

Knowledge Sharing Impact Factors Selection for Research Supervision

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ABSTRACT

Due to the impact of globalization, universities increasingly face new challenges and opportunities. Accordingly, they ought to be more innovative. Therefore, knowledge-sharing between students and supervisors is vital in universities. This research aims to systematically analyse and extract all the knowledge-sharing impact factors and choose adaptable ones for a research supervision domain. We carried out a literature review of empirical studies on knowledge-sharing quantitative research, published during the last decade (2000–2012). We have recognized 29 primary studies related to the purpose of this research. After considering these studies, we discovered the following, namely that, the ability of students to share, the culture of the respective university, knowledge-sharing social networks, flexible structure and design, supervisor support, learning strategies and IT systems are adaptable. In addition, it was found that suitable knowledge-sharing factors are not only supported by knowledge management model for research supervision and other research supervision models, but also have enough iteration in literature studies to support them.

KEYWORDS: Knowledge-sharing impact factors, Knowledge-sharing, Research supervision.

INTRODUCTION

Organizations use knowledge management techniques in order to improve innovation, efficiency and effectiveness in their companies (Lin *et al.*, 2012). There are some factors that have contributed to make knowledge management so famous in recent days. One of these factors is the globalization of economies. Myers *et al.* (1996) stated that this factor has forced firms to adapt and increase innovation and process speed. Globalization not only influences the business world but also impacts upon other sectors like higher education. It is the pressure on higher education institutions that has responded to global integration. Thus, universities in this competitive world should be more innovative and have their own specific competitive advantage. In universities, the concept of storing knowledge is not new, but sharing knowledge and using it among academics and students is new (Keramati and Azadeh, 2007). For academic institutions like business organizations, knowledge management can produce a competitive advantage.

The main output of universities is research results and new knowledge that should be managed by using knowledge management techniques. Knowledge-sharing and transferring in universities between students and supervisors is vital for universities, as it decreases the budget and provides an affordable way of doing research. The important objective of universities is to improve students' skills and educate them to become expert knowledge workers. Zhao (2003) argues that using a knowledge management approach in research supervision enhances the quality of research supervision process that leads to an improvement in scholars' research skills. She mentioned how knowledge-sharing can improve the retention rate for the quality of educational programs (such as student progress rate and completion rates). Literature studies include different factors which influence knowledge-sharing in organizations (Rhodes *et al.*, 2008). In spite of the availability of superior systems and a great amount of information in institutions, it is the organizational and behavioural factors in sharing knowledge that are vital in concluding the success or failure of knowledge-sharing technologies (Agarwal *et al.*, 2012; Boden *et al.*, 2012; Chen *et al.*, 2012; Chen and Cheng, 2012). Hence, knowledge-sharing success in research processes in universities depends on collaboration and knowledge-sharing among research group members, students and supervisors (Agarwal *et al.*, 2012; Chen and Chen, 2009; Cheng *et al.*, 2009; Sohail and Daud, 2009; Teh *et al.*, 2011; Wabwezi, 2011; Wangpipatwong, 2009)

Many studies have been conducted to verify the impact of different factors, namely; organizational, individual and technological, on knowledge-sharing in organizations. However, as far as the researcher is aware, only a few have conducted empirical studies to find out the impact of individual, organizational and technological factors on knowledge-sharing together. Also, a few studies were found that examined the effect of these factors in knowledge-sharing in universities.

The objective of this study is to extract knowledge-sharing impact factors from literature which are suitable and adaptable for the research supervision domain. Accordingly, in this review, most of the knowledge-sharing impact factors were extracted from literature, as well as key success tips in relation to knowledge-sharing extracted

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from a research supervision model. We also used a knowledge management model for research supervision (Zhao, 2003) as a superior and based model for factor selection and adaption in a supervision domain.

In this paper, some supervision models were first mentioned, and key success points of knowledge-sharing were then summarized. Subsequently, the research method of this review was described. The result factors (which are important for knowledge sharing in the research supervision domain) were then stated. Finally, the limitation of study and conclusion was mentioned.

The research supervision models

Soliman (1999) stated that, during the supervision process, the supervisor evaluates the work of the student and provides appropriate feedback for enhancement. The student frequently meets with the supervisor to discuss the progress of his/her work. Different modes of communication and collaboration are employed during that time. A number of guidelines and suggestions abound in the way meetings should be conducted including; the responsibilities of students and supervisors and problems and conflicts resolution that arise during the process.

In this study, some existing supervision models were reviewed and used to propose the key success tips of knowledge-sharing that these models emphasize. The Supervisory Management Styles (SMS) Model (Figure 1) was proposed by Gatfield and Alpert (2002). It suggested a four quadrant supervisory style management grid which advertises the understanding of supervisory styles and its changes during the supervisory period. The authors argue that supervisors tend to assume that they know which elements of the supervisory process and management styles are more appropriate for success. This model emphasizes the following points:

- Supervisors' support
- Management skill of students to manage research and their ability to communicate and collaborate.

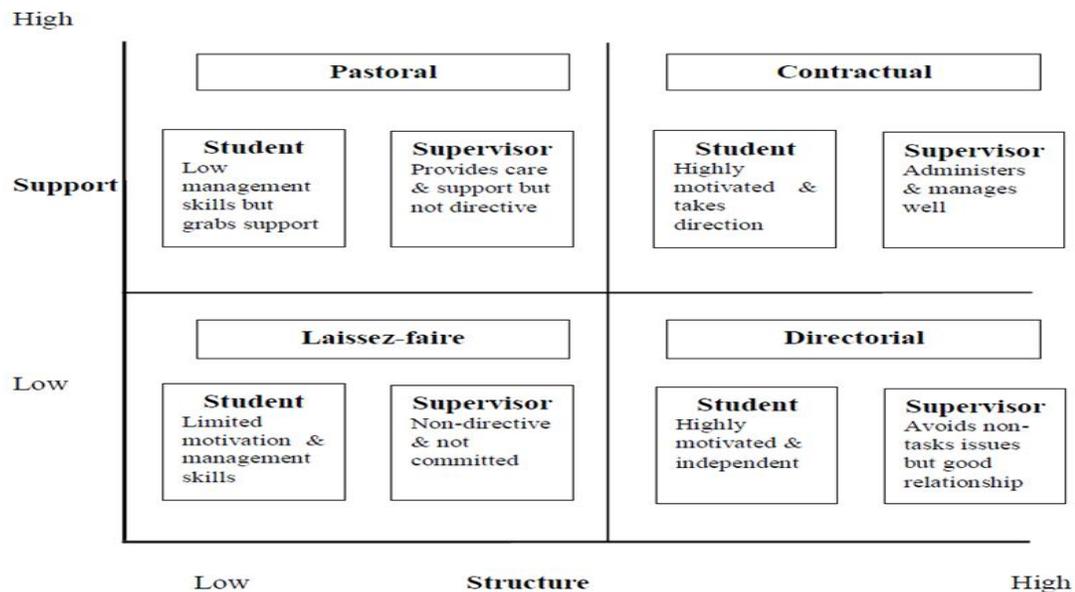


Figure 1: Supervisory management grid (source:Gatfield & Alpert, 2002)

