JIMMA UNIVERSITY
JIMMA INSTITUTE OF TECHNOLOGY
FACULTY OF COMPUTING AND INFORMATICS
INFORMATION SCIENCE DEPARTMENT

MSc. In Information Science (Information and Knowledge Management)

Developing a Knowledge Based Research Proposal Writing Supportive System for Novice Researchers

BY: -

EDMEALEM SINTAYEHU

JANUARY, 2021

JIMMA, ETHIOPIA

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A Thesis Submitted in Partial Fulfillment the Requirements for Degree of Masters of Science in Information Science (Information and Knowledge Management)

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Principal Advisor Million Meshesha (PhD)

Co-Advisor Samuel Sisay (MSc.)

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As members of the board of examining of the MSc thesis open defense examination of the above title, we members of the board (listed below), read and evaluated the thesis and examined the candidate.

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Declaration

I declare that the thesis is my original work and has not been presented for a degree in any other university. All the material sources used in this work are duly acknowledged.

_____

Edmealem Sintayehu

January, 2021

This thesis has been submitted to the department for examination with our approval as University advisors:

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Abstract

Scientific Research proposal writing skill is an important part for novice researchers, including postgraduate students. However, writing a clear, concise, readable, and understandable proposal has been identified as a great challenge for novice Researcher to convince proposal evaluator. This means then that novice researcher starts proposal work without adequately prepared and gets the necessary skill to review literature, define statement of the problem and formulate research methodology, among others. This is because some of the common mistakes and difficulties novice researchers faced and encounters need deep understanding, expertise and support. This finally leads some students' proposal have taken long to be approved because they have been found to be problematic and also, despite the standard completion time for Master students, majority of students goes beyond the stipulated standard minimum completion time. Even worse, seriously compromising the standards expected of a Postgraduate Student thesis.

This study therefore investigates common mistakes and difficulties that novice researcher's faced and the associated solution to assist them in writing acceptable proposal. To this end, the study develops a knowledge based system to assist novice researchers to enhance their proposal writing skill by mitigating the common mistakes and difficulties they commit or encountered. In this study, Design Science Research Methodology (DSRM) has been followed to assess and find solution for the problem. To design and develop the artifact, a Knowledge engineering process has been used for knowledge acquisition, modeling, representation and prototyping the knowledge based system. The performance of the proposed system was evaluated with 50 test cases. The results of the validation test indicate that the prototype registers on the average 85.0% accuracy. In addition, the prototype registers 84.6% user's acceptance with all the novice researchers proved the usefulness of the prototype. The prototype achieves a promising result and meets the objective of the study. However, in this study an attempt is made to apply rule based systems. Rule based systems solve problems from scratch, while case based systems use pre-stored situations to deal with similar new instances. Therefore, the integration of rule based and case based reasoning with intelligent User interface is left for further research.

Keywords: Novice Researchers**;** Research Proposal Writing; Knowledge Based System; Knowledge Based Supportive System

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Abbreviations and Acronyms

AI: Artificial Intelligence

AWE: Automated Writing Evaluator

DSRM: Design Science Research Methodology

IADE: The Intelligent Academic Discourse Evaluator

IE: Inference Engine

KADS : Knowledge Acquisition and Documentation Structuring

KBS: Knowledge-Based System

KB-RPWSS: Knowledge Based Research Proposal writing supportive System

RWT: Research Writing Tutor

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Ethiopian universities like other world universities require postgraduate students to submit well-written quality papers called dissertations or thesis in order for them to graduate with desired academic qualification. Thomas (2017) described a scientific research as a lengthy academic paper or dissertation based on original research. On this argument, James and Slater (2013) states that scientific research writing is the creation of a research project or dissertation that generally involves an empirical investigation of specific question(s) within the field of one's study. According to Asogwa, Wombo, and Ugwuoke (2014), the common theme to all these writing is to expand students' understanding within the field of study and be equipped with the knowledge and skills in conducting research, teaching, textbook and paper writing.

An academic proposal is the first step towards conducting actual research for producing a research report, thesis and dissertation. Its intent is to convince a supervisor or academic committee that the researcher topic and approach are sound, so that the researcher gains approval to proceed with the actual research (Asogwa et al, 2014). As well as indicating the researcher plan of action, an academic proposal should show the researcher theoretical positioning and his/her relationship to past work in the area.

However, the empirical literatures assert that, the thesis proposal writing is not an easy understanding by most postgraduate novice researchers (Joseph, 2019). As a result, student encountered difficulties and commit mistakes in their academic proposal writing. This in turn makes the students' research proposal report becomes substandard (Belay & Yekoyealem , 2016). Writing a research proposal below standard leads further to the student's research study being delayed and seriously compromised the standards expected of a Postgraduate Student thesis.

In the context of academic proposal writing, researchers want their target audience to understand and accept their ideas and arguments. Therefore, it is crucial as well that when writing for academic purposes, certain conventions and techniques must be used. It is of utmost importance that what is written will reach the targeted readers, to construct the intended meaning when reading the research thesis proposal. In other word, academics attempting to write thesis proposal must know how to write well in order to convince the research plan of action effectively. In order to achieve this, one must know the conventions of academic writing. This is

especially so if one is a novice or a new member of the academic discourse as in the case of the students attending the Research Methodology course (Joseph, 2019).

To capacitate researcher with the required thesis writing skill many universities across the globe include research methods courses that gear towards building the requisite profile to carry out a thesis especially the one submitted in partial fulfillment of the requirements for a master program. This course will prepare students for advanced research by examining how to plan, conduct and write a report on empirical investigations. The course will cover techniques applicable to each of the steps of a research project, including formulating research questions, theory building, data analysis, building evidence, assessing validity, and publishing.

In addition, to ease some of the researcher difficulties, it has become a common practice in many universities to set out a thesis guideline that clearly delineates how to write a research proposal as well as carry out the research process and produce the research report. In fact, successful completion of a thesis is more than just adhering to such guidelines and course; the candidate needs competence in generic and specific research skills (Biggam, 2015).

Even though, there are a number of studies that have been conducted worldwide to explore problems and challenges towards designing instructional strategies, the problem of scientific research writing is still residing as a major challenge for novice researchers (Huang, 2010). There is a need to support them with technology. The common mistakes committed and challenges faced by students and researchers in writing scientific research can be supported by suitable teaching strategies and tools which can be easily mastered by researchers and students to a great extent to make the research report clear, concise, readable, and understandable (Sher & Tarika , 2014). One of the potential fields is a knowledge based system.

Knowledge-based system is a system that contains tacit and explicit knowledge (Wielinga, Sandberg, & Schreiber, 1997). It is a program that suggests a solution for solving problems in a defined application domain (Kasabov, 1996). Knowledge-based system has been successful in almost every field of human activities due to its ability to represent, accommodate and learn knowledge. It is also capable of taking decisions and communicating with their users in a responsive or friendly way (Wielinga et al, 1997). Through using such a knowledge-based system, it is possible to get so many benefits like wise decisions, learning from experience, explanation and reasoning, and getting immediate solution for solving problems (Erika , 2003).

The emergence of Knowledge Based Systems (KBS) provides a means for students, doctors, lawyers, engineers and other people to use the computer as an aid in finding a solution for their problem. KBS is an interactive

computer programs that incorporate the knowledge and decision of experts in appropriate domains (Marcus & McDermott, 2011). They also bring new opportunities to the educational system (Kingston, 2008). Knowledge-based system can be developed following the knowledge engineering approach that involves knowledge acquisition (including, knowledge verification and validation), knowledge modeling, knowledge representation and finally knowledge-based construction (Schilstra & Spronck, 2001).

The knowledge acquisition process incorporates fact finding methods like interviews, questionnaires, record reviews and observation to acquire tacit and explicit knowledge. The acquired knowledge should be immediately documented in a knowledge representation scheme like rules, frames, scripts and semantic network that is natural, efficient, transparent, and developer friendly (Sajja & Akerkar, 2010). Finally, a knowledge base with rule base and fact base is constructed towards designing a KBS that can learn based on experience.

1.2 Motivation of the Study

Scientific research proposal writing is the base for all academic research work. Writing a scientific research proposal is a major part of working and studying in academia. Many novice researchers, upon preparing their first research proposal, write from the standpoint of their own interests and do not easily understand there is a protocol or standard convention to follow in writing acceptable proposals. Due to this, they frequently commit common mistakes and faced challenges. Unless they have good experience, skill or background in research proposal writing, it may be uncertain about their future work or progress.

Hence, it seems logical to start them early case; those who are trained and equipped with the necessary skills early in research writing would become better for future. Therefore, it has become an important and challenging issue to develop improvement strategies or tools for assisting novices in their common mistakes and difficulties.

To mitigate the novice researcher commonly seen mistakes and challenges and to enhance their research proposal writing skills from the existing worse condition, this study believes that adopting technology as aiding tool and representing domain expert knowledge in a way it is available to support novice researcher is inevitably.

In this regard knowledge based system can be used (Marcus & McDermott, 2011). The knowledge base system is useful to store important knowledge related with teaching and learning process. The rule-based system can

be used to extract the important information related with higher education. The decisions of best teaching and learning process can be found by this system. Knowledge-based systems are important as a teaching tool, because they are equipped with the unique features which allow users to ask question on how, why and what format and also have a learning capability. When they are applied in the class environment, they can give many benefits to student as they prepare responses to their questions with minimal involvement of the teacher.

So, the KBS system enables novice researchers in understanding the writing convention. It also supports them on the most frequent student common mistakes and difficulties such that novice researchers can easily aware the concept behind proposal writing. The KBS allows the researchers to increase their chances of gaining acceptance, and helps them to have better future writing experience; otherwise, an ill prepared proposal would leads bad research output which discourages students and novice researcher in their future motivation to engage in research while one that has well been designed promises success.

1.3 Statement of the Problem

Before students proceed to conducting research, they are required to have their research proposals approved. But there are unexpected problems and difficulties that Postgraduate researchers encounter when engaging in writing scientific research proposal (Manchishi, Ndhlovu, & Thomson, 2018). The task of writing research proposal for novice researcher is not a simple task, as it needs conceptual understanding of each component of research proposal, and then communication skill (both writing and other Language skills). However, if supported by suitable teaching strategies and tools it can be mastered by students and able to produce a clear, precise and well-scoped research proposal (Huang, 2010). In the scientific literature, many reasons are pointed out for student's poor quality of proposal writing in higher education. Quality of student's research proposal writing is affected by academic, institutional, psychological, social and personal interwoven factors (Mahammoda, 2016).

The empirical literatures assert that students face difficulties in writing their proposal and thesis. Manchishi et al. (2018) attempted to summarize the common mistakes committed and challenges faced by postgraduate students. Such mistakes include; unclear topics, unclear statement of the problem, poor literature review, inappropriate methodology and plagiarism. Students also encountered the following challenges: absence of a standard proposal format, identification of gaps in literature review, identification of appropriate literature to be reviewed, and supervisors not available for consultations. As per our preliminary survey, graduate students in our country also face the same challenges.

The need assessment conducted at Jimma University, Faculty of Computing and informatics in the Department of Information Science revealed that, out of the total concept notes submitted by novice researchers from the year 2011 to 2012 E.C. (Ethiopian calendar), 41.9% were accepted with a major and minor modification, 9.6% were incomplete, 6.4% were not evaluated and 41.9% were rejected. The survey also noted that there is no concept note accepted outright. Due to this, some students' proposal have taken long to be approved because they have been found to be problematic, as a result of which majority of students goes beyond the stipulated standard minimum completion time for Master students. In addition to this, comments given from proposal evaluators indicate that postgraduate students on their respective discipline programs do face challenges in proposal writing.

Novice researchers face many challenges during a research process. The most important are choosing the right topic, failure to state the problem clearly, failure to identify the gap in the literature, use of wrong methodology, poor literature review, and misunderstanding of research terminology. This situation is also characterized by unavailability of advisor for consultations, poor teaching and learning research method course, Language issues, Lack of supportive system, lack of materials and lack of good co-ordination between students and supervisors.

Therefore, it is obvious that most of the students lack conceptual understanding of proposal components and/or the required writing and language skills in the process of compiling their proposal. These issues which are faced by students further increase the supervisory burden or instigate conflict between students and supervisors, which ultimately hinder timely completion of students' studies. In some extreme cases, this also leads to some of the novice researcher to withdraw from their studies due to frustrations as they cannot continue with their thesis work to obtain their intended certificate, even when they had passed their course works creditably.

To guide students and to evaluate their writings works, several studies were conducted. The Intelligent Academic Discourse Evaluator (IADE) (Cotos, 2010), is a web based Automated Writing evaluator (AWE) program that was developed as an additional tool for students to practice with and make incremental improvements in their research article writing. Another research done by Ramaswamy, (2012) also attempted to develop, an online Research Writing Tutor (RWT). The Research Writing Tutor (RWT) uses an Intelligent Academic Discourse Evaluator (IADE), which is developed by Cotos, (2010) as its prototype. While IADE analyzes only the Introduction section of the research article, RWT is capable of analyzing all the sections of article (Introduction, Methods, Results, and Discussion/Conclusion) and categorizes each sentence as a particular rhetorical shift with a functional meaning.

However, there is no assistance system specifically done for research proposal writing, which is a very foundation for any scientific writing. In addition to this, the system developed to support student writing are criticized for their over-reliance on surface features of responses (since the system provide support while the student finished their writing) and the insensitivity to the Researchers responses (Bhola & Buckendahl, 2014) . They did not take into account user's knowledge level and skills to reach on decision consequently, to adapt a supportive presentation to the needs and abilities of individual users.

It is also a common trend in the university to set out a guideline for proposal writing that defines how to carry out as well as report the proposal process. However, the guidelines for proposal writing issued by tertiary university cover mainly the structure of the proposal (Biggam, 2015). These guidelines do not go into the depth of technical details. As such, the proposal writing at the detailed technical level is unguided by the university guidelines and also focused on the general concept rather than on the specific novice researcher common problem and difficulties. It had been assumed that at their level of qualification, novice researchers would have acquired the skills of proposal writing or would know where to look for guidance when necessary and they would prepare a technically sound proposal for submission. Unfortunately, this has not always been the case.

Nevertheless, one of the major issues faced by graduate novice researcher in academic writing is competence in discipline specific research proposal writing (Huang, 2010), which is an area that requires further attention. As to the researcher knowledge there is no research work that attempts to integrate a system that aims to support Scientific Research proposal writing. However, the emergence of Knowledge Based Systems (KBS) provides a means for students, researchers and supervisors to use the system as an aid in finding a solution for their problem. It is therefore the aim of this study is to design a knowledge-based system for supporting novice researchers in writing scientific research proposal.

To this end, the current study attempts to explore and answer the following research questions.

- What are the common mistakes or challenges beginner researchers are experiencing?
- What knowledge of scientific research writing style and conventions are there to write well research proposal?
- To what extent the proposed knowledge-based system supports novice researchers in scientific research writing?

1.4 Objective of the Study

1.4.1 General Objective

The general objective of this research is to design a knowledge based system that can provide a significant support for novice researchers in research proposal writing so as to enhance the student writing skill by mitigating the common mistakes and difficulties they commit or encountered and facilitate a timely completion of graduate studies with a desired academic qualification.

1.4.2 Specific Objectives

In order to achieve the general objective of the study, the following specific objectives are formulated.

1. To understand the challenges of novice researchers in scientific research proposal writing and identify the common mistakes beginner researchers are encountered.
2. To explore standard scientific research writing style to mitigate common errors novice's researchers experiencing
3. To identify, acquire, model and represent the knowledge required for the development of a knowledge-based system.
4. To develop and evaluate the effectiveness and usability of prototype knowledge-based system

1.5 Scope and Limitation of the Study

This research focuses on supporting postgraduate novice researchers from computing field discipline in scientific research writing. The research is limited for a specific scientific research writing, which only targets on the first part, the thesis proposal and the system is not intended to replace research advisor.

The study covers the following research proposal component including topic selection, preliminary pages, introduction, literature review, methodology, work plan and budget, reference organizing and appendix.

Emphasizing the problems of preparing presentation, writing research report, including, local language features are out of the scope of the current study. This study targets the different computing disciplines such as Information Science, Information Technology, Computer Science and Computer Networking novice researchers. In this study, both tacit knowledge and explicit knowledge data sources are used to obtain reliable information about the challenges and errors novice researchers and researchers faced during the preparation of proposal writing. Sources of data are postgraduate students, research advisors and research method course lecturers' from Jimma University, Wollo University and Wollega University.

The limitations for this research is extracting the English writing common errors and codify it into a format that can be used in knowledge based system and then representing it into rule based. So, it could not be handled by the system as many as expected in scientific writing.

1.6 Significance of the Study

The primary beneficiaries of this research output are computing discipline novice researchers who have no experience before, in scientific research proposal writing. This improves their scientific writing comprehension ability and gives them good writing experience. It also minimizes the common errors and difficulties beginner researchers are committed and encountered during proposal writing. Also the system can act like their advisor in case of absence of their advisor since research advisor could not be available 24 hours a day and 7 days a week.

Research method course Instructors can be benefited from the system. They can use the system to aid the teaching-learning process of scientific writing. So, the system can assist their students in addition to the lecture notes. This in turn reduces the lecturer burden. The knowledge based research proposal writing supporting system (KB-RPWSS) can also serve as a hands-on approach in the way research methods and proposal writing could be taught to students. This will also help to clarify all the weaknesses, which students exhibited. In addition to this lecturer can use the system in classroom as aiding tool in teaching learning process of research method course to their student. This will enhance the student writing skills. This study also explored a commonly used standard proposal format based on domain expert suggestion to harmonize the student proposal work; so, proposal evaluators could use this format and guidance as a basis of assessment and evaluation, and also graduate student can prepare themselves based on the provided standard format by the domain expert.
To the best of the researcher knowledge, there has not been any research undertaken to apply a System to Support Scientific Research proposal writing. Therefore, this study initiates other researchers to conduct further study in the area to assist students in improving their research proposal writing skill.

1.7 Methodology of the Study

According to Zina O'Leary (2004), methodology is the framework associated with a particular set of paradigmatic assumptions that researcher use to conduct their research following scientific method. The researcher should have thought quite seriously about his/her research methodology to decide upon the most appropriate methods (Catherine, 2009). A research has been done under a set of methods and techniques. To

this end, the researcher gives care in the selection of methodologies that he has used based on which the step-by-step procedures are specified and methods used at each step are defined.

1.7.1 Research Design

This study follows design science research. Design science research methodology is a research cycle that creates, evaluates information technology artifacts intended to solve problems identified in an organization (Hevner, March, & Park, 2004). It involves a rigorous process to design artifacts to solve observed problems, to make research contributions, to evaluate the designs, and to communicate the results to appropriate audiences. Such artifacts may include constructs, models, methods, and instantiations. They might also include social innovations or new properties of technical, social, and/or informational resources; in short, this definition includes any designed object with an embedded solution to an understood research problem (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2008).

Design science is an outcome-based methodology for information technology research, which offers specific guidelines for evaluation and iteration within research projects. Design science research focuses on the development and performance of (designed) artifacts with the explicit intention of improving the functional performance of the artifact. Design science research is typically applied to categories of artifacts including algorithms, human/computer interfaces, design methodologies (including process models) and languages.

According to Peffers et al, (2008), for IS researchers in which Design Science research offers an important paradigm for conducting applicable, yet rigorous, research. A conceptual process could help researchers for successfully carrying out Design Science research and a mental model for its presentation. For the research community, such a process and mental model could help them to recognize such research and to respect its objectives, processes, and outputs (Peffers et al. 2008).

Peffers et al., (2008) describe the process of DSRM model with six phases (as presented in figure 1.1), such as problem definition and motivation, suggest objective of the solution, Design and development of artifact, Demonstration, Evaluation and Communication.

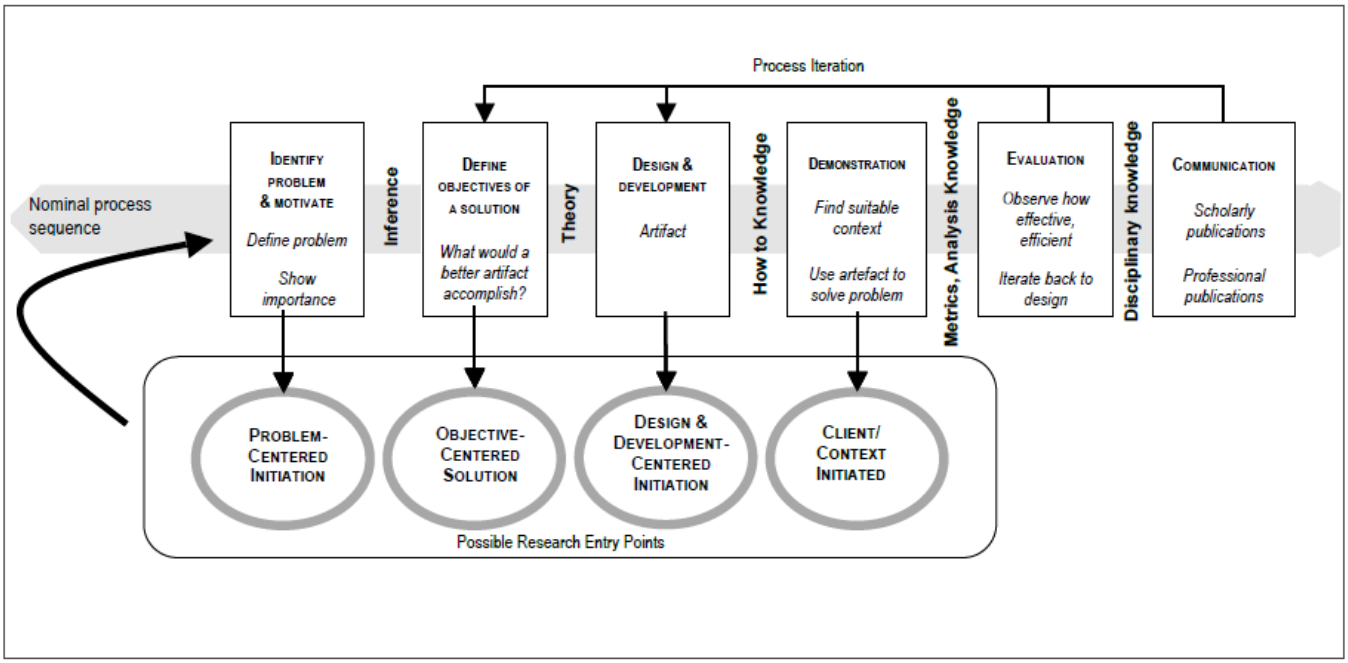

Figure 1. 1 Design science research methodology process model (Peffers et al. 2008)

1.7.2 Problem Identification and Motivation

This is the first phase in the process model of DSRM, which is responsible to define the research problem with motivation. In this study, the researcher begun defining the research problem and justify the value of a solution through assessment of gaps of prior research related to this study and conducting a preliminary need assessment. Based on the problem defined the researcher proposed an effective solution by analyzing the problem domain. The values of the solution motivate the researcher and the audience to follow the solution and to accept the result and helps to understand the reasoning associated with the researcher understanding of the problem.

