coauthors	(Li and Gillet, 2013)	Conference paper

Table 4.4 Continued.

	Dashboard items	Reason	References	Type of paper
8.	Mendeley statistics which is information related to: - discipline, - academic status and - country of readers for each article	To measure impact of research papers	(Mohammadi et al., 2014)	Journal paper
9.	Total number of researchers in research domain	To know number of researchers in research area	(Masud et al., 2012)	Journal paper
10.	Information about other researchers that shared same research interest	To accelerate collaborative research	(Masud et al., 2012)	Journal paper
11.	Publication trends	To know trends on number of publications in the research area whether growing or shrinking	(Osborne et al., 2013)	Book section
12.	Information about publication platforms	One of characteristics the reliable journals publications is journals that peers are publishing in	(Abrizah et al., 2014)	Conference paper
		To support exploration of potentially publishing platforms	(Kalb et al., 2009)	Journal paper
13.	Follow up of one particular author	To alert about latest articles	(Baez et al., 2011)	Journal paper
			(Abrizah et al., 2014)	Conference paper

4.3.2 Dashboard Items Identified from the Social Research Network Sites

The ResearchGate, Academia.edu, Mendeley and Google Scholar Citations are some examples of the SRNS that mostly used by the researchers (Gruzd et al., 2012; Nentwich and König, 2014). These SRNS have been reviewed in order to find the dashboard items as been discussed in Section 2.6. Table 4.5 shows comparison of the dashboard items identified based on the review of the SRNS.

Table 4.5
Comparison of dashboard items identified based on review of Social Research Network Sites

| | Dashboard items | Social Research Network Sites (SRNS) | | | | Frequency |
		ResearchGate	Academia.edu	Mendeley	Google Scholar Citations	
1.	Total number of publications	/	/	/	/	4
2.	Publications category	/		/	/	3
3.	Information about publication platforms	/	/		/	3
4.	Number of citations in each article	/			/	2
5.	Co-authors list	/			/	2
6.	Number of downloads in each article	/				1
7.	Citations graph by year in each article				/	1
8.	Top publication papers	/				1
9.	Impact factor	/				1
10.	Information about discipline of readers in each article			/		1
11.	Information about academic status of readers in each article			/		1
12.	Information about country of readers in each article			/		1
13.	Information about institution of readers in each article	/				1

4.3.3 Proposed Dashboard Items

The dashboard items are parts of the important elements in developing the dashboard information model for researchers. The dashboard items that had been identified from literature studies (Table 4.4) and from review on the SRNS (Table 4.5) are compared in order to propose dashboard items to be used in developing the dashboard information model. Table 4.6 shows the comparison of dashboard items identified from literature studies and based on review SRNS. Based on the comparison, most of the dashboard items are found in both literature studies and review on SRNS. However, there are some dashboard items are found only in literature studies (dashboard items number 9, 10 and 11) and found only in review on SRNS (dashboard items number 15 and 16).

Table 4.6
Comparison of dashboard items identified from literature studies and based on review of Social Research Network Sites

	Dashboard items	From literature studies	From review on Social Research Network Sites (SRNS)			
			ResearchGate	Academia.edu	Mendeley	Google Scholar Citations
1.	Total number of publication	Stvilia et al.'s study as cited in (Gruzd et al., 2012)	/	/	/	/
		(Ramsden, 1994)				
2.	Publications category	Niu and Hemminger's study as cited in (Mohammadi et al., 2014)	/		/	/
3.	Number of downloads in each article	(O'Leary, 2008; Thelwall and Kousha, 2015)	/			
4.	Number of citations in each article	(Ramsden, 1994; O'Leary, 2008; Priem et al., 2012; Yan and Ding, 2012; Thelwall and Kousha, 2014)	/			/

Table 4.6 Continued.

	Dashboard items	From literature studies	From review on Social Research Network Sites (SRNS)			
			ResearchGate	Academia.edu	Mendeley	Google Scholar Citations
5.	Top publication papers	(Thelwall and Kousha, 2015)	/			
6.	Impact factor	(Jones, 2003; Mathur and Sharma, 2009; Masud et al., 2012; Li and Gillet, 2013)	/			
7.	Co-authors list	(Reinhardt et al., 2012b; Yan and Ding, 2012; Li and Gillet, 2013)	/			/
8.	Information about publication platforms	(Kalb et al., 2009; Baez et al., 2011; Abrizah et al., 2014)	/	/		/
9.	Statistics on number of researchers in research domain	(Masud et al., 2012)				
10.	Information about other researchers that shared same research interest	(Masud et al., 2012)				
11.	Statistic on number of publications in research domain	(Osborne et al., 2013)				
12.	Statistics related to discipline type of readers in each article	(Mohammadi et al., 2014)			/	
13.	Statistics related to academic status of readers in each article	(Mohammadi et al., 2014)			/	
14.	Statistics related to country of readers in each article	(Mohammadi et al., 2014)			/	
15.	Statistics related to institution of readers in each article		/			
16.	Citations graph by year in each article					/

All dashboard items identified from literature studies and review on SRNS are merging as the proposed dashboard items (Table 4.7) to be considered as basis element to develop the dashboard information model. The dashboard items need to be validated by conducting a survey in order to know the perceptions of the researchers towards the dashboard items.

Table 4.7
Proposed dashboard items identified based on analysis from literature studies and based on review of Social Research Network Sites

		Dashboard items
1.		Total number of publication
2.		Publications category
3.		Number of downloads in each article
4.		Number of citations in each article
5.		Top publication papers
6.		Impact factor
7.		Co-authors list
8.		Information about publication platforms
9.		Statistics on number of researchers in research domain
10.		Information about other researchers that shared same research interest
11.		Statistic on number of publications in research domain
12.		Statistics related to discipline type of readers in each article
13.		Statistics related to academic status of readers in each article
14.		Statistics related to country of readers in each article
15.		Statistics related to institution of readers in each article
16.		Citations graph by year in each article

4.4   Conclusion

This chapter is preceded with discussion on the relevancy of dashboard to support the researcher needs. We find out that the dashboard can be used to assist the researcher needs on: monitoring their own research performance, monitoring research trends and alerting them with upcoming events. Then, we identify the suitable dashboard items that can be used to satisfy the researcher needs in the dashboard. There are two approaches used to identify the dashboard items which are from the literature studies and review on the current SRNS. The dashboard items identified based on two

approaches of identification is combined to be proposed of dashboard items. Based on the analysis, we found16 proposed of dashboard items.

In the next chapter, we are going to discuss on the survey result that are used to validate the proposed dashboard items. Based on the result of factor analysis, the dashboard items are grouped and it will became the basis element to develop the dashboard information model.
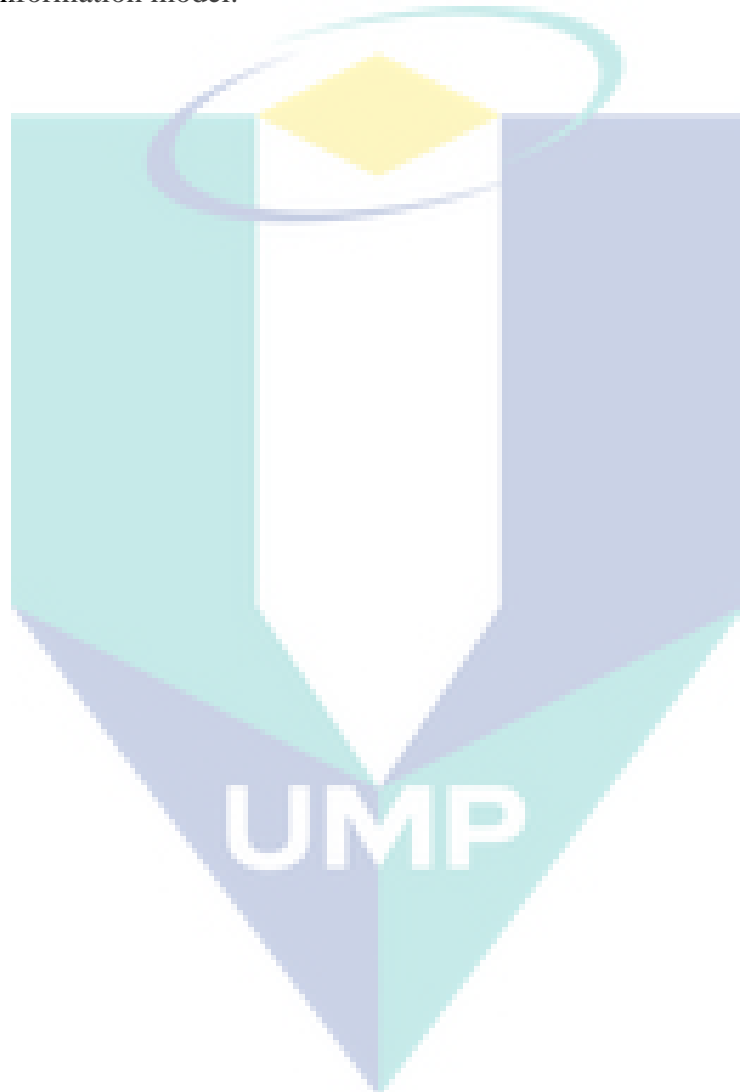
CHAPTER 5

DEVELOPMENT OF DASHBOARD INFORMATION MODEL

5.1 Introduction

In Chapter 4, the relevance of dashboard to researcher needs was discovered. The finding of the dashboard relevancy has affect to the identification of dashboard items to satisfy the researcher needs. The identification of dashboard items is using two approaches which are from literature studies and review the current SRNS.

The survey is used in order to validate the proposed dashboard items. In this chapter, it is preceded by the discussion on the pretesting finding. It proceeds with the discussion on the survey results and analysis. Then, this chapter discuss on the development of dashboard information model.

5.2 Pretesting Finding

The objective of the pretesting is to obtain feedback from the respondents whether they can understand the survey. The pretesting can allows us a chance to make correction on the survey before using it to collect a real data (Litwin, 1995). The pretesting is conducted by distribute the link of online survey through email to the academic staffs and postgraduate students from different faculties in UMP. The explanation about pretesting of the survey is discussed in Section 3.3.3.1. The pretesting took about two weeks (from end week of July 2014 to start week of August 2014) to accomplish. The survey data in the pretesting is analyzed using a statistical program,

Statistical Package for the Social Sciences (SPSS). Two types of data analysis conducted in the pretesting are the descriptive statistics of the respondents and the description of the feedbacks regarding the survey.

Firstly, the background information of the respondents in the pretesting is discussed. Total number of respondents participated in the pretesting are 16. These 16 respondents are considered enough for the pretesting, based on the statement where the less formal pretesting can be conducted with a smaller convenience sample which are at least five to ten respondents (Grimm, 2010; tools4dev, n.d.). Even though the number of the respondents is small, it should be able to identify issues with the survey (tools4dev, n.d.). The respondents consist of academic staffs (professor, associate professor, senior lecturer and lecturer) and postgraduate students (PhD and Master student). Table 5.1 shows the background information of the respondents in the pretesting and it is discussed as follows. The respondents consist of eight male and eight female. In terms of age group, majority of the respondents are in age range of 31 - 40 years (43.8 %), followed by age range of 21 - 30 years (31.3 %) and age range of 41 - 50 years (25.0 %). In terms of position, the total percentage of academic staffs with 56.4 % is higher than the total percentage of the postgraduate students with 43.8 %. In the academic staffs group, majority of the respondents are lecturers (31.3 %), followed by senior lecturers (12.5 %), associate professors (6.3 %) and professors (6.3 %). While in the postgraduate students group, majority of the respondents are PhD students (25.0 %) and followed by Master students (18.8 %). Regarding the years of involvement in research, majority of the respondents involved in research in the range of 1 - 5 years (68.8 %), followed by range of 6 - 10 years (25.0 %) and range of more than 10 years (6.3 %). For percentage of the respondents know about dashboard, there are only 43.8 % of the respondent know about the dashboard.

Table 5.1
Background information of the respondents in the pretesting

Variables	Number (N)	Percent (%)
Gender		
Male	8	50.0
Female	8	50.0

Table 5.1 Continued.

Variables	Number (N)	Percent (%)
Age group (years)		
21 – 30	5	31.3
31 – 40	7	43.8
41 – 50	4	25.0
Position		
Professor	1	6.3
Associate Professor	1	6.3
Senior lecturer	2	12.5
Lecturer	5	31.3
Postgraduate student (PhD)	4	25.0
Postgraduate student (Master)	3	18.8
Years of involvement in research		
1 - 5 years	11	68.8
6 - 10 years	4	25.0
More than 10 years	1	6.3
Know about dashboard		
Yes	7	43.8
No	9	56.3

Figure 5.1 shows the total respondents in the pretesting are from different faculties in UMP in order to show the respondents participated come from various research backgrounds. It shows the highest respondents is from Faculty of Computer Systems & Software Engineering (FSKKP) with eight respondents, followed by the respondents from Faculty of Industrial Sciences & Technology (FIST), Faculty of Chemical & Natural Resources Engineering (FKKSA) and Centre for Modern Languages and Human Sciences (CMLHS) with two respondents in each faculties and also one respondent from Faculty of Mechanical Engineering (FKM) and Faculty of Manufacturing Engineering (FKP), respectively.
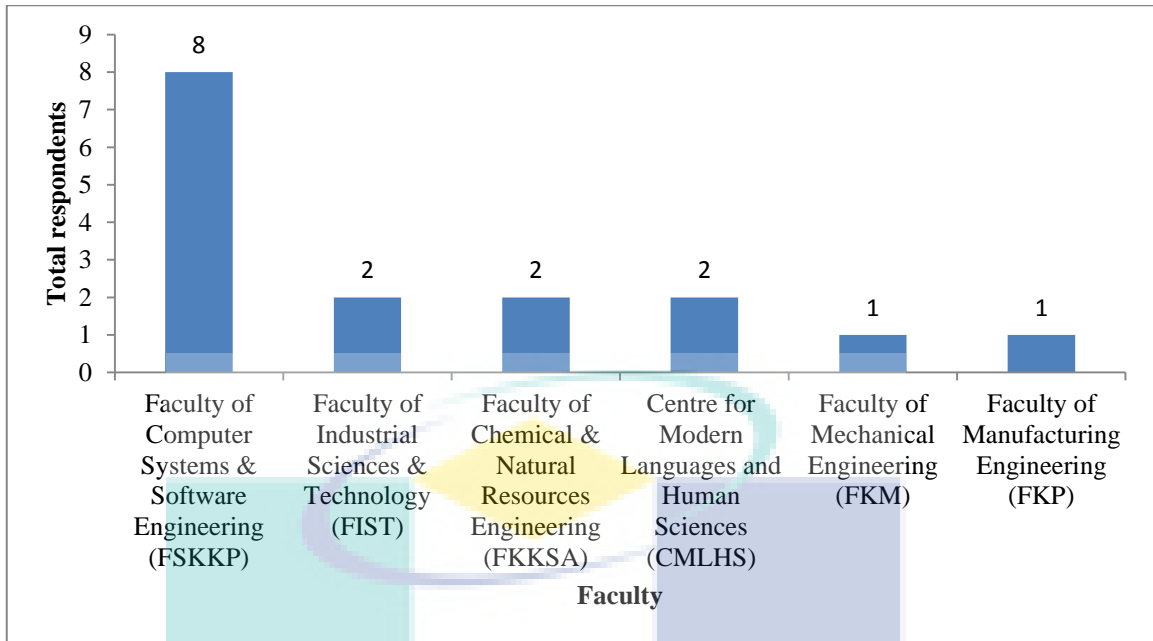
Figure 5.1. Total respondents based on faculties.

All of the respondents have used the SRNS. Among the SRNS options, Google Scholar Citations has been identified as the mostly used with 37.1 %, followed by ResearchGate with 25.7 %, Academia.edu with 25.7 % and Mendeley with 11.4 %, as shown in Figure 5.2.
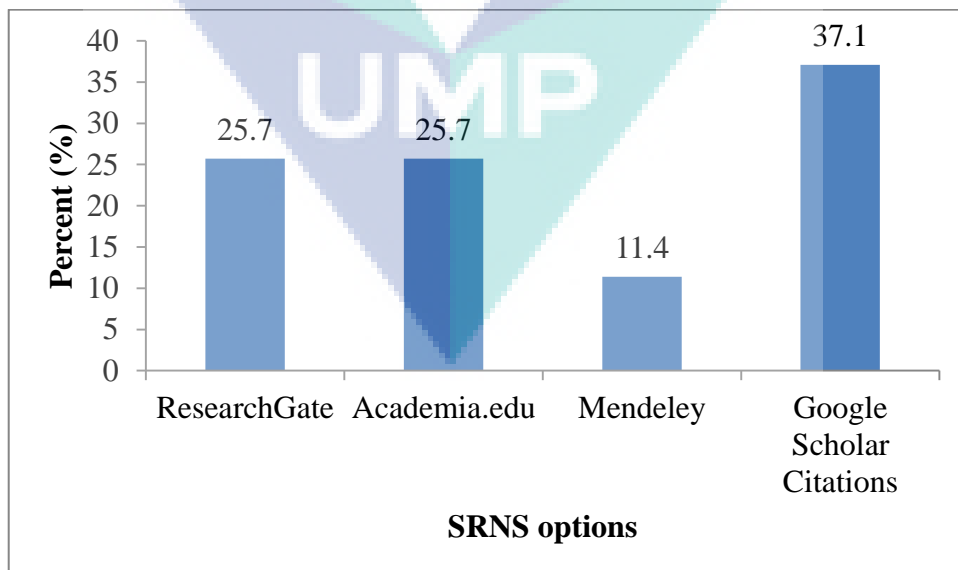
Figure 5.2. Percentage of respondents use Social Research Network Sites options in the pretesting.

Next, the validity of the survey can be check through the pretesting. The validity means to check how well the survey measures what it sets out to measure (Litwin, 1995). In this study, content validity is performed to ensure that the survey contains everything it should and does not include anything that it should not (Litwin, 1995). At the end section of the survey used for the pretesting, there are some questions provided to ask feedback from the respondents about the content of the survey as shown in Table 3.3 (Section 3.3.3.1). The feedback questions are measured by using five-point scales (question number 1 – 3 as shown in Table 3.3). This type of questions produces ordinal data, which means the data can be ordered. In order to analyze these questions, median and Interquartile Range (IQR) is used (Manikandan, 2011). The median is a measure of central tendency, and it shows what most of the respondents seem to believe, or the 'likeliest' response. While the IQR is a measure of dispersion, and it shows whether the responses are clustered together or scattered across the range of possible responses. A small IQR means of consensus, thus the findings should emphasize on the median. While a large IQR means the opinion is polarized, thus the dissonance of opinion should be emphasized (Kostoulas, 2014). Table 5.2 shows the results content validity of the survey and it is discussed as follow:

i. The findings for the question number 1 show: nine respondents agreed that majority of the questions in the instrument are self-explanatory to the target respondents, the other five respondents agreed that some of the questions are self-explanatory and only two respondents agreed that all of the questions are self-explanatory. The findings show the value of median = 4 and IQR = 1. Since the IQR value is small, it means the opinion is consensus. The conclusions based on the feedback given by the respondents is majority of the questions in the instrument are self-explanatory to the target respondents.

ii. The findings for the question number 2 show: ten respondents agreed that majority of the questions in the instrument are suitable to the target respondents, the other four respondents agreed that some of the questions are suitable and only two respondents agreed that all of the questions are suitable. The findings show the value of median = 4 and IQR = 1. Since the IQR value is small, it means the opinion is consensus. The conclusions based on the feedback given by

the respondents is majority of the questions in the instrument are suitable to the target respondents.

iii.   The findings for the question number 3 show: seven respondents agreed that most extent of the instrument is valid to be used to investigate perception of researchers towards dashboard items in the SRNS, five respondents agreed that some extent of the instrument is valid, three respondents agreed that the instrument is valid and only one respondent agreed that certain extent of the instrument is valid. The findings show the value of median = 4 and IQR = 1. Since the IQR value is small, it means the opinion is consensus. The conclusion based on the feedback given by the respondents is the instrument, to the most extent, can be considered valid to be used to investigate perception of researchers towards dashboard items in the SRNS.

Table 5.2
Findings on content validity of the survey

Questions in the feedback form	Responses	Frequency	Median	Interquartile Range (IQR)
1. Are the questions in the instrument self-explanatory to the target respondents?	(1) No	0	4	1
	(2) Yes to only a few	0		
	(3) Yes to some	5		
	(4) Yes to majority	9		
	(5) Yes to all	2		
2. The suitability of questions to the target respondents?	(1) Not suitable	0	4	1
	(2) Suitable for a few questions	0		
	(3) Suitable for some questions	4		
	(4) Suitable for majority questions	10		
	(5) Suitable for all questions	2		

Table 5.2 Continued.

Questions in the feedback form	Responses	Frequency	Median	Interquartile Range (IQR)
3. Do you think the instrument is a valid instrument to be used to investigate perception of researchers towards dashboard items in Social Research Network Sites (SRNS)?	(1) No	0	4	1
	(2) Yes to certain extent only	1		
	(3) Yes to some extent	5		
	(4) Yes to most extent	7		
	(5) Yes	3		

In the feedback form, open-ended question is also included in order to ask recommendation from the respondents to improve the survey (question number 4 as shown in Table 3.3). From the analysis of respondents' feedback, several changes were made to improve the survey as shown in Table 5.3.

Table 5.3
Changes in the survey after pretesting

Survey questions	Before pretesting	After pretesting
Question number 2	Choice of answer for age group: • 21-30 • 31-40 • 41-50 • 51-60	Added choice of answer for age group: • 61 and above
Question number 11	Top influences of researcher tend to have many co-authors	Deleted the question because the researchers did not understand with the sentences

From the outcomes of the pretesting of the survey, it can be conclude that the survey is valid and successful in meeting its objectives to assess perceptions of the researchers towards dashboard items in the SRNS.

5.3 Survey Results and Analysis

The purpose of the survey is to collect the perceptions of the researchers towards the dashboard items that are identified based on analysis from literature studies and by review on the current SRNS as discussed in Section 4.3. The explanation about the survey implementation is discussed in Section 3.3.3.2. The survey is distributed using two approaches which are manually distributed hardcopy survey and link of online survey sent via email address of the respondents. The researchers participated in the survey consist of academic staffs and postgraduate students that have been involved in doing the research and come from universities in Malaysia. The survey took about three months (from August 2014 to November 2014) to accomplish due to time constraints of the researchers. During the data collection process, there is some problem found related to distribution of the survey through email where 4 % of the email address of the respondents tends to be either invalid or inaccessible.