The Blended Postgraduate Supervision (BPS) Model was suggested by De Beer and Mason (2009) and noted that blended learning is mostly offered by using three ways, namely; the classroom, the virtual classroom and online courses. They argue that postgraduate supervision is very similar to blended learning in these delivery methods, with the exception being that there is rarely a classroom instruction but rather face-to-face interaction between students and supervisors. The main idea is to provide students with links on web pages that allow students to access various topics either internally through Web CT or the internet. This is an opportunity for students to discuss and consult with their supervisor and use different technology in order to create and share knowledge (De Beer and Mason, 2009). Research is an important way of learning for postgraduate students, in that it allows them to enrich their experiences and extend the boundaries of their knowledge. The use of IT-Based communication, social media, online databases and E-learning systems can improve their ability to capture, transfer and share knowledge (De Beer and Mason, 2009).

In the area of blended postgraduate supervision, the role of supervisors is to represent the key sources of information to be accessed by students in face-to-face consultations and via the internet and libraries, and then evaluate what the student has gained from it.

Thus, this model emphasizes the following points:

- Using Web technology

- Using IT-Based communication
- Supervisors' support

The Knowledge Management (KM) Model for supervision process is the superior model which we used to choose knowledge-sharing impact factors from, since it is the only research supervision model which is specific for knowledge management and knowledge-sharing. Using this approach, we can choose factors which are specific for a research supervision environment. This model was proposed by Zhao (2003).

In order for students to graduate successfully, the supervisory process is vital. It is responsible, complex and subtle. A systematic knowledge-sharing approach is then needed to assist both supervisors and students to obtain, share and apply knowledge. A knowledge-sharing approach means the supervisor focuses on assisting students so as to enhance knowledge-sharing ability in research supervision. This knowledge-sharing ability refers not only to the skill of using superior technological resources to manage information, but also to the ability to make a decision about selecting and using information (Zhao, 2001, 2003).

Furthermore, the author maintains that postgraduate supervision encompasses knowledge management and believes that the effectiveness of supervision can be enhanced by integrating its concepts. Figure 2 below depicts the knowledge management model for research supervision.

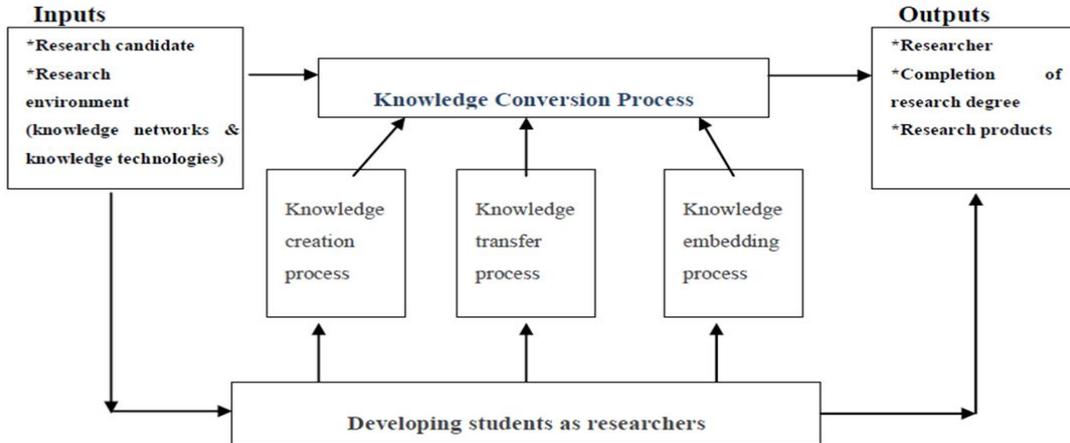


Figure 2: Knowledge management model for research supervision (source:Zhao, 2003)

In a knowledge-based university with the new trend of research supervision, knowledge-sharing between supervisors and among students is essential. Accordingly, the universities are following the new supervision arrangements and structures. Some of these models offered by Zhao (2003) are namely: a coursework model, a collaborative cohort model, a workshop model, a methodology group model and a conference model. Knowledge-management approaches cause these changes to supervision models.

For example, using knowledge-sharing social networks among students is one of the most popular knowledge-sharing approaches in order to enhance learning. These networks use information technology like social media, weblog and teleconferencing. The transfer of knowledge is a key to organizational success, quality and competitiveness. In universities, publications, presentations, websites, white papers, reports and policies can be found examples of methods used to transfer knowledge. The main challenge confronting institutions of higher education, however, is to shift the emphasis placed on key skills, business processes, and technologies in order to create systematic and well-integrated approaches to generate, codify and transfer knowledge throughout the institution(Zhao, 2001).

There are close synergies between the research supervision process and the knowledge exchange process in the knowledge management model which is illustrated in Figure 2. The model suggested that research students extend new knowledge (knowledge creation) in the following ways, namely: by synthesising and integrating this knowledge (knowledge transfer), enhancing their understanding and developing new ideas and contributing to the existing knowledge in that field (knowledge embedding). Thus, research supervision is obviously a knowledge creation, transfer and embedding process. This process needs innovation-oriented students and suitable research environments (research universities) that can provide knowledge infrastructure, such as IT systems and networks of experts (supervisors and lecturers). The output of this process is qualified researchers who finish their research degrees and have enough ability to manage knowledge and create new knowledge, there by adding value to the knowledge-based society. Therefore, they are able to fit in well with a knowledge-based society. The supervisors focus on guiding students in order to improve these knowledge management skills (Zhao, 2003).