To assess and explore the challenges and the common errors beginner researchers are encountered. This study selected three Ethiopian Government Universities, which includes Jimma University, Wollega University and Wollo University. The researcher preferred to conduct the survey in these Universities due to the following reasons. Those universities are ranked by Ministry of Science and Higher Education as 1st, 2nd and 3rd Generation Universities respectively based on research-oriented capability. So, those universities can represent the rest of the countries Government Public Universities.

In this study, the researcher employed both primary and secondary data sources to obtain reliable information about scientific research proposal writing. Sources of primary data are students, lecturers of research method

course and research advisors. The researcher used secondary sources of data by using document analysis (like handouts, guidelines and books), and related works review, such as books, journal articles, conference papers and the internet for supporting the primary sources of the data.

Study population and sampling

In order to assess and determine the challenges and the common mistakes beginner researchers encountered this study focused on postgraduate student that already presented their proposal or concept paper. Teachers who have the exposure in teaching learning research methodology course and research advisor were also included in this study. Accordingly, 71 students have been taken as a population for this study from the three universities.

Due to the fact that the student population is mostly too large for the researcher to consider, small but carefully chosen samples were used to represent the population. The sample size reflected the characteristics of the population from which it is drawn.

There are several methods for determining the sample size. This study takes a simple formula from Yamane to determine the sample size. As cited by Robert-Jan Mora (2010), from Yamane (1967), the formula to determine the sample size is shown below:

$$\mathbf{n} = \frac{\boldsymbol{N}}{\mathbf{1}+\boldsymbol{N}(\boldsymbol{e})^{\mathbf{2}}} \qquad (1.\ 1)$$

Where: n, N & e are sample size, population size and the level of precision, respectively. This formula assumes a degree of variability (i.e. proportion) of 0.05 and a confidence level of 95%. Accordingly, the sample size of students used in this study is 60 from the total population of 71.

Next, sample students have been selected from each department using proportional simple random sampling technique based on a list of students in the computing faculty of Jimma University, Wollega University, and Wollo University (as shown below in table 1.1). Proportional simple random sampling technique is a sampling technique appropriate to meet the objective of the study sample and allows researchers to obtain a sample population that best represents the entire population being studied from each university.

Table 1. 1 Samples considered for the current study

University	**Total**	**Sampled**
Jimma University	45	38
Wollega University	9	8
Wollo University	17	14
Total	71	60

Questionnaire

Both closed and open-ended questionnaires were used to collect quantitative and qualitative data from sampled students. This is because questionnaire is convenient to conduct survey and to acquire necessary information from large number of study subject with short period. Furthermore, it makes possible an economy of time and expense and provides a high proportion of usable response (Best & Kahn, 2003). The questionnaire was prepared in English language, because all of the sample students can have the necessary skills to read and understand the concepts that were incorporated.

The questionnaire had two parts. The first part of the questionnaire describes the respondents' background information, such as department, their batch and area of specialization. The second and the largest part incorporate the whole possible factor that contributes to the quality of scientific research writing specifically in the process of research proposal writing.

The researchers were dispatched and collected the questionnaires through the assigned data collectors. To make the data collection procedure smart and cleared from confusions, the data collectors was properly oriented about the data collection procedures by the principal researcher.

Interview

Semi-structured interview was used to gather in-depth qualitative data from selected research advisor and research method course lecturer. Because interview has greatest potential to release more in-depth information, provide opportunity to observe non-verbal behavior of respondents, gave opportunities for clearing up misunderstandings, as well as it can be adjusted to meet many diverse situations (Best & Kahn, 2003). The researcher conducted the interview to get in depth information and used for data triangulation. The interview is presented to experienced teacher and research advisor in the university about the whole research conducting

process, reasons for the delay of proposal approval, poor quality of research proposal, what should be done to motivate, encourage and uplift student in research proposal writing.

To get answer for the research question raised, the researcher followed a series of data gathering procedures. These procedures helped the researcher to get accurate and relevant data from the sample units. For this procedure the researcher was fulfilled all the precondition to collect the data from the target population like letters of authorization from Jimma University, Department of information science to the concerned universities, signing an agreement with the data collector by introducing my objectives and purposes.

Then, the final questionnaires administered to sampled students in the selected University. The participants were allowed to give their own answers to each item independently and the data collectors closely assisted and supervised them to solve any confusion regarding to the instrument. Finally, the questionnaires were collected and made it ready for data analysis.

In addition, the researcher conducted a kind of semi-structured interview with Senior Researcher Advisor and Research method course lecturer for acquiring knowledge. During the interview, the researcher took down notes where responses were not clear. To conduct the process of interview, the researcher attempted to select free and calm environment to lessen communication barriers that disturb the interviewing process.

1.7.3 Define the objectives of a solution

After the researcher collected relevant data and information from all selected informants for this study, the data was presented, organized, analyzed and interpreted for better understanding of the current problem novices faced in proposal writing.

The primary data collected from the survey questionnaire analyzed on the latest version of statistical package of SPSS in order to report the research questions. The data collected from students through closed ended questionnaire (the quantitative one) was processed and analyzed using several sets of statistical tools. Descriptive analysis is employed to have the presentation of the data in frequency and percent.

The qualitative data is organized according to concepts identified from research questions, transcribed and then analyzed according to their major concepts. The results of the qualitative data are then presented using narration. Moreover, the thematic approach was followed to display the analysis and findings from both quantitative and qualitative data. The themes for the data analyses were derived from the conceptual framework of the study that is grounded in the basic research questions. Analysis of quantitative data displayed first and then in corporate by qualitative data analysis in the form of texts and quotes.

1.7.4 Design and Development

This phase of the DSR process model involves determining the artifact's desired functionality and its architecture and then creating the actual artifact. In this phase, this study follows a knowledge engineering process model to develop the proposed system. Over the years, the discipline of knowledge engineering has evolved into the development of theory, methods and tools for developing knowledge-intensive applications (Marcus & McDermott, 2011). So, in this phase of Design science research process model we employed a Knowledge engineering method for knowledge acquisition, knowledge modeling, knowledge representation and prototype development.

Knowledge acquisition (KA):- is the process of acquiring relevant knowledge from domain experts and other sources of information such as books, databases, guidelines, manuals, journal articles, computer files, etc. KA is the process of eliciting, structuring and representing (formalizing) domain knowledge acquired from the different sources. Knowledge acquisition is the first step and critical task in the development of knowledge based system (Sagheb, 2009). The knowledge acquisition process of this study consists of activities such as gathering essential knowledge, analyzing the knowledge, identifying vital concepts and modeling the knowledge using decision trees. For this study it is very necessary to acquire tacit and explicit knowledge which is very important for the development of the prototype system. Therefore, to design a good knowledge-based system both primary and secondary data is acquired from different sources. Before critical knowledge is gathered from the domain experts, a preliminary assessment has been done to investigate where students gets conceptual difficulty in writing proposal writing. Primary knowledge gathered from experts in the domain area, the research adviser and research method course instructors of the University in this context, using semi-structured interview and by administering questionnaires. In fact, getting experienced and qualified experts knowledge is globally an issue, especially for developing countries like Ethiopia, for consultation and knowledge acquisition in the different domain areas. Due to this, the researcher selects seven research advisors based on their academic level, exposure to teach research method course and experience in research advising. Accordingly all participants are PhD candidates and PhD holder. As a result, the selected sample research advisors have broad and deep competence in terms of knowledge, problem solving skill and experience.

Knowledge modeling: - Modeling of domain knowledge implies capturing the static structure of information and knowledge types. Decision trees (DTs) are modeling tools that are used in a variety of different settings to organize and break down clusters of data (Makhfi, 2011). Similarly, decision tree have been widely used in practical applications area, due to its interpretability and ease of use. Currently, decision trees are used in many disciplines such as medical diagnosis, cognitive science, law and computer diagnosis. The decision tree was

used for the whole novice researcher difficulties in writing each section of proposal to understand the dimension of the problem. Each tree either starts with a set of possible causes for specific proposal section difficulties or starts with taking some input like research interest, planed action and/or willingness for the difficulties researcher faced to reach a solution.

Knowledge representation: - after the knowledge is acquired and modeled, it was represented using rule-based knowledge representation method. For this research, the knowledge representation method, i.e. rule based is chosen; because, it clearly demonstrates the domain knowledge. In a rule-based system, much of the knowledge is represented as rules, that is, as conditional sentences relating statements of facts with one another in the form of IF-THEN statements. As a result, rule-based representation method is more appropriate to represent and demonstrate the real domain knowledge.

Prototype development: - Prototyping approach was followed to develop the knowledge based system. Prototyping allows participating users who are students and domain experts for evaluating systems accuracy, performance, effectiveness and efficiency. So that the researcher has developed a prototype which mitigate common novice researcher mistakes and difficulties occurred during proposal writing based on the conceptual difficulty that is surveyed from students and the method to correct mistakes and difficulties as interviewed the domain expert and document analysis.

To develop knowledge based systems there are various tools which are available both freely and commercially. SWI prolog are among the most widely used programming language and known frameworks for teaching and academic research purpose (Aamodt & Plaza, 2013). In this study, Prolog (i.e. SWI prolog) is used for constructing the knowledge base. Prolog is a high level, programming language that is specifically designed for applications in AI. It is based on predicate calculus that is often used to develop automated proof systems and automated problem solvers (Cordingley, 1989). Prolog, by the nature of being logical, can be very powerful. It is flexible, especially compared to shells, and because it includes a control strategy there is no need to write an inference mechanism (Kingston, 2008).

1.7.5 Demonstration

The DSR process of Peffers et al. (2008) contains a demonstration and an evaluation activity. Demonstration illustrates the use of the artifact to solve one or several problem instances, and is considered as an early evaluation activity. This could involve its use in experimentation, simulation, a case study, proof, or other appropriate activity. During demonstration the researcher used the developed prototype to show practice based

and practical illustrative scenario. This style is typically used to demonstrate, by analysis or logical reasoning, that the artifact works (efficacy, technical feasibility), based on an illustrative scenario, using sample selected examples. The researcher also selected some problematic section of proposal to explain how the system solve and infer a solution including the detailed functionality of the system prototype in this report paper in the respective section.

Accordingly, for this purpose a total of 25 participants were selected based on their specialty program and willingness which also helps the researcher to get a good and constructive feedback from the different reflection made by the participant.

The participants for the demonstration purpose were splitted into three different groups. The first group was domain experts (Group I=7) and the participants in the second demonstration set consisted of novice students who passed proposal writing phase (Group II=10). The participants in third set of demonstration consisted of students who did not start proposal or concept note writing (Group III=8). All the participants in the demonstration phase except group I are graduate students at Jimma University, which differing by the exposure for research proposal writing. The main motive of having these two different set of evaluation groups was to identify if there were any difference in the adaptability and acceptability of the system by different group of users who were have different levels of experience and practice on academic writing.

Before starting the demonstration phase, the researcher first provided a general overview on the research aim and objectives. Following this, Procedures like how the study provides a solution to the observed research problem and for the student common problems and difficulties, how user interacts to the system, how the system infers a solution for user request were briefly explained. Finally, they were given extensive training in each section where the system provides a support. During these sessions the students were allowed to reflect their ideas and shown lectures about, had knowledge quizzes on and did interactive exercises to practice on different sections. Finally to identify the possible prototype improvements opportunities and to reach the desired ends, comment were given from the participants. Based on the comments the proposed system was revised to improve with respect to its, completeness, correctness, clarity and easy use. The demonstration for all group lasted about five and a half day.

1.7.6 Evaluation

Once the prototype is developed and demonstrated, the performance and user acceptance of the system should be tested. Evaluation is a central and essential activity in conducting rigorous design science research. Artifact

can be evaluated using its goal, environment, structure, activity and evolution which are shown in the following figure 1.2.

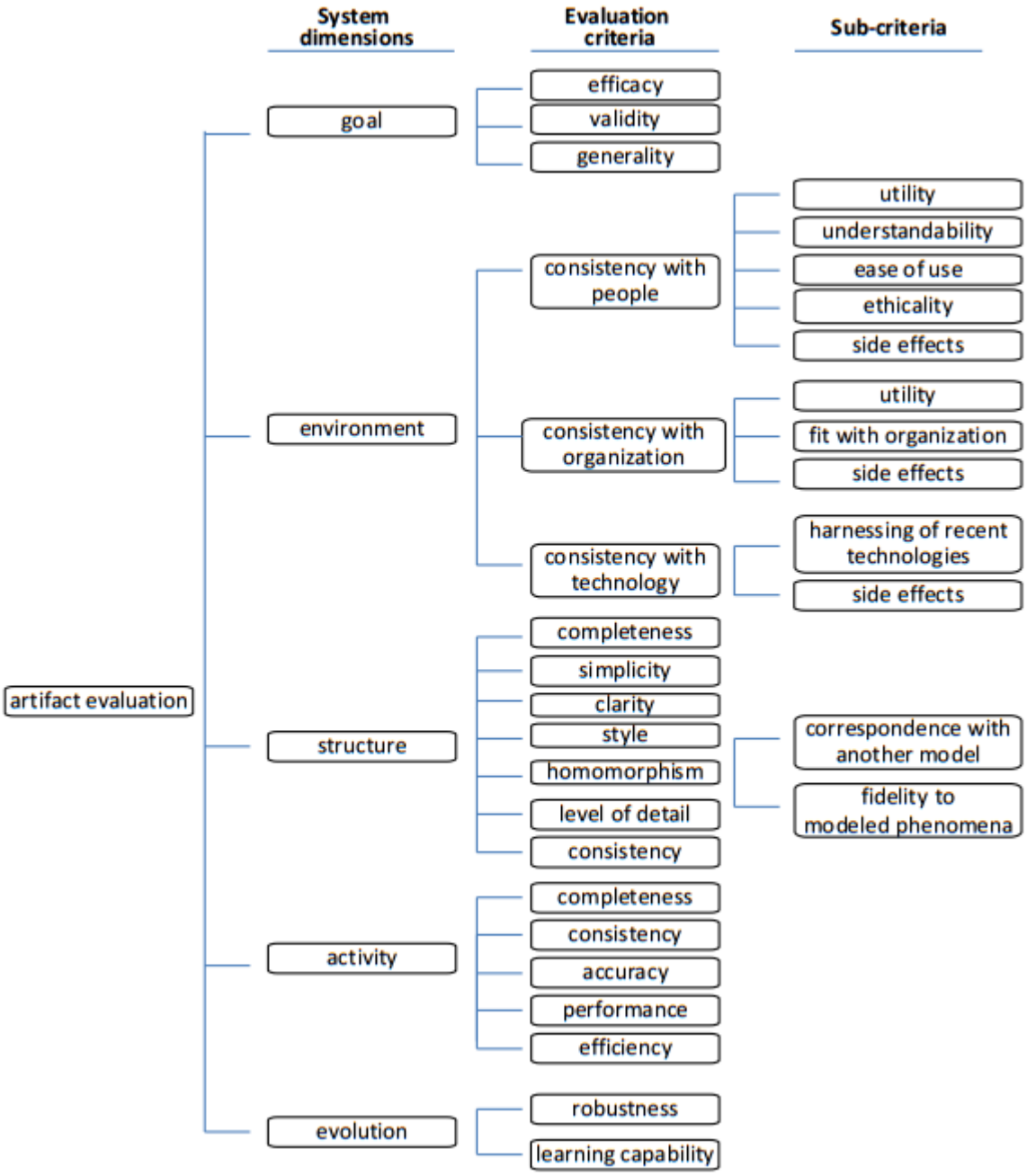

Figure 1. 2 Artifact evaluation criteria (Prat, Comyn-Wattiau, & Akoka, 2014)

Accordingly, for User acceptance testing purpose the researcher used the evaluation criteria recommended by Prat et al., (2014) which only consists of System's easiness, effectiveness, performance (time), accuracy, completeness, utility and learning capability. The user acceptance testing from the point of system dimensions helps the researcher to determine the acceptability and usability of the knowledge based system. And all the

content of the questionnaire is prepared based on the chosen criteria. The type of questionnaires distributed for feedback collection from the evaluators was close ended and open-ended questionnaires. For closed ended questionnaires, the evaluators allowed to rate the options using checkbox questions. The options of the check box questions are excellent, very good, good, fair, and poor. Then, the researcher assigned numeric value for each of the options given in words. Finally calculate the total user acceptance by using the following formula (Aboneh, 2013):

$$\mathbf{AVP} = \sum_{k=1}^{n} \mathbf{SVi}.\frac{\mathbf{NRi}}{\mathbf{TNR}}$$

Where AVP is average performance, SV is scale value, TNR is total number of respondent and NR is number of respondent then the result of user acceptance is used to calculate average performance of the prototype out of 100%. .

Before user acceptance test was conducted, system performance evaluation were takes place. The performance of the system is tested and validated using test cases. This is done by collecting already solved case questionnaire. Test cases are used to measure the accuracy of the system. For the purpose of validation processes a total of 50 cases was selected. To achieve the goal of the system evaluators purposively selected according to their willingness and specialty. Following performance evaluation, the system has been evaluated by user acceptance testing and usefulness.

1.7.7 Communication

Design science research must be presented effectively to both technology-oriented and management-oriented audiences. So, the result of this research, problem and its importance, the artifact, its utility and novelty, the rigor of its design, and its effectiveness will be communicated to researchers and other relevant audiences. The research report will be submitted to the department for defense as partial fulfillment of the master's program. The university would use its digital portal to upload this research work and they can put the hard copy to the university library. In addition to this, the researcher also has a plan to publish an article to present the result and effectiveness of the system to the audience in journal.

1.8 Operational Definitions

Domain expert: - is a person who expertise in his/her domain area. In addition, a research advisor who guides and advises researchers in research writing is a domain expert in his domain.

Knowledge based system: - is the collection of relevant knowledge that is stored in the computer and is organized in such a manner that it can be used for inferences, which is the reasoning process of Artificial Intelligence that takes place in the brain of an Artificial Intelligence process.

Novice researchers: - they are new researchers or beginners who have no deep knowledge about conducting research proposal writing.

1.9 Organization of the Study

This study comprises five chapters.

Chapter one: discusses background of the study, the problem statement and research questions, the general and the specific objectives of the study, and methodologies that the researcher used to conduct this study.

Chapter two: discusses about theoretical and related works review that are relevant for this study. In this chapter, the researcher discussions about knowledge bases systems, types of knowledge representation techniques, System Performance Evaluation Methods and related works which are relevant for this study.

Chapter three: presents the data presentation, analysis and interpretation of the data gathered by different instruments, mainly questionnaire and semi-structured interview. The summary of the quantitative data is presented by the use of Tables that incorporates various statistical tools. Similarly, the qualitative data was organized, analyzed and used to elaborate the result of the quantitative data. This chapters also discusses how this study defines objectives to the observed problem.

Chapter four: this chapter presents the knowledge acquisition processes which show how the required knowledge for system is acquired, how the acquired knowledge is modeled so that it would be easy to represent it into the system and knowledge representation techniques. Also this chapter presents the architectural design of the system, knowledge base and inference engine.

Chapter five: discusses about Demonstration and Evaluation of the proposed system. In this chapter the system demonstration is held also the system performance from the point of system performance and user acceptance is evaluated.

Chapter six: Finally, the researcher dedicated chapter six for conclusion and recommendation. In this chapter, the researcher discussed the evaluation results and based on the result the researcher presents findings and concludes the study by recommending future works.

CHAPTER TWO
LITERATURE REVIEW AND RELATED WORKS

2.1 Overview

Knowledge-Based System (KBS) is one of the major family members of the artificial intelligence (AI) group. With availability of advanced computing facilities and other resources, attention is now turning to more and more demanding tasks, which might require intelligence. The society and industry are becoming knowledge oriented and relying on experts' decision-making abilities. KBS can act as an expert on demand without wasting time, anytime and anywhere. KBS can save money by leveraging expert, allowing users to function at higher level and promoting consistency (Sajja & Akerkar, 2010).

According to Kesarwani & Misra, (2013), a knowledge base is the collection of relevant knowledge that is stored in the computer and is organized in such a manner that it can be used for inferences, which is the reasoning process of Artificial Intelligence that takes place in the brain of an Artificial Intelligence process.

One may consider the KBS as a productive tool, having knowledge of multiple experts for long period of time. In fact, a KBS is a computer-based system, which uses and generates knowledge from data, information and knowledge. These systems are capable of understanding the information under process and can take decision based on the residing information/knowledge in the system where as the traditional computer systems do not know or understand the data/information they process (Sajja & Akerkar, 2010).

