Exploring the Soft System Methodology in Development of Knowledge Management Conceptual Model: A Sytematic Literature Review

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ABSTRACT

Soft System Methodology (SSM) is common guidance to conceptualise Knowledge Management (KM) model since its benefit to handle complex situations. This study highlights SSM implementation on KM conceptual model using Systematic Literature Review (SLR) to produce insights about current implementation and promising chances in the future. This study also concerns on KM conceptual models as created without certain features in many case studies. Many various interpretation can arise to understand how system should work. This situation affected more spending time to validate KM conceptual model with stakeholders. Using SLR, this study criticises the importance of features as provided in eligible articles. Out of 144 articles from 2009 until 2019 as delivered from Scopus query, this study selected 12 articles about SSM on KM. It classified them into several criteria: published year, sector, and related KM life cycle. By mapping them to solve research questions, this study promoted actors, activities, and sequential order of activities as recommended features. By implementing them, KM conceptual model creation can be faster and accepted by stakeholders.

Keywords: Knowledge management; Soft system methodology; Conceptual model; Systematic literature review; SSM; KM conceptual model.

1. INTRODUCTION

Knowledge management (KM) has fundamental contribution for a qualified organisation[1]. Through information exchange as circulated in organisation, KM becomes success key factor to survive and empower organisational capability [2]. It has been proven on many organisations in various sectors and various scales. In digital business as current trend, KM also satisfies the organisation through good performance[3-4]. Using digital platform, an organisation can capture, store, and distribute knowledge by considering different needs.

Conceptualisation becomes important step when developing KM. It visualises real world into imaginary picture as used to illustrate the ecosystem based on proposed solution. The imaginary picture describes how objects and processes harmonise each other in ideal point of view. It is risky since the proposed solution can be inaccurate or inadequate when implemented in real world. Sometimes, different interpretation can also reduce its reliability where the actors play different roles others than scenario. In other context, some academicians have stated their researches on KM conceptual model require formal testing[5-8]. As impact, other academician cannot fully adopt the proposed KM conceptual model when it had not been tested yet, especially for the result generalisation process. Therefore, qualified conceptual model in KM becomes mandatory requirement to generate qualified KM implementation.

Soft System Methodology (SSM) is empirically adopted

when formulate KM implementation[9-10] due to its advantage to cover complex situations[11]. Moreover, Checkland has claimed that SSM can be relied on messy situation of all kinds. In SSM sequential step, conceptual model is produced on Step 4: Constructing the conceptual model. It is constructed after defining the ecosystem with specific identified problems. SSM also emphasises strictly validation among the identified problems, conceptual model, and stakeholders in ecosystem. It also indicates the importance of qualified conceptual model to ensure its validity and acceptance on stakeholders.

This study delivered a Systematic Literature Review (SLR) on KM conceptual model using SSM. It aimed to highlight and summarise the performance of produced conceptual model in KM as learning lesson for further researches. Choosing SSM as scope, this study concerned to specify the conceptual model as constructed based on identified problems and become candidate of solution. It aggregated related literatures as empirical experience of SSM on KM. This study also focused to criticise useful pattern on conceptual models as recommended features to be embedded. Therefore, it can increase probability of acceptance to achieve efficiency while time, cost, and resources are limited.

This study includes some sections as follow. After describing the background in Section 1, this study explains the method for SLR in Section 2. Section 3 reveals results while the Section 4 presents the implications and discussions. Finally, Section 5 and 6 narrate the conclusions and recommendations respectively.

2. METHOD

This study has demonstrated meta-review to extract insights from collected literatures. It adopted SLR technique as performed by Kitchenham et.al[12] considering its capability to exposure meta-analysis using specific criteria and sequential phases. This study is classified as desk research using mono method qualitative for content analysis and deduction approach for extracting the conclusion. Generally, this study was comprised five phases: research question postulate; data sources and searching strategies; inclusion-exclusion criteria development; quality assessment; and data extraction.

2.1 Research Questions Postulate

Research question is main baseline when the SLR runs. It actualises the expected goals as produced in the results[12-15]. Without clear research question, SLR processes lose control and cannot fulfill expected goals since the results are not relevant to occurred problems. Considering the occurred problems and expected contribution as confirmed in Introduction, this study postulated research questions as follow and extracted into criteria in next phase:

- [RQ.01] How wide the implementation of SSM as method to construct KM conceptual model?
- [RQ.02] How to contribute qualified KM conceptual model from SSM by evaluating the components?

2.2 Data Sources and Searching Strategies

Following the research question as postulated in previous phase, this study relies on Scopus by considering its reputation in research domain. It indexes many trustable publishers in scientific context, such as IEEE, Emerald Insight, Springer, and ACM. It can optimise searching process more efficient than visit one by one.