Knowledge management is an academic advantage and economic resource that promotes the quality of a university and manages the research supervision as a knowledge acquisition process in order to add value to the university. It is also an indicator for governments by which to judge the quality of a particular university. The

process of learning occurs when individuals share their knowledge, since knowledge is embedded in the minds of people. The key success tips of knowledge-sharing which this superior model and also previous models emphasised are shown in Table 1.

Table 1: The key success tips of knowledge-sharing in Zhao (2003) Model

No.	The key success tips of knowledge sharing
1	Flexible structure of university
2	Learning strategy which leads to a systematic knowledge-sharing approach in a university
3	Supervisors' support to enhance knowledge-sharing ability in research supervision (also mentioned in SMS and BPS)
4	Knowledge-sharing social networks among students and Social Networks of experts (supervisors and lecturers)
5	Culture of university
6	Knowledge-sharing ability of students (also mentioned in SMS)
7	Knowledge repositories through guiding students to present and publish their works
8	IT Systems (also mentioned in BPS)

METHODOLOGY

The goal of this study is to extract knowledge-sharing impact factors from literature studies and choose appropriate ones for use in a research supervision domain. At the planning stage of this review, a review protocol was developed. The protocol has six steps (see Figure 3). In the first step, a research strategy is developed in order to achieve the objectives of the study. This step includes selection of search terms and determining relevant literature. In the next step, research selection criteria are identified to find relevant studies which address his research objective. The next step is data extraction. In the data extraction step, a data extraction form is designed (see Table 2) and all selection papers are reviewed. In this step we use Microsoft OneNote to classify papers and enter the data of extraction forms. We then extract all the knowledge-sharing impact factors. The next step involves matching these factors with a superior supervision model (knowledge management supervision model). In this step, the specific factors for research supervision were selected and in the last step, based on iteration of factor in literature, the priority of factor was defined and more priority factors were chosen to develop the research model.

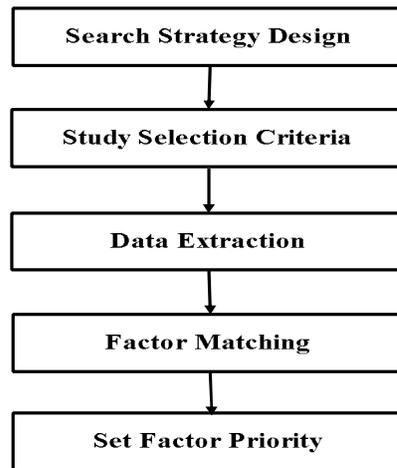


Figure 3: Steps of review protocol.

Search Strategy

In the research strategy, the first search term is identified, literature resources are then selected and the search process is designed.

Search Terms

The following stages are utilized to formulate the search terms (Wen *et al.*, 2011):

- Extract important terms from the research objectives.
- Find synonyms and alternative spellings for important terms.
- Test the keywords in related books or papers.
- Utilize the Boolean OR and the Boolean AND to create search strings.

The results are as follows:

(Knowledge and sharing and impact and factors) or (knowledge and sharing and factors) or (knowledge and sharing and university) and (knowledge and sharing and factors) or (knowledge and sharing and higher institution) or (important factors and Knowledge and sharing)

LITERATURE RESOURCES

For this study three electronic databases (Web of Knowledge, Scopus, and Google Scholar) were searched to gather the literature resources.

Search Process

To find the relevant sources (those that meet the selection criteria), the search process was identified. This process has two stages, namely:

- Stage 1: search the three different electronic databases and gather all the results together.
- Stage 2: find more relevant papers and consider the reference list of each applicable paper to discover extra related papers.

Software Endnote (<http://www.endnote.com>) was utilized to manage all references and to manage content of papers, Microsoft OneNote was used. Sixty (60) relevant papers were found in the search process.

Study Selection

After the search process, the result should be reviewed and, based on research criteria; some relevant results should be selected. Many candidate papers cannot answer the research questions; hence more filtering is needed to achieve the best results.

The selection process has two stages, namely:

- Stage1: Apply research criteria to the candidate papers in order to select papers that can strongly support research questions.
- Stage 2: Apply the quality assessment criteria so as to select the qualitative papers.

The following inclusion and exclusion criteria were defined and the selection process was done by reading the abstract, introduction, research method, results and conclusion of the papers. Figure 4 shows the search and selection process.

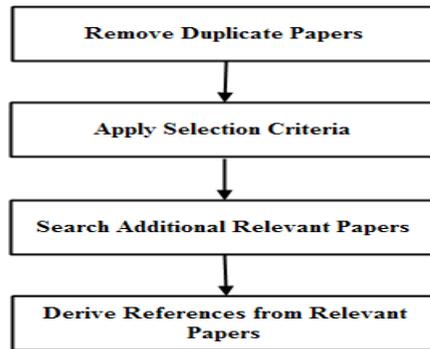


Figure 4: Search and selection process

Inclusion Criteria:

- Focus on knowledge-sharing of impact factors.
- Only quantitative research was selected.
- Important features used in universities or educational environment were mentioned
- For studies that have both a conference version and a journal version, only the journal version will be included
- For duplicate publications of the same study, only the most complete and newest one will be included

Exclusion Criteria:

- Papers that only offer the model or solution without any quantitative evidence.
- Review papers will be excluded.

Figure 5 shows the number of papers which we selected from different databases after using the above criteria; most of the papers were gathered from Google Scholar.

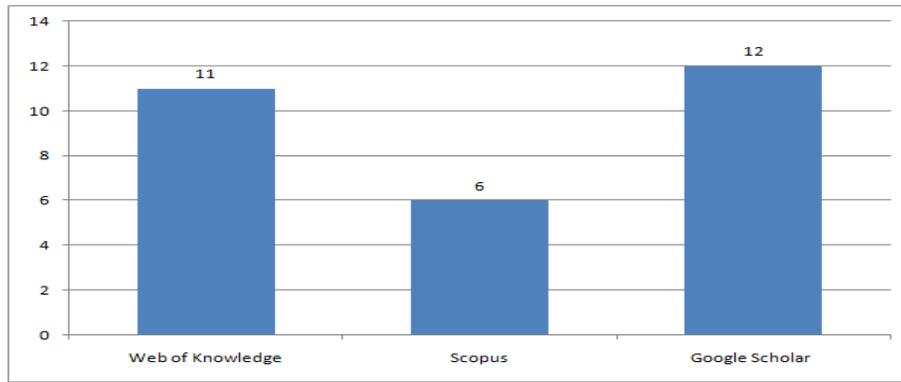


Figure 5: Number of papers in different databases

The period of papers was restricted from 1 January 2000 to November 2012. Figure 6 shows the number of selected papers per year.