2.2 History of Knowledge Based Systems

In the late 1960's to early 1970's, expert systems began to emerge as a branch of Artificial Intelligence (Aronson & Turban , 2007) . The intellectual roots of expert systems can be found in the ambitions of Artificial Intelligence to develop "thinking computers". Domain specific knowledge was used as a basis for the development of the first intelligent systems in various domains.

The main examples of the Knowledge Based System (KBS) developed at the early stages of AI include DENDRAL in 1960s and 1970s, MYCIN in 1976, PUFF in 1979, CADUCEUS in 1984, QMR in 1988, and WATSON in 2016 (Al-Aqbi, 2017). Pulmonary function analysis (PUFF) was of the oldest KBS in the field of medicine. It was developed for the interpretation of respiratory tests for diagnosis of pulmonary disorders. Patient inhales/exhales through a tube connected to computerized instrument, which measures flow rates and air volumes. PUFF accepts this data along with auxiliary data (age, sex, smoking history), and prints diagnosis

in English. As for the knowledge base, a knowledge engineer sat down with an expert pulmonary physiologist at the Pacific Medical Center in San Francisco and developed rules (64 in all). A more recent version of PUFF had about 400 rules (Geiwitz et al., 1990).

MYCIN, a precursor to PUFF, was developed for the identification of bacteria in blood and urine samples and prescription of antibiotics in 1976. It uses IF-THEN rules to represent knowledge. It also interacts with a physician to acquire clinical data. The system asks questions based on current hypothesis and known data and reasons backward from its goal of recommending a therapy for a particular patient. It stores approximately 500 IF-THEN rules and can recognize about 100 causes of bacterial infection. TEIRESIAS serves as a front-end to MYCIN. It was the first program to provide explanations of how conclusions were reached. TEIRESIAS can answer "why" questions by examining its internal tree of sub goals as cited by (Fetene, 2017).

2.3 Components of Knowledge Based System

The three major components of Knowledge Based system (KBS) are: Knowledge base (KB), inference engine (IE), and user interface (UI) (Sajja & Akerkar, 2010). For a better interaction with users, a KBS should preferably contain an explanation subsystem component or justifier. The knowledge engineer converts experts' knowledge into a form that can be manipulated by computer software. This knowledge is then stored in a knowledge base. The user provides information about a specific problem via a user interface. The inference engine uses the knowledge provided to come to some conclusions and/or give advice about the specific problem (Sajja & Akerkar, 2010). Figure 2.1 shows the architecture of a knowledge based system.

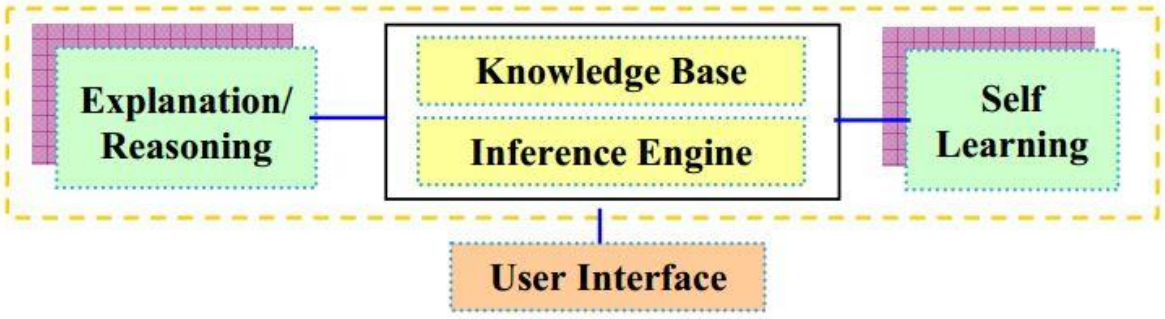

Figure 2. 1 Architecture of a knowledge-based system (Sajja & Akerkar, 2010)

2.3.1 The Knowledge Base

The knowledge base can be used as a repository of knowledge in various forms. This may include an empty Work Space to store temporary results and information/knowledge pieces/chunks. The knowledge base is the core component of any knowledge-based system. It contains knowledge acquired from the domain expert (Geiwitz et al., 1990). In rule based knowledge-based system, the knowledge base is modeled to include two components: rule base of heuristic rules that are used to solve specific problems in a particular domain, and facts. A rule is a conditional statement that links given conditions to actions or outcomes. A knowledge base can combine the knowledge of multiple human experts (Sajja & Akerkar, 2010). It represents the repository of knowledge for specific and narrow domain for the knowledge-based system. So, the most important part of knowledge-based system is the knowledge base and the power of any knowledge-based system and Knowledge-based system inherently in the adequate and integration of knowledge representation forms used for the particular domain. In this sense, the most important component, in developing knowledge-based system, is the building of the knowledge base; this process is part of knowledge engineering which is an important field at present century (Wielinga et al. 1997).

2.3.2 The Inference Engine

The Inference Engine (IE) is a software program, which infers the knowledge available in the knowledge base. The inference engine is the component that provides a methodology for reasoning and formulating conclusions. The inference engine provides directions about how to use the system's knowledge to solve problems (Al Ahmar, 2010). The purpose of the inference engine is to seek information and relationships from the knowledge base and to provide answers, predictions, and suggestions in the way a human expert will. The inference engine must find the right facts, interpretations, and rules and assembles them correctly.

There are two broad kinds of inference engines used in rule-based systems, such as forward and backward chaining. A rule-based system consists of IF-THEN rules, a bunch of facts, and an interpreter controlling the application of the rules, given the facts. These IF-THEN rule statements are used to formulate the conditional statements that comprise the complete knowledge base. A single IF-THEN rule assumes the form 'IF x is A THEN y is B' and the IF-part of the rule 'x is A 'is called the antecedent or premise, while the THEN-part of the rule 'y is B' is called the consequent or conclusion (Erdani, 2012).

Forward chaining: this is chaining strategy that starts with the facts and works forward to the conclusions (Nalepa, 2015). In a forward chaining system, the initial facts are processed first, and keep using the rules to draw new conclusions given those facts. During forward chaining, the inference engines first predetermine the

criterion and the next steps are to add the criterion one at a time, until the entire chain has been trained. With data driven control, facts in the system are represented in a working memory, which is continually updated. Rules in the system represent possible actions to take when specified conditions hold items in the working memory. The conditions are usually patterns that must match with the items in the working memory. In forward chaining, actions are usually involves adding or deleting items from the working memory. Interpreter of the inference engine controls the application of the rules, given the working memory. The system will first check to find all the rules whose condition holds true (Nalepa, 2015). Both data driven and goal driven chaining method follows the same procedures. However, the difference lies on the inference process. The system keeps track of the current state of problem solution and looks for rules. This cycle will be repeated until no rules fire or the specified goal state is satisfied (Rajeswari, 2012).

Backward chaining: this strategy focuses its effort by only considering rules that are applicable to the particular goal (Al Ahmar, 2010). It is similar with forward chaining the difference is it receives the problem description as a set of conclusions instead of conditions and tries to find the premises that cause the conclusion. Given a goal state and then the system try to prove if the goal matches with the initial facts. When a match is found goal is succeeded. But, if it doesn't then the inference engine start to check the next rules whose conclusions (previously referred to as actions) match with the given fact. Note that a backward chaining system does not need to update a working memory instead it keeps track of what goal is needed to prove its main hypothesis. Goal driven control is commonly known as top-down or backward chaining (Nalepa, 2015).

The choice from backward chaining and forward chaining depends on how domain experts solve the problems. If the domain experts solve a problem by first collecting data and infer a solution from this data, then it is forward chaining. But if the domain expert starts hypothetical solution and then attempts to find facts to prove the hypothesis, then it is a backward chaining (Turban, et al., 2010).

Forward Vs Backward reasoning: According to Nalepa (2015), both forward chaining and backward chaining have similar function. But, the difference occurs due to the data structure of knowledge based system. The following point give us a clear ideas how and when to apply each reasoning mechanisms.

- Whether you use forward or backwards reasoning to solve a problem, it depends on the properties of your rule set and initial facts.
- Sometimes if you have particular goal to test some hypothesis, then backward chaining is more efficient, as you avoid drawing a conclusion from irrelevant facts.

- Sometimes backward chaining can be very wasteful - there may be many possible ways of proving the hypothesis, and it may require checking almost all of the rules before you find one that works.
- When you have a small set of initial facts; and when there is lots of different rules which allow you to draw the same conclusion it is better to use forward chaining.
- Backward chaining may be better if you are trying to prove a single fact, given a large set of initial facts. Because if you used forward chaining lots of rules would be eligible to fire in any cycle.

2.3.3 The User Interface

The User Interface is one of the major components of a knowledge-based system, which allows bidirectional communication between system and user is considered to be a critical part of the success of a knowledge-based system. The user interface consists of all screens of interaction between the user and the ES (Al Ahmar, 2010).

The input/output interface defines the way in which the knowledge-based system interacts with the user and other systems. Interfaces are usually graphical with screen displays, windowing, and mouse control. They receive input from the user and display output to the user. Some systems use natural language front ends that accept English-like responses but most use a graphical user interface (GUI) with a mouse device to allow the user to choose from selections in dialog boxes and menu bars (Aebissa, 2012).

2.3.4 The Explanation/Reasoning Component

As an expert's power lies in his explanation and reasoning capabilities, the knowledge-based system's creditability also depends on the Explanation and Reasoning of the decision made/suggested by the system (Sajja & Akerkar, 2010). This is an important component of a knowledge-based system that can explain the system's reasoning and justify its conclusions. Another unique feature of a knowledge base system is; its ability to explain its advice or recommendations and even to justify why a certain action was recommended. The explanation subsystem enables the knowledge base system to examine its own reasoning and explain its operations. The ability to trace responsibility for conclusions to their sources is crucial, both in the transfer of expertise and in problem solving.

The explanation facility explains how the system arrived at the recommendation. Depending on the tool used to implement the knowledge base system, the explanation may be either in a natural language or simply a

listing of rule numbers. Explanation is essential in knowledge-based systems used for training and evaluation (Sajja & Akerkar, 2010).

The explanation facility is expected to provide the ***WHY, HOW and WHYNOT*** Explanations (Kingston, 2008)

The WHY Explanation: This explanation session is asked by users why a fact is requested by the system. The system asks the user for an input continuously and the user asks for the system why the question was asked by the system before answering the system's question.

The HOW Explanation: This explanation mainly uses to determine how a certain conclusion or recommendation was reached. Users raise this explanation at the end of certain conclusion or recommendation to know exactly how that specific conclusion was reached. It follows a step-by-step approach to reach the Final answer.

The WHYNOT Explanation: Such a question is raised if expected results were not reached. Users in this case are interested to know why certain request was unsuccessful.

2.3.5 The Learning Component

Self-learning is one of the elements of KBS which tries to imitate the learning capability of human beings. It is possible to update the knowledge base of the KBS either manually or automatically using machine learning algorithms (Eds and Akerkar, 2010). According to Akerkar and Sajja (2010), learning is a scientific task that enables the knowledge-based system to learn automatically from the inference process, cases executed, and environment. To carry out such tasks, one needs to have a control mechanism that discovers general conjectures and knowledge from specific data and experience, based on sound statistical and computational principles".

One of the key characteristics of KBS is the capability to learn. According to Castillo et al., (2008), there are three methods of learning. These are structural learning, parametric learning and learning by memorization.

Structural learning: denotes to certain features associated to the structure of knowledge such as rules and probability distributions. For example, finding a new related symptom for a certain disease or incorporating a new rule in the knowledge base.

Parametric learning: denotes to conjecturing the parameters required to build the knowledge base. For example, conjecture of probabilities associated with symptoms or diseases.

Learning by memorization: denotes the capability of KBS to learn from experience based on the existing data. Using this method, KBS can carry out different activities such as storing or memorizing knowledge, and learning from the facts base.

2.4 Knowledge Base Development Process

Mostly knowledge engineering is the process of building a knowledge-based system, with the following main phases: planning, knowledge acquisition, knowledge representation and evaluation (Sajja & Akerkar, 2010). The knowledge of the expert(s) is stored in his/her mind in a very abstract way. Also, every expert may not be familiar with knowledge-based systems terminology and the way to develop an intelligent system. The Knowledge Engineer (KE) is responsible person to acquire, transfer and represent the experts' knowledge in form of computer system (Sajja & Akerkar, 2010). People, Experts, Teachers, Students and Testers are the main users' groups of knowledge-based systems.

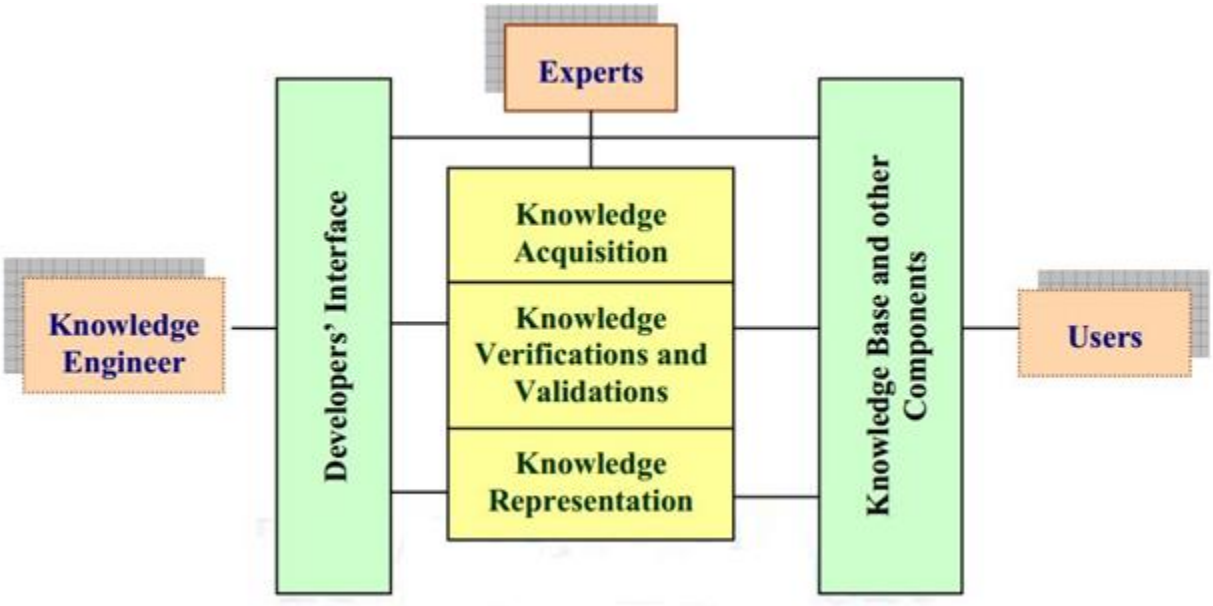

Figure 2. 2: Development of a knowledge-based system (Sajja & Akerkar, 2010)

2.4.1 Knowledge Acquisition

The first task in the development of knowledge base is knowledge acquisition. Knowledge acquisition is considered as one of the most important task in the knowledge-based system development life cycle (Cordingley, 1989) Knowledge acquisition is to obtain facts and rules from the domain expert so that the system can draw expert level conclusions. The process of knowledge acquisition is difficult especially in case

if the knowledge engineer is unfamiliar with the domain and when a knowledge engine tries to extract tacit knowledge which is stored in the subconscious mind of experts and reflected in the mental models, insights, values, and actions of the experts. Knowledge acquisition is crucial for the success of a knowledge-based system and regarded as a bottleneck in the development of a knowledge-based system. The main reason for this bottleneck is communication difficulties between the knowledge engineer and the domain expert. There exist several methods to extract human knowledge; some commonly used approaches of knowledge acquisition include interviews, questionnaires, record reviews and observation to acquire factual and explicit knowledge (Sajja & Akerkar, 2010).

Knowledge acquisition is comprised of two tasks: knowledge elicitation and knowledge representation. In knowledge elicitation, domain knowledge is obtained through various means including interviews with experts and book and journal references. In knowledge representation, the elicited knowledge is converted to a form for efficient computer manipulation (Cordingley, 1989).

Knowledge in its primary form can be obtained from four sources: literature, human specialists, existing models, and examples. Methods of collecting, organizing, and formalizing knowledge are many and vary widely depending on the source. When knowledge is extracted from human specialists, the acquisition process is often called knowledge elicitation. The job of knowledge elicitation from human experts can be very difficult due to the inexplicit nature of human knowledge. There is no universal agreement on which knowledge elicitation technique to use when. It is most common to start with interviews and then use other methods when considered useful. The knowledge engineer must be versatile and willing to weigh the various methods in order to please the experts and elicit the most information (Marcus & McDermott, 2011).

Knowledge Acquisition Tools

The knowledge acquisition phase requires a significant degree of interaction between the knowledge engineer and the specialist. During this phase, the knowledge engineer uses techniques and tools to elicit tacit knowledge from discipline specialists. A diversity of knowledge acquisition tools is presented in the Knowledge Acquisition Matrix (Marcus & McDermott, 2011). The following are list of techniques used for acquiring knowledge:

Interview is the most commonly used form of knowledge acquisition (Kasabov, 1996).It involves a direct dialog between the expert and the knowledge engineer. Information is collected with the aid of conventional instruments (e.g., tape recorders, questionnaires) and is subsequently transcribed, analyzed, and coded. Based on its structure, interview can be classified into **structure, semi structure and unstructured interview**. A structured interview is a systematic, goal-oriented process that enables organized communication between the

knowledge engineer and the expert. On the other hand, a semi-structured interview is an interview which has a guide that usually includes both closed-ended and open-ended questions. It is more flexible than structured one. In these kinds of interview the interviewer has a chance to change the order of questions and expand the dimension of questions based on the participants' responses (Thomas , 2017). Unstructured Interview is conducted informally, usually as a starting point. Of knowledge acquisition. . Starting informally saves time; it helps to move quickly to the basic structure of the domain. Usually, it is followed by a formal technique. Unstructured interviewing seldom provides complete or well-organized descriptions of cognitive processes (Sher & Tarika , 2014).The structure reduces the interpretation problems inherent in unstructured interviews and allows the knowledge engineer to prevent the distortion caused by the subjectivity of the domain expert (Sher & Tarika , 2014).□

Questionnaire: A Questionnaire can help an expert express what he knows by encouraging him to relax and do the cognitive work necessary to formulate his ideas. On the other hand, a knowledge acquirer is better prepared to help when questions are more specific; Specific questions imply that the knowledge acquirer has some corporate/domain knowledge, both in terms of being able to construct the question and of being able to comprehend the answers (James & Slater, 2013).

Observations: - Sometimes it is possible to observe an expert at work. In many ways, this is the most obvious and straightforward approach to knowledge acquisition. However, the difficulties involved should not be underestimated. For example, most experts advise several people and may work in several domains simultaneously. In this case, the knowledge engineer's observations will cover all the other activities as well. Therefore, large quantities of knowledge are being collected, of which only a little is useful. In particular, if recordings or videotapes are made, the cost of transcribing large amounts of knowledge should be carefully considered. Observations, which can be viewed as a special case of protocols, are of two types: motor movements and eye movements (Cordingley, 1989).

Document Analysis: - Document analysis involves gathering information from existing documentation. May or may not involve interaction with a human expert to confirm or add to this information (Cordingley, 1989). Document analysis is a form of qualitative research in which documents are interpreted by the researcher to give voice and meaning around an assessment topic (Bowen, 2009).This method sometimes used when the acquired knowledge or the information from domain expert is insufficient or difficult to elicit.

2.4.2 Knowledge Modeling

Knowledge engineers make use of a number of ways of representing knowledge when acquiring knowledge from experts. These are usually referred to as knowledge models. Knowledge models are the structural representation of knowledge by using symbols to represent pieces of knowledge and relationships between them. They are set of concept maps and associated resources about a particular domain of knowledge (Canas, Hill, & Lott, 2003).

Several key contributions made during the 1980s, including Allen Newell's notions of knowledge level, William Clancy's critical analyses and the broader wave of second generation ES research, which have shaped our current perception of the knowledge acquisition problem (Rajeswari, 2012). Central to the current perception is the knowledge model, which views knowledge acquisition as the construction of a model of problem-solving behavior, that is, a model in terms of knowledge instead of representations. The concept of knowledge-level modeling has matured considerably. The practical knowledge level models incorporated in today's methodologies do not simply reflect the knowledge content of a system; they also make explicit the structures within which the knowledge operates in solving various classes of problems. This enables the reuse of models across applications.

As discussed by Milton, (2003), knowledge models include symbolic character-based languages, such as logic, diagrammatic representations, such as networks and ladders, tabular representations, such as matrices and structured text, such as hypertext. Ladders are hierarchical (tree-like) diagrams. Some important types of ladders are concept ladder, composition ladder, and decision tree and attribute ladder. Network diagrams on the other hand show nodes connected by arrows. Depending on the type of network diagram, the nodes might represent any type of concept, attribute, value or task, and the arrows between the nodes any type of relationship. Examples of network diagrams include concept maps, process maps and state transition networks. Tabular representations make use of tables or grids. Three important types are forms, frames, timelines and matrices/grids.

According to Rajeswari, (2012), decision trees (DTs) are modeling tools that are used in a variety of different settings to organize and break down clusters of data. Similarly, decision tree has been widely used in practical applications area, due to its interpretability and ease of use. Currently, decision trees are used in many disciplines such as medical diagnosis, cognitive science, law and computer diagnosis. Decision tree structures are the bases for the development of prototype knowledge-based system.