2.3 Inclusion-Exclusion Criteria Development

Inclusion-exclusion criteria reflect logical thinking when determine scope of SLR. They help researchers to distinguished the necessary literatures and keep consistency as reminded by 6th Pautasso's rule[16]. As unveiled by Budgen and Brereton[17],

SLR mandates inclusion and exclusion in any method. It was proven by any SLR researches[12-15].

This study captured published period since 2009 until 2019 to accommodate trends in research domain about a decade. This period actualised the 10th Pautasso's rule[16]: be up-to-date, but do not forget older studies. It also mandates the articles have been in published without any under-review process or similar circumstances. It allowed Engineering, Computer Science, Business, Social, and Decision System as domain fields due to their relationship with practical information systems area. Those criteria were detailed in Table 1 and compose the following query (run in searching feature on Scopus): TITLE-ABS-KEY ((("soft" AND "system" AND "methodology") OR "SSM") AND (("knowledge" AND "management"))) AND (LIMIT-TO (SUBJAREA, "ENGI") OR LIMIT-TO (SUBJAREA, "COMP") OR LIMIT-TO (SUBJAREA, "BUSI") OR LIMIT-TO (SUBJAREA, "SOCI") OR LIMIT-TO (SUBJAREA, "DECI")) AND (LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012) OR LIMIT-TO (PUBYEAR, 2011) OR LIMIT-TO (PUBYEAR, 2010) OR LIMIT-TO (PUBYEAR, 2009)) AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMITTO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp")) AND (LIMIT-TO (LANGUAGE, "English"))

Note= the query is embedded into previous paragraph

As the initial results, 144 titles of article were retrieved by Scopus. Using duplicate testing, they had no similarity each other. Since 41 ones were not available in full-text article, they were excluded and 103 remaining ones were taken to next phase for quality assessment.

2.4 Quality Assessment

The 103 remaining articles were assessed to evaluate their qualification. The assessment comprised two main steps: TAIC screening and content evaluation. TAIC (Title, Abstract,

Table 1. Inclusion-exclusion criteria

Criteria	Inclusion side	Exclusion side
Publishing status	Article should be in published status	Article is in under-review, upcoming, or retracted
Document type	Article should be journal article or conference paper proceeding	Article is as academic thesis, conference foreword, conference keynote speaker's paper, or bibliographies.
Field	Article should cover Engineering, Computer Science, Business, Social, and Decision System	Article should cover any area other than Engineering, Computer Science, Business, Social, and Decision System
Keyword	Article's title should contain "soft system methodology" and "knowledge management"	Article's title does not contain "soft system methodology" and "knowledge management"
Published period	Article should be published in 2009 until 2019	Article was published before 2009 or will be published in 2020 or more
Language	Article should be written in English	Article is written in any language other than English

Table 2. The eligible articles

Title	First Author
Contextual-based knowledge creation for agroindustrial innovation	Anggraeni[20]
Understanding stakeholders' perspective of cost estimation in project management	Doloi[21]
Farm machinery management information system	Fountas[22]
Insights into operationalising communities of practice from SSM-based inquiry processes	Ison[23]
A new management approach to knowledge-creating strategic decision-making in organisations	Jafari[24]
Sustainability focused decision-making in building renovation	Kamari[25]
Enterprise architecture model for implementation Knowledge Management System (KMS)	Lusa[26]
Development of the conceptual model of energy and utility management in textile processing: A soft systems approach	Ngai[27]
Enabling integrated knowledge acquisition and management in health care teams	Pentland[9]
Soft systems methodology a conceptual model of knowledge management systems initiatives in Malaysian public universities	Saad[10]
Soft-system knowledge management framework for new product development	Shankar[28]
Ecosystem-based management in challenging conditions: Implications of a case study from north-eastern Turkey	Unalan[29]

Table 3. Recapitulation of selection processes

Publisher	Initial	Screened	Eligible
ACM	6	1	0
Emerald Insight	29	3	1
IEEE eXplore	17	3	1
Inderscience	2	1	1
Int. Mountain Society	2	0	0
Operational Res. Society	2	1	1
Sciencedirect	11	4	4
Springerlink	9	3	2
Taylor and Francis	3	1	1
Wiley Online Library	3	1	0
Others	19	3	1
Cannot be accessed	41	0	0
Total	144	21	12

Introduction, and Conclusion) screening captured parts of full-text article to judge how strength relationship between articles to the criteria as stipulated in Table 1. Since those parts were representative, this step can consume less time. This step related with 1st question on quality assessment as introduced in Database of Abstracts of Reviews of Effects (DARE) York University[12,18], "Are the review's inclusion and exclusion criteria described and appropriate?". This step classified each article into three categories: strongly related, rather related, and no related. The first and second categories were kept in

the selection process while the last one would be eliminated. It found 82 articles were failed to meet inclusion criteria so that there were 21 survived articles.