A total of 203 survey received is used for analysis purposes in this study. The number of collected survey which is 203 is lower than the required number of sample size in this study which is 385 as discussed in Section 3.3.3.2. As we plan to perform the factor analysis to analyze the survey result in order to group the dashboard items, we follow the general guideline of sample size by Tabachnick and Fidell (1996) which recommend that 50 sample as very poor, 100 as poor, 200 as fair, 300 as good, 500 as very good, and 1 000 as excellent. Thus, the 203 sample in this study can be considered as enough.

The survey data is analyzed using a statistical program, Statistical Package for the Social Sciences (SPSS). The analysis of the survey data using statistical methods are conducted which are descriptive statistic to discuss on the respondents background, factor analysis to group the dashboard items, calculating Cronbach's coefficient alpha to check the internal consistency reliability of questions in the survey and independent sample t-test to analyze differences in perceptions of dashboard items between senior and junior researchers.

5.3.1   Background Information of Respondents in the Actual Survey

The respondents participated in the actual survey are academic researchers come from universities in Malaysia. Table 5.4 shows the background information of the respondents according to gender, age group, position and years of involvement in research. In terms of gender, 59.6 % are male respondents while 40.4 % respondents are female. In terms of age group, majority of the respondents is in age range of 31 - 40 years, amounting to 37.9 %. The other respondents are in age range of 21 - 30 years (33.5 %), age range of 41 - 50 years (14.3 %) and age range of 51 - 60 years (13.3 %). Only a small percentage of 1.0 % is in age range of 61 years and above. In terms of position, the total percentage of academic staffs with 54.2 % is higher than the total percentage of the postgraduate students with 45.8 %. In the academic staffs group, majority of the respondents are senior lecturers (18.2 %), followed by lecturers (15.8 %), associate professors (10.8 %) and professors (9.4 %). While in the postgraduate students group, majority of the respondents are Master students (25.6 %) and followed by PhD students (20.2 %). For years of involvement in research, majority of respondents involved in research is in the range of 1 - 5 years (61.1 %), followed by more than 10 years (21.2 %) and 6 - 10 years (17.7 %).

Table 5.4

Background information of the respondents participated in the actual survey

Variables	Number (N)	Percent (%)
Gender		
Male	121	59.6
Female	82	40.4
Age group (years)		
21 – 30	68	33.5
31 – 40	77	37.9
41 – 50	29	14.3
51 – 60	27	13.3
61 and above	2	1.0
Position		
Professor	19	9.4
Associate Professor	22	10.8
Senior lecturer	37	18.2
Lecturer	32	15.8
Postgraduate student (PhD)	41	20.2
Postgraduate student (Master)	52	25.6

Table 5.4 Continued.

Variables	Number (N)	Percent (%)
Years of involvement in research		
1 - 5 years	124	61.1
6 - 10 years	36	17.7
More than 10 years	43	21.2

Figure 5.3 shows the percentage of respondents use the SRNS. Majority of the respondents have used the SRNS with 99 %.
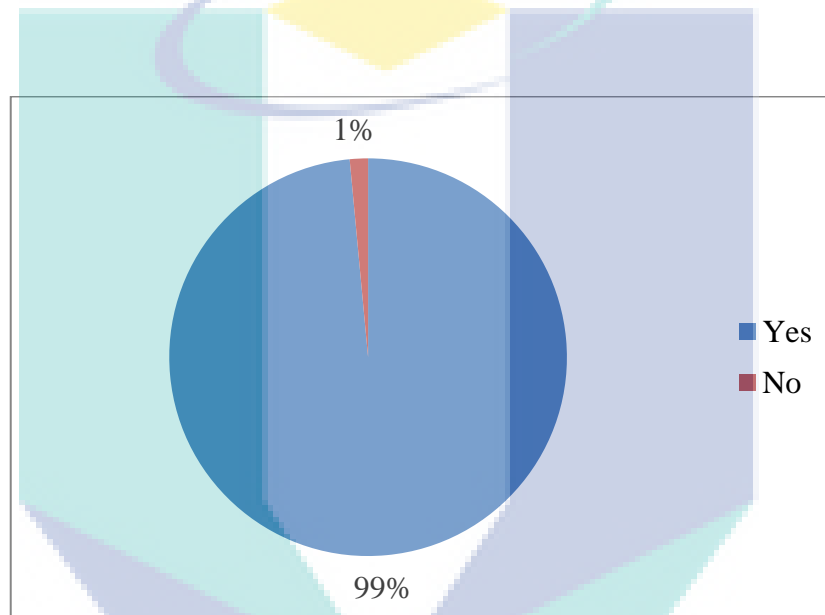
Figure 5.3. Percentage of respondents use Social Research Network Sites.

Figure 5.4 shows the percentage of respondents use the SRNS options. The Google Scholar Citations option has been identified as the mostly used with 40 %, followed by ResearchGate with 24 %, Academia.edu with 20.4 %, Mendeley with 13.8 % and lastly is the other SRNS options with 0.7 %. For example of the other SRNS options that are mentioned by the respondents are SSRN.com, Scival Experts and Mygrants.
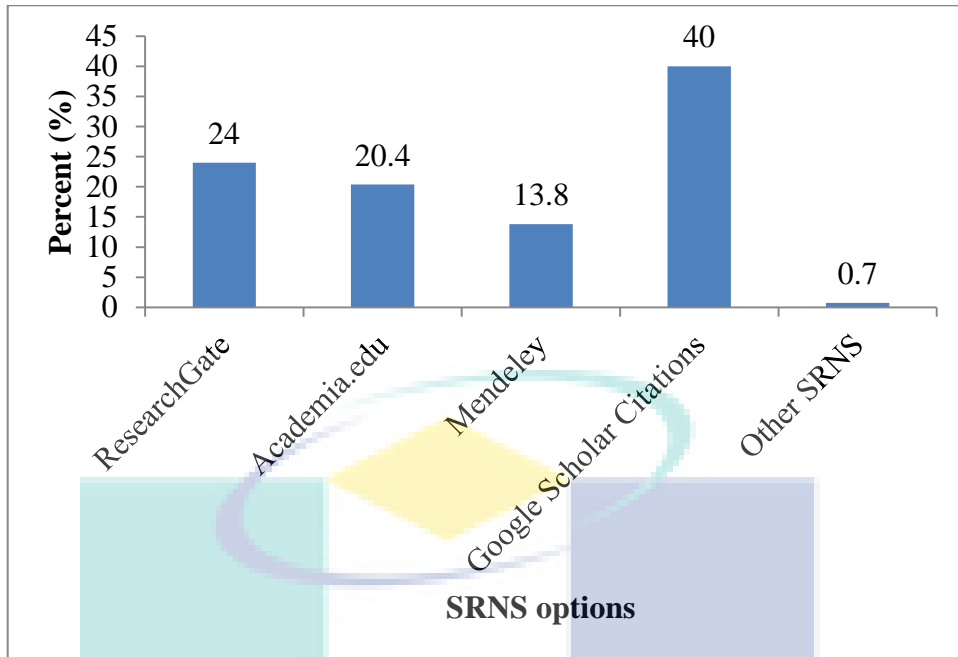
Figure 5.4. Percentage of respondents use Social Research Network Sites options.

Figure 5.5 shows the percentage of respondents know about dashboard. There are only 29 % of the respondents know about the dashboard.
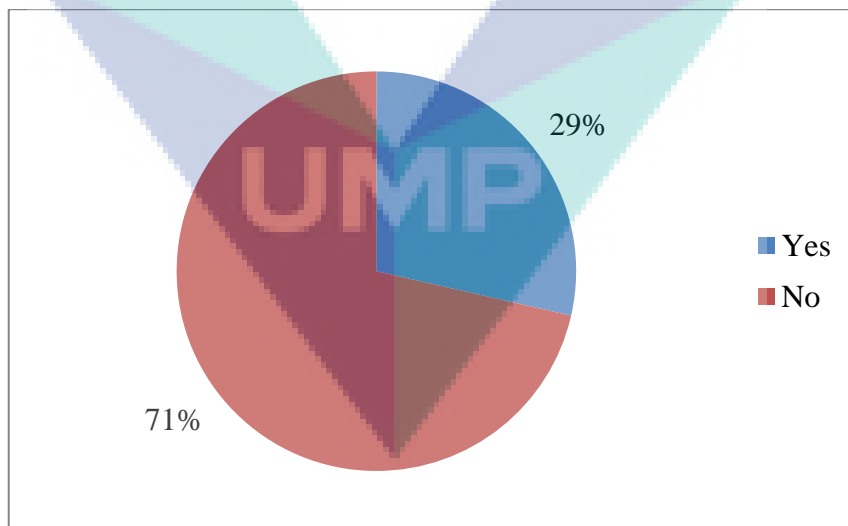
Figure 5.5. Percentage of respondents know about dashboard.

5.3.2 Grouping of Dashboard Items Using Factor Analysis

The survey data is analyzed using factor analysis to group the dashboard items based on purposes. Bryman and Cramer's study as cited in Parsian (2009) found that the factor analysis is a technique that tries to group variables with similar characteristics together, and a small number of factors can be produced from a large number of variables. There are two types of the factor analysis which are Confirmatory Factor Analysis (CFA) and Exploratory Factor Analysis (EFA). In this study, the EFA is used to examine the inter-correlations between all variables. Then, the EFA is used to reduce the data into a smaller number of factors. The factors produced by factor analysis can then be used as input for further step to develop the dashboard information model.

Initially, the factorability of the 18 questions in the survey related to the dashboard items is examined. The factorability is performed in order to check whether our data is suitable to perform factor analysis. Firstly, we need to do is to look over the Correlation Matrix to ensure we have correlation coefficients greater than 0.3 in magnitude. If we do not have any correlations over 0.3 it might indicate factor analysis is not appropriate to perform. As shown in Table 5.5, there are quite a number of correlations greater than 0.3 which tentatively suggests factor analysis is appropriate to perform in this study.

Table 5.5
Correlation matrix

	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27
Q10	1.000	0.665	0.512	0.409	0.429	0.524	0.485	0.464	0.471	0.390	0.415	0.432	0.515	0.405	0.427	0.390	0.406	0.382
Q11	0.665	1.000	0.689	0.539	0.458	0.581	0.583	0.620	0.475	0.439	0.458	0.427	0.567	0.471	0.521	0.552	0.534	0.500
Q12	0.512	0.689	1.000	0.555	0.518	0.622	0.502	0.470	0.462	0.430	0.462	0.451	0.585	0.499	0.506	0.516	0.580	0.489
Q13	0.409	0.539	0.555	1.000	0.441	0.579	0.471	0.465	0.458	0.458	0.508	0.504	0.545	0.421	0.376	0.625	0.518	0.490
Q14	0.429	0.458	0.518	0.441	1.000	0.693	0.572	0.510	0.431	0.376	0.515	0.560	0.607	0.499	0.504	0.438	0.553	0.511
Q15	0.524	0.581	0.622	0.579	0.693	1.000	0.651	0.611	0.578	0.499	0.590	0.547	0.650	0.562	0.570	0.532	0.554	0.553
Q16	0.485	0.583	0.502	0.471	0.572	0.651	1.000	0.710	0.593	0.540	0.613	0.651	0.583	0.529	0.561	0.576	0.581	0.592

Table 5.5 Continued.

	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27
Q17	0.464	0.620	0.462	0.531	0.510	0.611	0.710	1.000	0.619	0.499	0.619	0.599	0.569	0.482	0.597	0.609	0.588	0.626
Q18	0.471	0.475	0.470	0.465	0.431	0.578	0.593	0.619	1.000	0.767	0.779	0.712	0.607	0.583	0.580	0.524	0.552	0.588
Q19	0.390	0.439	0.430	0.458	0.376	0.499	0.540	0.499	0.767	1.000	0.742	0.704	0.492	0.545	0.609	0.503	0.489	0.507
Q20	0.415	0.458	0.462	0.508	0.515	0.590	0.613	0.619	0.779	0.742	1.000	0.845	0.619	0.632	0.674	0.540	0.569	0.585
Q21	0.432	0.427	0.451	0.504	0.560	0.547	0.651	0.599	0.712	0.704	0.845	1.000	0.639	0.657	0.644	0.560	0.561	0.611
Q22	0.515	0.567	0.585	0.545	0.607	0.650	0.583	0.569	0.607	0.492	0.619	0.639	1.000	0.644	0.544	0.589	0.602	0.640
Q23	0.471	0.405	0.471	0.499	0.421	0.499	0.562	0.529	0.583	0.545	0.632	0.657	0.644	1.000	0.729	0.570	0.589	0.590

Table 5.5 Continued.

	Q24	Q25	Q26	Q27
Q10	0.427	0.390	0.406	0.382
Q11	0.521	0.552	0.534	0.500
Q12	0.506	0.516	0.580	0.489
Q13	0.376	0.625	0.518	0.490
Q14	0.504	0.438	0.553	0.511
Q15	0.570	0.532	0.554	0.553
Q16	0.561	0.576	0.581	0.592
Q17	0.597	0.609	0.588	0.626
Q18	0.580	0.524	0.552	0.588
Q19	0.609	0.503	0.489	0.507
Q20	0.674	0.540	0.569	0.585
Q21	0.644	0.560	0.561	0.611
Q22	0.544	0.589	0.602	0.640
Q23	0.729	0.570	0.589	0.590
Q24	1.000	0.665	0.682	0.696
Q25	0.665	1.000	0.780	0.771
Q26	0.682	0.780	1.000	0.876
Q27	0.696	0.771	0.876	1.000

Secondly, the value of Kaiser-Meyer Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test is checked. The first statistical test, KMO is used to examine sample sufficiency. Kaiser's study as cited in Parsian (2009) recommends that KMO values should be greater than 0.5 for a satisfactory factor analysis to proceed. The KMO values between 0.5 and 0.7 describes as mediocre; values between 0.7 and 0.8 as good; values between 0.8 and 0.9 as great and values above 0.9 are superb. As shown in Table 5.6, the KMO value is 0.926, which falls into the range of being superb, and it indicates that the data is suitable for the factor analysis. The second statistical test, Bartlett's test is used to indicate strength of the relationship among variables. The Bartlett's test of sphericity is significant if it is less than 0.05. As shown in Table 5.6, the Bartlett's test is significant with Sig. value of 0.000 which is less than 0.05, and it indicates that the data is suitable for the factor analysis. Both results of the two statistical tests, the KMO and Bartlett's Test in this study shows that it is satisfied to conduct the factor analysis.

Table 5.6
KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.926
Bartlett's Test of Sphericity	Approx. Chi-Square	3118.011
	df	153
	Sig.	0.000

Lastly, the value of anti-image correlation matrix is checked as shown in Table 5.7. It shows that the diagonals value of the anti-image correlation matrix that has been highlighted is all above 0.5. Thus, it supports the inclusion of each item in the factor analysis.

Table 5.7

Anti-image correlation matrix

	Q10	Q11	Q12	Q13	Q14	Q15	Q16
Q10	0.927[a]	-0.429	0.029	-0.010	-0.018	-0.100	-0.025
Q11	-0.429	0.908[a]	-0.393	-0.080	0.035	0.053	-0.125
Q12	0.029	-0.393	0.927[a]	-0.168	-0.032	-0.182	0.012
Q13	-0.010	-0.080	-0.168	0.912[a]	0.008	-0.215	0.143
Q14	-0.018	0.035	-0.032	0.008	0.926[a]	-0.396	-0.030
Q15	-0.100	0.053	-0.182	-0.215	-0.396	0.934[a]	-0.207
Q16	-0.025	-0.125	0.012	0.143	-0.030	-0.207	0.956[a]
Q17	0.065	-0.274	0.167	-0.137	-0.030	-0.069	-0.315
Q18	-0.154	-0.125	-0.061	0.104	0.130	-0.094	-0.072
Q19	0.049	0.089	0.009	-0.115	0.078	-0.011	0.036
Q20	0.106	-0.016	0.069	-0.103	0.225	-0.094	0.010
Q21	-0.119	0.180	-0.038	-0.087	-0.218	-0.080	-0.216
Q22	-0.108	-0.066	-0.122	-0.031	-0.181	-0.088	0.028
Q23	0.059	-0.038	0.002	-0.017	0.034	-0.073	-0.020
Q24	-0.075	-0.045	-0.085	0.319	0.151	-0.092	0.106
Q25	0.063	-0.071	0.068	-0.380	-0.225	0.032	-0.091
Q26	-0.039	0.039	-0.249	-0.007	-0.052	0.126	-0.048
Q27	0.084	-0.001	0.159	0.044	0.088	-0.068	0.001

a. Measures of Sampling Adequacy (MSA)

Table 5.7 Continued.

	Q17	Q18	Q19	Q20	Q21	Q22	Q23
Q10	0.065	-0.154	0.049	0.106	-0.119	-0.108	0.059
Q11	-0.274	0.089	-0.089	0.180	-0.066	-0.038	
Q12	0.167	-0.061	0.009	-0.016	-0.122	0.002	
Q13	-0.137	0.104	-0.115	0.069	-0.031	-0.017	
Q14	-0.030	0.130	0.078	0.036	-0.181	0.034	
Q15	-0.069	-0.094	-0.011	-0.094	-0.087	-0.088	-0.073
Q16	-0.315	0.010	-0.072	0.036	-0.030	0.028	-0.020
Q17	0.937[a]	-0.209	0.172	-0.070	0.014	0.003	0.160
Q18	-0.209	0.926[a]	-0.445	-0.293	-0.098	-0.098	-0.424
Q19	0.172	-0.445	0.931[a]	-0.132	-0.173	0.092	0.058
Q20	-0.070	-0.293	-0.132	0.926[a]	-0.506	-0.077	-0.098
Q21	-0.030	0.014	-0.173	-0.506	0.914[a]	-0.076	-0.185
Q22	0.003	-0.098	0.092	-0.077	-0.076	0.956[a]	-0.263
Q23	0.160	-0.206	0.058	-0.216	-0.185	-0.263	0.939[a]
Q24	-0.169	0.175	-0.098	-0.117	0.164	0.106	-0.064
Q25	-0.046	0.028	-0.025	0.115	-0.041	-0.083	-0.008
Q26	0.038	-0.009	0.012	-0.117	0.106	0.188	-0.424
Q27	-0.091	-0.109	0.053	0.129	-0.158	-0.216	0.078

a. Measures of Sampling Adequacy (MSA)

Table 5.7 Continued.

	Q24	Q25	Q26	Q27
Q10	-0.075	0.063	-0.039	0.084
Q11	-0.045	-0.071	0.039	-0.001
Q12	-0.085	0.068	-0.249	0.159
Q13	0.319	-0.380	-0.007	0.044
Q14	-0.052	0.151	-0.225	0.088
Q15	-0.092	0.032	0.126	-0.068
Q16	0.106	-0.091	-0.048	0.001
Q17	-0.169	-0.046	0.038	-0.091
Q18	0.175	0.028	-0.009	-0.109
Q19	-0.206	-0.025	0.012	0.053
Q20	-0.216	0.115	-0.117	0.129
Q21	0.016	-0.041	0.164	-0.158
Q22	0.188	-0.083	0.106	-0.216
Q23	-0.424	-0.008	-0.064	0.078
Q24	0.910[a]	-0.229	-0.024	-0.165
Q25	-0.229	0.940[a]	-0.271	-0.156
Q26	-0.024	-0.271	0.900[a]	-0.642
Q27	-0.165	-0.156	-0.642	0.907[a]

a. Measures of Sampling Adequacy (MSA)

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The 18 questions in the survey related to the dashboard items are factor analyzed using Principal Component Analysis as extraction method and Varimax as rotation technique. The Principal Component Analysis goal is to reduce the measured variables to a smaller set of composite components. The Varimax is an orthogonal rotation technique which maximizes the variances of loadings on the new axes. The eigenvalues and scree plot are used to determine how many factors to retain. As shown in Table 5.8, there are three factors extracted with eigenvalues greater than one.

Table 5.8
Total variance explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.502	58.345	58.345	4.493	24.963	24.963
2	1.273	7.071	65.417	4.468	24.820	49.783
3	1.021	5.672	71.089	3.835	21.306	71.089
4	0.752	4.179	75.267			
5	0.683	3.795	79.062			
6	0.642	3.564	82.626			
7	0.459	2.550	85.176			
8	0.425	2.364	87.540			
9	0.379	2.104	89.644			
10	0.339	1.886	91.530			
11	0.309	1.715	93.245			
12	0.253	1.406	94.651			
13	0.225	1.250	95.901			
14	0.194	1.080	96.981			
15	0.178	0.990	97.971			
16	0.148	0.822	98.793			
17	0.130	0.725	99.518			
18	0.087	0.482	100.000			
Extraction Method: Principal Component Analysis.						

As shown in Figure 5.6, the fourth factor has an eigenvalue of less than one. Thus, only three factors have been retained.
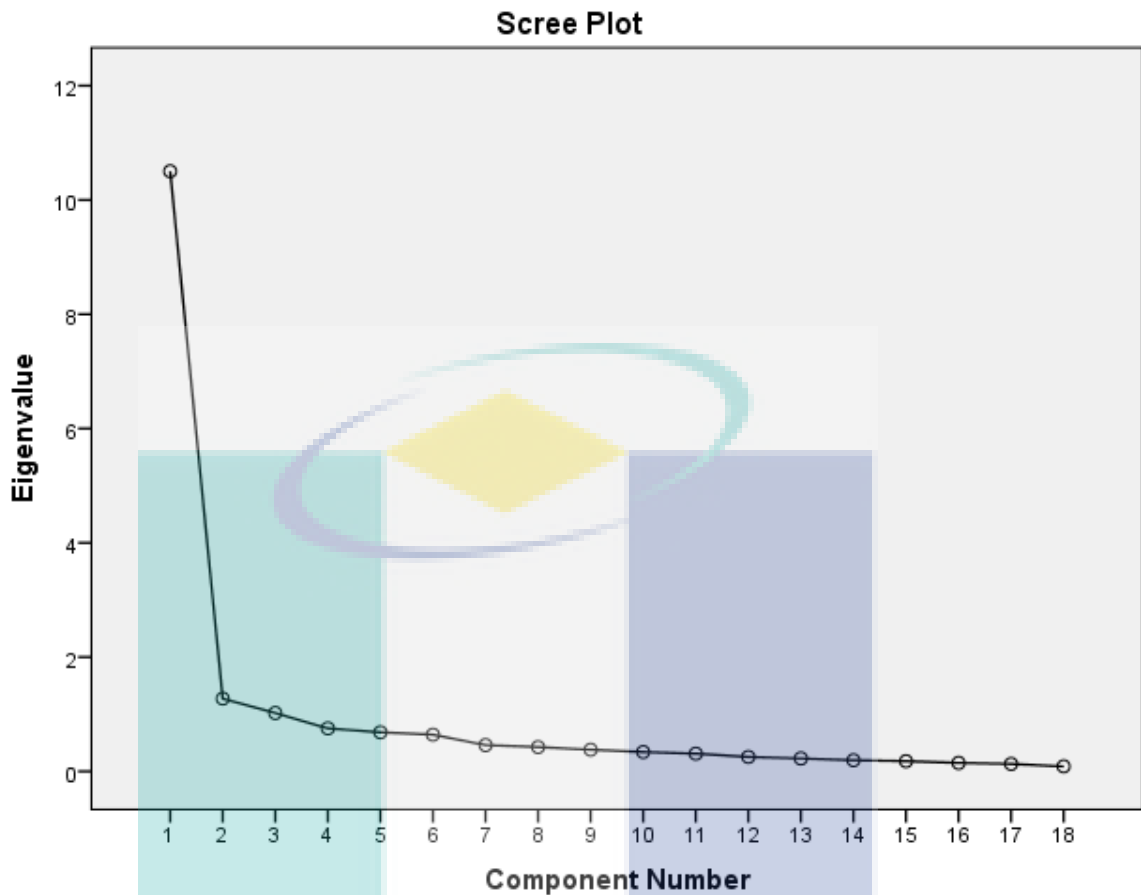
Figure 5.6. Scree plot.