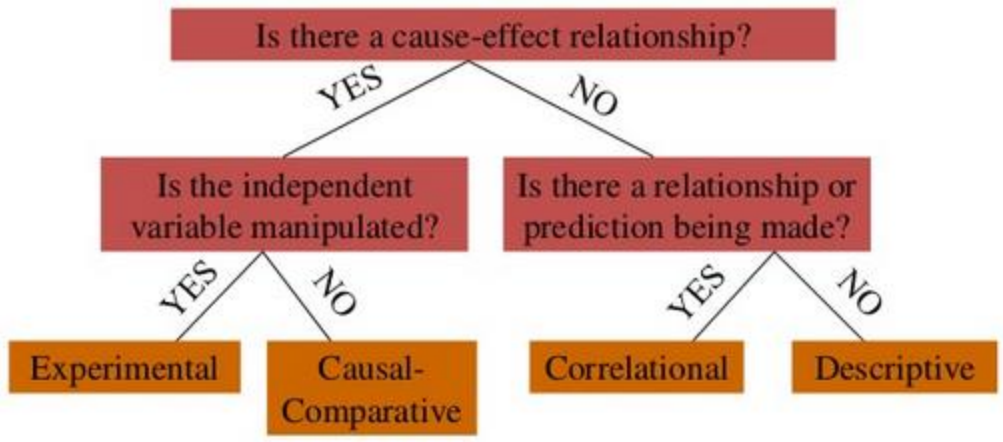

Figure 2. 3 Sample decision tree example (lisay, 2012)

2.4.3 Knowledge Representation

The acquired knowledge should be immediately documented in a knowledge representation scheme. In knowledge representation, the elicited knowledge is converted to a form for efficient computer manipulation. At this initial stage, the selected knowledge representation strategy might not be permanent. However documented knowledge will lead the knowledge engineer/ developer to better understanding of the system and provides guidelines to proceed further.

A knowledge representation (KR) is an idea to enable an individual to determine consequences by thinking rather than acting, i.e., by reasoning about the world rather than taking action in it. The knowledge acquired from experts or induced from a set of data must be represented in a format that is both understandable by humans and executable on computers. Good Knowledge Representation Languages should be Expressive, Concise, Unambiguous, and Independent of context, Efficient and effective (Kesarwani & Misra, 2013).

Nowadays rule-based and case-based are the most widely used knowledge representation scheme. Case-Based Representation is a computer technique which combines the knowledge-based support philosophy with a simulation of human reasoning when past experience is used, i.e. mentally searching for similar situations happened in the past and reusing the experience gained in those situations (Kesarwani & Misra, 2013). The concept of case-based reasoning is founded on the idea of using explicit, documented experiences to solve new problems. The decision maker uses previous, explicit experiences, called cases, to help him solve a present problem. He retrieves the appropriate cases from a larger set of cases. The similarities between a present problem and the retrieved case are the basis for the latter's selection (Rajeswari, 2012).

Rule based reasoning is a system whose knowledge representation in a set of rules and facts (Sajja & Akerkar, 2010). Symbolic rules are one of the most popular knowledge representation and reasoning methods. This popularity is mainly due their naturalness, which facilitates comprehension of the represented knowledge. The basic forms of a rule, if<condition> then<conclusion> where <condition> represents premises, and <conclusion> represents associated action for the premises. The condition of the rules is connected between each other with logical connectives such as, AND, OR, NOT, etc., thus forming a logical function. When sufficient conditions of a rule are satisfied, then the conclusion is derived and the rule is said to be fired. Rules based reasoning was dominantly applied to represent general knowledge. Rule based knowledge-based systems have a significant role in many different domain areas such as medical diagnosis, electronic troubleshooting and data interpretations. A typical rule-based system consists of a list of rules, a cluster of facts and an interpreter (Prentzas & Hatzilygeroudis, 2007). Rules in the system represent possible actions to take when specified conditions hold items in the working memory. The conditions are usually patterns that must match with the items in the working memory.

Advantages of Rule Based Systems Some of the advantages of rule-based systems are the following (Sajja & Akerkar, 2010).

- **Homogeneity:** Because of the uniform syntax, the meaning and interpretation of each rule can be easily analyzed.
- **Simplicity:** Since the syntax is simple, it is easy to understand the meaning of rules. Domain experts can often understand the rules without an explicit translation. Rules therefore can be self-documenting to a good extent.
- **Independence:** While adding new knowledge one need not be worried about where in the rule base the rule is added, or what the interactions with other rules are. In theory, each rule is an independent piece of knowledge about the domain.
- **Modularity:** The independence of rules leads to modularity in the rule base. You can create a prototype system fairly quickly by creating a few rules. This can be improved by modifying the rules based on performance and adding new rules.
- **Knowledge is separated from use and control:** The separation of the rule base from the inference engine separates the knowledge from how it is used to solve the problem. This means that the same inference engine can be used with different rule bases and a rule base can be used with different inference engines.

2.5 Knowledge Based System Development Tools

In the late 1980s and early 1990s, when commercial interest in knowledge-based systems was at its peak, approximately 200 KBS tools were commercially available. Many are still available but are no longer described as KBS tools for marketing reasons; common alternative terms include “intelligent decision support tools”, “enterprise support tools” or “knowledge management tools (Kingston, 2008).

A Knowledge Base System tool is a set of software instructions and utilities taken to be a software package designed to assist the development of knowledge-based systems (Kingston, 2008). Personal computers, typical programming languages like java and framework like .NET can also be used in KBS development. These programming languages are general purpose and also being used to develop other applications than AI application. KBS shell with the readymade utilities of self-learning; explanation facility and inference engine, like Java Expert System Shell (JESS), JRULES, and CLIPS are more specific and can also be useful to develop KBS.

There are many knowledge-based system tools. According to Kingston (2008), different authors classified KBS development tools based on their functionality. The simplistic nature and additional feature it provides is used as parameters to select KBS development tools. Also, many programming languages and tools used to develop knowledge-based systems, some of which are Lisp, prolog and Clips (Aronson & Turban , 2007). Programming languages, Prolog and LISP environment rank high in the field of artificial intelligence (AI) research. LISP is an older general-purpose language used to build a program, which imitates human behavior while Prolog came later and focuses on knowledge bases and knowledge-based systems.

Lisp is a general-purpose language which has a rich set of data types as well as built-in data structures like lists, trees and maps. On the other hand, Prolog is a declarative programming language that specializes in inference-based reasoning. It uses specialized logic to derive new knowledge from a list of rules known as a knowledge base. The language works well for tasks like proving mathematical theorems and building knowledge and knowledge-based systems. The major advantage of these languages, as compared to conventional programming languages, is the simplicity of the addition, elimination, or substitution of new rules and memory management capabilities (Al Ahmar, 2010).

2.6 Methods of Evaluation

An important component of any software development effort is the testing and evaluation of the software system (solution) to ensure correctness of the outputs and user satisfaction with the product in solving the given problem. According to Thomas, (2014), Knowledge based systems evaluation method can be split into verification, validation and evaluation of human factors.

Verification is an evaluation process that should be implemented during system design and development to answer the question Did we build the system correctly. Verification can be defined as the process that involves checking for compliance with the system specifications, checking for syntactic and semantic errors in the knowledge-based system. Specification assessment includes user interface, explanation facility, real time performance and security provisions specified in the system design. To verify the knowledge-based system, it is possible to use either a program proof or a test strategy. The program proof confirms total correctness of the program logic with mathematical methods and the test proof strategy confirms partial correctness of the program with given test cases (s).

Validation: The concept of validation refers to determining the correctness of the system with respect to users' needs. Validation criteria include comparisons with known results (e.g. past cases or solved problem), comparison against expert performance, and comparison against theoretical possibilities. Empirical validation checks whether the results of content remain stable when the system is under full workload. The system test examines the complete system performance in its working environment. Validation tests include user acceptance surveys, direct comparison on random test cases between human expert and that of the system.

Evaluation of human factors is the process of determining the acceptability and usability of the knowledge-based system by users. Usefulness of a system is often measured by examining user satisfaction. User satisfaction is measured from different point of views such as content satisfaction, interface satisfaction and institutional objective. Personal aspect such as individuals 'dislike of computer takes into consideration.

2.7 Related Works

Advancements in computing technology led to the introduction of artificial intelligence (AI) in educational system in the 1970s, the integration of which was called intelligent tutoring systems (ITS) (Al-Aqbi, 2017). AWE (Automated Writing Evaluators) is also relatively a new field which has been of interest to a lot of researchers. Those systems have the potential to support students in teaching and learning of writing skills (Ramaswamy, 2012). Below, automated system is presented as related work which are designed to help researchers.

An automated research paper editing bot is designed by Richa et al., (2019), which is aimed at minimizing the time spent and handwork involved while drafting the research paper. Thus, to minimize such a problem Richa et al., (2019) used python libraries to enhance user interaction with the bot and make it easy to use, text classification algorithms to provide the text analysis required in order to ease the editing operations and speech recognition. In his paper he mentioned that his developed tools reduces handwork of the researcher up to a

great degree. In his work he lefts details like font and style editing features, secure access of document, user authentication to make the system more reliable and robust for future model of his project.

The Intelligent Academic Discourse Evaluator (IADE) (Cotos, Elena, 2010), the prototype for RWT, is a web-based AWE program that was developed as an additional tool for students to practice with and make incremental improvements on their drafts of research article introductions. To develop the IADE, he used Hypertext Preprocessor (PHP) module to accept student article for analysis in the web browser. The PHP gets the analyzed data and displays it back to the user after saving them to the database. The result of his study revealed that the IADE'S feedback drew the participants' attention to the discourse form of their draft helping them notice the negative evidence in their writing, motivating them to revise it. It was also observed that there was an improvement in the quality of the discourse as the users changed the content, vocabulary, grammar, structure and mechanics of the writing. The users believed that the interaction with IADE and its feedback helped them learn about moves. As a future work he put further work in the other section of article

Ramaswamy, (2012) attempted to develop, an online tutor for research writing which uses the Intelligent Academic Discourse Evaluator (IADE) (Cotos, Elena, 2010) as its prototype. While IADE analyzes only the introduction section of the research article, RWT is capable of analyzing all the sections of a research. His main motive was to help students in a classroom environment providing individualized automated feedback. RWT uses the corpus-based approach which consists of training the machine-learning system with a wide set of real-world discipline specific examples of use of language. RWT consists of the analysis and demonstration modules. As he expected, the users who did not have a background or understanding of academic research writing found the tool to be less useful than the users who understood the purpose of the tool. Also, the level of trust on automated systems was low among this group when compared to the other groups which attended courses or workshops on academic writing. Tools like plagiarism check and grammar corrections were his future work

Going by the literature, it can be observed that there are a variety of automated systems developed over the years which can be seen from the above related work to help and evaluate the users' research report writing works. However, the empirical literatures assert that thesis writing especially the first part, the thesis proposal writing is not an easy understanding by most postgraduate novice Researcher and they lacked major academic writing competency to solve mistakes. This is mainly related to a lack of a hands-on approach to comprehend well the research concepts (Huang, 2010). Due to this novice face challenging tasks and commit different mistakes in their proposal writing. Consequently, a weak foundation leads to a bad research and this also impedes the postgraduate students to complete their thesis and dissertations on time.

In our country, a research work was done by Belay & Yekoyealem (2016). The objective of this research was to investigate the competencies of student researchers through a variety of techniques: assessment of the qualities of MA thesis produced in three selected departments in Addis Ababa University. Thematic analysis and synthesis of data indicated that there is a serious gap in the general, specific and behavioral research competencies of students. It has been documented in his paper that the quality of MA thesis projects in Addis Ababa University seems to be seriously compromised. Students did not seem to develop the required knowledge, skills, and ethical behaviors to conduct scientific research. Even this research was done for assessing the competency of researcher in research writing.

To conclude, there is no supportive system specifically done for research proposal writing, which is a very foundation for any scientific research work. Thus, this research is on this first part of scientific research to design a KBS that can update its knowledge through experience.

CHAPTER THREE
PROBLEM IDENTIFICATION AND OBJECTIVES OF THE SOLUTION

3.1 Overview

This chapter presents the data analysis and interpretation of the data gathered by different instruments, mainly questionnaire and semi-structured interview on assessing the major challenges of novice researcher while writing their research proposal report. The data helps as a requirement for the knowledge based system. The summary of the quantitative data is presented by the use of tables that incorporates various statistical tools. Similarly, the qualitative data was organized by themes, analyzed and used to elaborate the result of the quantitative one. Thus, the qualitative data is used to support the result obtained from the interpretation of the quantitative data. Data presentation and analysis in this very research is divided into researchers and experts perspectives.

This chapter also infers the objectives of a solution from the problem definition and knowledge of what is possible and feasible. The objectives of the solution shows how the new artifact is expected to support solutions to problems not hitherto addressed.

3.2 Data Presentations and Analysis from Researcher's Perspective

A total of 63 respondents were randomly sampled including all novice researchers, master's candidate. The researcher has dispatched questionnaire for students to evaluate the perception of students in the overall process on research proposal writing and to explore the major challenges and conceptual difficulties of the student which also impede them from writing acceptable proposal. Seven senior Research Supervisor have also been the participant of the study to strengthening the data obtained from the student since, conducting proposal writing process is between advisor-advisee and finally to attain the possible solution for the student challenge and conceptual difficulties. Out of the total 63 questionnaires distributed, the total returned questionnaire is 60 of them are returned with 95% return rate.

3.2.1 Researchers Satisfaction in their Research Preparation

The research method course is the basic requirement of novice researcher to write a research report and to apply scientific method to their research. Successful completion of the course capacitates the students to write a Research proposal report related to their own research topic. Understanding the researcher's satisfaction can show whether they are adequately prepared or not. Table 3.1 provides summary of their perception on how adequate they were prepared for proposal writing.

Table 3. 1 Researchers satisfaction in research course and their preparedness for proposal writing

Degree of satisfaction	Satisfaction in terms of being prepared for Proposal Writing		Satisfaction with Regard to Research Course Module	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Very dissatisfied	17	28	15	25
Dissatisfied	22	37	24	40
Neutral	10	17	10	17
Satisfied	5	8	5	8
Very satisfied	6	10	6	10
Total	60	100	60	100

According to the above table, out of the total respondents, 65% the participant mentioned that they are not satisfied with their being prepared for proposal writing techniques. The same number of researcher replied that they were not satisfied with the research methodology course taught. On the other hand, 10% of respondents indicated that they were very satisfied with the way they were being prepared and taught the research module for proposal writing.

3.2.2 Concept Note Evaluation Result

A concept paper is meant to give the researcher department an idea of his/her area of research interest in order to avail the necessary assistance for novice researcher to develop a full-fledged research proposal. This study also conducts a survey in Jimma University (JU), Faculty of Computing and informatics, Information Science department to understand the concept note acceptance rate of Novice researcher. This helps the researcher to understand how sever the problem is and to make the reader feel the urgency of the problem. Summary of respondents reply is presented below in table 3.2.

Table 3. 2 Concept note evaluation result for students of Information Science department at JU

	Year 2011		**Year 2012**	
Acceptance Level	**Frequency**	**Percent**	**Frequency**	**Percent**
Concept Note Accepted Outright	-	-	-	-
Concept Note Accepted with modifications	4	44	-	-

Concept Note Accepted with Minor Revisions	-	-	5	23
Concept Note Accepted with Major Revisions	-	-	4	18
Incomplete Concept Note	-	-	3	14
Yet to be evaluated Concept Note	-	-	2	9
Proposals Rejected	5	56	8	36
Total	**9**		**22**	

The above Table 3.2 shows that in the year 2011 and 2012 out of the total concept note submitted for evaluation in the information science department most of them that accounts for 56% and 36% respectively were rejected. On the other hand, in both years none of the concept notes were accepted outright.

In conclusion we can confidently say that the results of this study in this aspect clearly show that graduates are poorly equipped to write research proposal. Therefore, a broad-based solution to the problem must be developed; so that research proposals of acceptable quality are produced that can culminate into a good research because a proposal is the foundation of a research.

3.3 Factors Affecting Quality of Research Proposal

Quality of student's research proposal work is affected by different interwoven factors in higher educational institutions. These are academic, institutional, psychological, social and personal as well as economic, which overlap with one other (Mahammoda, 2016). Different thematic analysis and synthesis of data indicated that there is a serious gap in the general, specific and behavioral research competencies of students. The quality of the thesis work is to such a level today that appears seriously compromising the standards expected of a Postgraduate Student thesis.

The first international conference on Academic research for Development was held in Addis Abeba on the major factors which affects the quality of postgraduate research work in Ethiopian University and challenges instructors face in research. According to this report Postgraduate Research quality in Ethiopian University has affected by manifold factors like, academic, social, and personal, psychological, institutional, economic those are directly or indirectly, interrelated and supervisors are facing multifaceted challenges, which arise from students work and institutional working system. (Mulu , 2017). Generic and specific competencies, behaviors and others factors generally presented so far as the cornerstones for a successful student writing need, therefore, to be periodically gauged in the various graduate programs to ensure not only quality thesis or dissertations but, more importantly, quality postgraduate education.

Based on the above benchmarks the researcher conducts a survey to explore whether those factors were having a negative impact on research proposal writing by novice researchers.

3.3.1 Academic Impact on the Novice Researcher' Proposal Writing

Academic factors have a direct and/or indirect impact on the student writing skill. By understand this, the study infer what is possible and feasible to challenge the challenge. Table 3.3 presents academic factors that have an impact on the novice researchers' proposal writing.

Table 3. 3 Academic impact on the novice researcher' proposal writing

Parameters	High		Medium		Low		Remark
	Freq.	Perc.	Freq	Perc.	Freq.	Perc.	
Incompletion of research Method course	30	50	16	27	14	23	High
Lack of experience	33	55	17	28	10	17	High
Lack of advisor's commitment/ inadequate support from supervisor	16	27	34	57	10	17	Medium
Poor language skill	29	48	17	28	14	23	High
Poor teaching learning Research Methodology Course and Strategy	35	58	15	25	10	17	High

- Freq. = Frequency; Perc. = Percentage

Among the different parameters from the academic factor as depicted in table 3.3 above: incompletion of research method course, lack of experience, poor language skill, poor teaching learning research methodology course and strategy, are rated as it has a high impact on the student proposal work and lack of advisor's commitment rated as medium.

Incompletion of research Method course: Incompletion of research course affect the quality of student's research proposal work by limiting their potential from applying scientific research method. This also impedes them from writing a good research work. However, students should have expected knowledge of a scientific way to research a problem area and a knowledge to write a scientific research, which they can acquire from research course to do quality research because the basic objectives of such courses are to capacitate those pupils for that action. This also confirmed by Ball and Pleco (2006) and outlined the importance of completion of research course in that the completion of an introductory and basic course in research methods is a critical step for postgraduate students who will conduct their own original research.

Lack of experience: Student lack of experience can be related to: as the study reviled in the table 3.3, to the Incompletion of research Method Course. This challenging condition doesn't allow the student to learn from previous course or strategy which also in turn unable to have a previous experience (lack complete skills).

Lack of advisor's commitment: Poor supervision also affected the quality of research resulting in plagiarized research work of novice researcher that can caused by lack of advisor's commitment. In evidence for this, scanty supervision found to be one of the major factors that negatively affect students' advancement in research (Kangaia & Mapolisa 2012). Nevertheless, students' lack of goal in learning and other factor can force supervisors to act irresponsibly during research supervision since supervision is providing support for the learners and he/she also should be eager to scramble on the task plateau.

Poor language skill: English language proficiency is the problem for most students in research proposal writing whose mother tongue is not English. For most Ethiopian, English is the second language. Therefore, most students have English writing problems and this hinders in their effective writing of the good research proposals and reports. Due to language barrier, students fail to present and argue their research concepts and ideas. Some of the students even fail to construct good sentences when writing their research proposal and reports. Also, both native and non-native speakers (NNS) find articulating ideas in the conventions of written English for academic writing as the most frequent challenges (Llosa, Beck, & Zhao, 2011).

Specifically, NNS have reported less facility of expression, restriction to simple style, difficulty to provide appropriate amount of force on the claims for their research (Flowerdew, 1999). Given that some of the issues faced by students in writing their proposal in English include the following. Grammatical Problems, Problems of Sentence Structure, Problem of Word Choice, Punctuation Problems ….

Poor teaching learning Research Methodology Course and Strategy: Most of instructors use only the lecturing method when training research courses to postgraduate students where power point presentation is used in delivering the materials. The researcher is in the view that, using this lecture delivery method alone is not always suitable for students because power point presentations make students not to comprehend well the research concepts.

3.3.2 Institutional Impact on the Novice Researcher' Proposal Writing

Institutional management system and environment has its own impact on novice students' writing, those impacts have either facilitate good writing experience opportunity or make student suffer from the impact. Table 3.4 depicts institutional impact in proposal writing.

Table 3. 4: Institutional impact in proposal writing by novice researcher'

Parameters	High		Medium		Low		Remark
	Freq.	Perc.	Freq.	Perc.	Freq.	Perc.	

Scarcity of reference materials	19	32	24	40	17	28	Medium
Poor service delivery system of library	26	43	20	33	14	23	High
Absence of Standard Research Writing Guidance	29	48	17	28	14	23	High
Un-proportional ratios between students and supervisor	19	32	24	40	17	28	Medium
Absence of supportive system/tool/strategy	39	65	14	23	7	12	High

As depicted in table 3.4 above: Scarcity of reference materials and Un-proportional ratios between students and supervisor is rated as Medium. On the other hand, absence of supportive system/tool/strategy, absence of standard research writing guidance, poor service delivery system of library is rated as having a high impact.