In the second step, content evaluation, this study employed full-checking to the full-text article. 21 survived articles were assessed in this step. Their eligibility was examined considering these questions:

- [EQ1] Does article exactly describe the research methodology? (Taken from Balaid et.al[19])
- [EQ2] Does article reveal standard artifacts as guided by SSM?
- [EQ3] Does article reveal testing/validation/verification as quality control in final systematics?

Each question contributed 0 until 2 points following the suitability of the article, so that maximum total score is 6. Article with total score 3 or less were be eliminated. Overall, 12 articles were eligible by this threshold and elected to meta-analysis review. Table 2 shows their general information as sorted by its first author's last name while Table 3 reveals the recapitulation of selection processes based on publisher. The selection processes are illustrated in Fig. 1.

2.5 Data Coding and Analysis

This step comprised two main frames of classification: width of implementation and features on KM conceptual model. The first one decomposed the eligible articles into several categorises based their informative attributes which reflect how wide the SSM on KM conceptual model is implemented. It represented RQ.01 through these attributes: journal/conference name, article type, published year, related KM life cycle, and related sector. Relates strongly with RQ.02, the second frame comprised classifications on availability of features and validation technique. All classifications relied on data coding by marking content of full-text body that related
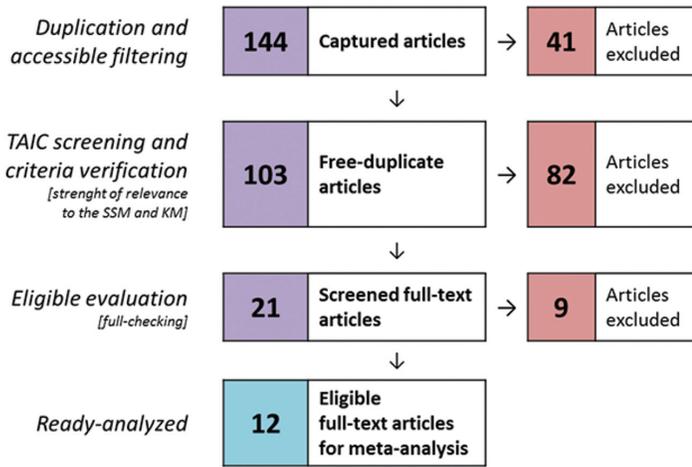
Duplication and accessible filtering

144 Captured articles → 41 Articles excluded

TAIC screening and criteria verification
[strenght of relevance to the SSM and KM]

103 Free-duplicate articles → 82 Articles excluded

Eligible evaluation
[full-checking]

21 Screened full-text articles → 9 Articles excluded

Ready-analyzed

12 Eligible full-text articles for meta-analysis

Figure 1. Selection scheme.

Table 4. Recapitulation of journal/conference name

Publisher	Journal/Conference Name	n
Emerald Insight	J. of Knowledge Management	1
IEEE	Int. Conf. on ICT Convergence	1
Inderscience	Int. J. of Management and Enterprise Development	1
Operational Res. Society	Knowledge Management Research and Practice	1
	Int. J. of Project Management	1
	Computers and Electronics in Agriculture	1
Sciencedirect	Int. J. of Sustainable Built Environment	1
	Int. J. of Production Economics	1
	Systemic Practice and Action Research	1
Springerlink	Int. Conf. on Knowledge Management and Information Sharing	1
Taylor and Francis	Int. J. of Water Resources Development	1
Other	Gadjah Mada International J. of Business	1

to the proper category. This study aggregated all coding to produce distribution mapping.

3. RESULTS AND ANALYSIS
3.1 Width of Implementation

This sub-section solved the RQ.01, which actualised as mapping in some criteria. The first criterion is journal/conference name as shown in Table 4. Ten articles were journals (83.33 %) while the others were conference proceeding (16.67 %). It indicated that more authors choose journal as publication medium which may be caused by journal's capacity to contain
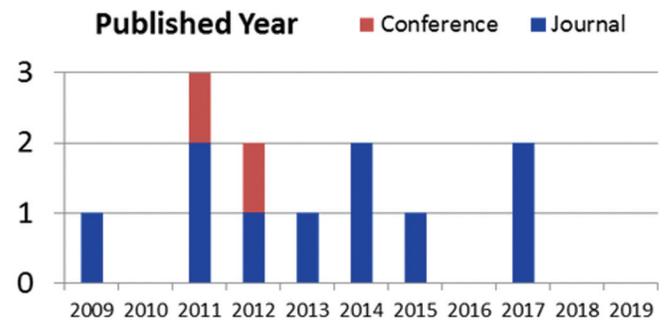
the SSM artifacts in more pages than conference proceeding. It allows the authors to narrate their analysis and findings more comprehensive. In the fact, SSM spends more space to deliver their artifacts, such as rich picture, CATWOE and PQR analysis, root definition, and conceptual model[11].