Table 5.9 shows the factor loadings after rotation and is used to interpret the factors. Before beginning interpretation, we need to check for cross-loadings. A cross-loading is an item with factor loading greater than 0.4 load on more than one factor. In this study, there are five items been highlighted because they are items cross-loading which are Q23, Q22, Q16, Q17 and Q24. Firstly, item Q23 has factor loading 0.551 and 0.475 load on Factor 1 and 3, respectively. Secondly, item Q22 has factor loading 0.425, 0.554 and 0.406 load on Factor 1, 2 and 3, respectively. Thirdly, item Q16 has factor loading 0.485 and 0.524 load on Factor 1 and 2, respectively. Fourthly, item Q17 has factor loading 0.438, 0.498 and 0.417 load on Factor 1, 2 and 3, respectively. Lastly, item Q24 has factor loading 0.531 and 0.600 load on Factor 1 and 3, respectively. This would suggest they are poor / unreliable items and may need to be deleted from the analysis. In this study, we decided to delete the five items cross-loading (Q23, Q22, Q16, Q17 and Q24). Thus, we need to re-run factor analysis without the offending items.

Table 5.9
Rotated component matrix

Rotated Component Matrix[a]			
	Component		
	1	2	3
Q20	0.833	0.281	0.288
Q19	0.815	0.228	0.202
Q21	0.797	0.279	0.320
Q18	0.790	0.324	0.236
Q23	0.551	0.296	0.475
Q11	0.174	0.800	0.277
Q10	0.256	0.767	0.036
Q12	0.169	0.730	0.329
Q15	0.382	0.682	0.296
Q13	0.240	0.571	0.370
Q14	0.311	0.570	0.323
Q22	0.425	0.554	0.406
Q16	0.485	0.524	0.349
Q17	0.438	0.498	0.417
Q26	0.266	0.333	0.828
Q27	0.341	0.263	0.825
Q25	0.264	0.333	0.791
Q24	0.531	0.262	0.600
Extraction Method: Principal Component Analysis.			
Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 6 iterations.			

A Principal Component Analysis with Varimax rotation is conducted on the 13 questions in the survey related to the dashboard items. Table 5.10 shows the rotated factor loadings after deleting the five items cross-loadings (Q23, Q22, Q16, Q17 and Q24). There are three factors extracted explaining 74.261 % of total variance, where the first factor explained 25.801 % of the variance; the second factor explained 25.174 % of the variance; and the third factor explained 23.287 % of the variance. The items that are suitable to load on each factor have been highlighted.

Table 5.10
Result of re-run factor analysis

Questions in the survey related to the dashboard items		Factor		
		1	2	3
Q20	I want to know which institution cites my publication	0.838	0.273	0.300

Table 5.10 Continued.

Questions in the survey related to the dashboard items		Factor		
		1	2	3
Q19	I want to know academic status of readers who cites my publication	0.829	0.234	0.216
Q18	I want to know discipline type of readers who cites my publication	0.799	0.312	0.249
Q21	I want to know which country cites my publication	0.793	0.265	0.332
Q11	I want to see total number of publications	0.175	0.802	0.283
Q10	I want to see co-authors list	0.261	0.778	0.044
Q12	I want to see publications category list	0.175	0.749	0.334
Q15	I want to know my top publication papers	0.378	0.671	0.311
Q13	I want to see impact factor of a journal paper	0.259	0.562	0.386
Q14	I want to see citations graph by year in my publication	0.304	0.554	0.341
Q26	I want to see upcoming conference based on my research domain	0.268	0.325	0.839
Q27	I want to see related journal based on my research domain	0.341	0.242	0.836
Q25	I want to know about publication platform based on my research domain	0.266	0.321	0.801
Eigenvalues		3.612	3.524	3.260
Percentage of variance (%)		25.801	25.174	23.287
Total variance (%)		74.261		

Table 5.11 shows the interpretation on result of re-run factor analysis. In order to aid interpretation, the column of "Questions in the survey related to the dashboard items" in Table 5.10 has been changed into column of "Dashboard items" in Table 5.11. Then, we look at the dashboard items that load on the same factor in order to identify common themes.

Factor 1 is formed by four dashboard items which are statistics related to institution of readers in each article (Q20), statistics related to academic status of readers in each article (Q19), statistics related to discipline type of readers (Q18) and

statistics related to country of readers in each article (Q21). Dashboard items that load on the first factor represent publication impact.

Factor 2 is formed by six dashboard items which are total number of publications (Q11), co-authors list (Q10), publications category list (Q12), top publication papers (Q15), impact factor (Q13), and citations graph by year in each article (Q14). Dashboard items that load on the second factor represent publication achievements.

Factor 3 is formed by three dashboard items which are information about upcoming conference publication platforms based on research domain (Q26), information about journals publication platforms based on research domain (Q27) and information publication platforms based on research domain (Q25). Dashboard items that load on the third factor represent alert on upcoming events.

Table 5.11
Interpretation on result of re-run factor analysis

Dashboard items		Factor		
		1	2	3
		Publication impact	Publication achievements	Alert on upcoming events
Q20	Statistics related to institution of readers in each article	0.838		
Q19	Statistics related to academic status of readers in each article	0.829		
Q18	Statistics related to discipline type of readers	0.799		
Q21	Statistics related to country of readers in each article	0.793		
Q11	Total number of publications		0.802	
Q10	Co-authors list		0.778	
Q12	Publications category list		0.749	
Q15	Top publication papers		0.671	
Q13	Impact factor		0.562	
Q14	Citations graph by year in each article		0.554	
Q26	Information about upcoming conference publication platforms based on research domain			0.839

Table 5.11 Continued.

Dashboard items		Factor		
		1	2	3
		Publication impact	Publication achievements	Alert on upcoming events
Q27	Information about journals publication platforms based on research domain			0.836
Q25	Information publication platforms based on research domain			0.801

5.3.3   Internal Consistency Reliability

Internal consistency reliability is an indicator of how well the sets of items measure the same issue (Litwin, 1995). It is most commonly used to determine reliability of the Likert-scale questions in a survey (Radhakrishna, 2007). The internal consistency is measured by calculating a Cronbach's coefficient alpha. The Cronbach's coefficient alpha value of 0.70 or higher is considered acceptable reliability (Radhakrishna, 2007). In this study as shown in Appendix A, the survey questions number 10 – 27 are used to measure perception of the respondents towards the dashboard items. Each question was a 7-point Likert scale from "strongly disagree" to "strongly agree". Based on Table 5.10, the survey questions of dashboard items are grouped into three factors. In order to understand whether the survey questions are reliably measure perception of the respondents towards the dashboard items, a Cronbach's alpha was run.

Table 5.12 shows the reliability statistics for items load on Factor 1 with the value of Cronbach's Alpha is 0.925. Table 5.13 shows the item-total statistics for items load on Factor 1. All values in the column "Cronbach's Alpha if Item Deleted" are less than the Cronbach's Alpha value of Factor 1 which is 0.925. It is noted that none of the items load on Factor 1 would substantially affect reliability if they were deleted.

Table 5.12
Reliability statistics for Factor 1

Cronbach's Alpha	N of items
0.925	4

Table 5.13
Item-total statistics for Factor 1

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q18	16.82	13.863	0.820	0.905
Q19	17.06	12.798	0.797	0.913
Q20	16.80	12.981	0.872	0.887
Q21	16.90	12.842	0.821	0.904

Table 5.14 shows the reliability statistics for items load on Factor 2 with the value of Cronbach's Alpha is 0.877. Table 5.15 shows the item-total statistics for items load on Factor 2. All values in the column "Cronbach's Alpha if Item Deleted" are less than the Cronbach's Alpha value of Factor 2 which is 0.877. It is noted that none of the items load on Factor 2 would substantially affect reliability if they were deleted.

Table 5.14
Reliability statistics for Factor 2

Cronbach's Alpha	N of items
0.877	6

Table 5.15
Item-total statistics for Factor 2

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q10	29.66	24.344	0.628	0.866
Q11	29.40	23.954	0.746	0.845
Q12	29.29	24.799	0.732	0.848
Q13	29.19	24.985	0.620	0.866
Q14	29.44	25.594	0.624	0.865
Q15	29.38	24.485	0.761	0.843

Table 5.16 shows the reliability statistics for items load on Factor 3 with the value of Cronbach's Alpha is 0.926. Table 5.17 shows the item-total statistics for items

load on Factor 3. In the column "Cronbach's Alpha if Item Deleted", there is a value for an item (Q25) higher than the Cronbach's Alpha value of Factor 3 which is 0.926. We need to re-run Cronbach's alpha excluding item Q25.

Table 5.16
Reliability statistics for Factor 3

Cronbach's Alpha	N of items
0.926	3

Table 5.17
Item-total statistics for Factor 3

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q25	11.95	5.681	0.801	0.934
Q26	12.01	5.678	0.879	0.870
Q27	12.05	5.655	0.872	0.876

Table 5.18 shows the re-run reliability statistics after deleting item Q25 on Factor 3 with the value of Cronbach's Alpha is 0.934.

Table **5.19** shows the re-run item-total statistics after deleting item Q25 on Factor 3.

Table 5.18
Re-run reliability statistics for Factor 3

Cronbach's Alpha	N of items
0.934	2

Table 5.19
Re-run item-total statistics for Factor 3

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q26	5.96	1.528	0.876	
Q27	6.00	1.500	0.876	

The values of Cronbach's Alpha for the items are as follows: 0.925 for Factor 1 (Table 5.12), 0.877 for Factor 2 (Table 5.14) and 0.934 for Factor 3 (Table 5.18).

Hence, we can conclude that all the items in the three factors have high internal consistency.

The importance of the items in each factor can be determined by calculating the Cronbach's Alpha after item is deleted. It is noted that when any of the item is deleted in Factor 1 and Factor 2, the Cronbach's Alpha value decreased, as can be seen in Table 5.13 and Table 5.15. However, when item Q25 is deleted in Factor 3, the Cronbach's Alpha value increased, as can be seen in Table 5.17. Hence, it can be concluded each item in the three factors except item Q25 is essential to be used to collect perception of the respondents towards the dashboard items.

5.3.4 Differences in Perception of Dashboard Items between Senior and Junior Researchers

The respondents can be categorized into two different groups which are senior and junior researchers. The senior researcher is define for those who is: 1) already in possession of a doctoral degree; and 2) have been involved more than five years in doing the research (Abrizah et al., 2014; Department of Materials Science & Metallurgy, n.d.). In this study, we need to find out whether there is a different perception towards the dashboard items between the senior and junior researchers. It can be analyzed using independent samples t-test.

The independent samples t-test is one type of t-test. The t-test is often used to compare the means from two different groups of data. It can help us find out if means are significantly different from one another or if they are relatively the same. If the means are significantly different, the Independent Variable (IV) had an effect on the Dependent Variable (DV). The independent samples t-test is used to compare groups of the respondents that are not related in any way. The groups are independent from one another. Therefore, respondents in one group have no relationship to the respondents in the second group. This is sometimes called a between subjects design. The independent samples t-test used in this study to analyze the differences in perception of dashboard items between senior and junior researchers. The independent samples t-test is

conducted to test DV (the mean perception of dashboard items) to IV (groups of researchers).

Table 5.20 shows the differences perception of dashboard items between groups of researchers based on analysis of independent samples t-tests. The recommended respondents' ratios between two groups must be within one to one and a half (1:1.5) to be compared (Liman et al., 2013). The number of respondents (N) for senior researcher is 62 and for junior researcher is 141. Thus, the number of respondents for the two groups of researchers in this study is considered enough to be compared. The mean perception of dashboard items for senior researcher is 5.8333 and for junior researcher is 5.8032. The standard deviation for senior researcher is 0.92304 and for junior researcher is 0.98159. The result of independent samples t-tests shows that $t = 0.205$, $df = 201$, $p = 0.838$. The Sig. (2-Tailed) value of 0.838 is greater than 0.05, which means that there is no statistically significant difference between the mean perception of dashboard items for the senior researcher and junior researcher.

Table 5.20
Differences in perception of dashboard items between group of researchers

Group of researchers	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Senior researcher	62	5.8333	0.92304	0.205	201	0.838
Junior researcher	141	5.8032	0.98159			

After running the independent samples t-test, it was found that there is no different perception towards the dashboard items between the senior and junior researchers. Thus, the proposed dashboard information model can be used to cater needs of the senior and junior researchers.

5.4 Development of Dashboard Information Model for Researchers in the Social Research Network Sites

In this study, the dashboard information model for the researcher in the SRNS is proposed in order to help the researchers aware on the latest information in the research

domain. The idea to design the dashboard information model is appear because there is an issue facing by the researchers while using the SRNS where there are huge amount of information in the SRNS. As a result, the researchers could not notice on the latest information in the research domain.

There are few phases have been done in order to develop the dashboard information model. First of all, the inclusion of the dashboard in the SRNS has been explored to understand its relevancy in supporting the researcher needs. Based on the analysis, the dashboard is identified as a significant tool in assisting the researcher needs on: monitoring their own research performance, monitoring research trends and alerting them with upcoming events. The explanation of the first phase is discussed in Section 3.3.1.

In the second phase, the proposed dashboard items have been identified based on analysis from the literature studies and review on the current SRNS. The dashboard items are selected based on its suitability to satisfy the researcher needs in the dashboard that have been identified in the first phase. The explanation of the second phase is discussed in Section 3.3.2.

In the third phase, the survey has been conducted in order to validate the dashboard items that have been identified in the second phase. The purpose of the survey is to identify perceptions of the researchers towards the dashboard items. The explanation of the third phase is discussed in Section 3.3.3.

The factor analysis has been analyzed using the survey result in order to group the dashboard items. The explanation regarding the grouping of the dashboard items using factor analysis is discussed in Section 5.3.2. Based on the interpretation on result of re-run factor analysis in Table 5.11 (Section 5.3.2) and result of internal consistency reliability in Section 5.3.3, the dashboard items can be divided into three groups which are publication impact, publication achievements and alert on upcoming events. Figure 5.7 shows the groups of dashboard items and it will be used to develop the dashboard information model.
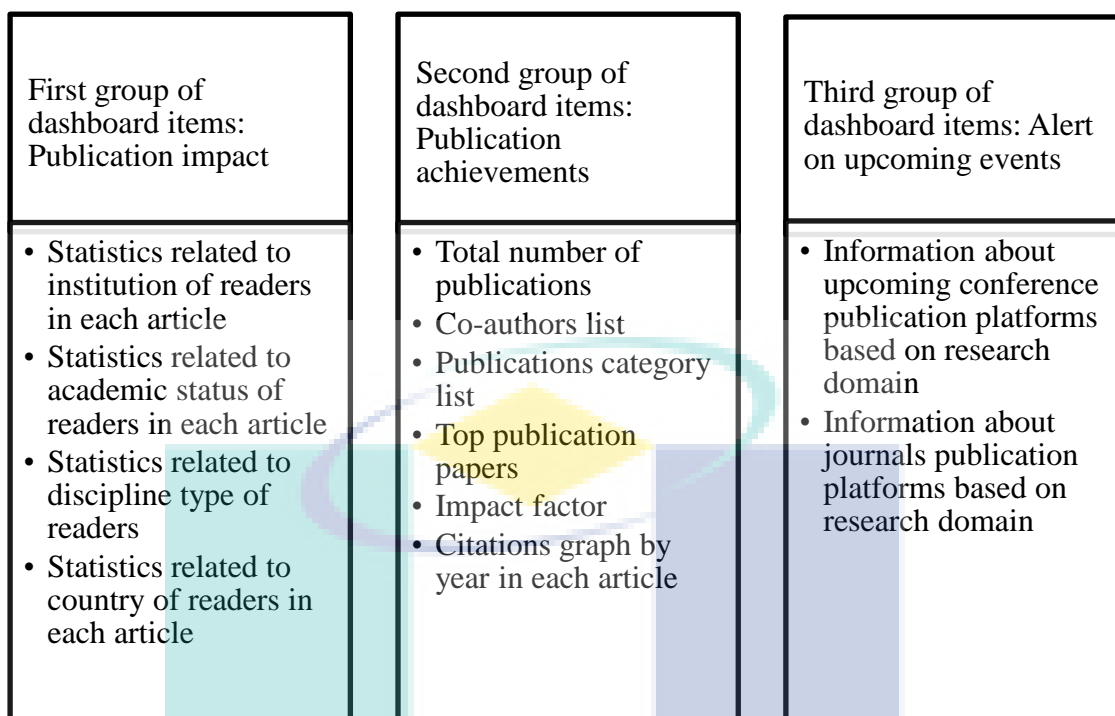
First group of dashboard items: Publication impact	Second group of dashboard items: Publication achievements	Third group of dashboard items: Alert on upcoming events
• Statistics related to institution of readers in each article • Statistics related to academic status of readers in each article • Statistics related to discipline type of readers • Statistics related to country of readers in each article	• Total number of publications • Co-authors list • Publications category list • Top publication papers • Impact factor • Citations graph by year in each article	• Information about upcoming conference publication platforms based on research domain • Information about journals publication platforms based on research domain

Figure 5.7. Groups of dashboard items.

Figure 5.8 shows the dashboard information model for the researchers in the SRNS. There are three dashboard components which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3), that are derived based on the three groups of the dashboard items as shown in Figure 5.7. Next, each three dashboard components including its purpose and dashboard items are going to be described.
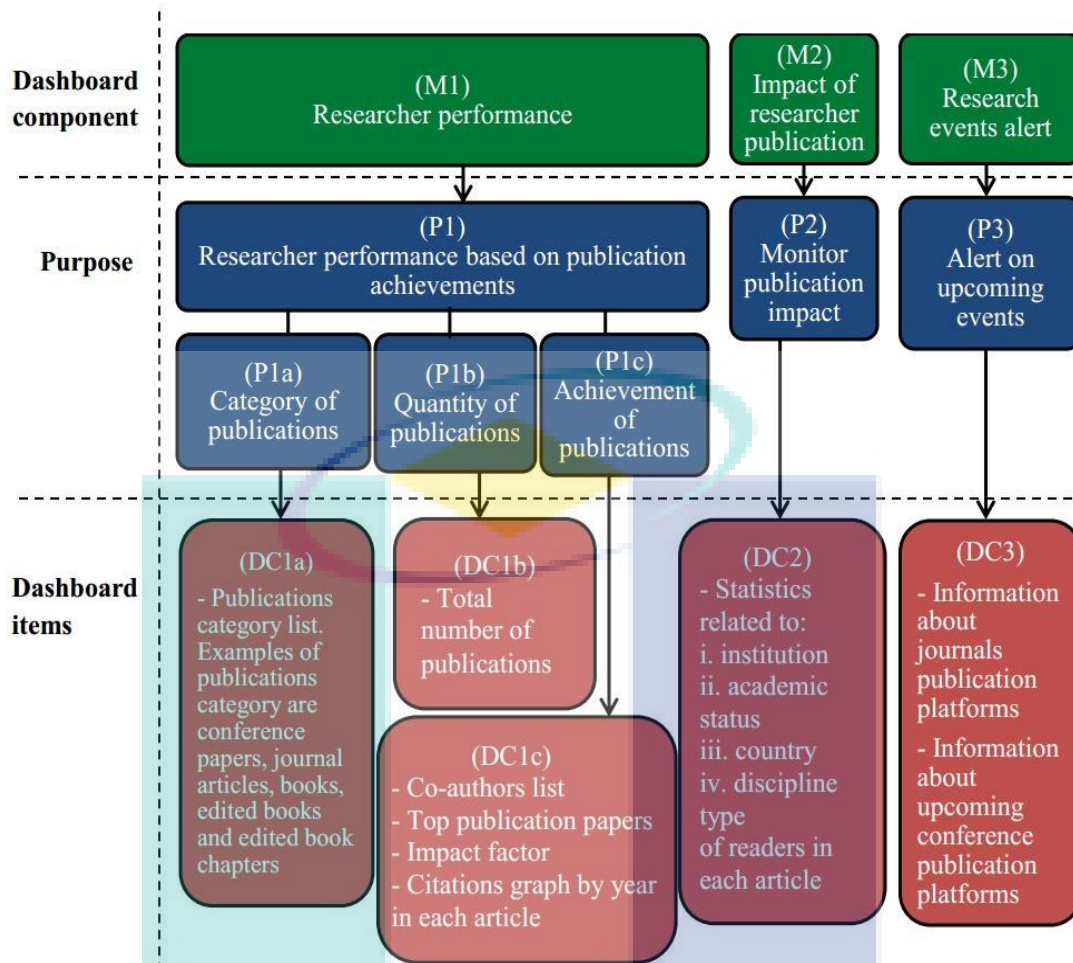
Figure 5.8. Dashboard information model for researchers in Social Research Network Sites.