Scarcity of reference materials and Poor service delivery system of library: Today, the basis for judging library is no longer on its stock holdings, but on accessibility and ease to use and retrieve its information resources. In contrast to this, still now the service delivery of most library system is characterized by unavailable and shortage of up to date books, journal articles, research papers. Currently there is a lack of variety in the content of institutional repositories, with majority of deposits being thesis and dissertations of graduating students. The number is significantly lower for materials like journal articles and conference articles, which are the mainstay for students when it comes to research documents, (Chan, 2009). In this case the number of material in the library is not fairly distributed to all students because the number of students is not proportional to the available materials. During this time student might not get alternative information from where they get other soft copy alternative that relate to their field of study. This is mainly due to lack of an information center or a supportive system in the library to aids the student to satisfy their needs. This challenges students to review recent and relevant literature in their research study. This is also noted by Yared (2012), Melese (2010) and Kiflom (2009) that shortage of relevant and up-to-date books, journals, and internet service is one of the major factors exacerbating quality problems of research. The proposed KBS tool have information to the student about the most and reputable journal in the field of computing. This makes the student sufficiently enough informed about most and reputable journal in the field of their study.

Absence of Standard Research Writing Guidance: Absence of Standard format and Guidance for the structure of the Masters Students proposal would be a problem and such a problem force each lecturer to use his own preferred format. In this case novice researcher could be confused and did not understand easily how

to sequence and develop the parts of a proposal because, what was right to one supervisor was wrong to others who would in turn be examiners of the proposal. To solve such problem the researcher was tries to assess what standard proposal format would research advisor recommends for computing discipline postgraduate researchers. The suggestion from the domain expert and document analysis helps the researcher to identify a common proposal format by which all computing field student can be served. This common proposal format was used by the knowledge-based system as a user interface main menu. So, every student can be served and get support based on this menu. Hence, students are not victims of the different orientations which exist between and among supervisors. Also, the structure and formatting requirements as stipulated in this system could be used as a basis of assessment of graduate student's proposal.

Un-proportional ratios between students and supervisor: The number of students pursuing postgraduate programs has increased tremendously in recent years. The increase in the number of students has essentially led to the increase in the number of students a supervisor is given to handle. In other words, the increasing number of students seemed to be un-proportional to the number of supervisors available in the institutions. With such a great number of students, it would be difficult for the supervisors to pay attention and to be available to all students' proposal support need. As a result, the students' research proposal becomes substandard. To overcome the problem, there is a need to propose a KBS to give real time support to the student anywhere and anytime. So, the KB system could also help the advisor by sharing their work load.

Absence of supportive system: using supportive system for teaching and learning purpose is an inevitably bring success and can completely change the way teachers teach , students learn and solve problem .In this regard scientifically implemented system can supports student in a number of ways. It enables them to identify problems quicker and easier and helps them better understand common problem and can get a support for their faced difficulties .This improve a current situation by encountering and solving problems, in an advanced way. So using supportive system in addition to the traditional teaching and learning strategy makes student become more engaged, they begin to take more control over their own learning, too.

3.3.3 Social and Personal Impact on the Novice Researcher' Proposal Writing

Social and personal impact has also a great impact on proposal writing. Analysis of the impact indicates to the study which aspect will need a solution. Accordingly, respondent's suggestion shows the level of social and personal impact on novice researchers' proposal writing, as shown in table 3.5.

Table 3. 5 Social and personal impact in proposal writing

Parameters	High		Medium		Low		Remark
	Freq.	Perc.	Freq.	Perc.	Freq.	Perc.	
Poor advisor-advisee relationship in research supervision	23	38	29	48	8	13	Medium
Lack of awareness on students-supervisors responsibilities	19	32	24	40	17	28	Medium
Lack of goal in learning	19	32	16	27	25	42	Low
Poor information sharing culture and relationship between the researcher	27	45	18	30	15	25	High

As depicted in table 3.5 above: Poor information sharing culture and relationship between the researcher is rated as High. On the other hand, Lack of awareness on students-supervisors responsibilities, and Poor advisor-advisee relationship in research supervision is rated as having a Medium impact. Also the majority of the student respond that Lack of goal in learning have not that much impact on their proposal writing quality

Poor advisor-advisee relationship in research supervision: Student learning is at the center of what advisors do, with the development of an effective advising relationship as the gateway to that learning experience. According to Campbell and Nutt (2008), academic advising is a "powerful educational strategy to engage and support student learning." Through the educational process of advising, an advisor can guide students through meaning-making, skill identification and development, critical thinking, scaffolding of knowledge, and acquisition of transferrable skills (Lowenstein, 2009). But sometimes Advisor-advisee relationship in research supervision is characterized by unfriendliness. This situation limits the connection between advisor and advisee in consequence the student loose from gaining an experience, skill and knowledge which is gained through by good relation. So, the student would insufficiently have equipped with writing a proposal; this in turn may lead to a substandard research output. Personal factors to quality of research are persistent in postgraduate student research such as lack of interest in the research topic and poor stress management of students.

Lack of awareness on students-supervisors responsibilities: Sometimes lack of awareness between supervisor-student responsibilities is also the cause of the conflicts between the students and the supervisors and this usually delay the accomplishment of research projects because the students do not spare enough time to read on how to write the good research reports (Blum & Preiss, 2005). Students should understand that they

are the owner of the research they are making. This situation lastly could create lack of appropriate support from supervisor.

Lack of goal in learning: Lack of goal in learning is also a factor that contributes to poor writing quality of proposal. Personal learning goals are about improving students' learning and achievement and building students' capacity to learn. They are about students becoming active participants in the learning process, empowering them to become independent learners, and motivating them to achieve their full potential. Previous research into the motivation and efficiency of students has indicated that students who set their own working goals tend to achieve more than when working on goals set for them by the teacher. Students who set their own learning goals have more confidence to take on more challenging tasks, regardless of their ability. Their motivation to improve and master a task is improved and their self-esteem remains strong, even in the case of failure. So, beside academic writing guideline there should be a system that support the student and made them goal oriented.

Poor information sharing culture and relationship between the researchers: Among postgraduate students it is also expected and a must to create a good culture to share information and idea on their proposal writing work. The knowledge seeking behavior of postgraduate students is rarely the subject of research as majority of the focus is on depositors and faculty. However, given the student to faculty ratio in any given institution, the best approach would be to foster knowledge sharing in graduate students in order to achieve the expected research output. Thus, focus should be placed on fostering a positive knowledge sharing atmosphere in order to achieve that goal.

3.3.4 Psychological Impact on the Novice Researcher' Proposal Writing

Understanding the Psychological impact on the novice researcher' proposal writing might also help the study to come up with a recommendation to the concerned body. Table 3.6 summarizes respondent's suggestion concerning psychological impact in proposal writing by novice researchers.

Table 3. 6: Psychological impact on proposal writing

	High		Medium		Low		Remark
Parameters	**Freq.**	**Perc.**	**Freq.**	**Perc.**	**Freq.**	**Perc.**	
Lack of open or unclear evaluation method for proposal work	30	50	18	30	12	20	High

Negative comment on proposal report	11	18	19	32	30	50	Low
Ambiguous comment (difficult to understand)	24	40	20	33	16	27	High

As depicted in table 3.6 above, among the different parameters from the Psychological impact: Lack of open or unclear evaluation method for proposal work and Ambiguous comment (difficult to understand) have a high impact on the student proposal work; On the other hand, Negative comment on proposal report rated as low impact.

Lack of open or unclear evaluation: Lack of open or unclear evaluation method for proposal work also affects the quality of research by hindering student's confidence on oral defense that may lead to psychological problems such as lack of motivation and becoming hopeless, since students did not attempt more to do research.

Negative and Ambiguous comment on proposal: Sometimes supervisor use very discouraging and unambiguous comments on the student proposal paper. Supervisors simply wrote, 'this is nonsense', 'wrong', 'you are not serious', 'bad English'. In this case, novice student lacked guidance as they were reprimands in nature or loose self-confidence and this has its own contribution for being stopper. Stoppers are those students who simply stop and abandon all hope of solving the problem on their own while they notice such comment from the advisor. This can be related to a lack of supportive tools like knowledge-based system to get help and fix the challenge. Generally, such comment affects the researcher's commitment and the student's confidence. This in turn led the researcher to have less motivation in the given topic of research.

3.4 Problematic Components of Research Proposal Writing

This study also tried to find out from participants which specific components had been problematic and difficult in their research proposal writing. Having seen the different factors that have impact on the student proposal writing, the researcher has surveyed every proposal component of the curriculum. Proposal component were gathered from the course outline of research method course and then approved by research method instructors. The components taken into consideration and respondents rating are shown in the table 3.7 below:

Table 3. 7: The most problematic specific component of the research proposal

	Frequency	**Percentage**
Topic selection	11	18.3

Introduction or statement of the problem	12	20.0
literature review	14	23.3
Research methodology	8	13.3
Timeline and budget	2	3.3
All parts or the remaining parts?	13	21.7

From table 3.7 above, most participants that accounts for 23.3% indicated that they had difficulties with literature review of research proposal writing. Next comes is difficulties in all the areas of research proposal writing with 22% of the total participants. In addition, 20% of participants indicated that they had difficulties in writing introduction part of proposal. 18.3% of participants mentioned that they had difficulties with topic selection and 13.3% of participants mentioned that they had difficulties with methodology. Besides, 3.3% of the total participants mentioned that they have a problem in formulating and writing Timeline and budget section while they write their proposal.

Table 3.8 below summarizes the conceptual difficulties of novice researcher in writing proposal. The researcher has reviewed different research works (Komba, 2016); (Biggam J. , 2008); (Manchishi et al., 2018); (Asogwa et al. 2014) to explore the most conceptual difficulties of proposal writing to novice researcher and also reviewed research course, Research Guidelines and curriculum as an additional source. Having approved the conceptual difficulties, the researcher presented the concept to investigate and to explore the level of those concepts in the student proposal writing. So, the student respondents were asked to rate every concept difficulty of proposal writing as hard, medium and easy.

Table 3. 8: Detail shortcomings in all aspects of novice researchers proposal writing

Conceptual difficulty of components in proposal writing	Hard		Medium		Easy		Remark
	Count	Percentage	Count	Percentage	Count	percentage	
Formulating descriptive proposal title	23	38	20	33	17	28	High
Organizing well the content structure	26	43	21	35	13	22	High
Stating the Abstract to make it concise	19	32	25	42	16	27	Medium
Research Topic							
Selecting and refining the research topic to make it adequate	29	48	21	35	10	17	High
Introduction							
Introducing topic importance	19	32	25	42	16	27	Medium
Providing General Background for the topic	19	32	27	45	14	23	Medium
Presenting previous related work on the topic area	21	35	24	40	15	25	Medium
Providing justification for the study	26	43	18	30	16	27	Hard
Stating and presenting the research problem clearly	27	45	20	33	13	22	Hard
Identifying and indicating a research gap	25	42	19	32	16	27	Hard
Ensuring/justify that the hypothesis(es) is/are relevant/applicable	22	37	20	33	18	30	Hard
Formulating research question or hypothesis(es)	23	38	19	32	19	32	Hard
Making the research problem important and relevant to target user	22	37	20	33	19	32	Hard
Making the objective/s of the research clear and measurable	18	30	24	40	18	30	Medium
Setting boundaries for what is the research covers or uncovers	19	32	23	38	18	30	Medium
Identifying terms that are unusual or not widely understood or have meanings unique to the area under study	20	33	23	38	17	28	Medium
Literature review							
Identifying the literature that you will review	23	38	20	33	17	28	Hard
Analyzing the literature that you review	21	35	20	33	19	32	Hard

Summarizing or paraphrasing the reviewed literature	26	43	20	33	14	23	Hard
Ensuring recent resource from reputable (well-known) source	21	35	20	33	19	32	Hard
Selecting an appropriate approach to organize and structure a literature review	22	37	20	33	18	30	Hard
Ensuring every source is acknowledged and the references contains all vital component	23	38	21	35	16	27	Hard
Stating and presenting the review literature clearly	25	42	18	30	17	28	Hard
Research Methodology							
Selecting appropriate research design	24	40	21	35	15	25	Hard
Timeline and budget plan							
Designing the timelines plan with the time given	6	10	25	42	29	48	Easy
Designing the budget plan	10	17	23	38	27	45	Easy
Reference							
Ensuring the References to contain all vital information and selecting appropriate reference style	19	32	24	40	17	28	Medium
Appendices							
Making the Appendices/Annexes helpful to a proposal reviewer	18	30	25	42	17	28	Medium

After the analysis was completed, it was possible to determine the level of the problems. The overall picture of the problems identified in the various aspects of proposal writing is mentioned in Table 3.8, which shows that designing the timelines plan with the time given (48%) and Designing the budget plan (45%) are rated as an easy part of proposal writing. Research proposal components, such as formulating descriptive proposal title, organizing well the content structure, research topic, statement of the problem, research questions, literature review, and research methodology are rated as hard. Stating the abstract, background, objective, scope and reference are rated by the respondents as medium level.

Having asked the student respondents, the conceptual difficulty they have in all components of research proposal, the researcher further asked the place where to find out any kind of help they need during proposal writing. Respondents answer is presented in table 3.9 below.

Table 3. 9: Place to find support for questions

Source of support	Frequency	Percent
previous report /related works	25	29
students	19	22
research advisor	16	18
books	14	16
guidelines given by the university	9	10
Supportive tools	4	5
Total	87	

[1]**Note:** *As we can see in the above table 3.9, the total frequency is increased since some question in questionnaire gives the respondent a chance to select more than one answer.*

The above table 3.9 depicted that students prefer different place to find the solution for any question. Accordingly, most respondents that accounts for 29 % prefer previous report or related works for any help, this might be available from previous student. The least preferred place is from guidelines given by the university.

1

The cross-tabulation analysis between the places where students prefer to have a support for their question, if any, and the reason for their preference is presented as follows in table 3.10.

Table 3. 10: Reason for choosing the place to find answers for questions.

Place to find answers for questions	Reason for choosing the place			Total	
	Easy to access	Easy to use	Easy to understand	Count	Percentage
From previous report /related works	9	7	5	21	35
From students	6	4	5	15	25
From proposal advisor	7	0	5	12	20
From books	1	2	2	5	8
From guidelines given by the university	2	2	2	6	10
Supportive tools	0	1	0	1	2
Total	25	16	19	60	100

The above table 3.10 depicted that students prefer to use different mechanisms to find the solution for any problem they come across. Accordingly, most respondents that accounts for 35 % students prefer previous report or related works for any help since they are easy to understand, easy to use and easy to access. Second and third preferred sources by 25% and 20% respondents are peer students and research advisor. The least preferred sources are books and supportive system by 8% and 2% respondents.

3.5 Mechanisms to Enhance Proposal Writing Skill

The other issue raised in the questionnaire is asking respondents for suggestions on how the performance of novice researchers' proposal writing can be enhanced. Table 3.11 below summarizes solution suggested by participants in the survey.

Table 3. 11: Suggested solutions to enhance the novice researchers' proposal writing skill

Suggested Solutions	Frequency	Percent
Providing Training or Seminar from the department to the student	10	12.0

Provision of Literature	16	19.3
Providing standard guidelines	9	10.8
Creating a knowledge-based system that supports on discipline Specific scientific research proposal writing like Research advisor	21	25.3
Provision of resources	6	7.2
Improving student-advisor relationship	9	10.8
Allow for more time to write proposal	12	14.5
Total	83	

[2]**Note:** *As we can see the total frequency is increased since some question in questionnaire gives the respondent a chance to select more than one answer*

The first item that has been proposed, as a way forward was a knowledge-based system that gives support on discipline specific scientific research proposal writing in the absence of research advisor. Second and third proposed solution by 16 % and 12% are provision of literature and allowing for more time to write proposal. The least preferred solution by 6% of respondents is provision of resources, which is followed by providing standard guidelines and Improving student-advisor relationship with equal response by 9%.

3.6 Analysis and Discussion from Advisour's Perspective

The study participants who have experience in Advisor-advise provided many reasons why some student's proposal delay and poor-quality problems in their proposal writing. Based on the analysis of the answers provided, the reasons for student poor research proposal were grouped into four main areas, which were broken into nine categories. The feedback from the, face-to-face interview and in-depth discussion with some lecturer, which have been also advisor in the University, were used in the analysis of the results.

[2]

The research advisor interviewees perceive that the four main root-cause factors (see table 3.12) for the novice proposal delay for acceptance and student's poor-quality proposal are; (1) student-related factors; (2) advisor-related factors; (3) competency and skill related factors, and (4) teaching methodologies and strategies.

Table 3. 12: Identified categories of root-cause factors

Root-Cause factors	Categories
Student related factors	Lack Previous experience
	Lack of motivation
	Personality issues
Advisor related factors	Lack of commitment
	Lack of subject knowledgeable
Competencies and Skills	Lack of General competence in Research Lack of specific research skills
Teaching methodologies and strategies	Facilities, Materials and Delivery systems
	Lack of student-friendly delivery

Student-related factors: In the opinion of computing faculty members who responded to the study, the first major area, and largest by far, for poor quality and delay of student's proposal is Student-related Factors. As seen in Table 3.12, under this area there are three categories: (1) lack of previous experiences; (2) Lack of Motivation or interest; and (3) Personality Issues.

- ***Lack of previous experience:*** The student-related factor that advisor interviewee mentioned most often was students lack of previous experience in any kind of research conducting practice work during research method course time. Advisor interview mentioned the reason that the research method course is not have enough time for practical aspects and absence of a hands-on approach in the way research methods and proposal writing be taught to students and in addition to this the time given to the research course create obstacle to finish the research course. Those reasons challenge the student from exercising or practicing a previous experience and skill which makes them a competent enough to how to propose and write a research idea. Teacher interviewees cited also many reasons, including students' lack of basic academic preparedness and poor review skills, lack of technical skills, poor reading culture, and more, without directly attributing responsibility. Because of this they have not been adequately prepared for writing research proposal (lack foundational skills such as general and specific skills).

- ***Lack of Motivation or Interest:*** Lack of Motivation or Interest, engagement, persistence, and "not being active learners" were mentioned frequently by advisor interviewing. This category included the following subcategories: Lack of motivation; Lack of goal in learning; Lack of interest, direction, or focus. They do not know what they want in life and have no clear goals as to where they are going and are not looking at something objectively, carefully and with an independent and a questioning frame of mind. In line with this, it is clear that academic research proposal writing is not an easy task as well.
- ***Personality Issues:*** This category includes Lack of social connection, Lack of support system and network, and Poor self-esteem and self-confidence. One teacher interviewed thought lack of self-confidence was the major reason for poor quality: here is a direct word from the instructor "Think most students poor quality because of a lack in self-confidence. Often the students that I see are bright but make poor quality due to their not believing that they are smart enough to do the work. We try to work through this and if there is some improvement in self-confidence, proposal writing quality will improved. "It is also believed by another instructor that Learning is social: - unfriendly relationship to the advisor or the classmates can make a student feel isolated and hence, un-engaged. The general feeling was that if students were "active on campus and have good interactions with the advisor and students outside of the classroom," they would be more likely to succeed in University. So, domain expert interviewees argue on that teachers need to encourage students to increase teamwork sprit. One teacher during interviewee concluded that, "for encouraging student's self-confidence, we instructors need to familiar students with the research communities like workshop and seminar instead of orienting students only to refer Journal Article.

Advisor Related Factors

- ***Lack of commitment***: Some interview advisor further claimed that lack of attractive compensation, student lack of goal, absence of encouraging environment to the advisor and other benefits may force the advisor to show less commitment. This in turn exacerbates the problem of quality in student proposal writing. Another interview said that, the quality of the proposal in other respects reflects the level of supervision. For example, one advisor pointed out that the challenges students face in writing proposal are often made more difficult by the fact that some supervisors have tacit knowledge of the features and approaches to thesis or dissertations that they do not communicate clearly to the students. So, the aforementioned challenges can cause a strong sense of isolation especially to a student those who have les social interaction in advisor-advise process which leads to poor quality.
- ***Lack of subject knowledgeable:*** Most of the time Director or thesis coordinator of the research either allocates academic supervisors or students seek a preferred academic supervisor. On the process of

assigning supervisor, one advisor said that some academic supervisor will ideally have background expertise in the area of the student study. However, this may not always be possible and student may be assigned a supervisor with more general subject knowledge. Due to this, the extent of a more general expert input will usually be limited to advice about the whole processes of the proposal. So, the committee and the researcher should consult with a subject expert.

Competencies and Skills related factors: In the time of interviewee, many respondents confirm the usefulness and successful completion of research method course by saying this, many universities across the globe include research methods courses that gear towards building the requisite profile to carry out a thesis especially the one submitted in partial fulfillment of the requirements for a master program. They also confirm that Successful completion of master program depends on the candidate competence in generic and specific research skills and certain personal qualities. So competent and skilled background in research provide students with knowledge that may not be only useful in professional dissertation work, but also in everyday life, as it enables more informed, critical, intelligent and effective research consumers.

- ***Lack of General competence in Research:*** One advisor said this MSc. thesis is an independent piece of original work demonstrating that the student is a competent researcher with advanced knowledge on a specific topic. This requirement for an independent work has turned dissertations into problematic areas for students. So there should be a strategy to support student. Another interview said also this "A competent student researcher is someone who can exhibit proficiency in handling the requirements of the various phases of a thesis and dissertation life cycle starting from the identification of relevant and feasible research problem up to reporting of the findings".

  Another Interview advisor also noted that Master's level learning is independent with the learning responsibility shifting from the lecturer to the learner and supervisors acting as a guide. This opportunity can be quite liberating, but it requires the building of new skills and confidence in the abilities of students. In order to use this opportunity one interview lecturer said, "A meaningfully and organized postgraduate program must plays an important role in providing context to student learning and providing a sense of what it means to be a researcher|" and graduate students' research engagement is also an important mechanism in enhancing the teaching-research nexus

- ***Lack of specific research skills:*** Interviewed research advisors suggested that, in addition to generic competencies and skills, student researchers need to develop various kinds of specific skills. First, Self-discipline skills, i.e. the student must plan to observe the timetable of activities even when unpredictable problems (e.g. illness) happen. Second, Organizing skills, i.e. the skill to structure the various aspects

of the proposal activities including the overall structure, sub sections within each chapter, as well as the ideas and arguments. Third, Technical skills, including internet searching skills, library skills, word processing skills, and data analysis software skills, design skill, computer programming skill. Fourth, Independent learning skills, i.e. To identify a research topic, put forward a research proposal, plan and implement dissertation activities by one self. Five, Social skills, i.e. to get along with supervisor, fellow students, research subjects, authorities in the research sites, etc. Lastly, Cooperative/collaborative learning skills, the skill required for sharing ideas about one's work with fellow students.