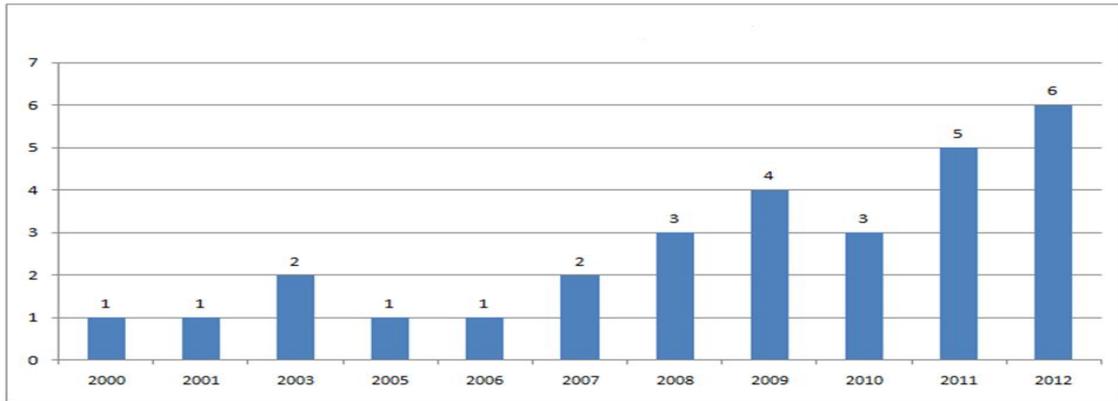


Figure 6: Number of selected papers per year

Data Extraction

To facilitate data extraction from selected papers, a suitable form of data extraction card was designed. This data extraction card is the pattern and guideline for extracting relevant data that contributes to addressing the research objectives. This card is also useful for research group work. Table 2 shows the form of data extraction card. In this study, the data extraction card is used as a pattern in Microsoft OneNote to extract and classify relevant papers.

Table 2: The form of data extraction card.

Year of publication
Article title
Name of authors
Source
Key words
Paper Motivation/ Objective/ contribution
Research Method used
Knowledge-sharing factors

Table 3 shows the 29 selected studies by using study selection criteria. This table also lists knowledge-sharing factors extracted from each paper and the type of factors that the paper examined. Types of factors include:

1. Individual
2. Organizational
3. Technical

It also shows whether or not the case of the quantitative paper was an educational one such as a university.

Table 3: The selected studies and their knowledge-sharing factors

ID	Author	year	Type of factors	Type	database	Knowledge sharing Factors	Educational case
S1	(Yue Wah et al.)	2007	2	Journal	Google Scholar	Structural Dimensions, Relational Dimensions, Agency Dimensions	√
S2	(Boden et al.)	2012	2	Journal	Web of Knowledge	Organizational culture	
S3	(Wangpipatwong)	2009	1,2,3	Conference	Google Scholar	Willingness to Share, Ability to Share, Instructor Support, Degree of Competition, Technology Availability,	√

						Technology Support	
S4	(Van den Hooff et al.)	2003	1,2	Journal	Google Scholar	Identification with community, trust, communality, connectivity, willingness to share, ability to share	√
S5	(Sohail and Daud)	2009	1,2	Journal	Scopus	Nature of knowledge, working culture, staff attitudes, motivation to share, opportunities to share	√
S6	(Rhodes et al.)	2008	2,3	Journal	Scopus	IT, learning strategy, trust culture, flexible structure and design	
S7	(Agarwal et al.)	2012	2,3	Journal	Google Scholar	Web based Technologies, User based Technologies, Leadership, Culture, Structure, roles and responsibilities, Information technology infrastructure	√
S8	(Hassandoust et al.)	2011	1,2,3	Journal	Google Scholar	Trust, Competition, Anticipated Reciprocal relationships, Willingness to share knowledge, Identification, Collectivism, Organizational Culture	√
S9	(Cheng et al.)	2009	1,2,3	Journal	Google Scholar	Incentive System, Management System, Organizational Culture, Individual Attitude, Personal Expectation, IT Application	√
S10	(Chen and Chen)	2009	1,2	Journal	Scopus	Attitude Toward Knowledge-Sharing, Knowledge Creation Self-Efficacy, Web-Specific Self-Efficacy, Subjective Norm, Social Network Ties, Knowledge-Sharing Intention	√
S11	(Teh et al.)	2011	1	Journal	Web of Knowledge	Conscientiousness, Neuroticism, Openness, Extraversion, agreeable attitude towards knowledge-sharing, Subjective Norm, Intention to share knowledge	√
S12	(Ismail and Yusof)	2010	1	Journal	Google Scholar	Awareness, trust, personality	S12
S13	(Babalhavaeji and Kermani)	2011	1	Journal	Web of Knowledge	Attitude, Intention, Intrinsic Motivation	S13
S14	(Rad et al.)	2011	1,2,3	Journal	Google Scholar	Organizational culture, Organizational structure, ICT infrastructure, Social trust, Relational social capital, Individual attitude toward knowledge sharing	S14
S15	(Lin et al.)	2012	1,2	Journal	Web of Knowledge	Altruism, Affect-based trust, Cognition-based trust, Legitimate power, Coercive power, Reciprocity, Expected reward, Expected association, Tangible reward, Cost, Willingness to share knowledge, Task inter-dependence	S15
S16	(Chen and Cheng)	2012	1,2	Journal	Web of Knowledge	Internal marketing, organizational culture, knowledge-sharing attitudes, Internal communication, Leadership, Management Support, Inter-departmental Interaction, Training and Openness, Trial and Innovation, Cooperation and Trust, Social Network, Facilitating Environment, Self-efficacy	S16
S17	(Chow and Chan)	2008	1,2	Journal	Web of Knowledge	Social trust, shared goals, social network, attitude toward knowledge-sharing, subjective norm about knowledge-sharing, intention to share knowledge	S17
S18	(Tsai et al.)	2012	1,2	Journal	Web of Knowledge	Anticipated reciprocal relationships, Perception of ethics, Organizational culture, Attitude toward knowledge-sharing, Subjective norm, Intention to share knowledge	S18
S19	(Chen et al.)	2012	2,3	Journal	Web of Knowledge	Group-based reward mechanism, Interpersonal trust, Investment for training: knowledge sender and recipient, Building shared acronyms, Time availability, Proximity of employees: Virtual Network, Proximity of employees: Physical network	S19
S20	(Matzler and Mueller)	2011	1	Journal	Web of Knowledge	Conscientiousness, Need for learning, Openness, Competitiveness	S20
S21	(McNeish and Mann)	2010	2	Journal	Google Scholar	Trust	S21
S22	(Van Den Brink)	2001	2,3	Conference	Google Scholar	Motivation, trust, competence leverage, knowledge crew, learning organization, organically structured organization, systems integrated into daily work process, knowledge champion, climate of openness, communities, collaboration, dialogue, knowledge repository, knowledge route map, collaborative platform	S22
S23	(Riege)	2005	1,2,3	Journal	Scopus	Trust, Experience and skills with technology, Organizational Culture, Degree of Competition, Technology Support, opportunities to share, flexible structure and design, roles and responsibilities, Leadership, ICT infrastructure, Social Network Ties, awareness, Time availability, collaborative platform, reward system	S23
S24	(Willem and Scarbrough)	2006	2	Journal	Web of Knowledge	Degree of Competition, Trust, flexible structure and design, roles and responsibilities, Social Network Ties	S24
S25	(Schepers and van den Berg)	2007	2	Journal	Scopus	Degree of Competition	S25
S26	(McEvily et al.)	2003	2	Journal	Web of Knowledge	Social Network Ties, Trust, collaboration	S26
S27	(Klein)	2008	2	Journal	Scopus	Learning strategy	S27
S28	(Wahlroos)	2010	1,2,3	Master thesis	Google	Benefits, Costs, Trust Issues, Experience and skills with Technology, Understanding of responsibilities, Managerial Implications, Organizational Culture, Web 2.0	S28