As exhibited in Fig. 2, this study also mapped the articles based on published year. It resulted degradation of usage since most of articles were published more than 5 years ago. Considering occurred trend, this study hopes the recommended features in KM conceptual model can inspire further research to increase SSM usage.

This study had mapped the 12 eligible into sector based on each case study. It represented width of SMM usage on KM conceptual model which dominated by farming with three articles. It has been discussed more than other sectors: manufacture, civil-environment, management, project

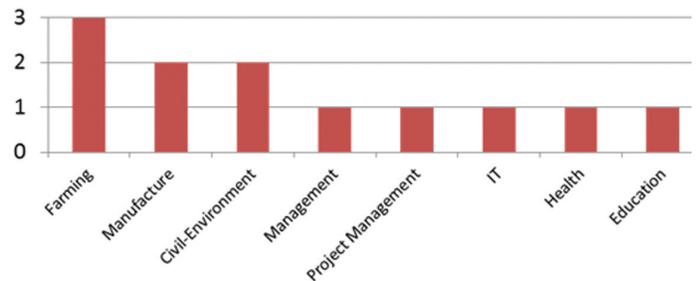**Figure 2. Trending usage of SSM on KM conceptual model.**

Figure 3. Mapping of the articles based on sectors.

management, IT, health, and education. However, its domination has thin gap since manufacture and civil-environment have two and the rests have one respectively article (Fig. 3). It signalised SSM on KM conceptual model has been demonstrated in wide and various domains. Moreover, it indicated high possibility to adopt SSM in new sectors. Therefore, the distribution in Fig. 3 may change in the future.

This study concerns on SSM usage on KM conceptual model so that the context of KM should be analysed. It performs by identifying which the related KM life cycle. Five steps of KM life cycle[30-32] are employed as category in this study. As detailed in Table 5, this study discovered some insightful information. First, most of articles implement SSM to solve knowledge sharing and usage/ learning/improving. Through deep investigation, those articles describe how KM should be

Table 5. Mapping the articles based on KM life cycle

KM Life Cycle Process		Implemented in
Process	References	
Knowledge Capturing	31, 32	9, 10, 20, 24
Knowledge Creating	30, 31, 32	24, 26
Knowledge Sharing	30, 31, 32	9, 10, 20, 21, 23, 26, 28
Knowledge ULI (Usage/ Learning/ Improving)	30, 31, 32	9, 10, 20, 22, 25, 27, 28, 29

Table 6. Implemented features

Feature	Benefit	Implemented by
Input-output	Clarify which are appropriate items to perform process and the expected output	9
Actors	Clarify who are the involved actors with their responsibilities/activities	21, 22, 25, 29
Activities	Clarify step-by-step to be followed when the system run	9, 10, 20, 21, 23, 24, 25, 27, 28, 29
Influencing factors	Strengthen the system with the related factors	10, 21, 26
KM life cycle	Clarify the relevance between system with KM life cycle	9, 24, 27, 28
Sequential order	Confirm the scenario of system to be run	9, 10, 24, 27, 29
Business and technology separation	Emphasize the role of IT aspect to support business aspect	26

distributed across organisation with various demography and requirements. Other researches on KM support this finding which state the importance of knowledge sharing[19] and usage.

3.2 Features on KM Conceptual Model

This subsection focuses to narrate how the implementation of features in each eligible literature. They were identified to discover optimisation when conceptualizing model in SSM. Hence, this study compared all eligible literatures, includes their effectiveness through validation/verification the proposed conceptual model. Table 6 unveils what are implemented features.

Table 6 unveils what were the activities as most implemented feature by SSM on KM conceptual model. It is followed by sequential order to point which the initial activity and its successor. Moreover, some articles mandate the actor as person in charge to act the activity. Therefore, this study highlights them as recommended features when conceptualise model on KM.

Concern the KM context, this study finds some article explicitly mention the relevant process of KM life cycle in the conceptual model. Although not mandatory and majority, this study promotes it as the recommended feature since it represents specific KM life cycle. By implementing it, researchers can

focus which type of KM so that literature review can be faster and more accurate.