Teaching Methodologies and Strategies

The factors in student failures from writing acceptable proposal that are not related to students but are related, instead, to the failures of the teaching methodologies and strategies were mentioned by teachers.

Advisor interviewed mentioned that there is a high turnover rate of instructors in the University which can really diminishes the working experience of the University in the overall teaching learning process. Because of this some of the instructors believe that there is no a kind of instructor assignment for research course based on the number of research paper publication or experience.

The teaching style of some school members was identified as contributing to novice researchers' failure from writing good research proposal report. The domain expert interview was mentioned this, some students had failed because lecturer could not respond to the teaching style, or they had a poor teacher who was unable to effectively communicate the material in the curriculum. As one interviewee put it, in cases like these, "It is not students who fail, but that faculty fails their students!" Using different teaching styles and active, problem-solving teaching was offered as the best way to fully engage students.

- **Facilities, materials, and delivery systems:** These are mentioned as most often overall root cause in general and most often root-cause under teaching methodologies and strategies. Lack of supportive system with the right skills in the subjects was also mentioned as a concern. A number of faculty members blamed the course delivery format, especially all time for theory class, for the poor writing quality of student's proposal. One interviewed teacher said this to strengthen the methodology failure "were asking students to answer what we did not teach them it is like asking a land to produce which is not planted". The materials sometimes do not get updated. We are still teaching the material that is prepared by other teachers as it is prepare according the knowledge of the author, which sometimes may not fit with the teacher. So, instructors need to have the intention to prepare their own material which can go along with their students. The way some teachers delivers the course is also under blamed

by the interviewed domain experts. It is mentioned that there are some examples, which do not exactly show the concept of research. It is highly believed by domain expert that "examples we used need to show the exact concept we want to explain not for the sake of example since we get it from the internet or other materials used. We need to use example which is near to students' eye or local works, the thing they know it well, for easy understanding." The domain expert also cited that, the length of courses was also a cause for poor student's proposal quality. So, teachers need to think over on how to preparing materials which is short and precise and can easily be understood by their students.

- **Lack of student-friendly delivery:** Another problem observed in teaching research method course is lack of student-friendly delivery. One instructor said that, "we are striving to make a change in student, so the course delivery style should be student-friendly and consistent. But some teachers present the course as per their interest and even do not follow the course outline. They amend even the course outline based on their interest; which is very wrong!"

  The domain experts believe that the reason why there is lack of skills on the part of students in conducting and writing proposal work is as a result of the poor teaching methodology adapted by some lecturers. The techniques used by them in the teaching learning process of research method course are not effective. They said that teachers of research method course do not employ multiple teaching methods to their students. They said that most students lack the understanding of concepts in major topics in the research method course due to the style/method of teaching. Some teachers only adapt the lecturing method; others project approach in addition to lecturing. The method either make the course easy to understand or difficult to understand. Beside to this they mentioned that most teachers do not consider the background of the novice students into consideration when teaching this course.

  They also said that some teachers of the research course teach only the theoretical aspect of the research method course neglecting the practical aspects that will provide the student the necessary skill and competence. In solving this problem, the experts believe that teachers of research method course must adapt more than one teaching method to improve their teaching in how to conduct and write a research to increase the skill and thinking capacity of the student.

3.7 Requirement Analysis

The assessment conducted in this study revealed that, out of the total concept note submitted to the department none of them accepted outright; rather some of them accepted with major and minor modification. Almost half of them on the average were rejected and students were expected to prepare again their concept note. Due to this, some students' research proposal have taken long time to be approved and start the actual research work.

The need assessment also discovered the following results. Participants in this research study were asked about their perception on how adequate they were prepared for proposal writing. The result revealed that the majority of the participants claimed that they were not satisfied with their being prepared for proposal writing techniques.

Participants in this research study were also asked about their perception on how adequate they thought the research course module was for it to prepare them for proposal writing. The majority of participants indicated that they were not satisfied with the research module being used to prepare them for proposal writing.

Both supervisors and students were also asked for their suggestion in order to eradicate or minimize the mistakes committed and challenges encountered when writing a proposal. Accordingly, they suggested a knowledge-based system as one of the options to enhance the student proposal writing. From the analysis the majority of student participant mentioned that, the persistence of a knowledge-based system as a supportive tool were their number one recommendation. The same idea also reflected by research advisor and research course lecturers during the in-depth interview and face to face discussion.

Similarly, the study also explored the reason for why students face difficulty or lack competency in writing research proposal .As also shown in the previous section for novice researcher proposal writing quality there are various contributing factors which have a negative impact on their writing like academic, social, and personal, psychological and institutional. In addition, weak background knowledge about research, lack of general and specific skill, Absence of supportive system, lack of motivation and lack of resources in the library create a challenging environment for the researcher. Due to this students encountered a lot of shortcomings in doing research because they are not sufficiently aware of the importance of research and conducting research is regarded as a laborious and daunting task for them. Consequently, those learners will produce a very poor-quality research.

According to the novice questionnaire response, the study noted that those factors were have a negative impact on the student proposal writing and in regard to the conceptual difficulties in each aspect of proposal writing section the study also shows that almost all concepts in proposal writing were taken and rated by the novice researcher as Hard and Medium.

From the discussion we made it is clear that, novice researchers from the three universities face challenges in the overall aspect of proposal writing which is convincing and with good standard. So, this situation makes the student insufficiently equipped with the necessary skills. So, it must be done something to foster the advisor to improve student's proposal writing skills which can also assist advisors, so that students can easily understand the skill needed to write proposal and get support about their common mistakes and difficulties.

This necessitates the need for developing knowledge based system. The system can support immediately when students have encountered challenges during proposal writing. Therefore, the application of new technology simplifies the working environment teaching learning of scientific research writing. In addition, the system also can reduce the burden of human expert by sharing their responsibility and energy, and also the student can get self-learn from the system.

Finally, the system be used as always available real time a hands-on approach in the way research methods and proposal writing should be taught to students. This will help clarify all the weaknesses which students exhibited. This also encourages students to read widely to enrich their knowledge and students can take intensive writing courses to write their proposal academically and correctly. This is also used as teaching and learning instrument for academic purpose.

3.7.1 Design Requirements for the Proposed Knowledge Based System

From the above data analysis result, students face many challenges. The major challenges include Incompletion of research course, lack of inadequate support, absence of research guidelines, poor teaching and learning research method course, proportional ratio between advisor and student, Poor advisor-advisee relationship in research supervision, Poor language skill are among others. Those challenges create obstacle to the student from getting the opportunity to learn the various aspects or concepts of the research proposal writing process like, formulating problem statement, framing useful research questions, selecting appropriate research design, reviewing literature and other. Due to this, novice researchers frequently commit common mistakes and faced difficulties. The following section define design requirement feature:

Those challenges can be overcome by designing a knowledge based system to some extent from the existing worse condition. An intelligent tutor can work with a vast number of students both together at the same time and be available all time and everywhere. If the student doesn't get appropriate help from an instructor or supervisor, or do not understand of him, he can use intelligent tutor to understand the course or the lesson. An intelligent tutoring system can also provide real-time data to teachers and advisor looking to improve teaching methods (Al-Aqbi, 2017). Because educational institutions cannot allocate a human tutor to every student, intelligent tutoring systems are a useful alternative to give any student individualized assistants and make them equipped with the necessary concepts.

Another challenge of student were the absence of common standard format to structure their report, Poor language skill, social, personal problem and among others but one of the application area of KBS is representing human knowledge to give assist or advice (Rai & Nikam, 2017). So, student Poor language skill,

absence of common proposal format, common mistakes, poor relationship and conceptual difficulties in every component of research proposal can be solved by acquiring the domain expert knowledge to represent and to avail to student needs. In this case Knowledge based system could give an advice when social and personal problem arise, so this study plan to give an advice to student on how to handle relationship and taking responsibility and how to manage conflict and stress. This makes the researcher to be well aware and motivate to have interest in research

The Knowledge-based system will be an important teaching tool to the student. This is because they are equipped with the unique features which allow users to ask question and can get support or advice on how, why and what format anywhere and anytime (Rai & Nikam, 2017). So, the KBS can serve as a handy tools for the student urgent questions, 'what' and 'why'.

3.7.2 Define Objective of the Solution

Generally, the proposed Knowledge based system have the following design support features

- **Providing common standard proposal format:** This feature is used by the system as a user interface to give a support on the student common mistakes, conceptual difficulties and technical difficulties and also used to harmonize the student proposal work to prepare themselves based on the provided standard format. In addition to this, examiner or proposal evaluator could use this format and guidance as a basis of assessment and evaluation.
- **Advice support:** This feature gives advice to the student on the common mistakes student commit and faced challenge. So, the most common mistakes gathered and explored from domain expert and document analysis will be used as an input by putting a slight modification or by finding other alternative solution to the problem then, novice can easily recognize such errors then they can avoid the mistakes by learning.
- **Technical support:** This feature encompasses a support on the student difficulties. For example giving support; in selecting research topics, in selecting research design, in writing statement of problem…).Those difficulties are not simple as common mistakes so the study plan to take some input from the researcher so by doing so the system can reach or provide appropriate decision and feedback
- **Explanation facility support:** This feature can support novice by explaining and justifying a fact by using what and why format.
- **Additional support:** This support features allows student to use the query word

According to Marcus and McDermott (2011) technologies, especially knowledge based system is playing a big role in educational development and for the revolution in learning systems. They bring new opportunities to the educational system. So, this research further go for to what extent the application of knowledge based system support novice researcher in mitigating the common student mistakes and difficulties so that knowledge engineering principles followed in the next chapter.

CHAPTER FOUR
KNOWLEDGE ACQUISITION, MODELING, REPRESENTATION AND PROTOTYPE DEVELOPMENT

The Knowledge Engineer (KE) is responsible person to acquire, transfer and represent the experts' knowledge so as to construct a knowledge base. In this chapter the overall process for knowledge acquisition, representation and development of the system is presented. After the necessary knowledge is acquired, modeled and represented, this chapter also presents how the KBS is implemented. Before starting the process, the researcher first attempt to design the knowledge based system architecture as presented here under.

4.1 Architecture for KBS

The architectural design of the KBS serves as a blueprint for the implementation of the system. The purpose of implementation is to show how the knowledge is codified internally and to show how the components of the prototype knowledge-based system interacts and interrelates (Mohammed & Saiyd, 2010). Figure 4.1 illustrates the architecture of the prototype system designed in this study.

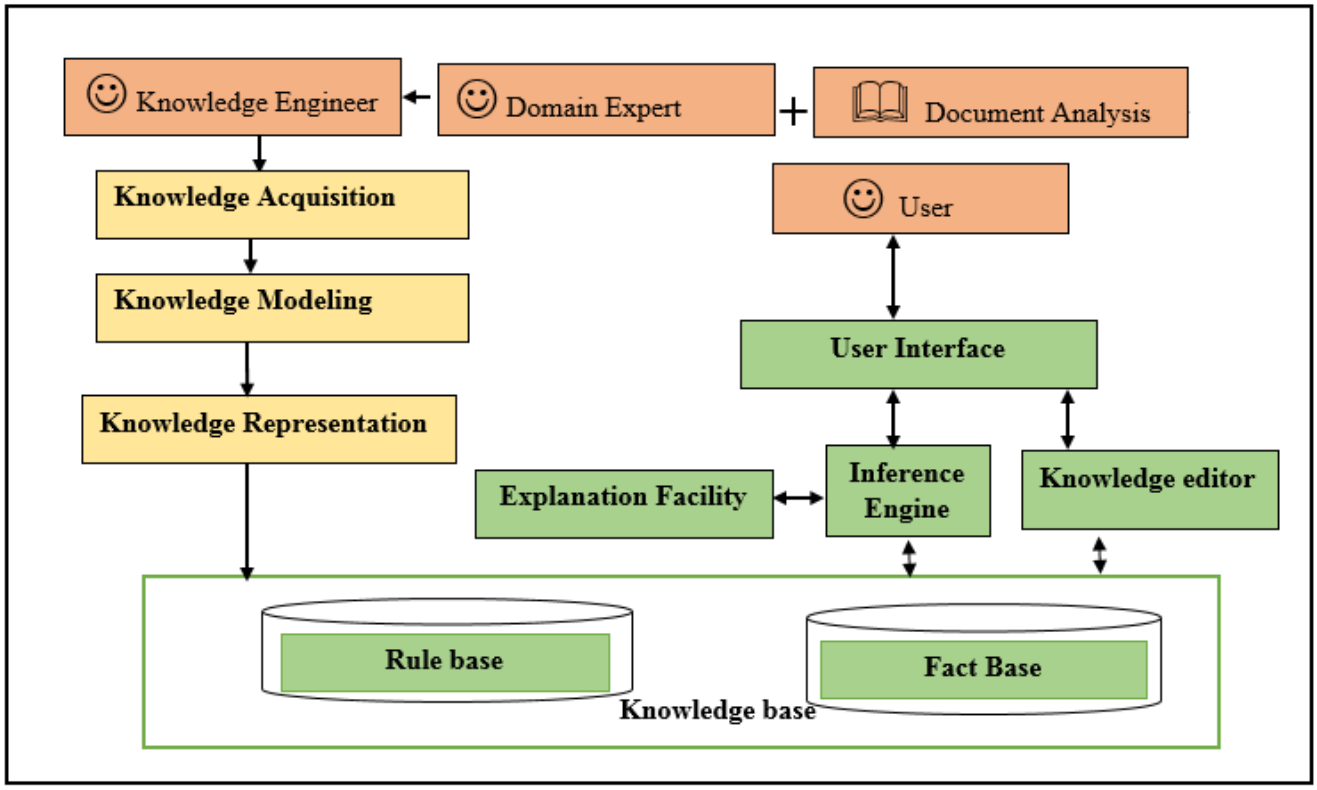

Figure 4. 1 The overall architecture of the KBS (a newly drawn)

As depicted in the architecture in figure 4.1, the knowledge-based system comprises of five basic components: knowledge base, fact base, inference engine, explanation facility and user interface but in addition to that in

this study two important component are added to enhance the knowledge based system capability such as, a knowledge editor component and a fact base. The above basic components are discussed below.

The knowledge base stores all relevant information, data, rules, cases, and relationships used by the expert system. A knowledge-base can combine the knowledge of multiple human experts.

Inference engine: The purpose of the inference engine is to seek information and relationships from the knowledge-base and to provide answers, predictions, and suggestions in the way a human expert would. The inference engine must find the right facts, interpretations, and rules and assemble them correctly. Two types of inference methods are commonly used – Backward chaining is the process of starting with conclusions and working backward to the supporting facts. Forward chaining starts with the facts and works forward to the conclusions.

Explanation facility: The explanation facility allows a user to understand how the expert system arrived at certain results and can provide clarification.

Very often specialized user interface software is used for designing, updating, and using expert systems. User interface: The purpose of the user interface is to ease use of the expert system for developers, users, and administrators

The overall purpose of the knowledge acquisition facility is to provide a convenient and efficient means for capturing and storing all components of the knowledge base.

4.2 Knowledge Acquisition

In this study, to acquire the needed knowledge, both primary (tacit knowledge) and secondary sources of knowledge are used. Before critical knowledge is gathered from the domain expert and document analysis, a preliminary assessment has been done to investigate where Novice researchers face shortcomings for all aspects of proposal writing. Accordingly, many shortfalls were identified that affect the proposals from being accepted for the next phase. The overall picture of the study shows, novice researchers have a difficulties in all sections of the proposal. So, based on this information the researcher gets to sampled domain expert to have knowledge for the system. Primary knowledge is gathered from experts in the domain area, the research advisor of the student in this context, using semi-structured interview and questionnaire. For this, the researcher purposely selected research advisors and research method course lecturers as per their academic level, seniority and experience. In addition to using domain expert interviewing and dispatching questionnaire for knowledge acquisition, the researcher also consulted different documents (such as reviewing of related documents, books, manuals and guidelines) for further knowledge acquisition.

Interviewing Domain Experts

To gather the required knowledge from the domain expert, the knowledge engineer first prepare a first-hand draft proposal format form to receive any comment and suggestions on the strength and weakness of the draft proposal format for computing postgraduate researcher. After collecting comment and suggestion from the domain expert, the researcher summarizes the different domain expert comment and suggestion, finally the organized proposal format was approved. Based on this format, the researcher also conduct a semi structure interview to acquire the expert's knowledge regarding to the commonly seen novice researcher mistakes and difficulties. Accordingly different common mistakes and difficulties was explored with the associated possible reason and solution.

Documents Review

The researcher has reviewed different additional documents so as to find common errors and difficulties that novice students are experiencing while writing a research proposal writing. After the researcher explored the common novice researcher mistakes and difficulties, different document analysis was also consulted to strength the domain expert acquired knowledge. Consequently, during each phase the researcher gather relevant knowledge which was significant to generate rules.

In addition, the domain experts were actively participated throughout the research work and they were consulted to confirm the correctness of the acquired knowledge. During face to face communication, the acquired knowledge from domain experts was recorded manually by using pen and paper sheet.

In view of the extensive nature of such domain expert comments and document analysis, the researcher is presenting summaries being thematically organized under the major components or sub headings of proposal format as shown below in table 4.1.

Table 4.1 the common mistakes and challenges of novice researcher

Proposal section	**Common Mistakes and Challenges**
Topic selection	1. Unable to understand current or available research topic 2. Unable to understand how to narrow a large topic area
PRELIMINARY PAGES	
Thesis title	3. Title is not informative 4. Broad and vague title to understand 5. Unnecessarily lengthy title 6. Use of abbreviations, initials, acronyms
Table of content	7. The omission of the 's' on contents,

	8. Table overcrowded, 9. Unnecessarily lengthy, 10. Omitting in the table of content the list of items which the appendix encompasses, 11. Mismatch between titles, page numbers, and formats in the list (of contents, tables, list of algorithms and figures) and their appearances in the text
List of tables	12. No Legend (caption) 13. Caption is not complete and self-explanatory
List of figures	14. No Legend (caption) 15. Source or owner is not acknowledged 16. Using distorting image
Abstract including keywords:	17. Failure to include important information, like purpose, and methods 18. Missing to include keywords in the abstract 19. Poor keyword that doesn't Represent the content of the researcher proposal report
Acknowledgements	20. Trend to acknowledge what other acknowledged 21. Acknowledging God in a manner to disclosing one's religious faith to the readers of the proposal 22. Acknowledgment expressing a prospective rather than retrospective indebtedness 23. Extra Exaggeration for received support 24. Acknowledged without explicitly expressing the support received 25. Forget or downplay the contribution of research participant
Acronyms and abbreviation:	26. Alphabetically unordered acronyms, 27. Lack clear understanding between acronym and abbreviation, 28. Creating acronyms that are not frequently used in the text, 29. Acronyms that coincide with other standard acronyms, 30. Not Introducing acronym before using it in the text
INTRODUCTION	
1.1 Background of the study	31. No justification 32. Refer source without Acknowledging
1.2 Statement of the problem and its justification	33. Missing to state the actual problem 34. Unable to contextualized the research problem 35. Gap is not indicated or newness of the problem 36. Significance is not usually discussed
1.3 Research Questions or Hypotheses of the Study	37. Unable to phrase and formulate questions and hypothesis 38. Define hypotheses alongside a research question, 39. Failure to stay focused on the research question
1.4 Research objectives (Main objective, specific objectives)	40. Ineffective (incomplete) research objectives 41. Single statement combining aim and objectives

1.5 Significance of the Study	42. No significance to academia or studies which did not solve any problem
1.6 Scope of the study	43. Absence of what aspects of the research problem will be excluded from the study
1.7 Operational Definitions	44. Using a Dictionary definition
LITERATURE REVIEW	
2.1 Conceptual literature review	45. Local literature not usually given much coverage 46. Did not understand the preliminary task to conduct and to write the review 47. Include unnecessary literatures 48. Quoting from old references, textbooks 49. Repeatedly taking ideas already quoted by others when it is still possible to access the original one 50. Failing to cite influential papers 51. Failing to keep up with recent developments 52. Failing to critically evaluate cited papers 53. Depending too much on secondary sources
2.2 Reviewing related works	
METHODOLOGY	
3.1 Research Design	54. Selecting wrong research design 55. Unfamiliarity with the fundamental terms, steps and concepts of some of the more commonly used approaches to make an informed decision, such as design science & experimental research.
Study Population	56. Undefined population with exact characteristics
Determination of the Sample size	57. Relying on what other graduate students state in their proposals
Sampling	58. Unsatisfactory sampling techniques and procedure
Questionnaire design & Data collection instruments	59. Failure to understand how different data types require different collection approaches. 60. Inadequate response options when designing questionnaire
Pre-testing (validity & reliability)	61. No pilot study for validity and reliability
Data Collection Procedure	62. Lack of knowledge of collection process
Data Analysis	63. No detailed information about how the data will be analyzed
3.2 Architecture design (design science & experimental research)	67 Unfamiliarity with the fundamental terms, steps and concepts of some of the more commonly used approaches to make an informed decision, such as design science & experimental research.
3.3 Prototype development(design science & experimental research)	
3.4 Testing and Evaluation (design science & experimental research)	68 Miss a test plan 69 Wrong selection of strategies and methods for evaluation

	70 Unaware of aspects and characteristics to be evaluated in DSR and Experimental Research 71 Miss guiding principles to follow in system evaluation
WORK PLAN AND BUDGET	
4.1 Work plan **4.1.1** GANTT Chart	72 Miss in stating the different components & phases of the study
4.2 Budget formulation **4.2.1** *Budget justification*	73 Exaggerated budget formulation 74 Unclear budget or no justifying briefly
Reference organization	75 Difficult to identify which reference style is appropriate to use in computing discipline research writing. 76 Poor citing of reference works, inconsistencies in reference citation, use of different citation styles in their submitted proposal report 77 Missing vital information from including in the reference
Appendices/Annexes	78 Undesignated Appendix

4.2.1 Topic Selection

According to the answer from the questionnaire and discussion with experts, the researcher understands that most novice researcher finds the task of identifying a researchable topic and narrowing a topic is one of the challenging tasks. During the interview, the domain expert mentions to the researcher some possible reason for the above challenges. According to the experts' suggestion, those problems may be related to the student limited knowledge on the research process or his/her unpreparedness for identifying research problem or research topics. But, the process of selection starts from selecting an area of interest-within that particular area, a problem is selected and narrowed down. Due to lack of sufficient knowledge and information regarding selection of research topic, researcher wastes a great deal of time in choosing futile and worthless research topics.