Factor Matching

In this part of the study, data synthesis techniques were utilized to answer the research objectives. Strong evidence was gathered in this stage to answer the questions. All the results of quantitative research studies were classified and aggregated to acquire a synthesis of new knowledge and evidence to meet the research objectives.

Firstly, all the factors from the literature studies were listed in Table 4, following which each factor should be compared with the key success tips of knowledge-sharing in Zhao (2003) Model (Table1).If the factor or the concept of it matched with one of the tips in that superior research supervision model, the factor will then be added to the selected factors list (Table 5).

Table 4: List all the knowledge-sharing impact factors extracted from literature studies.

	Factor	Type	References	Educational Iteration	Non Educational Iteration	Support by KM Model
1	Benefits	Individual	S28,	0	1	
2	Costs	Individual	S28,S15	0	2	
3	Trust	Organizational	S28,S4,S6,S8, S12,S14, S15,S10,S17, S19, S21,S29, S26, S21,S23	2	13	
4	Experience and skills with technology	Individual	S28,S23	0	2	√
5	Understanding of responsibilities	Individual	S28	0	1	
6	Managerial Implications	Organizational	S28	0	1	
7	Organizational Culture	Organizational	S28,S2,S5,S7,S8, S9, S14,S10,S18,S6,S23	5	6	√
8	Web 2.0(Web basedtechnologies)	Technological	S28,S7	1	1	√
9	StructuralDimensions	Organizational	S1	1	0	√
10	RelationalDimensions	Organizational	S1	1	0	√
11	AgencyDimensions	Organizational	S1	1	0	
12	Willingness to Share	Individual	S3,S4,S8,S15	2	2	
13	Ability to Share	Individual	S3,S4	1	1	√
14	Instructor Support	Organizational	S3, S10,S19,S28	1	3	√
15	Degree of Competition	Organizational	S3,S8,S20,S24,S25,S23	2	4	
16	Technology Availability	Technological	S3	1	0	√
17	Technology Support	Technological	S3,S23	1	1	√
18	identification with community	Organizational	S4	0	1	
19	communality	Organizational	S4	0	1	
20	connectivity	Organizational	S4	0	1	
21	Individual attitude	Individual	S18	6	3	
22	motivation to share	Individual	S5	1	0	
23	opportunities to share	Individual	S5,S23	1	1	
24	Learning strategy	Organizational	S6,S21,S27	0	3	√
25	flexible structure and design	Organizational	S6,S7,S14,S21,S24,S23	2	4	√
26	User-basedtechnologies	Technological	S7	1	0	
27	Leadership	Organizational	S7,S10,S23	1	2	
28	ICT infrastructure	Technological	S7,S14,S6,S23	2	2	√
29	Anticipatedreciprocalrelationship	Organizational	S8,S18	1	0	
30	Identification	Organizational	S8	1	0	
31	Collectivism	Organizational	S8	1	0	
32	Incentive System	Organizational	S9	1	0	
33	Management System	Organizational	S9	1	0	
34	Personal Expectation	Individual	S9	1	0	
35	IT Application	Technological	S9	1	0	√
36	KnowledgeCreation Self-Efficacy	Individual	S10	1	0	
37	Web-SpecificSelf-Efficacy	Individual	S10	1	0	
38	SubjectiveNorm	Organizational	S10,S11,S17,S18	2	2	
39	SocialNetwork Ties	Organizational	S10,S16,S17,S26,S24,S23	1	5	√
40	Knowledge-SharingIntention	Individual	S10,S11,S13,S17,S18,S23	3	3	
41	Conscientiousness	Individual	S11,S20	1	1	
42	Neuroticism	Individual	S11	1	0	
43	Openness	Individual	S11,S20	1	1	
44	Extraversion	Individual	S11	1	0	
45	Agreeable behaviour	Individual	S11	1	0	
46	Awareness	Individual	S12,S23	0	2	
47	Personality	Individual	S12	0	1	
48	IntrinsicMotivation	Individual	S13	1	0	
49	Relational social capital	Organizational	S14	1	0	√
50	Altruism	Individual	S15	0	1	
51	Legitimate power	Organizational	S15	0	1	
52	Coercive power	Organizational	S15	0	1	
53	Reciprocity	Organizational	S15	0	1	
54	Expected reward	Organizational	S15	0	1	
55	Expected association	Organizational	S15	0	1	
56	Tangible reward	Organizational	S15	0	1	
57	Task inter-dependence	Organizational	S15	0	1	