This study places the input-output as not-mandatory feature due to two considerations. First, it can cause the proposed KM conceptual model is too detailed so that researcher cannot distinguished between system model and conceptual model. Second, based on meta-analysis in 12 eligible articles, KM conceptual model focuses on the agreement or acceptance of proposed scenario. In addition, detail scenario will consume more time in conceptualising process.

Using different consideration, this study also does not promote business and technology separation as recommended feature. Paper by Lusa[26] as the only one implementing article was in IT sector (Fig. 3). This feature was relevant since its suitability, but it required further examination when adopted in other sectors.

3.3 Validation with Experts

This study had involved experts on KM to validate the findings using in-depth interview. It aimed to ensure their validity and prevent subjective interpretation. They gave objectively opinion about width of SSM implementation for KM conceptual in various sectors. Experts had recognised it where KM is adoptable for organisations in any scale and sector. Many researchers have believed SSM as helpful method to solve messy situation, includes KM context. They also agreed the importance of features as recommended in this study. Actors and processes are fundamental objects in many cases to describe how system works. Based on expert's experience, sequential order was critical issue when evaluating the KM conceptual model. Without sequential order, many people had different understanding about how each process should run systematically. Therefore, recommendation to propose those features is validated and feasible.

4. DISCUSSION AND IMPLICATION

As revealed in previous section, this study has explored systematic literature review on 12 eligible articles. It aims to answer research questions as postulated in RQ.01 and RQ.02. This section discusses the findings and their implication to the academic and practical context.

To solve RQ.01, this study found large utilisation of SSM to conceptualise KM model. This width is indicated by various sector which implementing SSM. Thin gap among sectors appeared high chance for distribution changing in the future. Moreover the researchers can adopt the SSM in not common area. As first implication, this study signalised big opportunity for expansion to trending issues, such as industry 4.0, sharing economy, and e-participation. Second one, the existing sectors

still need more implementation since current available articles are relatively few. More empirical implementations may bring clear and mature pattern to be followed on KM conceptual model.

Focus to the KM life cycle, this study highlighted the distribution of KM life cycle as adopting SSM. Knowledge sharing and ULI dominate the implementation since involvement of different stakeholders. It implies SSM as an empirical solution to handle problems in knowledge sharing or ULI. Using meta-analysis, CATWOE holds important role to clarify what are the stakeholders with their roles respectively. Generally, stakeholders' identification is difficult agenda when design knowledge sharing model. As third implication, it helps the researchers to generate more qualified conceptual models.

By implementing meta-analysis in eligible articles, this study promotes several features to be adopted when conceptualise KM model: actors, activities, and sequential order among those activities. Their existence aims to confirm how system works generally. They are composed based on root definition as formulated from CATWOE analysis. As fourth implication, this study advises their adoption as output in step 4 of SSM and become discussion when system validation with necessary stakeholders.

As stated in previous researchers, SSM need enrichment to deliver more qualified problem solving. Nguyen, Scognamillo, and Comer [33] had reminded that result of SSM requires assessment since its uncertainty data. Moreover, Rosenkopf [34] highlighted SSM failure to guide rich picture generation. Therefore, this study offers actors, activities, and sequential order as recommended features when generate KM conceptual model in SSM. They can enrich stakeholders with more understanding about how system will work. It can anticipate uncertainty data and ensure rich picture qualification. By adopting them, researches can assign the person in charge for every activity and ensure the timeline of activities.

5. CONCLUSION

This study has explored the implementation of SSM on KM conceptual model using SLR. The exploration focuses on two research questions as representing the width of SSM implementation and the recommended features. After capturing 144 possible articles through query in Scope index machine, this study performed screening and eligibility evaluation to deliver 12 eligible articles. Meta-analysis on them unveiled some insightful mapping that solved the research questions. SSM has been adopted in various domains and offer new domains in the future researches. Knowledge sharing and ULI dominated the implementation of SSM based on KM life cycle. This study emphasises the importance of actors, activities, and sequential order of activities as recommended features.

6. OUTLOOK FOR FURTHER RESEARCH

This study has limitation on searching process in Scopus as indexing machine. Scope can include reputable Q1 journals on Knowledge Management or Information Systems to improve the information quality. From the period, this searching process is conducted on March 17th 2019 so that the result can be fostered until fully 2019. The implementation of features for

SSM on KM conceptual model as advised requires objectively measurement to make ensure its efficiency and optimisation. It will prove the features' advantage empirically and objectively.

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CONTRIBUTORS

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