4.2.2 Preliminary Pages

The preliminary pages are expected to include title, list of contents, tables, and figures, acknowledgments, abstracts, acronyms and abbreviations. Below are the specific analysis and comments raised regarding student researchers' proposal work on these sections.

- **Title of the thesis:** The purpose of thesis title is to provide a brief, informative summary of the contents of the thesis document. Accordingly, the title should answer the question; i.e., what (the research theme), who (participants), and where (the research setting, context, or place) **(**James & Slater, 2013). But, in most of the Novice Researchers proposals either one of these basic components is missing or

more issues are included. The problem is, if the first problem happens (i.e. one or two of the component/s is missing), the research title becomes broad and vague to understand. On the other hand, if additional issues are included, it becomes unnecessarily lengthy and may even become very narrow.

- **Table of contents:** Containing too specific subtopics, which in some Novice Researchers proposals report it may even go up to four or even more levels of specification. Thus making the table overcrowded, and unnecessarily lengthy, omitting in the table of content the list of items which the appendix encompasses, mismatch between titles, page numbers, and formats in the list (of contents, tables, list of algorithms and figures) and their appearances in the text. Researcher must be sure to use short and clear headings throughout the document so, that the table of contents is easy to navigate. In this section the researcher must give emphasizes to the reader because, the reader will see the table of contents before reading and understanding the rest of his/her proposed idea. In addition, the researcher should also include all appendices in his/her table of contents.

- **List of tables and list of figures:** Figures and tables are often the quickest way to communicate large amounts of complex information that would be complicated to explain in text. Many readers will only look at your display items without reading the main text of your proposal. Therefore, ensure your display items can stand alone from the text and communicate clearly your most significant results. But most novice researcher miss some important points when listing a table and figure in their proposal report. The following are some common mistakes of novice researcher: No Legend (caption) above the table, Caption is not complete and self-explanatory, No Legend (caption) below the figure and Source or owner is not acknowledged.
- **Abstract:** The proposal should include a concise one paragraph statement, on one page explaining the intended research. This may be a couple of sentences setting out the problem that the researcher want to examine or the central question that he or she wish to address, the methodology that will be used and the expected results/outputs. But, Novice Researchers sometimes fails to highlight key points of the major section of the paper like, for example, purpose, and methods. Research advisor comments that some strong abstract must touches on all the sections in the proposal, including the introduction, where the researcher should give some information about the issue and why the researcher chose it. While the researcher does not want to go into detail about the problem, so, novice students need to state what issue their project will address. A proposal identifies a reason for the project, so the abstract also needs to establish how his/her project fulfills a need. They may indicate how their plan differs from previous research or fills a void in past research while summarizing information included in the literature review portion of their paper. In this section of proposal missing and inappropriate keyword

is common. Keywords are a tool to help indexers and search engines find relevant papers. If database search engines can find your proposal report, readers will be able to find it too. This will increase the number of people reading your proposed report, and likely lead to more citations. However, to be effective, Keywords must be chosen carefully. But most novice researcher did not give emphasis to select appropriate keyword for their proposal report.

- **Acknowledgement:** Research work is usually a collaborative work in which different individuals are involved in supporting the researcher in the process of proposal writing. Hence, although and in many cases being supported in the process may not be a right of a researcher, but it is expected from the researcher to express a sense of indebtedness to all those who provide different kind of support. Attempts made in this regard to acknowledging others are appreciated. It was observed that in many cases, God, advisors, parents and friends and secretaries are the ones who are commonly acknowledged for direct and indirect; actual and /or perceived; technical, material and /or psychological support. It is commonly said that acknowledgement section is the only place in the report where the researcher enjoys a relative freedom to write whatever s/he wishes to write about acknowledging others, although whom to acknowledge is a full right of the researcher, it should be realized, however, this freedom is accompanied by ethical responsibility and hence needs to be discharged judiciously. Such acknowledgement should also be honest and accounted for.
- **Acronyms and abbreviation:** Acronyms are symbols which are usually used to stand for names rather than actions. They are called for when the researcher have long names that are inconvenient for use as they are. For you to think of coining acronyms, the names to be symbolized must frequently occur in a text; thus, disturbing the smooth flow of ideas. They are coined by taking the first letters of words. Abbreviations are more familiar, standardized, and widely used symbolic representations (e.g. PC, AI, CPU ...) that hardly need designation in a particular research report. On the other hand, acronyms are created by a researcher, in a particular report, and for a specific use. Hence, it is hardly used in others reports. But, in most of the novice researchers report it is common to see long list of acronyms, describing standard acronyms that are already become part of the English vocabularies and may even be found in standard dictionaries (e.g. GPS, CNN). Use of those long, meaningless, and inconvenient acronyms which force readers make repeated references to the description, creating acronyms that are not frequently used in the text, use of acronyms that coincide with other standard acronyms thus creating a negative transfer for the reader who is familiar with the standard acronyms. Alphabetically unordered acronyms also be viewed in most of the student proposals.

4.2.3 Introduction

The introduction leads the reader from a general subject area to a particular topic of inquiry. It establishes the scope, context, and significance of the research being conducted by summarizing current understanding and background information about the topic.

The introduction also states the purpose of the work in the form of the research problem supported by a hypothesis or a set of research questions. Further, the introduction explains briefly the methodological approach used to examine the research problem, highlights the potential outcomes the researcher study can reveal, and outlines the remaining structure and organization of the paper.

In addition to the introduction, this chapter also deals with the background to the study, the statement of the problem, the objectives of the study, the research questions, the hypotheses, the scope of the study, the significance, Justification and operational definition of terms and concepts.

- **Background to the study**: The background has to provide the context of the study. It has to talk about the broader research area, what the current literature says about the research area, what are some of the gaps in existing studies, and how this led to the gap or need you intend to examine in your study. The background for a proposal has to provide a solid start and foundation to the proposal. Therefore, it helps to cite relevant literature and provide necessary statistics to show why your study is needed. So, researchers need to give sufficient background information to allow the reader understand the context and significance of the issue/question that he/she are trying to address. By so doing the researcher can motivate readers to read the rest of the proposal or can convince proposal evaluator for the next research work.

    - **Statement of the problem:** Most Novice researcher has a difficulty in articulating what gap the research is meant to fill. Significance is not usually discussed in terms of how the study adds to the theoretical body of knowledge in the field and research gap or newness of the problem (justification) is not established. In many cases the study is justified either in terms of its practical benefits or in terms of the new setting it is conducted without establishing how the new setting would make a difference. But a problem statement is a concise description of an issue to be addressed or a condition to be improved upon. It identifies the gap between the current (problem) state and desired (goal) state of a process or product. The problem statement has other purposes, too. One is to identify and explain the problem in a concise but detailed way to give the reader a comprehensive view of what's going on. This includes identifying who the problem impacts, what the impacts are, where the problem occurs and

why and when it needs to be fixed. Another purpose of the problem statement is to clarify what the expected outcomes are. Establishing what the desired situation would look like helps provide an overarching idea about the project. The proposed solution and scope and goals of the solution are made clear through this statement.

- **Research Questions/ Hypotheses of the Study:**

A research question is an answerable inquiry into a specific concern or issue. It is the initial step in a research project. The 'initial step' means after you have an idea of what you want to study, the research question is the first active step in the research project. The research question should be a clear, focused question that summarizes the issue that the researcher will investigate. By defining exactly what the researcher is trying to find out, these questions influence most of the rest of the steps taken to conduct the research. Typically, a research question focuses on the research, determines the methodology and hypothesis, and guides all stages of inquiry, analysis, and reporting. With the right research questions, you will be able to gather useful information for your investigation.

A research hypothesis is a specific, clear, and testable proposition or predictive statement about the possible outcome of a scientific research study based on a particular property of a population, such as presumed differences between groups on a particular variable or relationships between variables. A hypothesis is a statement that can be tested by scientific research. If you want to test a relationship between two or more things, you need to write hypotheses before you start your experiment or data collection.

- **Research objectives (Main objective, specific objectives):** Defining a clear research question, aim and objectives is a crucial step for novice researcher in their research project. However, these terms are often confused. The research question formulates a research problem that the researcher wants to investigate. The scope of the question is informed by the researcher research aim and research objectives. A research aim expresses the intention or an aspiration of the research study; it summarizes in a single sentence what you hope to achieve at the end of a research project. The researcher aim should be specific and phrased in such a way that it is possible to identify when it has been achieved. But one quite frequent error is collapsing all the information on a project's research aim and research objectives into a single paragraph. This makes it hard for readers to absorb the information and distinguish the project's overall research aim from its more specific research objectives. A project's general research aim and specific research objectives should be clearly distinguished, and present them in separate sentences or paragraphs. Each research objective should be numbered.

Another common error is phrasing research aims or objectives in such a way that their meaning is vague or ambiguous. It is important that a final statement of research aims and objectives minimizes the potential for misunderstanding or misinterpretation by readers. Another reasonably common error is confusing 'research objectives' with 'project objectives'. And, researchers incorrectly include objectives of the study in their statement of research objectives

- **Significance of the Study**: In this section novice researcher should demonstrate why it is worthwhile to go through the pains of research (Sometime this component can be devoted to a separate section known as 'Justification of Study'). And researcher should State the benefits to be derived from the research and indicate who is likely to benefit and how this is likely to happen. Significance further includes how the research result might of benefit to theory, knowledge, practice, policy and future research.

  This refers to the relevance of the study in terms of academic contributions and practical use that might be made of the findings to the organization/sector in which the researcher is based and to the public at large. The researcher must tell the reader the reasons why and how s/he thinks the findings might change policies, theory or practice. In short s/he should indicate who will benefit from the findings of the study and how.

  - **Scope of the study (geographical, time and content scope):** The Scope provides for the boundary or limits or the research in terms of content (i.e. independent and dependent variables to be investigated), geographical area and time span of the research. This refers to the contextual and conceptual boundaries of the study which may include population /sample size, the key concerns of study and the extent it tries to resolve the problem. Referring to the data use and collection it also covers the spatial extent (geography area), temporal (the period the data covers) and thematic area. But in most novice researcher it is common to see, absence of what aspects of the research problem will be excluded from their study.

  - **Operational Definitions:** This is the definition of a variable in terms of the operations or techniques used to measure or manipulate it. The key concepts to be used in the study have to be clearly defined. The definition should be operational and not a dictionary definition.

4.2.4 Literature Review

It is a concise overview of what has been studied, argued, and established about a topic. After reading the literature review, the audience should feel like they can engage in an informed and intelligent conversation

about the focus area. In writing the literature review, students are expected to convey to readers what knowledge and ideas have been established on a topic, and what their strengths and weaknesses are.

In computing field, most novice researcher's mistake had to do with poor literature review. Most Supervisors stated that instead of writing literature review in order to inform the study, students ended up answering their own research questions with their literature. In addition, students failed to identify gaps. They fail to discuss the literature, instead, they agree with every book they read. Most of the literature lacks the researcher's voice. One supervisor had said, "Novice researchers fail to write a proper literature review. We can't hear the researcher's voice and they just report other peoples' findings without saying how it relates to their study. It's a big problem"

In most of the Novice researcher's proposal papers one can observe so many unnecessary literatures included making the study document bulky with no consideration to use it in the discussion. Quoting from old references, textbooks, repeatedly taking ideas already quoted by others when it is still possible to access the original one showing, quoting the obvious and local literature not usually given much coverage with a pretext that it is non-existent is some of the novice common problems. Also, Student researcher just summarize the different source they get but a good literature review doesn't just summarize sources – it analyzes, synthesizes, and critically evaluates to give a clear picture of the state of knowledge on the subject. The factors that contribute to poor literature is the student less understanding on how to review the different resource and what steps the researcher follows.

In order to conduct and write a literature review, research advisor give advice to the researcher that Conducting a literature review is the preliminary task to write the review which also involves the task of collecting, evaluating and analyzing publications (such as books and journal articles) that relate to the researcher questions. The researcher also takes this information to acquire further knowledge from document analysis.

- **Conceptual Review:** This is a type of intermediate theory that attempt to connect to all aspects of inquiry (e.g., problem definition, purpose, literature review, methodology, data collection and analysis). Conceptual frameworks can act like maps that give coherence to empirical inquiry. Because conceptual frameworks are potentially so close to empirical inquiry, they take different forms depending upon the research question or problem.
- **Related work:** A related work section that surveys previous work should be related to what the study is proposing to explore. This section should be carefully written and organized to make the relationships between the earlier research efforts clear and to also explain how that research relates to your proposed work. It is primarily this section that makes it apparent to the committee that you are, in fact, prepared

to undertake your proposed work. The work you reference should be quite extensive, relevant and recent. Insufficient references suggest to the committee that you may not be aware of all the related work and this means that it is possible that your work may already have been done by someone else. The inclusion of irrelevant (or too many) references may lead committee members to question your understanding of the area. Finally, lack of recent references might suggest that your proposed work is no longer of interest or is, perhaps, too hard a problem that other researchers have chosen to overlook. Finally, be careful to base your related work on quality publications. All (or very close to all) of your referenced papers should be from well-respected, refereed sources (i.e. journals or top tier conferences in your selected area). Referring to dubious papers lessens the committee's confidence in your thesis proposal. Finally, your selected papers should reflect a reasonable amount of breadth in terms of authorship and source. Insufficient breadth might lead the committee to fear that you are following individual opinion instead of well-founded and widely accepted scientific results.

4.2.5 Methodology

In proposal writing, introduction, literature review, work plan and budget formulation are the same for all academic disciplines. But, the methodology depends on the research design or approach selected. So the study only focuses on a research design which is common in computing field discipline (Survey research, Design Science Research and experimental research). Computing field researchers uses methodologies to tackle questions within the discipline. In Computing Science, different methodologies are mostly used to prove facts about algorithms and system, or, to evaluate new solutions for problems, or to build an artifact either a physical artifact or a software system to demonstrate that it is possible. Or to understand the processes used to accomplish tasks in Computing Science or to defining an abstract model for a real system. The methodology chapter provides your readers the information on what procedures will be followed by the researcher to undertake to come up with the research results.

- **Research design:** In this proposal section, it is expected from student to describe the kind of research they will conduct to complete their project and explain how they will conduct their research in as much detail as possible. But using wrong methodology is a common mistake by computing filed novice researchers. One Supervisors stated that, students used methods and techniques without properly thinking of how they apply to the study. Understanding the type of research design that may best fit a given research agenda can be daunting task for novice researchers. In many instances, the problem can seem to be overwhelming in that the novice does not possess the basic familiarity with the fundamental

terms and concepts of some of the more commonly used approaches to make an informed decision. So, the novice researcher – a graduate student, faces numerous challenges when attempting to add to the body of knowledge through an original, scholarly inquiry. This means that students lack practical knowledge on how they can apply the knowledge learnt in class to the writing of the proposals. In order to help the student from such a problem and to give a support or help in Selecting which research method to use for their research study. The researcher also reviewed the computing curriculum and other document this helps the researcher to understand the nature of computing discipline research and to asses a methodology that can be best applied in the different field of computing.

- **Architecture design:** Under this section researcher are supposed to inform about how they will use the requirements extracted or gathered from survey, case study or observation study. This part of the methodology may be utilized by students who have one of their objectives as to design an artefact (model, framework, approach etc.) or aim to conduct experiments. This section of the proposal should explain the details of the proposed plan. How will you go about exploring and addressing the primary intension of the research project? What will be your methods?
- **Prototype development:** During this stage of the methodology students are supposed to use the designed artefact to finally realize a prototype from the artefact. This stage is usually undertaken by students in the faculty of Computing. Students are supposed to inform in their proposal report that, how they do the implementation**.** It is also a realization of an application, or execution of a plan, idea, model, design, specification, standard, algorithm, or policy. In any system development, an implementation is a realization of a technical specification or algorithm as a program, software component, or hardware components, or data preparation, or installation, or testing, or maintenance, or other computer system. Many implementations may exist for a given specification or standard.
- **Testing and evaluation of the prototype:** In this phase or section of the proposal a test plan should be designed and proposed to evaluate the research output. Evaluation provides evidence that a new technology developed in DSR or a model or prototype developed in Experimental research "works" or achieves the purpose for which it was designed. Without evaluation, outcomes of DSR and Experimental research are unsubstantiated assertions that the designed artifacts, if implemented and deployed in practice, will achieve their purpose. Rigorous, scientific research requires evidence. But how should rigorous evaluation be designed and conducted? What strategies and methods should be used for evaluation in a particular DSR or Experimental Research? How can the evaluation be designed to be both effective (rigorous) and efficient (prudently using resources, including time)? What would constitute good guidance for answering these questions? Are they still the challenging question of

novice researcher? The main reason behind this challenge is there is little guidance in the DSR and Experimental Research literature about the choice of strategies and methods for evaluation. Due to this, novice researchers are faced with difficulties and confused to understand the major concept around DSR and Experimental Research evaluation.

4.2.6 Work Plan and Budget

- **Work plan:** Work plan is a schedule, chart or graph that summarizes the different components of a research proposal and how they will be implemented in a coherent way within a specific time-span. It may include: The tasks to be performed; When and where the tasks will be performed; Who will perform the tasks and the time each person will spend on them; A good work time plan enables both the investigators and the advisor to monitor project progress and provide timely feedback for research modification or adjustments.
- **Budget formulation:** Budget items need to be explicitly stated as follows: Personnel: supervisors, data collector, Consumable supplies: stationeries, computers and educational materials, Travel: cost of projected-related travel, Communications: postage, telephone, telegram, fax, And e-mail charges associated with a project, Publication: the cost incurred of preparing and publishing the results of the research. It includes; technical reports, manuscripts, illustrations, graphics, photography, slides, and overheads and other direct costs: costs of all items that do not fit into any of the above direct costs. In most novice researcher they miss a budget justification

4.2.7 Reference Organization

Referencing or citing sources a writer uses is an important part of academic writing. It allows the writer to acknowledge the ideas or words of others used in his/her work and avoid plagiarism. Referencing also demonstrates that the writer has read relevant background literature and can provide authority for statements made. Proper citation allows others to locate the materials used. But many postgraduate novice researcher face difficulties in citing references in their academic work. These include poor citing of reference works, inconsistencies in reference citation, and use of different citation styles in their submitted proposal report.

You must give references to all the information that you obtain from books, papers in journals, and other sources. References may be made in the main text using index numbers in brackets (IEE) or authors name (APA style). But note must be made that mix is not allowed and one should keep consistency in using either of the two standards. The information you give in the reference list must be enough for readers to find the books and papers in a library or a database. It also demonstrates to those interested in your proposal how well

versed you are on the particular area of research. As a general guideline, there are certain items that must be included from each source reference. Student must sure that every reference in your main text must appear in the list at the end of your proposal, and every reference in the list must be mentioned in the researcher main text.

4.2.8 Appendices/Annexes

Appendices in the proposal should be clearly labeled and provide supportive information that relates directly to the proposed project. Appendices are occasionally used for letters of endorsement or collaboration, and reprints of relevant articles if they are not available electronically and any additional information you think might be helpful to a proposal reviewer. For example, include: Questionnaires & other data collocation forms Dummy tables, Biographical data on the principal investigator and the consent form (if any). If two or more appendices are included in a proposal, they should be designated Appendix A, Appendix B separately etc.