58	internal marketing	Organizational	S16	0	1	
59	Internal Communication	Organizational	S16,S26	0	2	
60	Inter-departmental Interaction	Organizational	S16	0	1	
61	Training and Openness	Organizational	S16	0	1	√
62	Trial and Innovation	Organizational	S16	0	1	
63	Facilitating Environment	Organizational	S16	0	1	
64	Self-efficacy	Individual	S16	0	1	
65	Shared goals	Organizational	S17	0	1	
66	Perception of ethics	Individual	S18	0	1	
67	Group-based reward mechanism	Organizational	S19	0	1	
68	Investment for training: knowledge sender and recipient	Organizational	S19	0	1	√
69	Building the shared acronyms	Organizational	S19	0	1	
70	Time availability	Organizational	S19,S23	0	2	
71	Proximity of employees: Virtualnetwork	Technological	S19	0	1	√
72	Proximity of employees: Physicalnetwork	Technological	S19	0	1	
73	Need for learning	Individual	S20	0	1	
74	Competence leverage	Organizational	S21	0	1	
75	Knowledge crew	Organizational	S21	0	1	
76	Slack	Organizational	S21	0	1	
77	Systems integrated into daily work process	Organizational	S21	0	1	
78	Metrics	Organizational	S21	0	1	
79	Knowledge champion	Organizational	S21	0	1	
80	Climate of openness	Organizational	S21	0	1	
81	Communities	Organizational	S21	0	1	
82	Collaboration	Organizational	S21	0	1	
83	Dialogue	Organizational	S21	0	1	
84	Knowledge repository	Technological	S21	0	1	√
85	Knowledge route map	Technological	S21	0	1	
86	Collaborative platform	Technological	S21,S23	0	2	
87	Motivation	Organizational	S21	0	1	
88	Reward system	Organizational	S6,S23	0	2	

Figure 7 shows most iterative knowledge-sharing factors in literature based on the information provided in Table 4.

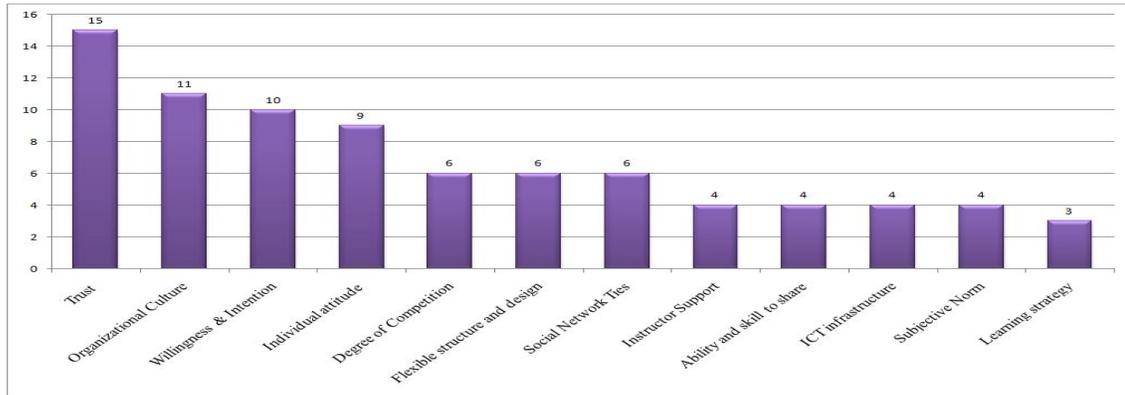


Figure 7: Most iterative knowledge-sharing factors in literature

We then matched the factors from Table 4 with the key success tips of supervision models. The result is shown in Table 5.

Table 5: List of matched factors to the key success factors of knowledge-sharing in superior supervision model.

No.	The key success tips of knowledge-sharing in superior supervision Model	Selected Knowledge-sharing Factors
1	Knowledge-sharing ability of students (also mentioned in SMS)	Ability to share , experience and skills with technology
2	Culture of university	Organizational Culture
3	Knowledge-sharing social networks among students and networks of experts (supervisors and lecturers)	Relational Dimensions, Social Network Ties, Relational social capital
4	Flexible structure of university	Structural Dimensions, flexible structure and design, roles and responsibilities
5	Supervisors' support to enhance knowledge-sharing ability in research supervision (also mentioned in SMS and BPS)	Instructor Support
6	Learning strategy which led to a systematic knowledge-sharing approach at university	Learning strategy, Training and Openness, Investment for training
7	IT Systems (also mentioned in BPS)	Technology Availability, Technology Support, ICT infrastructure, Web 2.0(Web-based technologies), IT Application
8	Knowledge repositories through guiding students to present and publish their works	Knowledge repository

Factors Priority

The last step in this study is to merge same and similar factors and give priority to them. After matching the knowledge-sharing impact factors to the key success tips of knowledge-sharing in superior supervision model, some factors were also matched with each key success tip. We then merged all the factors that matched one key success tip and sorted the results based on the type of factors (organizational, technical, individual) and educational iteration (the number of papers that used this factor in an educational environment), as well as non-educational iteration. The result was shown in Table 6.

Table 6: The result of factor selection process, sorted by type and iteration.