Figure 5.9 shows the first dashboard component in the dashboard information model which is researcher performance (M1). The purpose of (M1) is to monitor the performance of the researchers based on their own publication achievements (P1). The dashboard items in (M1), derived from the second group of dashboard items as shown in Figure 5.7, can be divided into three distinct purposes, which are category of publications (P1a), quantity of publications (P1b) and achievement of publications (P1c). The dashboard item for category of publications (P1a) are the different types of publications list (DC1a), such as conference papers, journal articles, books, edited books and edited book chapters. The dashboard item for the quantity of publications (P1b) is the total number of publications (DC1b). The dashboard items for achievement of publications (P1c) are the list of co-authors, top publication papers, impact factor and citations graph by year in each article (DC1c). Based on the discussions of dashboard

characteristics in Table 2.3 (Section 2.5), the dashboard characteristic that can be used in the dashboard component (M1) is monitor in order to display dashboard items to monitor the researcher performance.
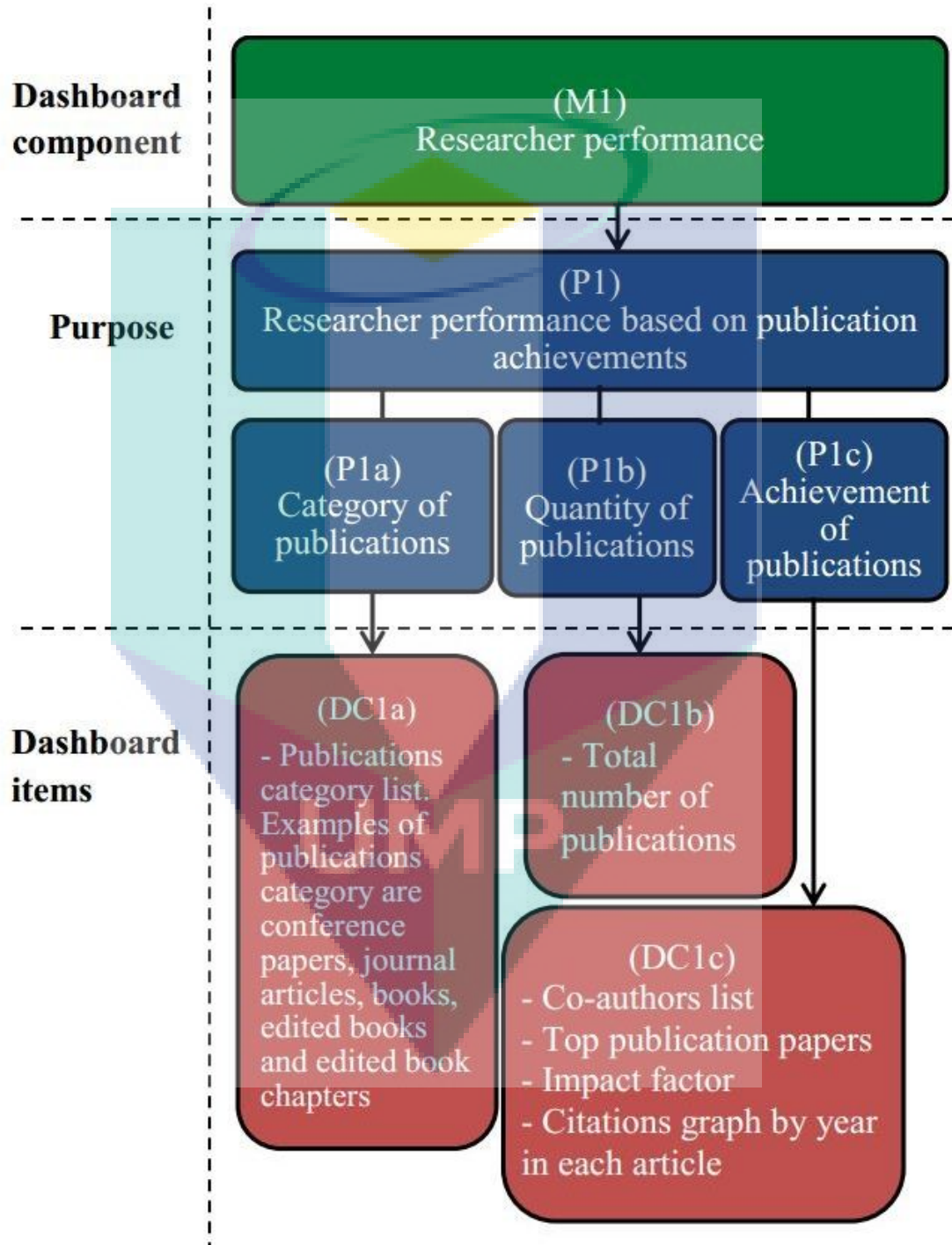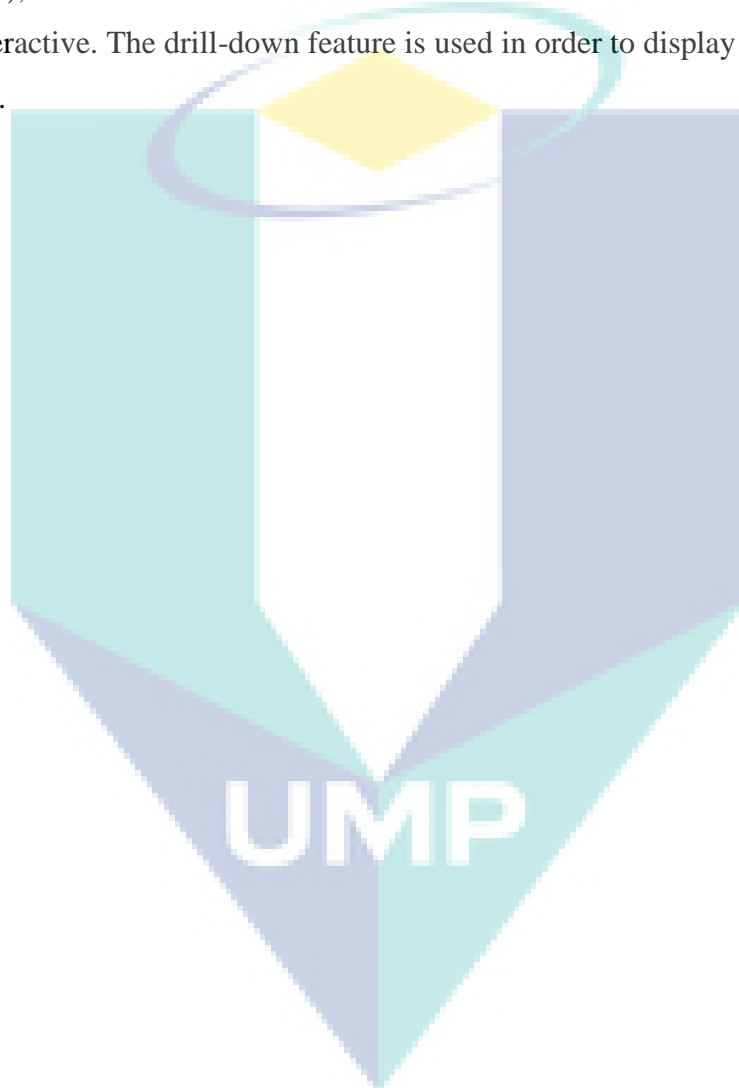

Figure 5.9. Dashboard component researcher performance (M1) in the dashboard information model.

Figure 5.10 shows the second dashboard component in the dashboard information model which is impact of researcher publication (M2). The purpose of (M2) is to enable the researchers to monitor their own publication impact. The dashboard items in (M2), derived from the first group of dashboard items as shown in Figure 5.7, are the statistics related to institution, academic status, country and type of discipline in each article (DC2). Based on the discussions of dashboard characteristics in Table 2.3 (Section 2.5), the dashboard characteristic that can be used in the dashboard component (M2) is interactive. The drill-down feature is used in order to display dashboard items in each article.
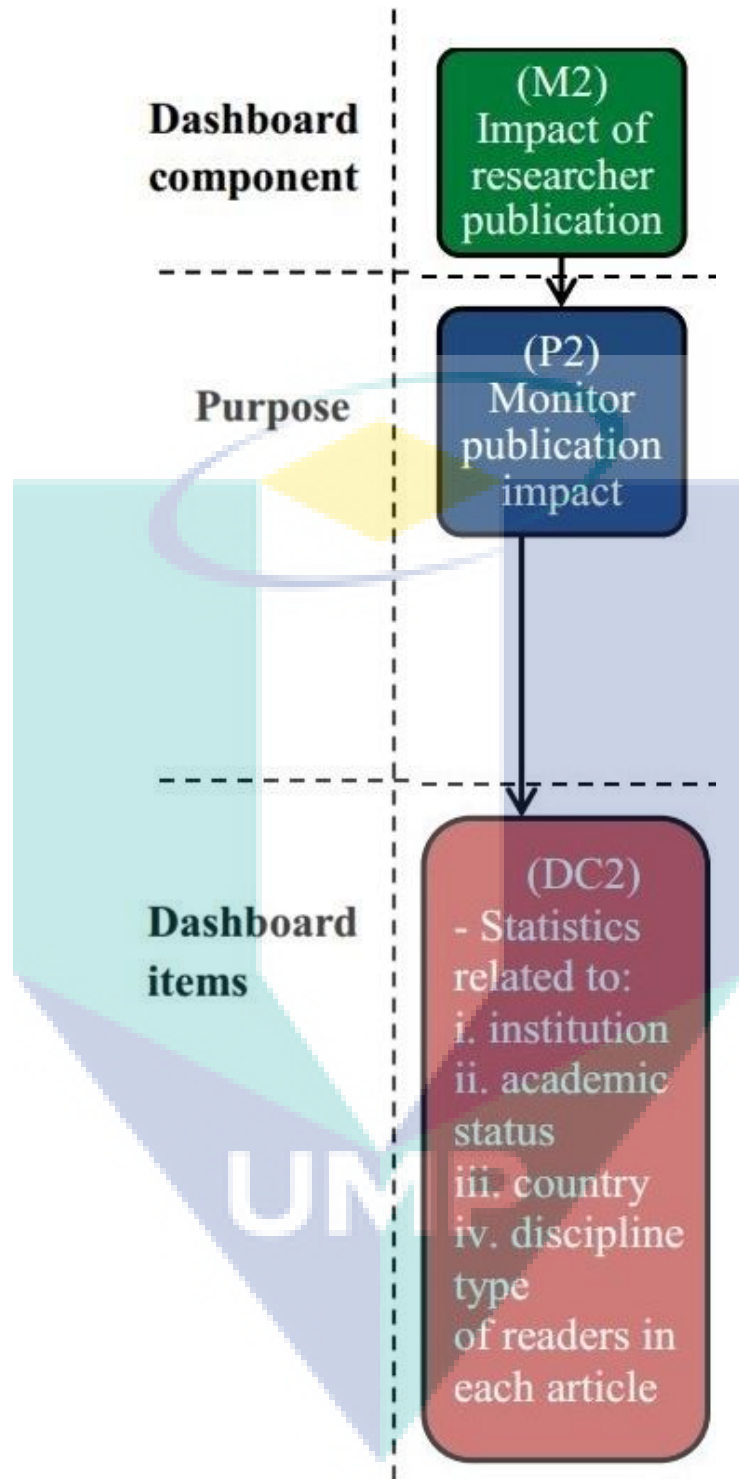
Figure 5.10. Dashboard component impact of researcher publication (M2) in the dashboard information model.

Figure 5.11 shows the third dashboard component in the dashboard information model which is research events alert (M3). The purpose of (M3) is to make the researchers alert on upcoming events (P3) that are related to their research domain. The dashboard items in (M3), derived from the third group of purposes dashboard items as shown in Figure 5.7, are information on related journals and upcoming conference publication platforms (DC3). This dashboard items would enable the researcher to view any upcoming conference and journal that are related to their research domain. Based on the discussions of dashboard characteristics in Table 2.3 (Section 2.5), the dashboard characteristic that can be used in the dashboard component (M3) is responsive. The alert mechanism is used in order to display dashboard items of research events related to the research domain of the researchers.
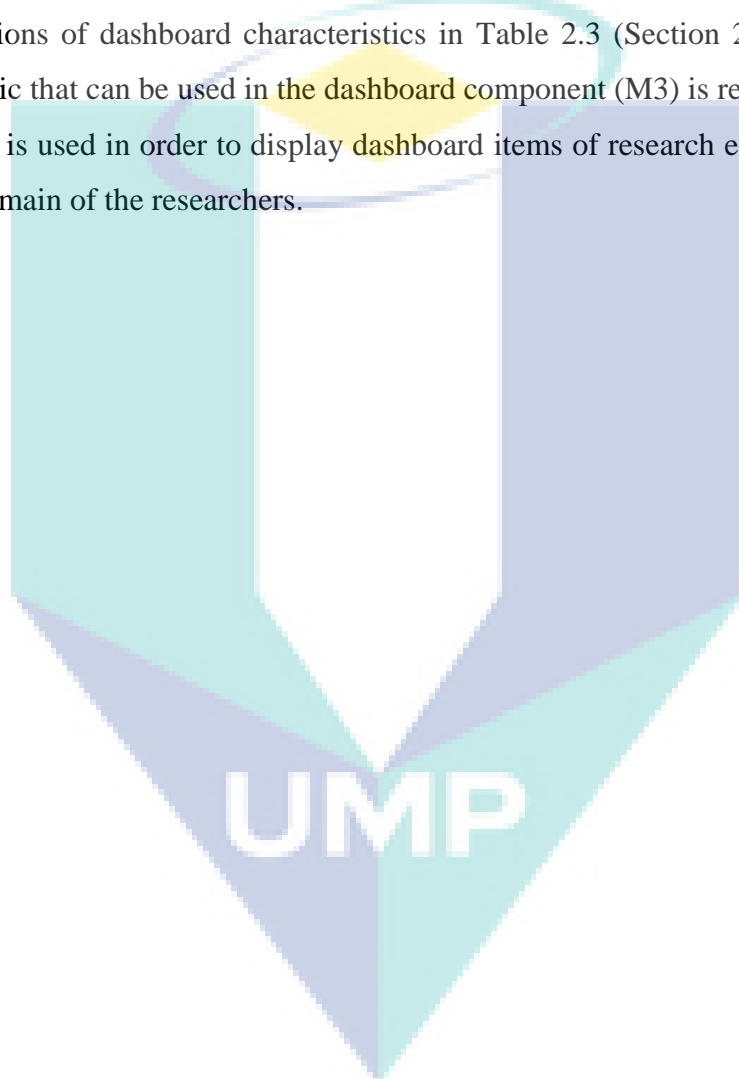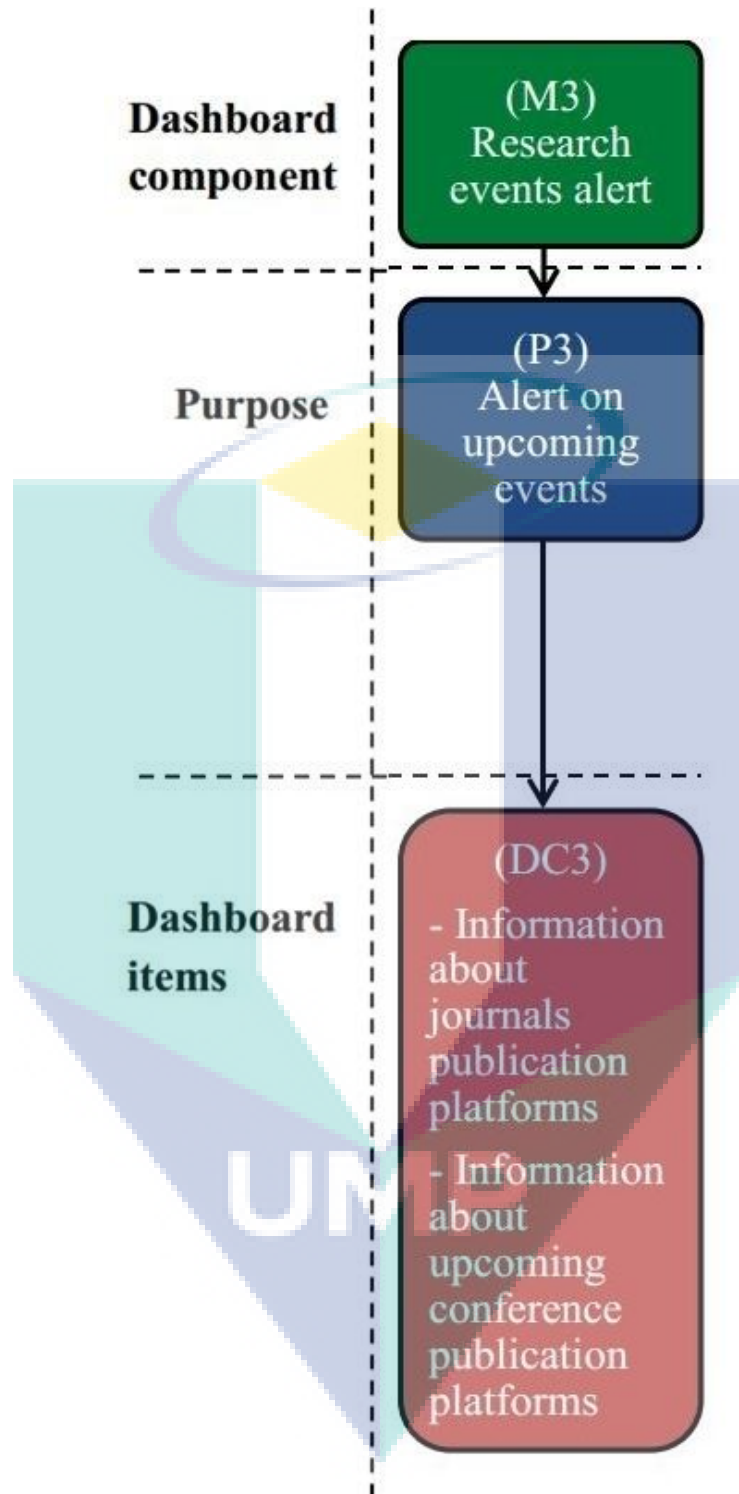
Figure 5.11. Dashboard component research events alert (M3) in the dashboard information model.

5.5 Conclusion

This chapter is preceded with discussion on the pretesting finding. There is some modification is done in the survey in order to meet its objective in exploring perceptions of the researchers towards dashboard items in SRNS. Then, this chapter has discussed the analysis the survey data. A total of 203 surveys are received based on the response of academic staffs and postgraduate students come from universities in Malaysia. The factor analysis is performed on the survey data in order to group the dashboard items. It was found that there are three groups of dashboard items which are publication impact, publication achievements and alert on upcoming events. The questions in the survey are checked its reliability and it is considered as a high level of internal consistency reliability reliable after deleting item Q25. The independent sample t-test is conducted to analyze differences in perception of dashboard items between senior and junior researchers. It was found that the dashboard information model can be used to cater needs of the senior and junior researchers, since there is no difference in perception of dashboard items between senior and junior researchers. The groups of dashboard items become basis element to develop the dashboard information model for researchers in the SRNS. There are three dashboard components in the dashboard information model which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3). Each three dashboard components in the dashboard model has its purpose and dashboard items.

CHAPTER 6

VERIFICATION OF DASHBOARD INFORMATION MODEL

6.1   Introduction

In order to develop the dashboard information model, the statistical analysis has been conducted using the survey data. The factor analysis is conducted to group the dashboard items, and it shows the dashboard items can be grouped into three purposes which are publication impact, publication achievements and alert on upcoming events. Based on the result of factor analysis, the dashboard information model is developed and it has three dashboard components which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3). Then, the independent sample t-test is conducted to analyze differences in perceptions of dashboard items between senior and junior researchers, and it shows there is no difference in perceptions of dashboard items between groups of the researchers. Thus, the dashboard information model can be used to cater the needs of the senior and junior researchers.

This chapter begins with the discussion on verification of dashboard information model based on the analysis of interview conducted with the researchers. Then, this chapter describes discussion of dashboard information model.

6.2 Verification Result of Dashboard Information Model Based On Analysis of Interview

The interview is conducted with the researchers in order to verify the dashboard information model. The researchers participated in the interview consist of academic staffs and postgraduate students that have been involved in doing the research and come from selected university in Malaysia. The respondents are individually interviewed and each interview session lasts about 30 minutes. The interview took almost two months (from April 2015 to June 2015) to accomplish due to time constraints of the researchers. In the interview session, first of all, the respondents are given brief introduction about the study as shown in Appendix B (Section A). Next, the respondents view the dashboard information model with its description as shown in Appendix B (Section B) and accompanied with the mock-up prototyping that are used to represent the dashboard information model as shown in Appendix B (Section C). Then, the respondents are asked using the prepared interview questions as shown in Appendix B (Section D). Lastly, the information about the respondents is recorded as shown in Appendix B (Section E). The explanation regarding activities for verification of the dashboard information model is discussed in Section 3.3.5.

The interview questions will help measure the respondents' satisfaction towards the three dashboard components in the dashboard information model which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3). This is done in order to determine if the dashboard information model meets the requirements and provide sufficient information to the researchers. They were also asked to suggest other dashboard items that should be added into the dashboard information model and their intention on using the mock-up prototyping that are used to represent the dashboard information model. The type of interview used in this study is a semi-structured interview, where the interview questions started with a close-ended question ("yes" and "no" options) and followed by open-ended question in which the respondents indicate reasons for their responses. In order to analyze the interview result, the responses from the respondents were examined. Then, we identify common themes based on the respondents' response. If the majority of the respondents agreed on a set of

interview questions, it is assumed that the dashboard information model can be accepted by the respondents.

There are seven respondents participated in the interview. The interview is terminated once the results from the respondents are found to be consistent. This is similar to the approach used in a study by Nielsen who found that it is sufficient to test using five respondents if the same findings are repeatedly obtained (Day, 2007). The respondents were made up of five senior researchers and two junior researchers as shown in Table 6.1. A senior researcher was defined as one who has a doctoral degree and has been involved more than five years in doing the research (Abrizah et al., 2014; Department of Materials Science & Metallurgy, n.d.). In this study, the senior researchers consist of professors and senior lecturers who have been involved in the research for nine to 19 years. The junior researchers consist of a PhD student and a Masters student, who have been involved in research for three and two years, respectively. In terms of the SRNS usage, all of the respondents, except one, have used the SRNS for their research works. The Google Scholar Citations is an example of the SRNS that is mostly used by the respondents.