No	Factor	Type	References	Educational iteration	Non educational iteration
1	Knowledge-sharing ability of students	Individual	S3, S4, S28, , S23	1	3
2	Culture of university	Organizational	S28, S2, S5, S7 S8, S9, S14, S16, S18, S6, , S23	5	6
3	Knowledge-sharing social networks	Organizational	S1, S10, S16, S17, S26, S24, , S23, S14, S19	3	6
4	Flexible structure and design	Organizational	S6, S7, S14, S21, S24, , S23, S1	3	4
5	Supervisor Support	Organizational	S3, S16, S28, S19	1	3
6	Learning strategy	Organizational	S6, S21, S27, S16, S19, S20	0	6
7	IT Systems	Technological	S28, S7, S9, S3, , S23, S14, S6	4	3
8	Knowledge repository	Technological	S21	0	1

RESULT AND DISCUSSION

Type of Factors that Impact upon Knowledge-Sharing

There are some factors that impact upon knowledge-sharing in organizations. Some scientists categorize them in different methods, but most literature studies divide them into three sub groups. Cheng *et al.* (2009) stated that knowledge-sharing factors can be grouped into three sub groups, namely; technical factors, individual factors and organizational factors. Organizational factors refer to the factors that have not developed from individual personality; they are instead related to the environment of organization and the relationship between persons in the organization. They are organized as external factors. Individual factors are extracted from individual personality traits like beliefs, attitudes and feelings. They are internal factors. Technological factors are related to information technology like software and hardware for knowledge management systems, which are used in sharing activities. Riege (2005) discussed potential knowledge-sharing barriers and divided them into three main groups, namely; individual, organizational and technological barriers. The study was done by Wangpipatwong (2009) to consider the impact factors that influence knowledge-sharing among students. He categorized these factors into three domains, namely; classroom, individual and technological domains. Wahlroos (2010) in his thesis also categorized these factors into three aspects, namely; individual, organizational and technological aspects.

Review of the Results of Factor Selection

In this study, we identified 27 studies, being quantitative research that examined knowledge-sharing factors in different case studies. These papers were published from 2000 until 2012; among them three papers were published in a conference. One of them is in the form of a book chapter and another is in the form of a master thesis, while the rest are published in journals. Twelve (12) papers were obtained from Google Scholar and a further 11 of them from Web of Knowledge database; with the rest being from Scopus. We extracted from all of these papers 88 knowledge-sharing impact factors. Fifty-two (52) of them are organizational factors, 25 of them are individual factors and 11 of them are technical factors. From these papers, 11 of them examined knowledge-sharing factors in educational environments (universities, institutions). We wanted to extract from these 88 factors suitable features for a research supervision domain. Our criteria for selection come from research supervision models, especially the Zhao Model, which is currently the only model of knowledge management in research supervision. Therefore, based on knowledge-sharing key success tips from the knowledge management model in research supervision, we chose the factors from a total of 88 knowledge-sharing factors and matched them to each of the tips. The result was shown in Table 6. This table was also ordered on the type of factor (individual, organizational and technical) and educational iteration (number of papers which used these factors to investigate knowledge-sharing in an educational environment) and non-educational iteration.

The first factor is an individual factor, namely: knowledge-sharing ability of students. This factor is supported by one educational paper (the scope of the paper is aimed at a university or other educational institute) and three non-educational papers. The amount of papers that support this factor is enough to select it as an appropriate and adaptable factor for a supervision domain.

The next factor is an organizational factor, namely: culture of university, which is strongly supported by 5 educational papers and 6 non-educational papers. It is therefore obvious that this factor is suitable for a supervision domain. In addition, 5 other researchers examined this factor in an educational environment. The next factor (flexible structure) is also supported by acceptable educational papers (3 papers) and 4 non-educational papers. The fifth factor (Supervisor Support) is supported by one educational paper and three non-

educational papers. Hence, it has acceptable iteration to be used for the supervision domain. Learning strategy is the next factor. No educational papers support it, but 6 non-educational papers do support it. This factor has not been examined before in an educational environment. It is suitable for a supervision domain and has acceptable iteration, but has not been supported by educational papers.

The next factor is a technical factor (IT Systems), which is strongly supported by 4 educational papers and 3 non-educational papers. It is acceptable for a supervision domain. Knowledge repository is not supported by educational papers. Further, it is supported by only one non-educational paper, so it does not have enough iteration in literature and is not acceptable for inclusion in this domain. The result of factor selection for the supervision domain was shown in Figure 8.

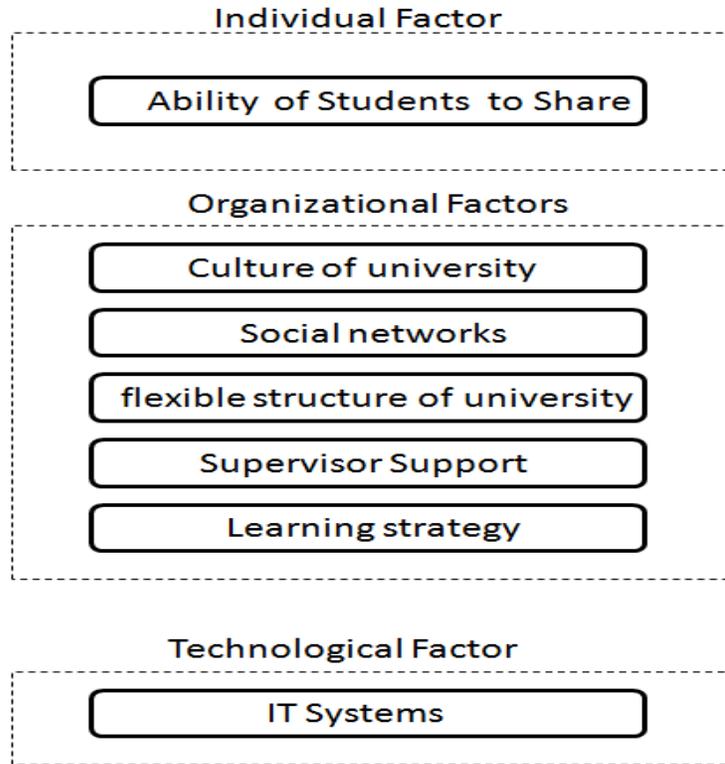


Figure 8: Adaptable knowledge-sharing factors for research supervision domain

Adaptable Knowledge-sharing Factors for Research Supervision Domain

Knowledge-sharing and Ability to Share

Zhao (2003), in the knowledge management model for supervision, stated that supervisors focus on guiding students in order to improve knowledge management skills. Knowledge management ability helps students to improve their ability to manage advanced IT resources, as well as enhancing their decision-making ability to select the right information (Raisinghani, 2000). This approach improves critical thinking in students which is an important ability for a research dissertation. Gatfield and Alpert (2002) noted in The Supervisory Management Styles Model that levels of motivation and management skills of students are an important fundamental of the success of a full supervision process. They mentioned that the ability of students to communicate and share knowledge is one of the dimensions of this model.