The interview result regarding the verification of the dashboard information model for all respondents as shown in Table 6.1 and is discussed as follows. Firstly, the results regarding the intention of the respondents to use the mock-up prototyping that are used to represent the dashboard information model is discussed. Then, the satisfaction of the respondents towards each of the three dashboard components in the dashboard information model which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3) is discussed.

i. Intention of the respondents to use the mock-up prototyping that are used to represent the dashboard information model

All respondents agreed to use the mock-up prototyping. Thus, it shows that the dashboard information model can be accepted by the respondents.

ii. Satisfaction of the respondents towards the dashboard component researcher performance (M1) in the dashboard information model

All respondents agreed that the dashboard items (DC1a, DC1b and DC1c) in the dashboard component (M1) meet their needs to monitor research performance based on publication achievements (P1). For the questions that were used to check whether if the dashboard component of (M1) provides sufficient information for the purpose of monitoring research performance based on publication achievements (P1), only one respondent (Respondent 7) agreed that it provide sufficient information. The respondents' feedbacks on the enhancement of the other dashboard items are:

a. "Should include h-index" – Respondent 1, Respondent 2, Respondent 3, Respondent 4, Respondent 5 and Respondent 6

The h-index is a measurement for the purpose of describing the productivity and impact of the researcher. The h-index is determined using two pieces of information, which are the total number of publication papers (Np) and the number of citations (Nc) for each paper. The researchers can identify their own h-index, where Np = Nc. For example, the researcher with h-index of five means the researcher has five publication papers with at least five citations in each of the publication papers. The h-index can remove bias for a highly cited publication paper or total number of publication papers. The suggestion regarding h-index can be considered to be included in the dashboard component of (M1). The importance of h-index can be seen based on the statement from one of the respondents who stated that: "Researcher performance not only depends on publications. Also, his or her achievements are important. For example, some people have lot of publications with low impact and those publications are not considered as great achievements. On the other hand, some researchers have less number of publications with very high impact." – Respondent 5

b. "Should include a graph to view publication published by year" –
    Respondent 6

    The respondent suggested this dashboard item because it would
    enable the researchers to monitor their published paper by year.
    This dashboard item can be considered to be included in the
    dashboard component (M1).

Figure 6.1 shows the modified dashboard component researcher
performance (M1) in the dashboard information model. The added dashboard
items which are graph to view publication published by year and h-index are
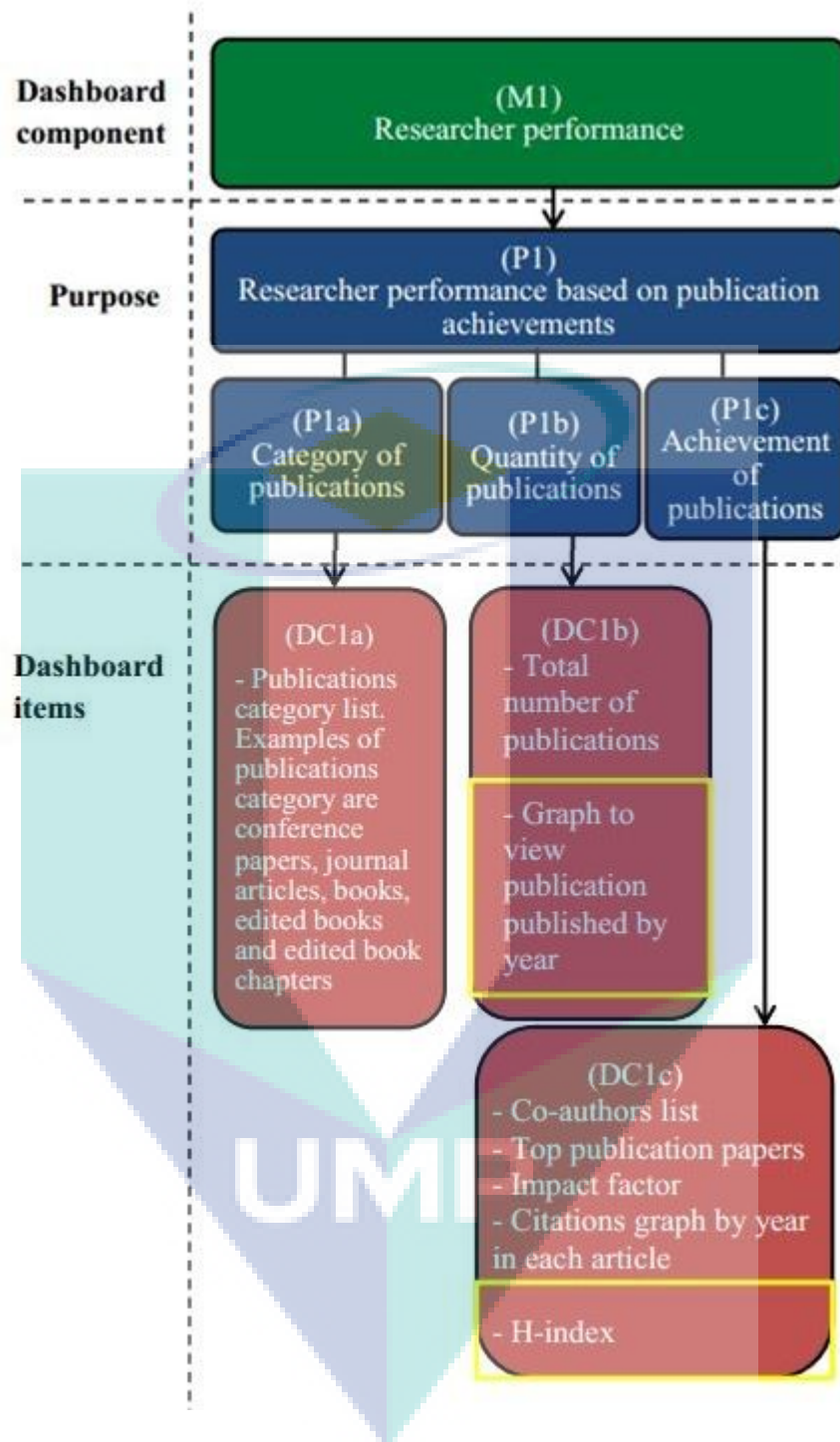highlighted in yellow boxes.
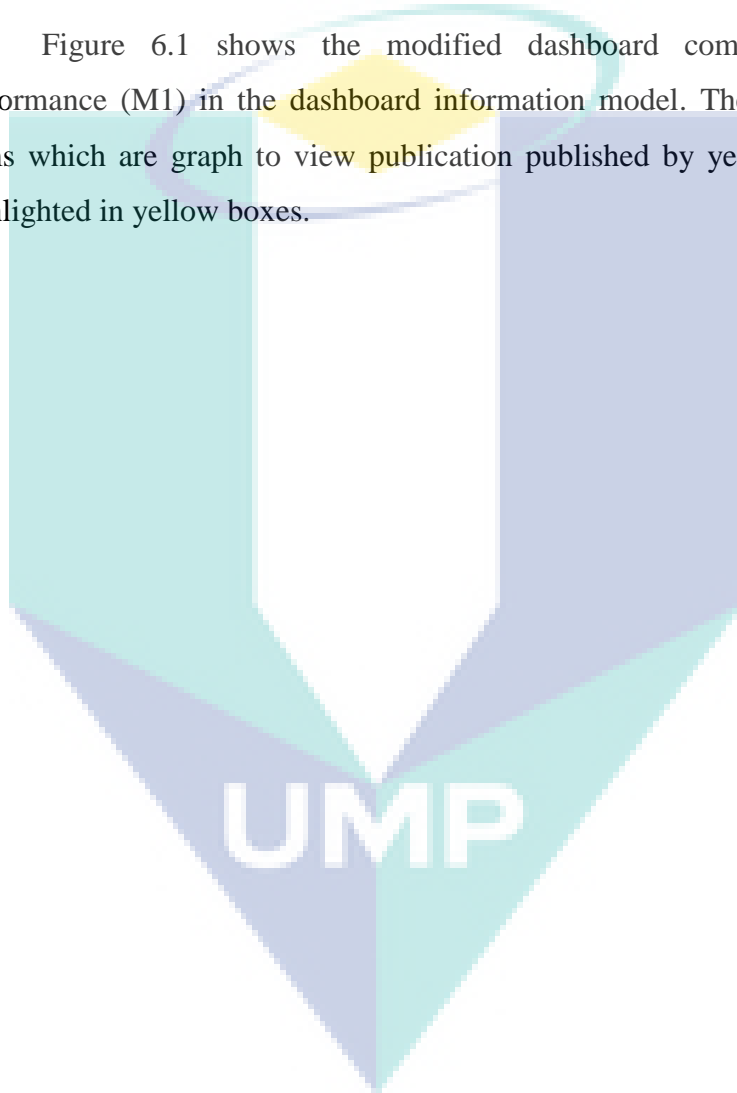
Figure 6.1. Modified dashboard component researcher performance (M1) in the dashboard information model.

iii. Satisfaction of the respondents towards the dashboard component impact of researcher publication (M2) in the dashboard information model

All respondents agreed that the dashboard items (DC2) in the dashboard component (M2) meet their needs to monitor their own publication impact (P2). For the questions that were used to check if the dashboard component (M2) provides sufficient information for the purpose of monitoring publication impact (P2), all respondents agreed that it provide sufficient information.

iv. Satisfaction of the respondents towards the dashboard component research events alert (M3) in the dashboard information model

All respondents agreed that the dashboard items (DC3) in the dashboard component (M3) meet their needs to be alert of upcoming events (P3). For the questions that were used to check if the dashboard component (M3) provide sufficient information for the purpose of alerting on upcoming events (P3), four out of seven respondents (Respondent 3, Respondent 5, Respondent 6 and Respondent 7) agreed that it provide sufficient information. The respondents' feedbacks on the enhancement of the other dashboard items are:

a. "Should include job posting advertisement" – Respondent 1
b. "Should include grants application advertisement" – Respondent 2
c. "Should include workshop advertisement" – Respondent 4

However, these suggestions could not be considered to be included in the dashboard items because the dashboard component of research events alert (M3) would only alert the researchers of upcoming conference and journal publication platforms that are related to their domain.

Table 6.1
Result regarding verification of the dashboard information model

Interview questions		Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
Dashboard component researcher performance (M1)	Qu1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Qu2	No	No	No	No	No	No	Yes
	Qu3	Should include h-index	Should include h-index	Should include h-index	Should include h-index	Should include h-index. Researcher performance not only depends on publications.	Should include h-index and a graph to view publication published by year	

UMP

Table 6.1 Continued.

Interview questions		Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
Dashboard component researcher performance (M1)	Qu3					Also, his / her inversions and achievements are important. For example, some people have lot of publications with low impact and those publications are not considered as great achievements. On the other hand, some researchers have less number of publications with very high impact.		

Table 6.1 Continued.

Interview questions		Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
Dashboard component impact of researcher publication (M2)	Qu4	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Qu5	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Qu6							
Dashboard component research events alert (M3)	Qu7	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Qu8	No	No	Yes	No	Yes	Yes	Yes
	Qu9	Should include job posting advertisement	Should include grants application advertisement		Should include workshop advertisement			

Table 6.1 Continued.

Interview questions		Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
Intention to use the mock-up prototyping that are used to represent the dashboard information model	Qu10	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6.1 Continued.

Interview questions		Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
Background information of the respondents	Position	Professor	Senior lecturer	Senior lecturer	Senior lecturer	Postgraduate student (PhD)	Senior lecturer	Postgraduate student (Master)
	Years of research experience	15 years	9 years	19 years	10 years	3 years	15 years	2 years
	Use of Social Research Network Sites	Yes. For example: ResearchGate, Academia.edu, Google Scholar Citations	Yes. For example: Google Scholar Citations	Yes. For example: Google Scholar Citations	Yes. For example: ResearchGate, Academia.edu, Mendeley and Google Scholar Citations	Yes. For example: ResearchGate and Google Scholar Citations	No	Yes. For example: ResearchGate and Google Scholar Citations

From the discussion of the interview result regarding the verification of the dashboard information model, it shows that the respondents can accept the dashboard information model and they intend to use the mock-up prototyping. The dashboard information model needs some enhancement of the dashboard items in the dashboard components of researcher performance (M1) to provide sufficient information. Figure 6.2 shows a finalized dashboard information model for the researchers in the SRNS.
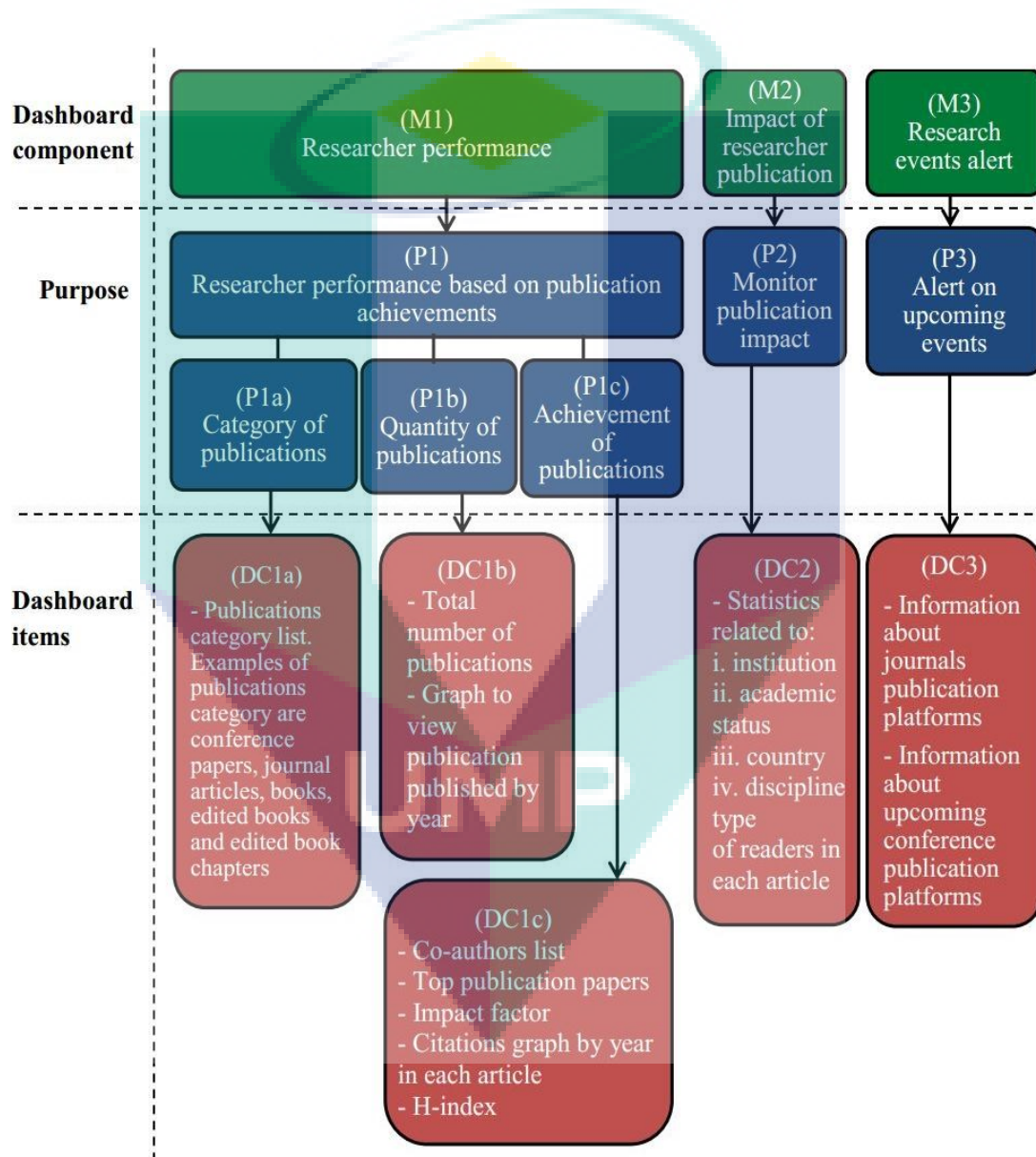

Figure 6.2. Finalized dashboard information model for researchers in Social Research Network Sites.

6.3   Discussion

This study has discussed on the development of the dashboard information model. It is proposed to develop in order to cope with the huge amount of information in the SRNS. The dashboard can be used to provide awareness support for the researchers. Many steps have been done to develop the dashboard information model. Firstly, the analysis relevance of dashboard for the researchers has done to show the dashboard can be used to monitor the research performance, to monitor research trends and to alert with upcoming events. Then, the dashboard items that can satisfy the researcher needs on the dashboard are identified. Next, the dashboard items are validated by conducting the survey. There are 18 questions in the survey related to the dashboard items. The survey data is analyzed using the factor analysis. During the factor analysis, there are five items cross-loading (Q23, Q22, Q16, Q17 and Q24) deleted. After the factor analysis finished, the dashboard items can be grouped into three which are publication impact, publication achievements and alert on upcoming events. The researcher needs on the dashboard which is to monitor research trends are excluded from this study since there are no dashboard items that related to it. Next, the internal consistency reliability is conducted to analyze reliability of the survey. It is found item Q25 need to be deleted to increase the Cronbach's Alpha value. After that, the dashboard information model is developed based on the groups of dashboard items. The dashboard information model consist of three dashboard components which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3).

Next, this study continues with the verification of the dashboard information model by conducting the interview. In order to show the dashboard information model to the researchers, the mock-up prototyping is designed to represent the dashboard information model. The interview result shows that the researchers can accept the dashboard information model with some enhancement of the dashboard items which are graph to view publication published by year and h-index to be included in the dashboard component researcher performance (M1).

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A comparison is made to check the dashboard items between finalized dashboard information model (Figure 6.2) and four SRNS that being reviewed in this study (ResearchGate, Academia.edu, Mendeley and Google Scholar Citations). As shown in Table 6.2, the finalized dashboard information model has all dashboard items needed by the researchers compared to those four SRNS. The finalized dashboard information model can be embedded into the SRNS in order to provide awareness for the researchers to monitor their own research performance, monitor impact of publication and alert the researchers on upcoming events. The inclusion of dashboard information model into the SRNS can attract many users to use it in order to aware on the research-related information.

Table 6.2
Comparison of finalized dashboard information model with Social Research Network Sites

Dashboard items	Social Research Network Sites (SRNS)				Finalized dashboard information model
	ResearchGate	Academia.edu	Mendeley	Google Scholar Citations	
Dashboard component: Researcher performance (M1)					
1. Publications category list (DC1a)	/		/	/	/
2. Total number of publications (DC1b)	/	/	/	/	/
3. Graph to view publication published by year (DC1b)					/
4. Co-authors list (DC1c)	/			/	/
5. Top publication papers (DC1c)	/				/
6. Impact factor (DC1c)	/				/
7. Citations graph by year in each article (DC1c)				/	/
8. H-index (DC1c)				/	/
Dashboard component: Impact of researcher publication (M2)					
1. Statistics related to institution of readers in each article (DC2)	/				/
2. Statistics related to academic status of readers in each article (DC2)			/		/
3. Statistics related to country of readers in each article (DC2)			/		/

Table 6.2 Continued.

Dashboard items	Social Research Network Sites (SRNS)				Finalized dashboard information model
	ResearchGate	Academia.edu	Mendeley	Google Scholar Citations	
4. Statistics related to discipline type of readers in each article (DC2)			/		/
Dashboard component: Research events alert (M3)					
1. Information about journals publication platforms (DC3)					/
2. Information about upcoming conference publication platforms (DC3)					/

6.4   Summary

This chapter discusses verification of dashboard information model based on analysis of the interview. The respondents of the interview consist of the academic staffs and postgraduate students that have been doing research and come from selected university in Malaysia. From the interview, it shows that the respondents can accept the dashboard information model and they intend to use the mock-up prototyping that are used to represent the dashboard information model. The dashboard information model needs some enhancement of the dashboard items in the dashboard components researcher performance (M1) to provide sufficient information.

Lastly, this chapter discusses the comparison of dashboard items in the finalized dashboard information model and the four SRNS being reviewed in this study. It shows that the finalized dashboard information model has all the dashboard items and it can be used to provide awareness for the researchers to monitor their own research performance, monitor their own publication impact and alert the researchers on upcoming events.

CHAPTER 7

CONCLUSION

7.1   Introduction

This chapter firstly summarizes the work conducted in this study by discussed how the research objectives is achieved. Followed by, discussion on the limitation of the study. Next, the research contribution is discussed and ends with the suggestion for the further research.

7.2   Synthesis

The objectives of this study are:

i.   To evaluate the dashboard items identified from literature studies and review on the Social Research Network Sites (SRNS).

ii.   To develop a dashboard information model in order to construct effective information for the researchers.

iii.   To verify the dashboard information model.

The first objective of the study is to evaluate the dashboard items identified from literature studies and review on the Social Research Network Sites (SRNS). The inclusion of the dashboard in the SRNS has been explored first to understand its relevancy in supporting the researcher needs. The dashboard is identified as a significant tool in assisting the researcher needs on monitoring their own research performance, monitoring research trends and alerting them with upcoming events (Section 4.2). In order to satisfy the researcher needs in the dashboard, we need to identify dashboard items that are going to become basis element to develop the dashboard information model. There are two approaches used to identify the proposed dashboard items which are based on analysis from the literature studies and review on the current SRNS (Section 4.3). The proposed dashboard items that have been identified are validated by conducting the survey. The survey is distributed to the academic staffs and postgraduate students come from universities in Malaysia using two approaches which are manually distributed hardcopy survey and link of online survey sent via email address of the respondents. A total of 203 surveys are received to be used for analysis. Factor analysis is carried out in order to group the dashboard items. Based on the result of factor analysis, the dashboard items can be grouped into three which are publication impact, publication achievements and alert on upcoming events (Section 5.3.2).

The second objective of the study is to develop a dashboard information model in order to construct effective information for the researchers. Based on the result of factor analysis conducted, the grouping of dashboard items becomes basis element to develop the dashboard information model. As shown in Figure 5.8 (Section 5.4), there are three dashboard components which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3), that are derived based on the three groups of the dashboard items as shown in Figure 5.7 (Section 5.4). The explanation regarding the development of dashboard information model is discussed in Section 5.4.

The third objective of the study is to verify the dashboard information model. The interview is conducted with the researchers consist of academic staffs and postgraduate students from selected university in Malaysia. The purpose of the interview is to know whether the three dashboard components in the dashboard

information model which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3); meets the requirements and provide sufficient information to the researchers. The researchers can suggest other dashboard items that should be added into the dashboard information model. In order to make the respondents understand about the dashboard information model, the mock-up prototyping is design to represent the dashboard information model. The result from the interview has shown that the researchers accepted the dashboard information model and intended to use the mock-up prototyping. A few suggestions for enhancement of the dashboard items to be included in the dashboard information model have been received from the feedbacks; especially for the dashboard component researcher performance (M1). The added dashboard items included in the dashboard component researcher performance (M1) are graph to view publication published by year and h-index. The verification result of the dashboard information model is discussed in Section 6.2.

7.3   Research Contributions

This section discusses the research contributions to knowledge and practice. The discussions on both contributions are as follows.

7.3.1   Contribution to Knowledge

This research attempted to fill in gap in the social network research where limited research studied on requirements of the researchers in the social networking sites. The insufficient of the researchers' needs can be seen when the researchers use the SRNS, the researchers feel overwhelm with the huge amount of information in the SRNS. In order to handle the issue, the researchers need the awareness support to be embedded in their research practice (Reinhardt et al., 2012a; Reinhardt et al., 2012b). This study proposes to develop a dashboard information model in order to provide awareness of research-related information to the researchers.

In this study, at phase 1 in order to seek the relevance of dashboard for the researchers, the researcher needs have been analyzed by reviewing previous works regarding the researchers' reasons on using social networking sites. There are five points regarding the researcher needs identified which are monitor performance of researcher (RN1), to know information about the other researchers (RN2) and publication papers (RN3), alerts on upcoming events likes seminar and conferences (RN4) and to monitor research trends (RN5). These researcher needs are analyzed with the dashboard purposes in order to seek what researcher needs that can be supported by the dashboard. It was found that dashboard is a significant tool in assisting the researcher needs on monitoring their own research performance (RN1), alerting them with upcoming events (RN4) and monitoring research trends (RN5). The discussion on the relevance of dashboard to support the researcher needs can be seen in Section 4.2.

The dashboard items that can be used to satisfy the researcher needs which are to monitor performance of researcher (RN1), alerts on upcoming events likes seminar and conferences (RN4) and to monitor research trends (RN5) has been identified using two approaches which are based on analysis from literature studies and review from current SRNS. It was found that there are 16 proposed of dashboard items. The discussion on the identification of dashboard items can be seen in Section 4.3.

Then, the dashboard items are validated by conducting a survey. The purpose of survey is to collect perception of the researchers towards the dashboard items. After that, the survey data is analyzed using factor analysis. It was found that the dashboard items can be group into three which are publication impact, publication achievements and alert on upcoming events as been discussed in Section 5.3.2. The three groups of dashboard items become basis element to develop the dashboard information model. The development of dashboard information model consists of three dashboard components which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3). The discussion on the development of dashboard information model can be seen in Section 5.4.

7.3.2   Contribution to Practice

The contribution of this research to practice is the dashboard information model can be used as a guideline to assist the developers to develop a better online platform for the researchers. Based on the dashboard information model, the developers could understand what the dashboard items that needed by the researchers to be included in the dashboard. The inclusion of the dashboard into the SRNS can provide awareness support for researchers to monitor impact of researcher publication, be alert for events on a specific topic and can be used to monitor their research performance.

7.4   Further Research

There are some recommendations suggested towards this study in the future which are:

i.   To expand the sample of respondents in the study to include the researchers from the other countries and also include the researchers come from the company research centers.

This study is conducted with the cooperation of the researchers which are academic staffs (lecturers, senior lecturers, associate professors and professors) and postgraduate students (PhD students and Master students by research mode) come from universities in Malaysia. The survey is distributed among these researchers to validate the dashboard items that are analyzed based on the literature studies and review on the current SRNS. After the dashboard information model is developed, the interview is conducted with the researchers to verify the dashboard information model. Thus, the dashboard information model is developed based on needs of the academic researchers in Malaysia. The sample of respondents in this study should be expanding to include the researchers from the other countries and also include the researchers from the company research centers to test whether there is a difference needs and their feedback regarding the dashboard information model.

ii.   Include functionality in the dashboard.

This study designs the mock-up prototyping to represent the dashboard information model. The mock-up prototyping focus on the external appearance likes screen of the dashboard in the web browser without including functionality. For the further research, it should include the functionality of the dashboard to enable the respondents to interact with it.

iii.   Include visualization in the dashboard.

In this study, we identify the dashboard items to be included in the dashboard information model that can meet the researcher needs in the dashboard. In the verification of the dashboard information model, we check whether the dashboard items in the dashboard information model meet the researcher needs and provide sufficient information. For the further research, we want to identify the best way to visualize the dashboard items. Commonly, graphs and charts are used to present the information. It is important to identify the best type of visualization to make the information easily interpret by the dashboard user. Good visualization can prevent from the information overload.

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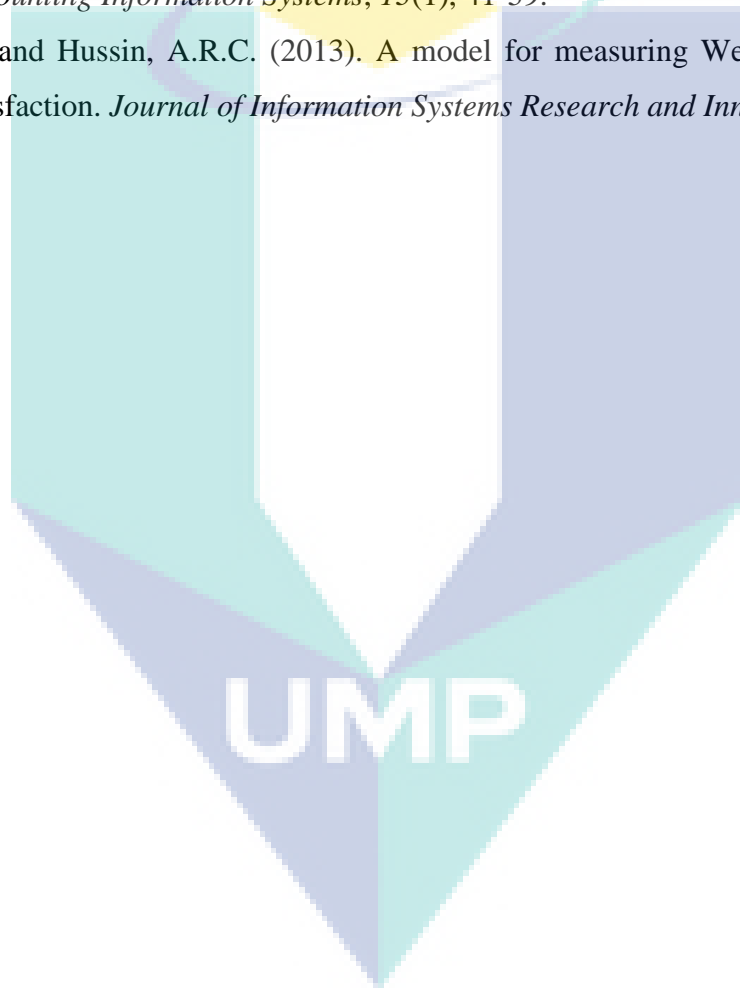
APPENDIX A:

THE SURVEY ON DASHBOARD ITEMS

IN SOCIAL RESEARCH NETWORK SITES FOR RESEARCHERS

Survey on dashboard items in Social Research Network Sites (SRNS) for researchers

Introduction: This survey is conducted to investigate perception of researchers towards dashboard items in Social Research Network Sites (SRNS). There are two parts in this section. Part A consists of respondent details and part B consists of respondent preferences about dashboard items. It should take approximately 15-20 minutes to complete the survey. Results of this survey will only be used for research purposes only.

Thank you very much for your cooperation.

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Glossary

1. Social Research Network Sites (SRNS) is a web-based service that allows individual researchers to do several tasks; to construct a public or semi-public profile within a bounded system for identity purpose, to articulate a list of other researchers with whom they share a connection and communicate for communication purpose, to share information with other researchers within the system for information purpose and to collaborate with other researchers within the system for collaboration purpose. For example, Academia.edu and Mendeley.
2. Dashboard is a place where the researcher can monitor the information at a glance such as performance of researcher and trend of research.

Part A: Respondent details

Please choose your answer.

1. **Gender** *
   Mark only one oval.

   ⬭ Male

   ⬭ Female

2. **Age group** *
   Mark only one oval.

   ⬭ 21-30

   ⬭ 31-40

   ⬭ 41-50

   ⬭ 51-60

   ⬭ 61 and above
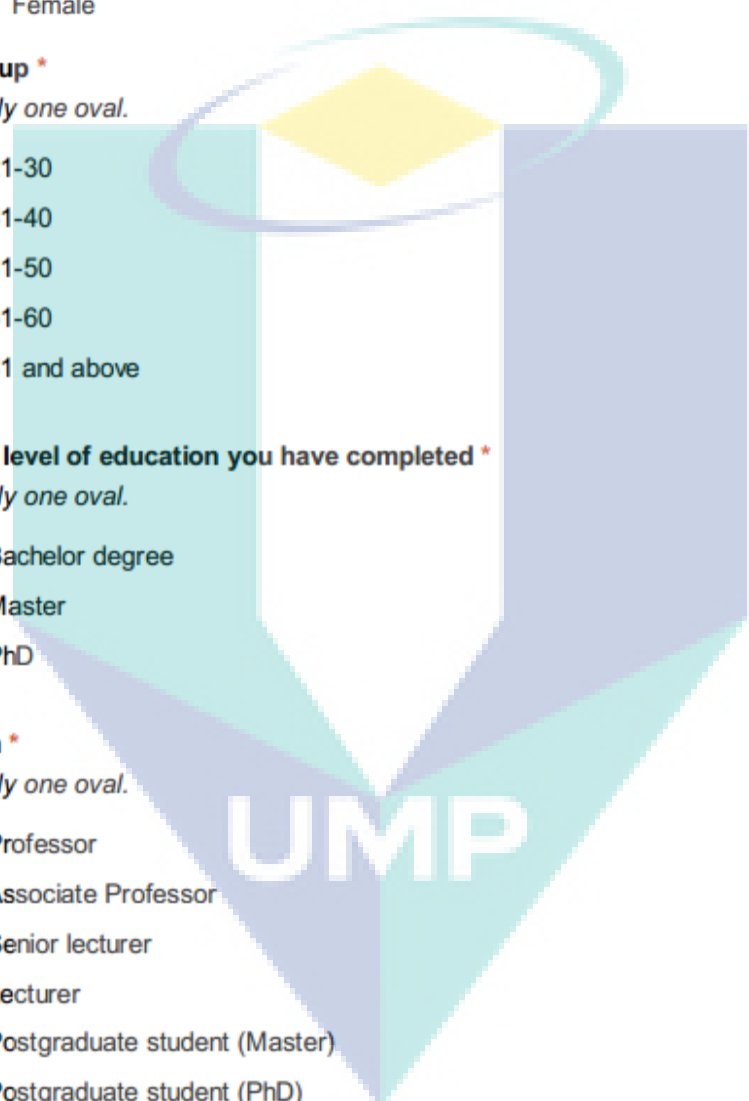
3. **Highest level of education you have completed** *
   Mark only one oval.

   ⬭ Bachelor degree

   ⬭ Master

   ⬭ PhD

4. **Position** *
   Mark only one oval.

   ⬭ Professor

   ⬭ Associate Professor

   ⬭ Senior lecturer

   ⬭ Lecturer

   ⬭ Postgraduate student (Master)

   ⬭ Postgraduate student (PhD)

5. **Years of involvement in research** *
   Mark only one oval.

   ( ) Less than 1 year

   ( ) 1-5 years

   ( ) 6-10 years

   ( ) More than 10 years

6. **Email** *

   _____

7. **Name of university** *

   _____

8. **Which Social Research Network Sites (SRNS) that you use for your research work? (you may choose more than one)** *
   Tick all that apply.

   [ ] None

   [ ] ResearchGate

   [ ] Academia.edu

   [ ] Mendeley

   [ ] Google Scholar Citations

   [ ] Other: _____

9. **Do you know about dashboard?** *
   Mark only one oval.

   ( ) Yes

   ( ) No
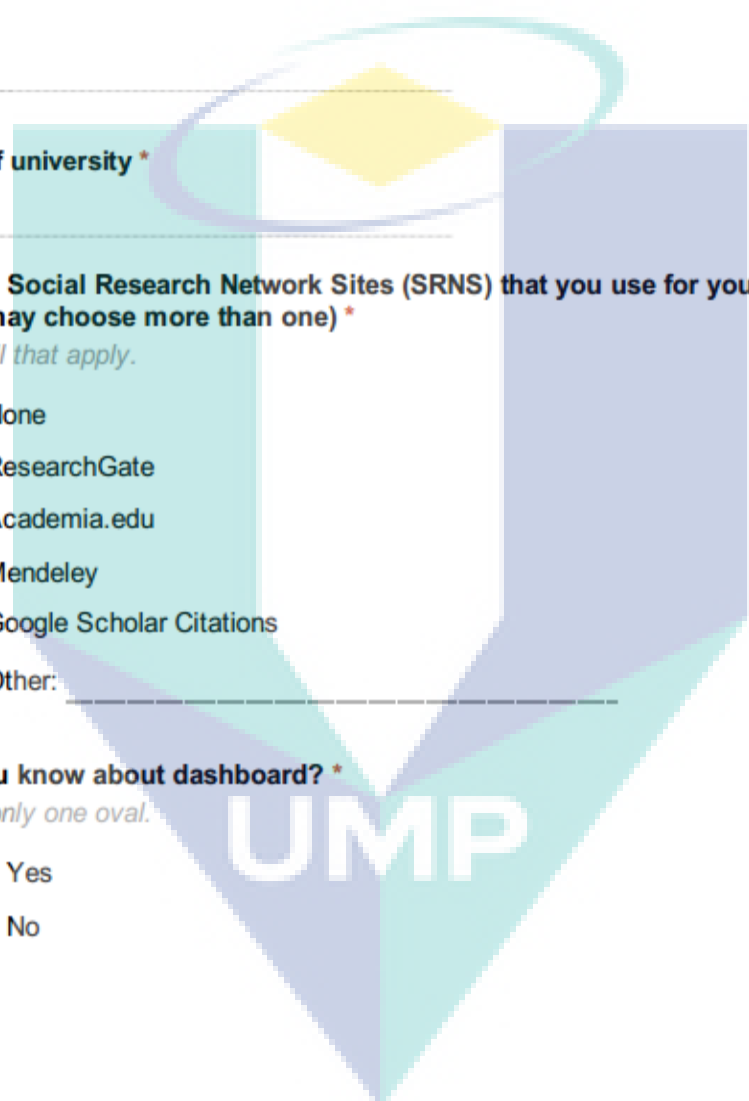
Part B: Respondent preferences about dashboard items

Please choose only one response scale for each of the statements.
The response scale is as follows:
1. Strongly disagree
2. Disagree
3. Somewhat disagree
4. Neither agree or disagree
5. Somewhat agree
6. Agree
7. Strongly agree

Dashboard item: Co-authors list. For example:

Co-authors

Bestoun S. Ahmed
Rusli Abdullah

View all co-authors
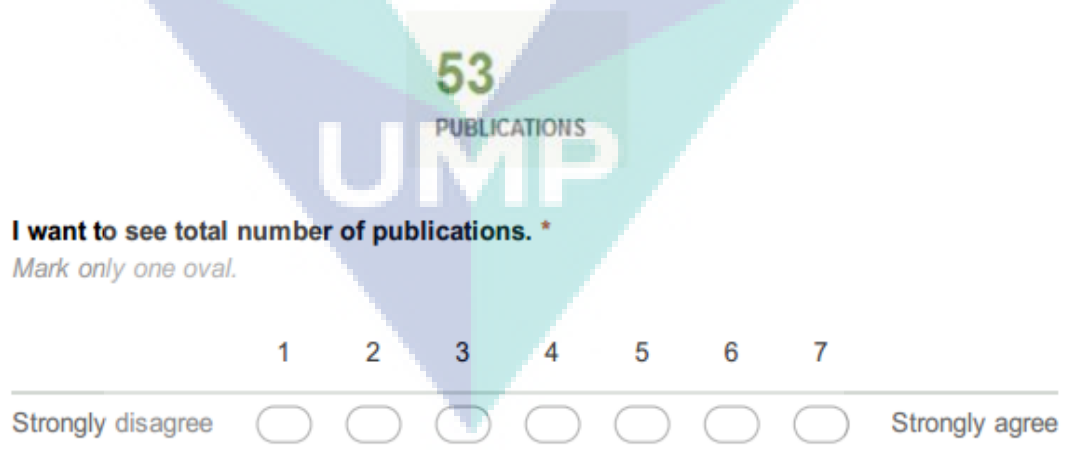
10. **I want to see co-authors list.** *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

Dashboard item: Total number of publications. For example:

53
PUBLICATIONS

11. **I want to see total number of publications.** *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

Dashboard item: Publications category list. For example:

Publications

▶ Journal Article (64)
▶ Book (10)
▶ Generic (1)
▶ Book Section (7)
▶ Conference Proceedings (47)
▶ Web Page (1)

12. **I want to see publications category list.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

Dashboard item: Impact factor of journal paper. For example:

Article: Development of software sensors for determining total phosphorus and total nitrogen in waters.

Eunhyoung Lee, Sanghoon Han, Hyunook Kim

[Show abstract]

International Journal of Environmental Research and Public Health 01/2013, 10(1):219-36. 2.00 Impact Factor

Source

13. **I want to see impact factor of a journal paper.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

147

Dashboard item: Citations graph by year in each publication. For example:
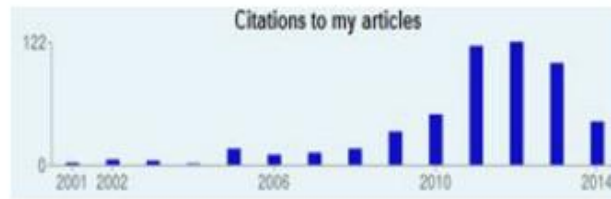
14. **I want to see citations graph by year in my publication.** *
    Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

Dashboard item: Top publication papers. For example:

TOP PUBLICATION VIEWS   last week / total

📄 Evaluation of aeration energy saving in two modified activated sludge processes.
Chemosphere 04/2014;
10 Views

📄 Determination of chemical oxygen demand (COD) using ultrasound digestion and oxidation-reduction potential-based titration.
Journal of Environmental Science and Health Part A 10/2007; 42(11):1665-70.
4 Views

📄 Evaluation of the Effectiveness of Five Odor Reducing Agents for Sewer System Odors Using an On-Line Total Reduced Sulfur Analyzer.
Sensors 01/2012; 12(12):16892-16906.
4 Views

15. **I want to know my top publication papers.** *
    Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

Dashboard item: Number of downloads in each publication. For example:

Article: **Evaluation of aeration energy saving in two modified activated sludge processes.**

Ingyu Lee, Honglae Lim, Byunghun Jung, Mark F Colosimo, Hyunook Kim

14   2   0
Views   Downloads   Citations

16. **I want to see number of downloads in my publication.** *

    Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

Dashboard item: Number of citations in each publication. For example:

Article: **Evaluation of aeration energy saving in two modified activated sludge processes.**

Ingyu Lee, Honglae Lim, Byunghun Jung, Mark F Colosimo, Hyunook Kim

14   2   0
Views   Downloads   Citations
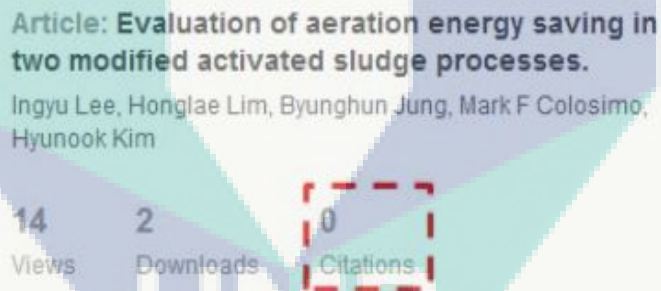
17. **I want to see number of citations in my publication.** *

    Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

Dashboard item: Publications cites by discipline. For example:

by Discipline
86% Computer and Information Science
3% Social Sciences
2% Electrical and Electronic Engineering

18. **I want to know discipline type of readers who cites my publication.** *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	⚪	⚪	⚪	⚪	⚪	⚪	⚪	Strongly agree

Dashboard item: Publications cites by academic status. For example:
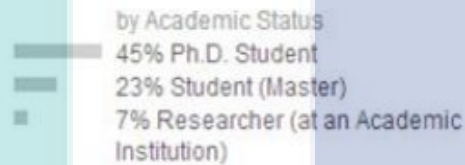
by Academic Status
45% Ph.D. Student
23% Student (Master)
7% Researcher (at an Academic Institution)

19. **I want to know academic status of readers who cites my publication.** *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	⚪	⚪	⚪	⚪	⚪	⚪	⚪	Strongly agree

150

Dashboard item: Publications cites by institution. For example:

Views by institution

1 University of Tasmania

20. I want to know which institution cites my publication. *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree
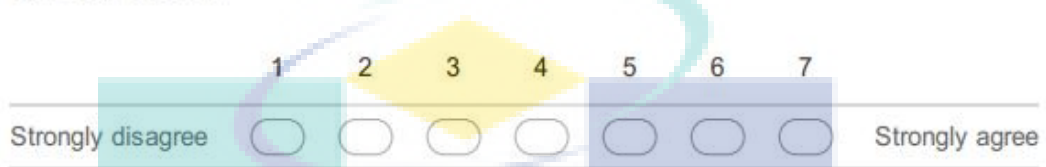
Dashboard item: Publications cites by country. For example:
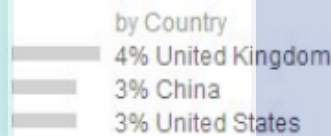
by Country

4% United Kingdom

3% China

3% United States

21. I want to know which country cites my publication. *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

Dashboard item: Statistic on number of publications in research domain. For example:

Number of publications for "social network"
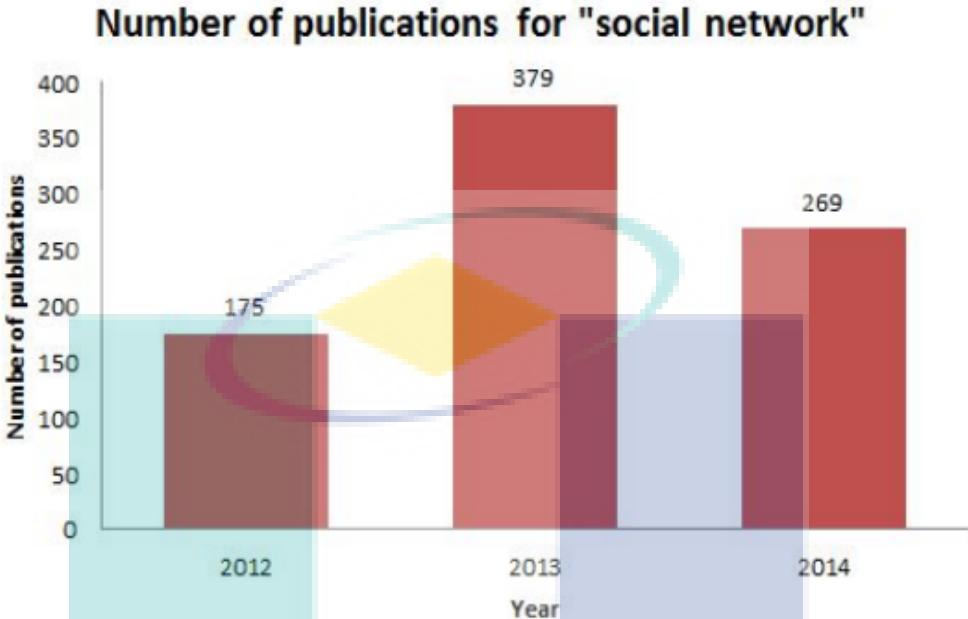
22. I want to see total number of publications in research domain. *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

23. I want to see total number of researchers based on research domain. *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

24. I want to know details of other researchers based on research domain. *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

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Dashboard item: Events alert. For example:

25. **I want to know about publication platform based on my research domain.** *
    Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

26. **I want to see upcoming conference based on my research domain.** *
    Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

27. **I want to see related journal based on my research domain.** *
    Mark only one oval.