Culture of University

Zhao (2003) noted that flexible structures and development culture are the key prerequisites of knowledge management in motivating students to create and share new knowledge. The process of learning occurs when individuals share their knowledge, since knowledge is embedded in the minds of people. Hence, a knowledge management approach can enhance the process of learning in universities

There are some cultural dimensions that influence knowledge-sharing in a university environment. One of these dimensions is trust. An organizational environment that highlights individual competition may cause an obstacle to knowledge-sharing, in contrast to a company that highlights cooperative teams which build trust and increase knowledge-sharing (Willem and Scarbrough, 2006). Szulanski (1996) identified fear of losing superiority and lack of adequate reward to explain an employee’s reluctance to share. In an ever-increasingly competitive landscape, creativity and innovation are becoming more and more important. “Employees are tending to share knowledge if they are operating in a culture that encourages them”. A fair reward system

motivates employees to share knowledge readily and serves as reinforcement of organizational trust culture (Rhodes *et al.*, 2008).

Knowledge-sharing Social Networks

Zhao (2003) stated that using knowledge-sharing social networks among students is one of the popular knowledge-sharing approaches used to enhance learning. These networks use information technology such as social media, weblog and teleconferencing. She also mentioned that networks of experts (supervisors and lecturers) are among the most important infrastructure elements of knowledge-sharing in universities.

Flexible Structure and Design

Zhao (2003) noted that flexible structures of a university are among the most important conditions of knowledge management by which to motivate students to create and share new knowledge. Several different structures may be required when an organisation faces a constantly changing environment. Cross-functional teams may facilitate the formulation of a knowledge map for employees to use in order to find appropriate knowledge (Rhodes *et al.*, 2008).

Supervisor Support

One dimension of the Supervisory Management Styles Model is supervisors' support. Hence, the support of supervisors plays an important role in all related activities of the supervision process, especially knowledge-sharing, in this process. The Blended Postgraduate Supervision Model also emphasizes the fact that without the support of supervisors, the process of using new technology to facilitate supervision and knowledge-sharing will not be successful. In blended postgraduate supervision, the role of supervisors represents key sources of information to be accessed by students in face-to-face consultations and via the Internet and libraries, and then evaluating what the student has gained from it. The use of technology facilitates creativity and communication which improves motivation (De Beer and Mason, 2009). In the model of Zhao (2003), a knowledge-sharing approach means the supervisor focuses on supporting students so as to improve their knowledge-sharing skills. In this model, supervisors' support is vital for the knowledge management approach and for successful knowledge-sharing in the research supervision process.

Learning Strategy

An appropriate learning strategy in university which leads to a systematic knowledge-sharing approach is needed to assist both supervisors and students to obtain, share and apply knowledge. A knowledge-sharing approach means that the supervisor focuses on assisting students in order to enhance knowledge-sharing ability in research supervision (Zhao, 2003).

The organizational learning concept was derived from the ability to learn from other employees and the culture of openness within an organization. These factors could have a significant effect on the knowledge-sharing process in the organization. (Rhodes *et al.*, 2008). Van Den Brink (2001) mentioned that learning strategy in organizations is one of the most effective organizational enablers for knowledge-sharing. In a university, which is a knowledge-based organization, an appropriate learning strategy is vital to contribute to knowledge-sharing and publishing.

IT Systems

IT systems such as e-learning, customer relationship management tools, blogs and portals can increase knowledge sharing capabilities (Rhodes *et al.*, 2008). However it must be stated that IT systems are only tools and not solutions, individuals are still responsible for sharing information and knowledge (Wong and Aspinwall, 2005). A key aspect of an organization's resources is its intellectual capital and knowledge base. This includes the skills and experience of its employees, its policies, processes and information repositories. A study by Riege (2005) state that the relationship between organizational knowledge and its competitiveness is dependent on its ability to integrate, share and apply the knowledge. Nonaka and Takeuchi (1995) state that knowledge management requires the organization to create new knowledge, transfer it and incorporate it into its products, services and systems. It is becoming more and more important for an organization to adapt to change based on its ability to embed knowledge in databases and support systems (Rhodes *et al.*, 2008). The Blended Postgraduate Supervision Model stated that the online Software Application facilitates the supervision process. (De Beer and Mason, 2009). In the model of Zhao (2003), students and supervisors use IT systems like the email system and e-learning by which to communicate and share knowledge. Thus, using IT systems can lead to a more flexible and high quality research supervision process.

Limitations of this review

Existing empirical studies have some limitations as they used either one or a limited number of universities or companies for their studies. Thus, the findings of this study may not be applicable due to a differing social context. It then becomes difficult to illustrate integrated evaluation results relating to under what situation and to what extent these results are valid. These studies did not mention under what conditions we can utilize their results. In general, the conclusion derived from a large number of studies is likely to be more reliable. It is obvious that the issue of inadequate studies for knowledge-sharing impacts factors in an educational

environment. The size of the sample of some studies was limited and, hence, care should be taken when generalizing the findings of these studies. Although the knowledge-sharing impact factors extracted in this study were based on extant research findings, due to the rapid change in the business environment, these knowledge-sharing factors may change over time.

CONCLUSION

This review investigated adaptable knowledge-sharing factors to be used in a research supervision domain. We have performed a wide literature search for appropriate studies published in the period 2000–2012 and finally recognized 29 primary empirical studies that are relevant to the research objective. We then extracted 88 knowledge sharing factors from them, by matching these factors with key success tips relating to a knowledge management model for research supervision. In addition, other research supervision models were used; of which 8 adaptable knowledge-sharing factors were the result. The results were then sorted by type of factor and educational iteration as well as non-educational iteration. Finally, one factor was eliminated because of poor iteration in literature and seven other factors were accepted. Hence, the result of this factor selection process for a supervision domain are namely: Knowledge-sharing and Ability to Share, Culture of University, Knowledge-sharing social Networks, flexible structure and design, Supervisor Support, Learning strategy and IT Systems. More quantitative research is needed to examine these factors in different universities and in different countries.

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