	1	2	3	4	5	6	7	
Strongly disagree	◯	◯	◯	◯	◯	◯	◯	Strongly agree

APPENDIX B:
THE INTERVIEW PROTOCOL

APPENDIX B (SECTION A):
THE BRIEF INTRODUCTION OF THIS RESEARCH STUDY

Many researchers have used social networking sites for their research works. There is a specialized social networking site for the researchers known as Social Research Network Sites (SRNS) (Bullinger et al., 2010). The researchers use the SRNS in order to fulfill their needs such as to find researchers with similar interests or expertise, to keep in touch with their peers and to share information (Giglia, 2011; Li and Gillet, 2013). Examples of the SRNS are Academia.edu, ResearchGate and Mendeley (Gruzd et al., 2012; Reinhardt et al., 2012a; Nentwich and König, 2014). However, the SRNS still have issues in supporting research activities where the researchers still explore many sites in order for them to use different features provided and this could be time consuming for the researchers to manage those sites (Collins and Hide, 2010; Cann et al., 2011; Masud et al., 2012; Nentwich and König, 2014). The researchers want to be noticed on latest information in the research field and to look for events on a specific topic but fail to do because they are huge amounts of information in the SRNS and it would overwhelm them (Masud et al., 2012; Reinhardt et al., 2012a; Reinhardt et al., 2014).

In order to cope with huge amount of information in the SRNS, the researchers need the awareness support to be embedded in their research practice (Reinhardt et al., 2012a; Reinhardt et al., 2012b). The awareness support can improves the effectiveness of how information is spread in communities (Lövstrand, 1991) and positively influences social interactions taking place in those communities (Gross et al., 2005). Therefore, the researchers will need a tool that can provide awareness support for the researchers. Dashboard can be used to provide awareness on current information in research field to the researchers because the dashboard can provide aggregated information about the system's current state, notifications and news (Reinhardt et al., 2014). Thus, we propose to develop a dashboard information model for the researchers

in the SRNS. The dashboard information model for the researchers can be used as a guideline for the social networking site developers to develop the SRNS that provide a better facility to help the researchers to do their research work by keep them inform about the current information in the research field.

The inclusion of dashboard in the SRNS has to be explored first to understand its relevancy in supporting the researchers work. We review previous works regarding dashboard usage to find the purposes of having dashboard and find researcher needs by reviewing researchers use scenario in the SRNS. Then, we analyze whether the dashboard purposes can satisfy the researcher needs. From the analysis, we found out that the dashboard is a significant tool in assisting the researchers on: 1) monitoring their own research performance, 2) monitoring research trends and 3) alerting them with upcoming events. The dashboard items to be put on the dashboard that can satisfy the needs of the researcher need to be identified and validated. The dashboard items are identified based on analysis from literature studies and review on the current SRNS. The validation the dashboard items is using empirical study via quantitative approach by conducting a survey. A factor analysis is conducted to group the dashboard items. From the factor analysis, the dashboard items can be grouped into three purposes which are monitor publication impact, publication achievements and alert on upcoming events. Then, the dashboard information model for the researchers is developed. Lastly, the interview is conducted to verify the dashboard information model and mock-up prototyping is used to represent the dashboard information model. Figure B.1 shows the process work in this study. The design and description about the dashboard information model for the researchers in the SRNS is shown in Appendix B (Section B).
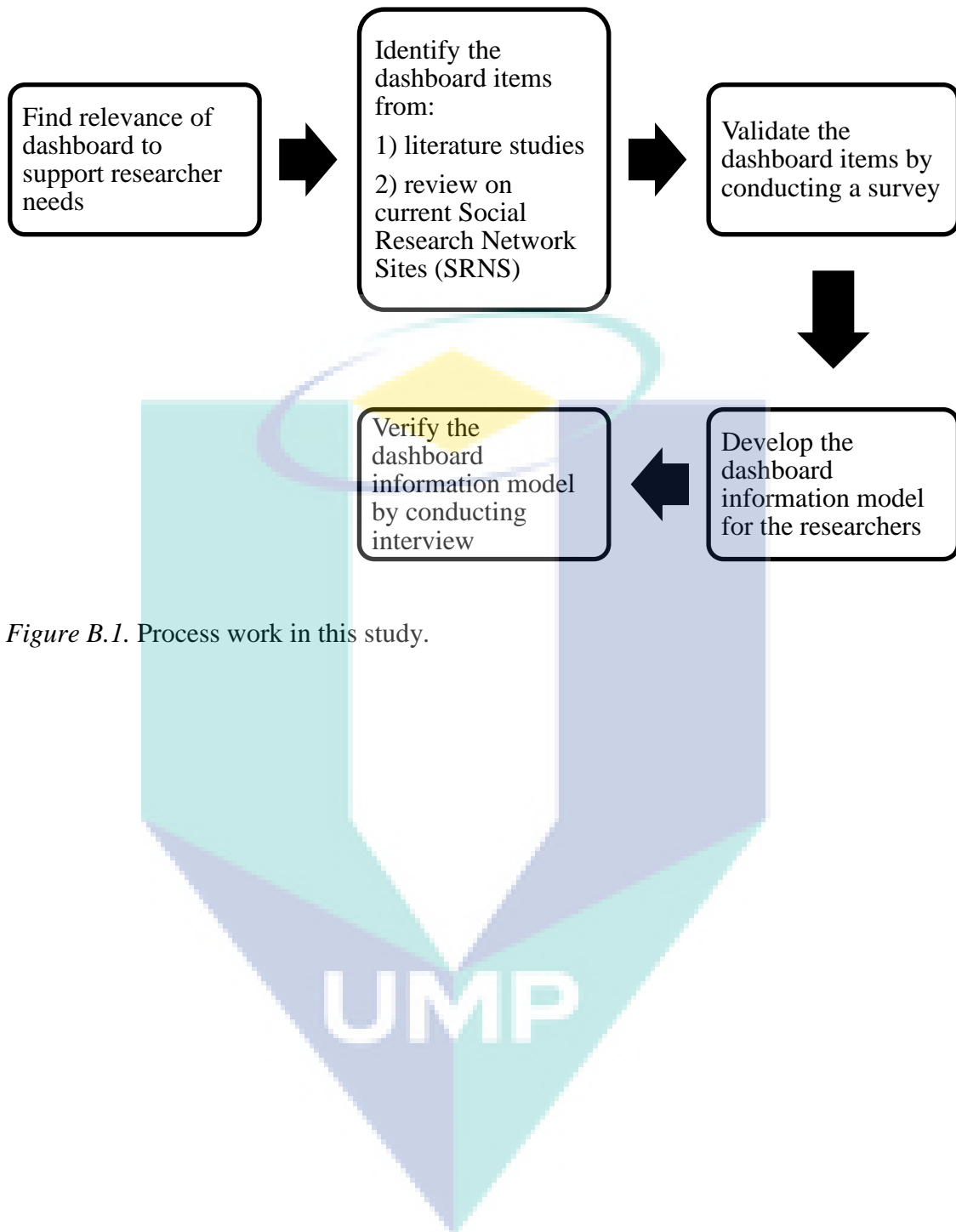
Figure B.1. Process work in this study.

APPENDIX B (SECTION B):
THE DEVELOPMENT AND DESCRIPTION OF DASHBOARD INFORMATION MODEL

Figure B.2 shows the development of dashboard information model for the researchers in the SRNS. There are three dashboard components in the dashboard information model which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3).

The first dashboard component in the dashboard model, researcher performance (M1) is used to monitor the performance of the researchers based on their own publication achievements (P1). The performance of the researcher based on the publications can be distinct into three things which are category of publications (P1a), quantity of publications (P1b) and achievement of publications (P1c). The publication paper can be categorized in different types such as conference papers, journal articles, books, edited books and edited book chapters (DC1a). Total number of publications (DC1b) is used to show quantity of publications. The dashboard items that can represent achievement of publications are co-authors list, top publication papers, impact factor of journal articles and citations graph by year in each article (DC1c).

The second dashboard component in the dashboard model is impact of researcher publication (M2). The purpose of (M2) is to enable the researchers to monitor their own publication impact. The dashboard items in (M2) are the statistics related to institution, academic status, country and type of discipline in each article (DC2).

The third dashboard component in the dashboard model, research events alert (M3) is used to alert on upcoming events (P3). The dashboard items are information about journals and upcoming conference publication platforms (DC3). In here, the

researcher is able to view the upcoming conference and journal that related to their research domains.

In order to understand the dashboard information model, we create interface design or also known as mock-up prototyping to represent the three dashboard components in the dashboard model which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3). The mock-up prototyping for the dashboard information model can be seen in Appendix B (Section C).
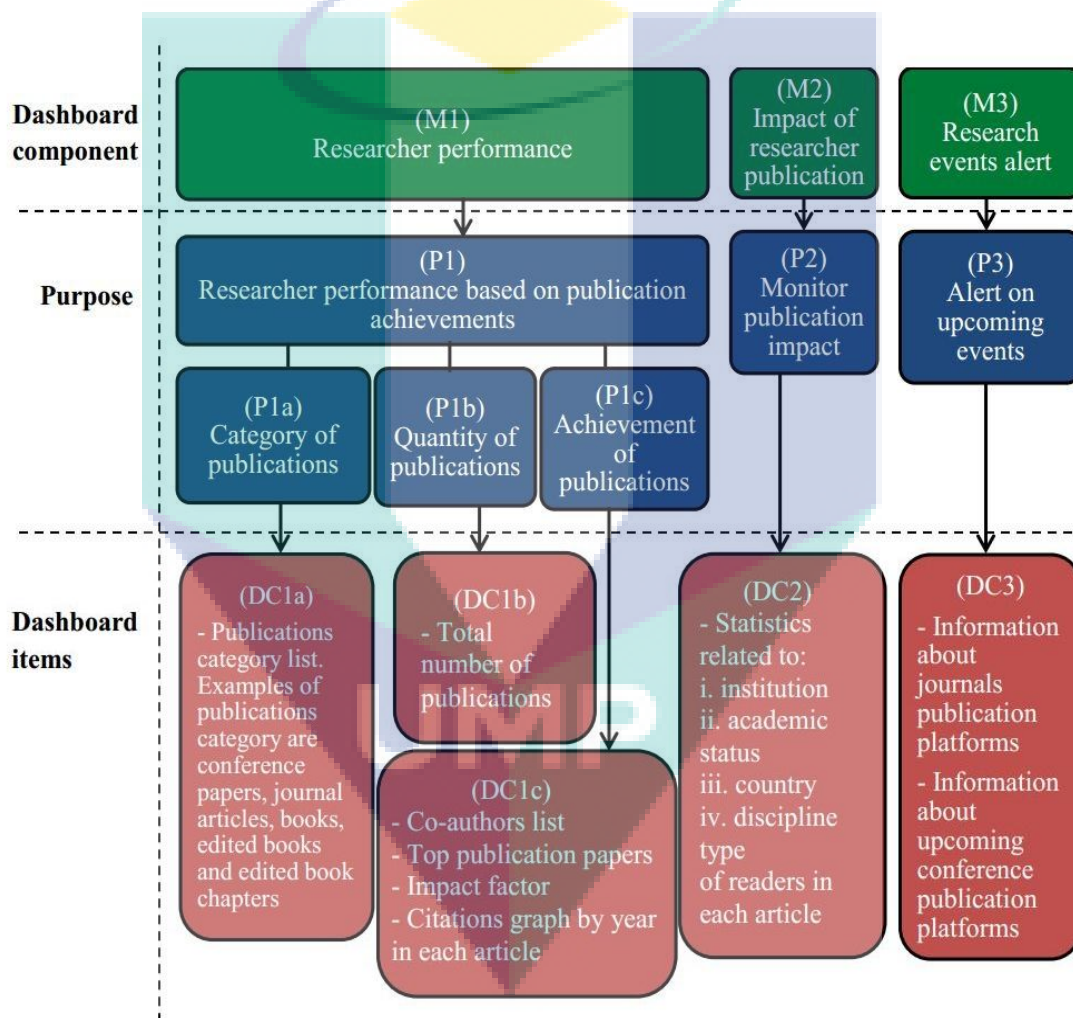

Figure B.2. Dashboard information model for researchers in Social Research Network Sites.

APPENDIX B (SECTION C):

THE MOCK-UP PROTOTYPING FOR THE DASHBOARD INFORMATION MODEL

The respondents can click this link to view the mock-up prototyping for the dashboard information model in a web browser http://dashboardmodel.webuda.com/modelV5/. The descriptions for the mock-up prototyping to represent each three dashboard components in the dashboard information model which are researcher performance (M1), impact of researcher publication (M2) and research events alert (M3) are as follows.

    i.   Dashboard component researcher performance.(M1)

        Figure B.3 shows the screen design for dashboard component researcher performance (M1) in the dashboard information model. The purpose of this screen is to make the researcher able to view their research performance based on their own publications (P1). As seen in Figure B.3, there is a chart to show number of publications based on category such as conference paper and journal article (DC1a). There are also a total number of publications (DC1b), a list of co-authors and top publication papers (DC1c) based on number of citations appear on top row of table of publications list as seen in Figure B.3. The researcher also can click on name of co-author to see the details of co-author as seen in Figure B.4. There is an option when the researcher can click on the title of conference paper or journal article in the table of publications list, a new screen will appear to show the detail of conference paper or journal article. For example, Figure B.5 shows the screen design for conference paper details and Figure B.6 shows the screen design for journal article details. As seen in Figure B.5 and Figure B.6, there are information that used to monitor

achievement of publications which are impact factor of journal articles and citations graph by year in each article (DC1c).
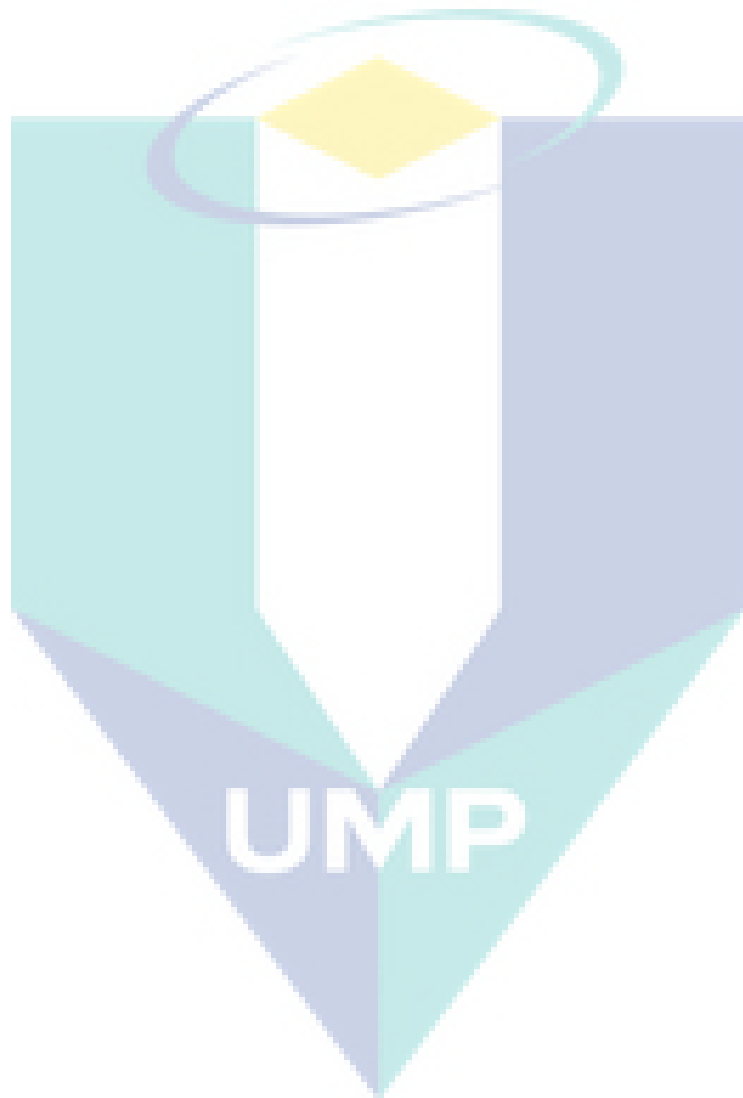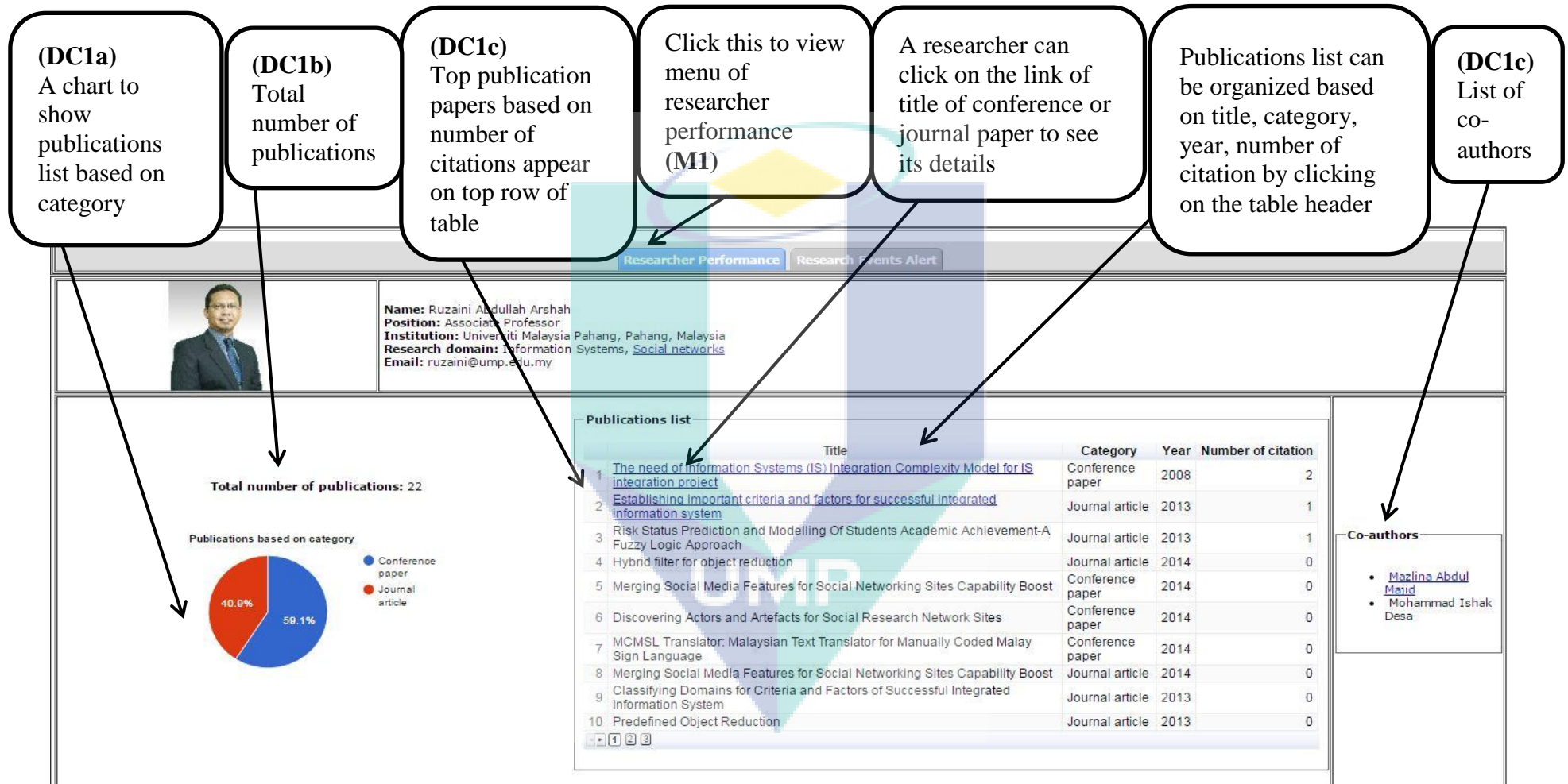
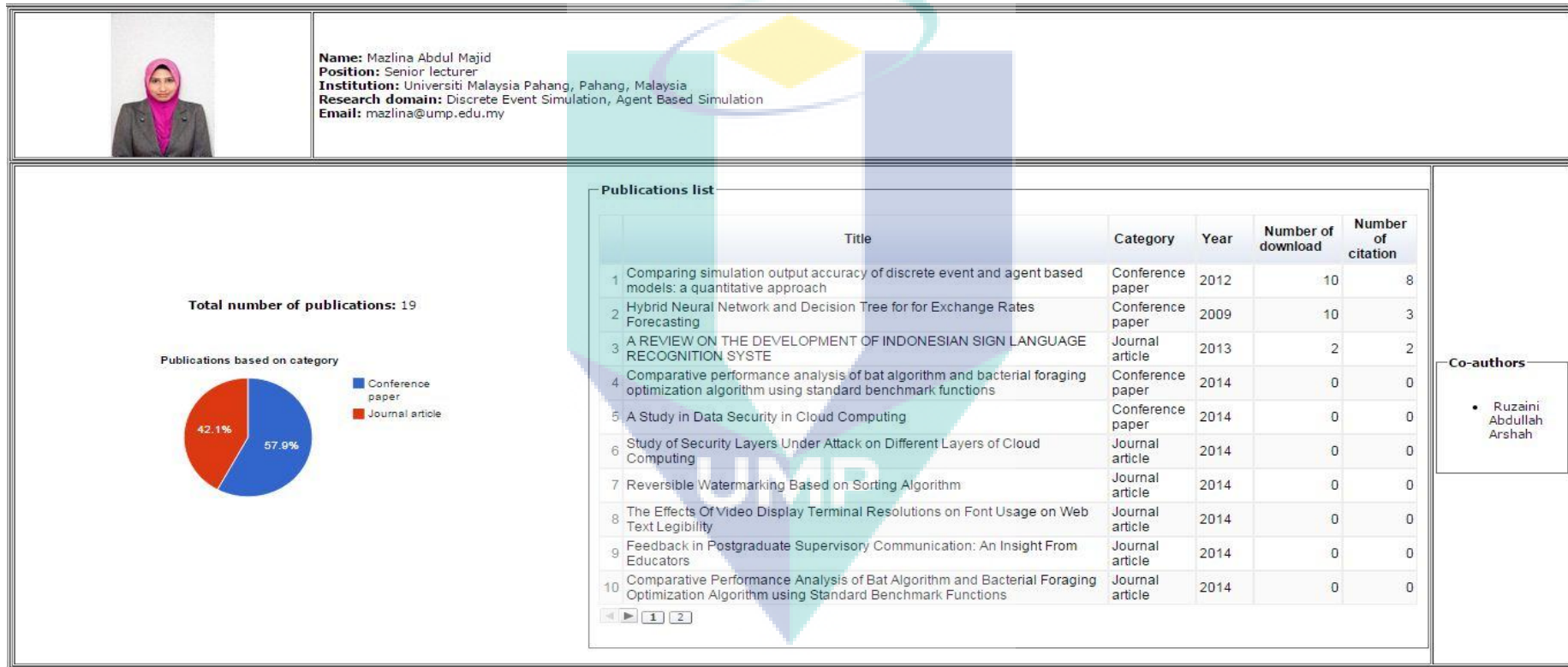*Figure B.3.* Screen design for dashboard component researcher performance (M1).

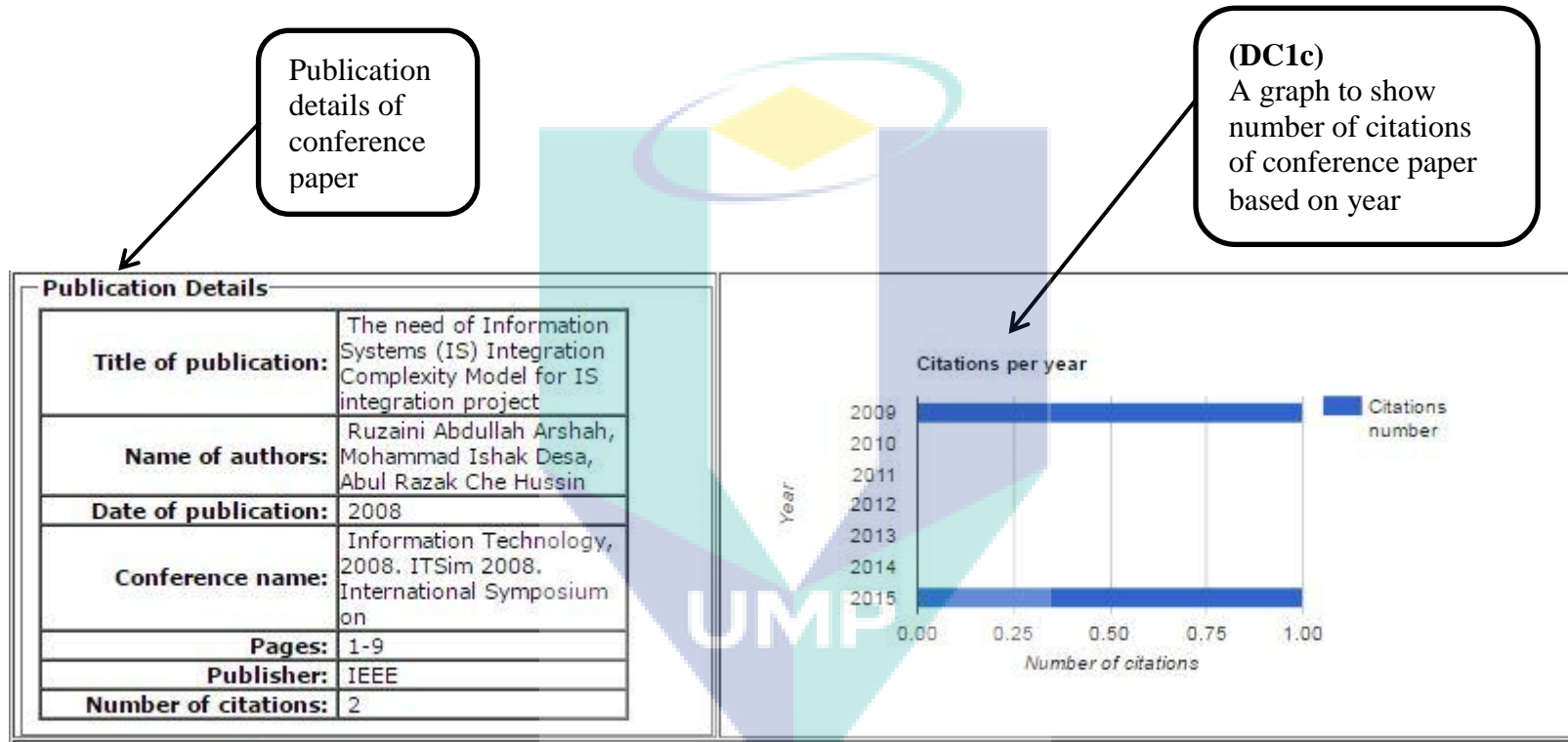*Figure B.4.* Screen design for co-author details.
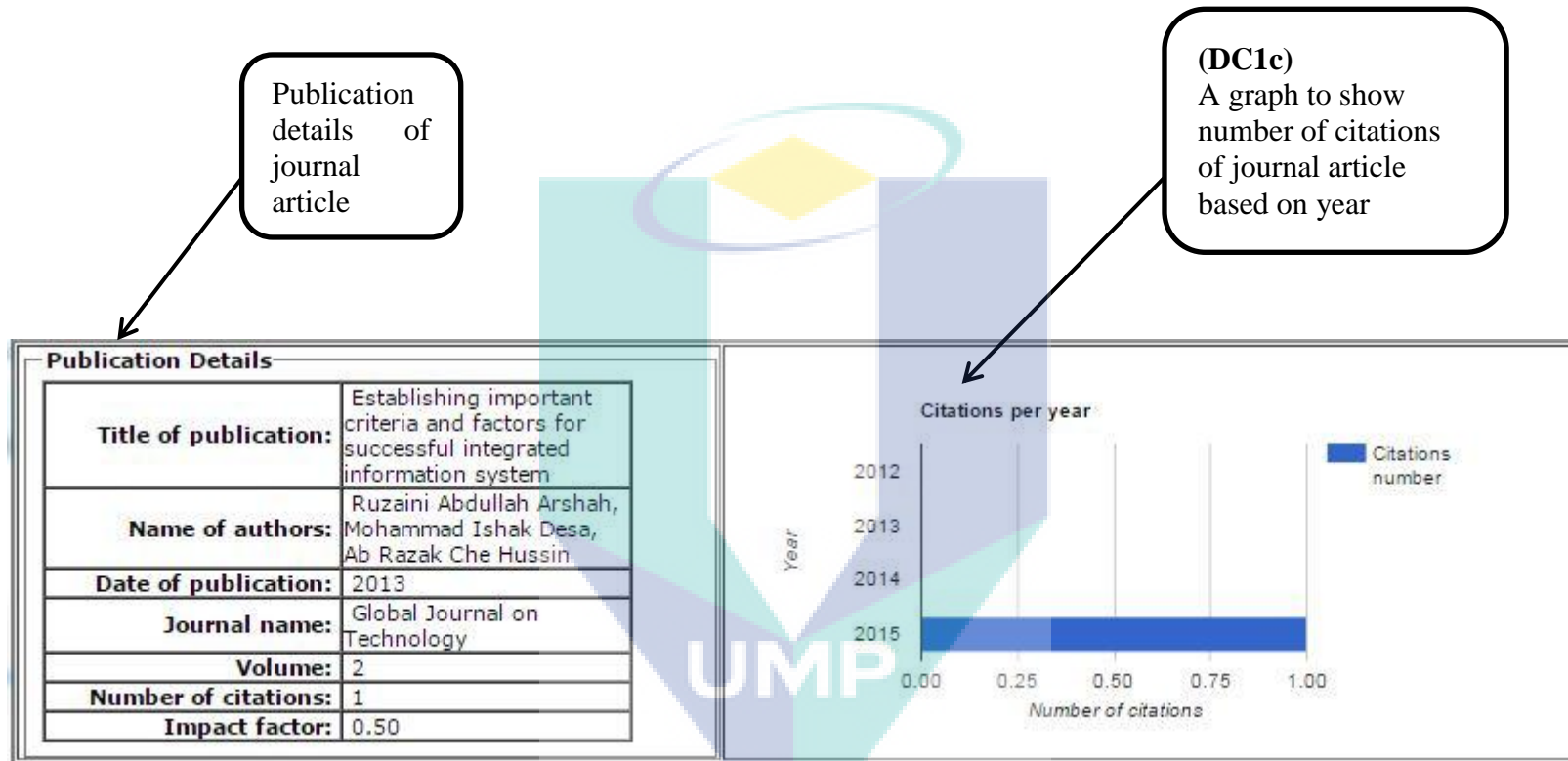
Publication details of conference paper

(DC1c)
A graph to show number of citations of conference paper based on year

Publication Details

Title of publication:	The need of Information Systems (IS) Integration Complexity Model for IS integration project
Name of authors:	Ruzaini Abdullah Arshah, Mohammad Ishak Desa, Abul Razak Che Hussin
Date of publication:	2008
Conference name:	Information Technology, 2008. ITSim 2008. International Symposium on
Pages:	1-9
Publisher:	IEEE
Number of citations:	2

Citations per year

Figure B.5. Screen design for conference paper details.

Publication details of journal article

(DC1c)
A graph to show number of citations of journal article based on year

Publication Details

Title of publication:	Establishing important criteria and factors for successful integrated information system
Name of authors:	Ruzaini Abdullah Arshah, Mohammad Ishak Desa, Ab Razak Che Hussin
Date of publication:	2013
Journal name:	Global Journal on Technology
Volume:	2
Number of citations:	1
Impact factor:	0.50

Citations per year

Year

2012
2013
2014
2015

0.00   0.25   0.50   0.75   1.00

Number of citations

Citations number

Figure B.6. Screen design for journal article details.

ii. Dashboard component impact of researcher publication (M2)

Figure B.7 shows the screen design for dashboard component impact of researcher publication (M2) in the dashboard information model. The purpose of this screen is to make the researcher able to monitor their own publication impact (P2). When the researcher can click on the title of conference paper or journal article in the table of publications list, a new screen will appear to show the detail of conference paper or journal article. In the new screen, there is a graph to show statistics of readers in each article based on institution, academic status, country and discipline type in each article (DC2) as seen in Figure B.7.

Statistic Information of Readers

by institution

by academic status

by country

by discipline type

(DC2)
A graph to show statistics of readers in conference paper based on institution, academic status, country and discipline type
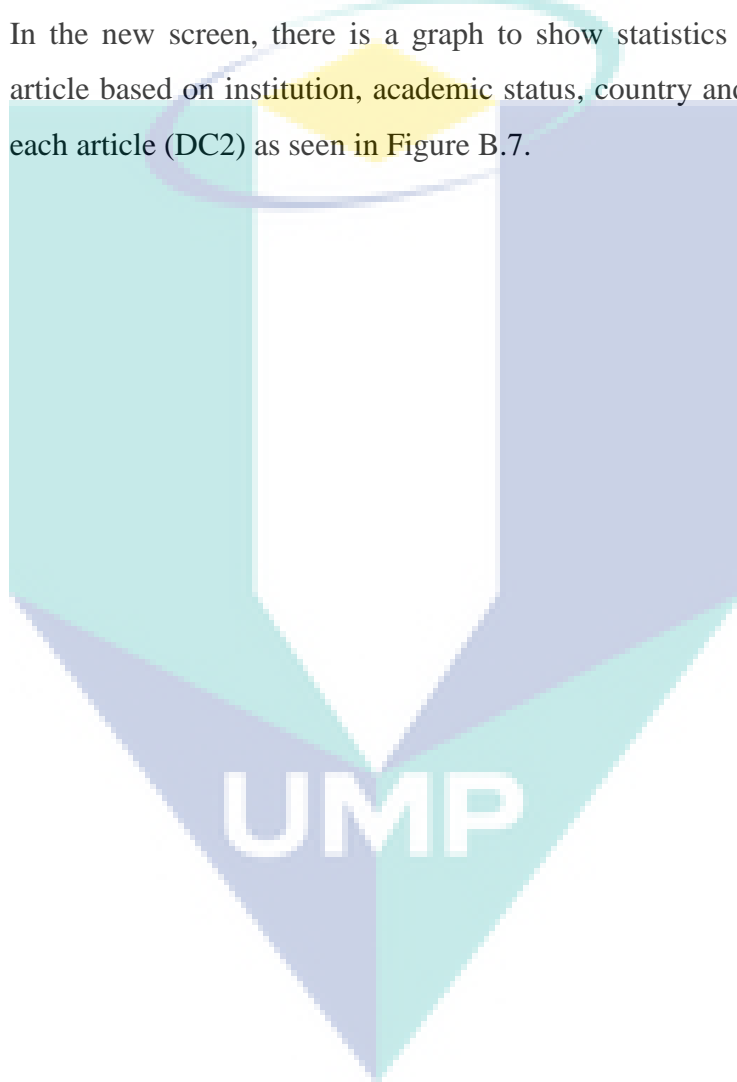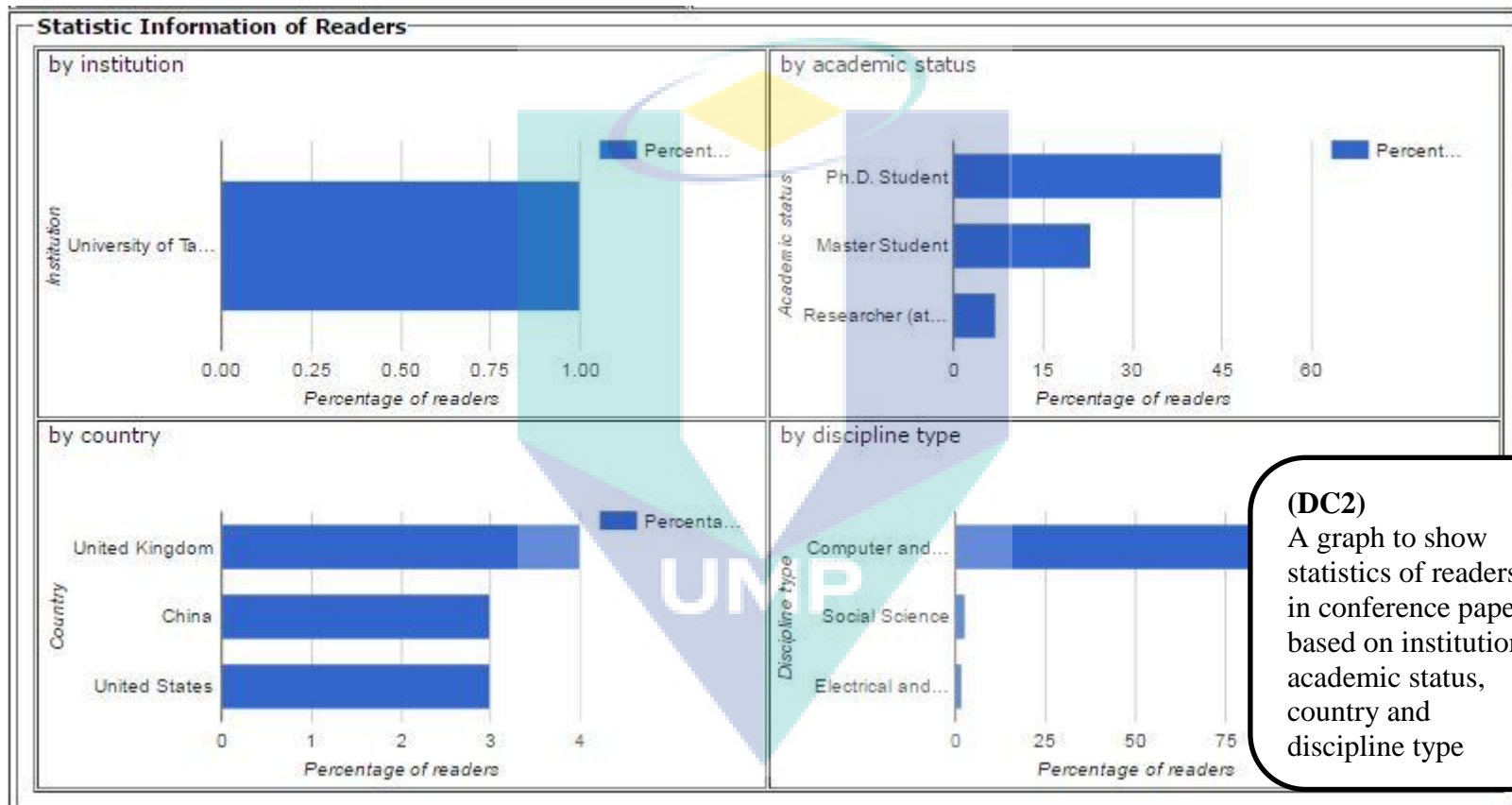
Figure B.7. Screen design for dashboard component impact of researcher publication (M2).

iii.   Dashboard component research events alert (M3)

Figure B.8 shows the screen design for dashboard component research events alert (M3) in the dashboard information model. The purpose of this screen is to make the researcher alert on upcoming events (P3) likes journal and conference publication platforms that related to the research domain that have been define by the researcher. For example, Figure B.8 shows the list of upcoming conference and Figure B.9 shows the list of journal publication platforms that related to the Information Systems research domain.

Figure B.8. Screen design for dashboard component research events alert (M3) to see list of upcoming conference.

Figure B.9. Screen design for dashboard component research events alert (M3) to see list of journal publication platforms.

APPENDIX B (SECTION D):
THE INTERVIEW QUESTIONS FOR THE DASHBOARD INFORMATION MODEL

In order to answer the interview questions, the respondents need to refer Appendix B (Section B) and Appendix B (Section C).

i.   Dashboard component researcher performance (M1)

Question 1 (Qu1)

Does the dashboard items (DC1a, DC1b and DC1c) in the dashboard component researcher performance (M1) meet researcher needs to monitor the performance of the researchers based on their own publication achievements (P1)?

☐ Yes	☐ No
Comment:	

Question 2 (Qu2)

Does the dashboard component researcher performance (M1) provide sufficient information?

☐ Yes	☐ No
Comment:	

Question 3 (Qu3)

If the dashboard component researcher performance (M1) does not provide sufficient information, what are the other dashboard items that should be added?

Comment:

ii. Dashboard component impact of researcher publication (M2)

Question 4 (Qu4)

Does the dashboard items (DC2) in the dashboard component impact of researcher publication (M2) meet researcher needs to monitor their own publication impact (P2)?

☐ Yes	☐ No
Comment:	

Question 5 (Qu5)

Does the dashboard component impact of researcher publication (M2) provide sufficient information?

☐ Yes	☐ No
Comment:	

Question 6 (Qu6)

If the dashboard component impact of researcher publication (M2) does not provide sufficient information, what are the other dashboard items that should be added?

Comment:

iii.   Dashboard component research events alert (M3)

Question 7 (Qu7)

Does the dashboard items (DC3) in the dashboard component research events alert (M3) meet researcher needs to alert on upcoming events (P3)?

☐ Yes	☐ No
Comment:	

Question 8 (Qu8)

Does the dashboard component research events alert (M3) provide sufficient information?

☐ Yes	☐ No
Comment:	

Question 9 (Qu9)

If the dashboard component research events alert (M3) does not provide sufficient information, what are the other dashboard items that should be added?

Comment:

iv.   Intention to use the mock-up prototyping that are used to represent the dashboard information model

Question 10 (Qu10)

Do you would like to use the mock-up prototyping that are used to represent the dashboard information model?

☐ Yes	☐ No
Comment:	

Position:	☐	Professor
	☐	Associate professor
	☐	Senior lecturer
	☐	Lecturer
	☐	Postgraduate student (PhD)
	☐	Postgraduate student (Master)
Years of research experience:		_____ years
Use of Social Research Network Sites (SRNS):	☐	No
	☐	Yes (If Yes, you can pick options below)
		☐ ResearchGate
		☐ Academia.edu
		☐ Mendeley
		☐ Google Scholar Citations
		☐ Other: _____

APPENDIX C:
LIST OF PUBLICATIONS

Apandi, S.H. and Abdullah Arshah, R. (2015). A design of proposed dashboard model for researchers in Social Research Network Sites. *The Second International Conference on Computational Science and Information Management 2015 (ICoCSIM-2015)*, pp. 54-59. (Best paper award)

Apandi, S.H. and Abdullah Arshah, R. (2015). The need of dashboard in Social Research Network Sites for researchers. *National Conference for Postgraduate Research 2015 (NCON-PGR 2015)*, pp. 60-70.

Apandi, S.H. and Abdullah Arshah, R. (2016). The need of dashboard in Social Research Network Sites for researchers. *International Journal of Software Engineering & Computer Systems (IJSECS)*, *2*, 120-132.

Apandi, S.H. and Abdullah Arshah, R. (2016). Validation of a proposed dashboard model for researchers in Social Research Network Sites. *Journal of Theoretical and Applied Information Technology*, *89*(2), 409-421.