4.3 Conceptual Modeling

Conceptual modeling of domain knowledge implies capturing the static structure of information and knowledge types (Milton, 2003). Decision trees (DTs) are modeling tools that are used in a variety of different settings to organize and break down clusters of data (Kingston, 2008). Similarly, decision tree has been widely used in practical applications areas, due to its interpretability and ease of use. Currently, decision trees are used in many disciplines such as medical diagnosis, cognitive science, law and computer diagnosis (Nalepa, 2015). The decision tree was used in this study to identify the possible novice weakness in each section of proposal. Each tree starts with a set of possible novice researcher shortcoming and ends with solutions. Decision tree structures are the bases for the development of prototype knowledge-based system. The prototype follows the same procedures as presented in the decision tree when finding and supporting the common mistakes and difficulties in any section of proposal. Below only three selected proposal section is shown with decision tree others remaining section are follows the same tree structure. Figure 4.2 below depicts a decision tree that shows

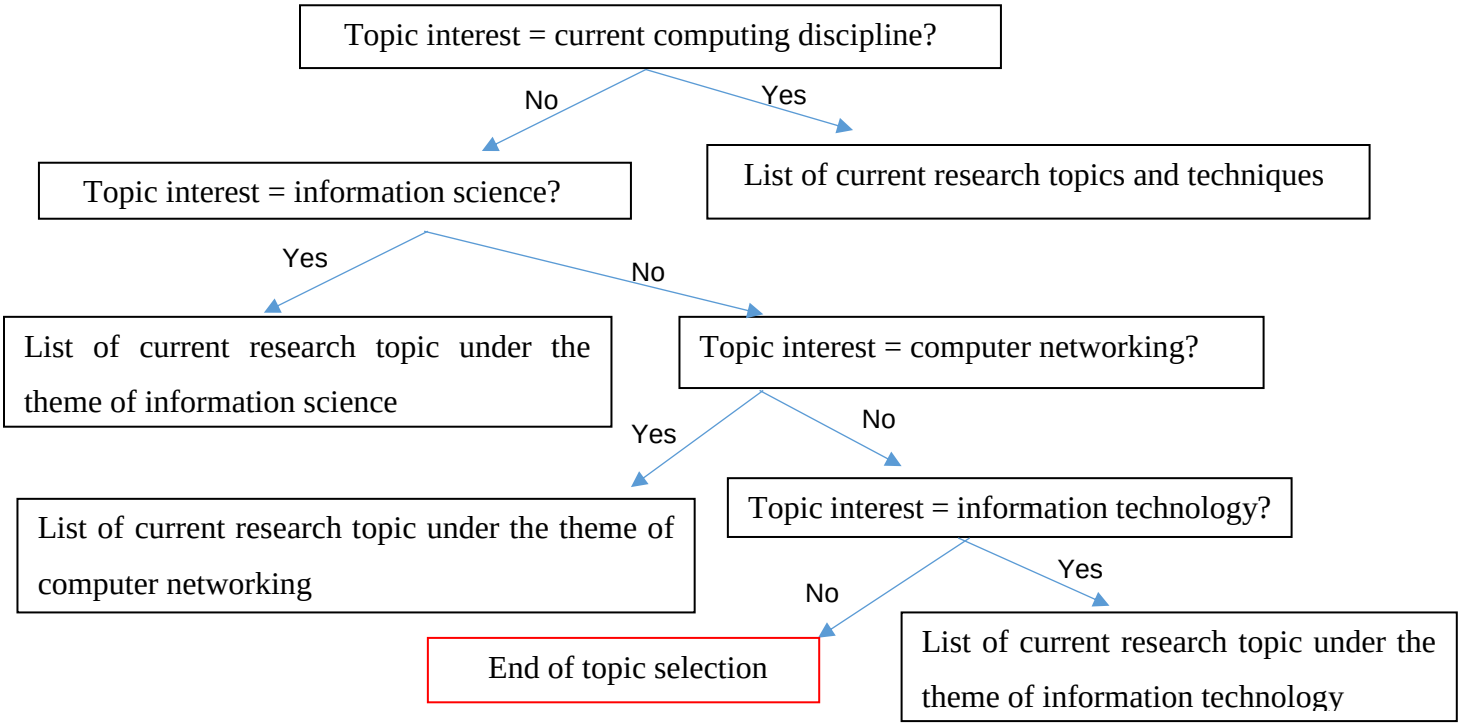

Figure 4. 2 Decision tree to select Research topic

The figure above shows that a decision trees to support novice researcher for their difficulties in selecting a research topic by checking whether they have interest or not in the three specialization filed of computing discipline. Figure 4.3 below depicts a decision tree that shows knowledge modelling for literature review

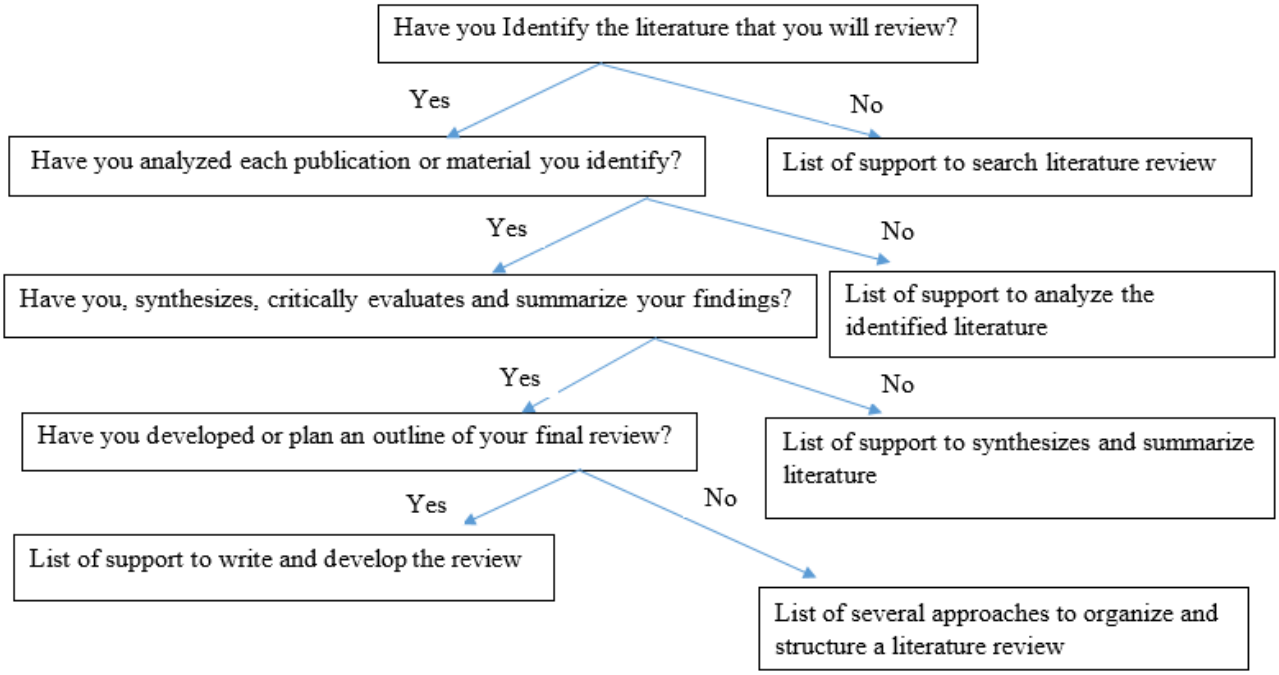

Figure 4. 3 Decision tree to support reviewing a literature

The figure below shows that a decision trees to support novice researcher for their difficulties in identifying, Decision on tree in modeling knowledge acquired for writing effective statement of the problem

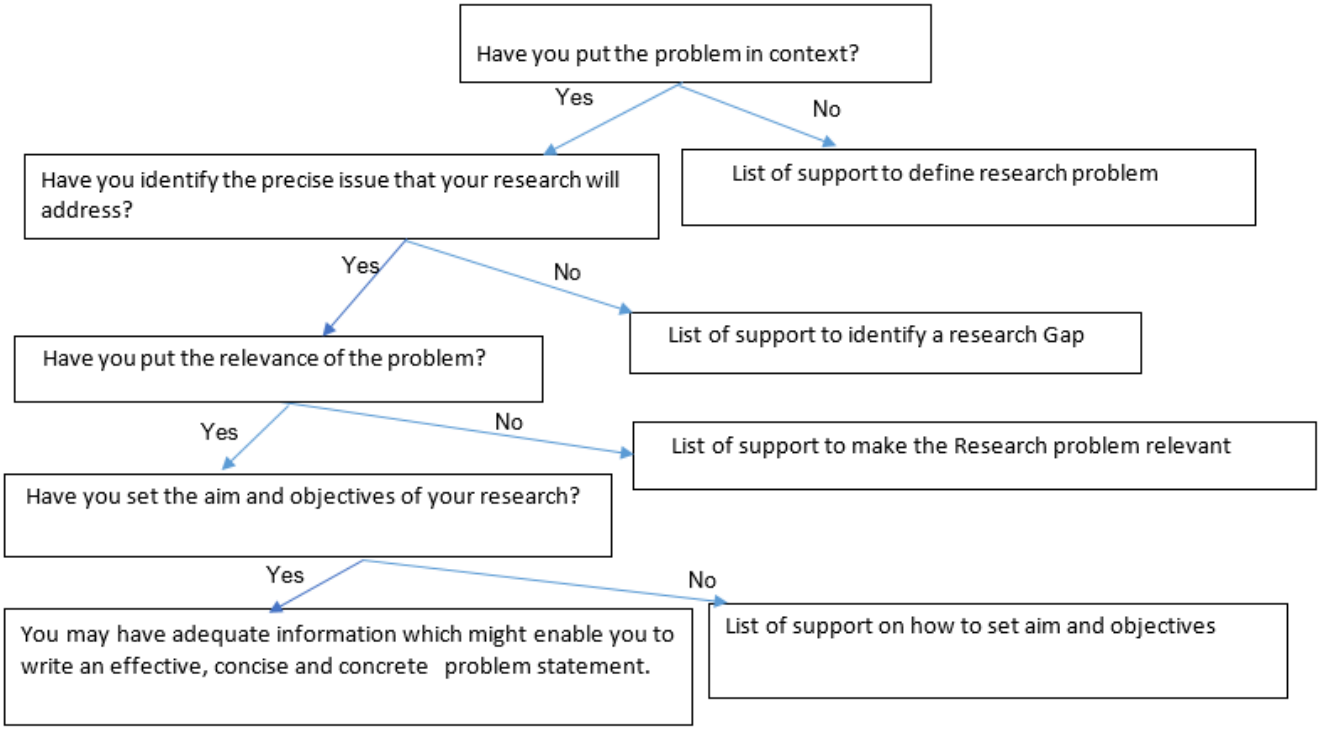

Figure 4. 4 Decision tree for writing effective statement of the problem

The figure above shows a decision tree to support novice in identifying the possible cause or difficulties that impede them from writing well formulated problem statement. If novice is certain to the question the no option makes the decision tree to reach on conclusion then further help also available or if novice answer is yes the tree goes to the next question. Figure 4.5 below provides a decision tree for modeling knowledge for determining research design that facilitates the research planned to conduct.

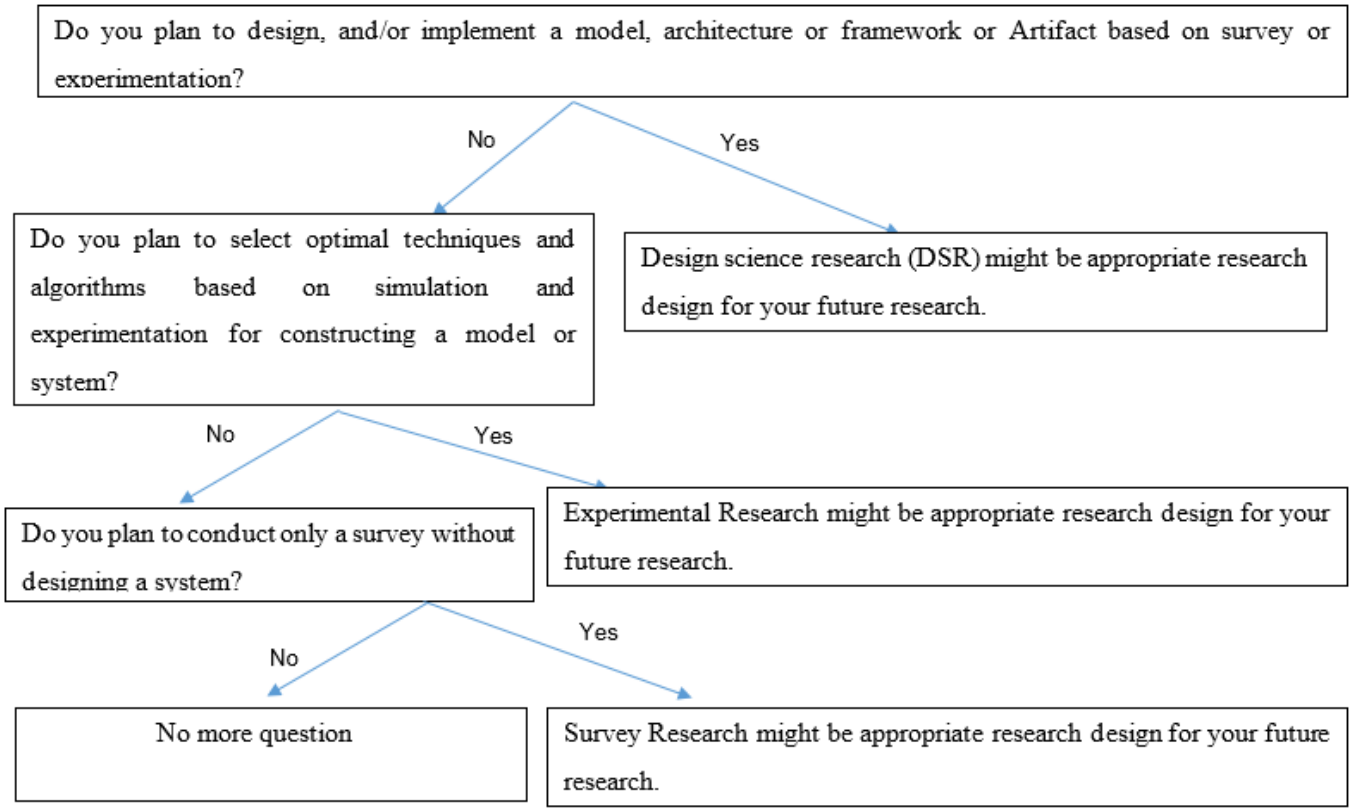

Figure 4. 5 Decision tree to select Research Design

4.4 Knowelage Representation

Once the knowledge has been acquired and modeled, the next step is knowledge representation using appropriate format that is both understandable by end-users, experts and inference engine (Sajja & Akerkar, 2010). Knowledge representation is a means of encoding the human expert's knowledge in an appropriate medium. It is the dedication to a vocabulary, data structure, and program that lets domain knowledge usable. There are several commonly used techniques for knowledge representation in the development of knowledge-based systems. These are logic, production rules, semantic nets, frames and cases knowledge representation methods. In this study a rule-based knowledge representation and reasoning is followed. Rule based is selected because it is one of the most commonly used technique for the development of knowledge-based systems.

Knowledge is represented in the form of condition-action pairs: IF this condition (or antecedent condition or premise) occurs, THEN some action (or conclusion or consequence) will occur.

The following rules in the knowledge base of the prototype are expressed with natural language rules IF … THEN …Proposal should contain all the key elements involved in designing a complete research study, with sufficient information that allows readers to assess the validity and usefulness of the proposed study. An effective proposal is judged on the quality of one's writing. It is, therefore, important that each section of the proposal writing must follow a governing rule to write convincing proposal based on the requirement of the academic requirement, which is also coherent, clear, and compelling proposal. Below only rules used for the statement of the problem and research design sections of research proposal is presented. Others sections also follow the same format. For some section of the proposal like, statement of the problem the condition IF-ELSE IF was used. The IF-ELSE IF statement executes some code if a condition is true and another code if that condition is false.

RULE 1:

IF

The researcher defines about the research problem; where and when does the problem arise? Who does the problem affect? What attempts have been made to solve the problem? **AND**

The researcher identify both what has been done and not done in the research **AND**

The researcher answers about the research problem; what will happen if the problem is not solved? Who will feel the consequences? Does the problem have wider relevance (e.g. are similar issues found in other contexts)? **AND**

The researcher set the overall purpose and concrete steps to take to achieve the aim of the study

THEN:

The researcher may have adequate information to write concise and concrete statement of problem.

RULE 2:

IF

The researcher cannot contextualize his/her motivating research area **OR**
The researcher did not identify the specific issues or problem to address in his or her study **OR**
The researcher did not state the relevance of the problem **OR**

The researcher did not set or plan a goal to solve the problem

THEN

The researcher may have not adequate information to formulate a problem statement.

RULE 3:

IF

The researcher plan to design, and/or implement a model, architecture or framework or Artifact based on survey or experimentation

THEN:

Design Science Research methodology is recommended to the researcher.

RULE 4:

IF

The researcher plan to select optimal techniques and algorithms based on simulation and experimentation for constructing a model or system

THEN:

Experimental research design is recommended to the researcher

RULE 5:

IF

The researcher plan to conduct only a survey without designing a system

THEN:

A survey Research is may be appropriate to the researcher

4.5 Knowledge Base

The knowledge base contains rule base and fact base. The rule base incorporates the relevant knowledge that was acquired from the domain experts as a rule. The knowledge base of the prototype contains the domain knowledge which is used to support the novice researcher common mistakes and difficulties in each proposal

writing section, such as statement of the problem, objective, research design. Sample rules in the knowledge base of the prototype system are discussed as follows.

Rule 1: Researcher plan = to design, and/or implement a model, architecture or framework or Artifact based on survey or experimentation

Write ('Design Science Research methodology is recommended to the researcher')

In the above rule 1, the system receive some information from the researcher by asking their planed work and action. Based on this information the system tries to recommend the research methodology. For example for the above rule, if the researcher response is yes then the system automatically draws conclusion that is displayed to the researcher '**Design Science Research methodology is recommended to the researcher'**

An additional component of the prototype system is fact base which is a database used to accumulate the set of facts which is used by the rules of the prototype system. It comprises facts about the specific case of each proposal section. Initially, the fact base can comprise known facts by the prototype system which is used by the inference engine to acquire facts and match them with the rules of the prototype system. The facts are added to the fact base by the knowledge editor when it is necessary. Therefore, it is the dynamic component of a knowledge-based system.

4.6 Knowledge Editor

An important area of KBS research is the development of practical approaches that enable users to add new facts and/or rules to an intelligent system which would bring computers closer to Meeting the challenge of end-user or authorized editor to add new facts and rules to update the KB. Therefore, the KBS needs to have many intelligent capabilities in order to support the complex dialogues that researchers conducted with the users, integrate the new facts and rules with existing facts and rules, and make appropriate decisions. So based on this the knowledge editor component allows the system to learn as per users' suggestion

The prototype system has a capability of learning new facts at run time without editing the code by knowledge engineer. For example for the research design section it is easy to add new planed student research Output such as model, artifact, architecture, framework, knowledge based system and others by authorized end-user. Due to the fact that various Student come up with a different research output plan for their study, the system editor might need to update and edit the KB by adding the possible student design plan option that best fits to a particular research methodology. By doing this, the system can came up with a different question to be asked. By considering this newly added fact, the system can suggest appropriate research methodology for the student. The inserted facts are stored on a separate knowledge base and become updated whenever the end-user ends

the program. Since, the system use the updated rules later, the researchers assumed that the system users(Novice Researcher) must understand well, what he or she plan to design and system editor must provide correct inputs only when it is required to add new knowledge. Figure 4.6 show how to add the new possible planned student design in the prototype system.

```
Do you want to a support in selecting research design(yes/no)?
|: yes.
% learnresearchdesign.pl compiled 0.00 sec, 5 clauses
Is your plan is based on survey or experimentation to design, and/or implement  :  framework ?

|: yes.

According to your response the following information might help you to use the recommended research design by giving some justification.The Design

Science Research Methodology is relatively a new approach as a methodology in the field of Computing because of it prominence rapid growth in

the discipline.By using this methodology one can creates and evaluates IT artifacts intended to solve identified organizational problems.so

The Knoweledge based system recommends you to use :-

Design Science Research
=======================
TYPE THE FOLLOWING WORD IN SMALL LETTER FOR THE FOLLOWING TASK AND SUPPORT

NOTE:           Dont forget to  Put dot(.) after typing the word:
================================================================================
yes     = To see other options       add     = To add new fact to the knowledge-based system

stop    = To exit and to stop       advice  = To get essential information
================================================================================
|: add.

Please type your user name and passsword

User Name :  edmealem.

Pass word :  sep22sat2003.
% learnresearchdesign.pl compiled 0.00 sec, 5 clauses

Please tell me the name of the new fact in addition to the privious facts
Fact/s? knowelage_based_system.
Thankyou!
The new fact is successfully added to the system!
```

Figure 4. 6 How to add new planed research design output

As shown in the figure 4.6 above if the domain expert type the word “add” the system asks user name and password for authentication. If the user name and password Mach, the system allows to add new fact to the

fact base. Then the system provides space to type the name of the new fact. If the user insert **Knowelage_based_system and** "**.**" (A dot) the new fact is saved in fact base as depicted in figure 4.7.

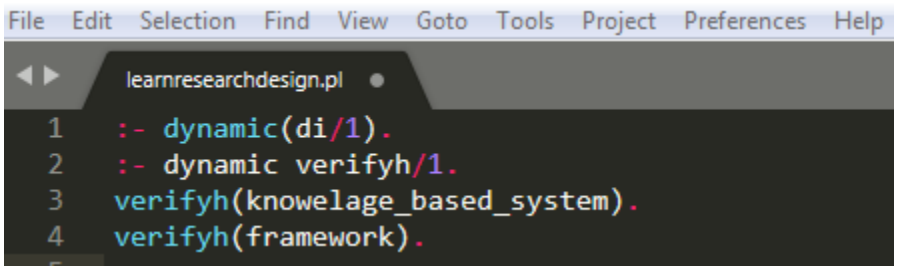

Figure 4. 7 The new fact added to fact base

The prototype system can remember the newly added student research output at running time. Figure 4.8 below shows when the developed system use new facts after it was added by knowledge editor. For instance **Knowledge based system** is added as new fact in the prototype system and used as new fact. The newly added fact is called by the main program by "**selflearnresearchdesign.pl**" at running time. There is a link called "adf" and "," (a coma) which adds the new fact into knowledge base.

```
This is General information about research design :
------------------------------------------------------------
In this proposal section, it is expected from student to describe the kind of research they will conduct

to complete their project and explain how they will conduct their research in as much detail as possible.

But using wrong methodology is a common mistake by computing filed novice researchers and in many instances,

the problem can seem to be overwhelming in that the novice does not possess the basic familiarity with the

fundamental terms and concepts of some of the more commonly used approaches to make an informed decision.

So, based on this,

Do you want to a support in selecting research design(yes/no)?
|: yes.
% learnresearchdesign.pl compiled 0.00 sec, 6 clauses
Is your plan is based on survey or experimentation to design, and/or implement : knowelage_based_system ?

|: yes.

According to your response the following information might help you to use the recommended research design by giving some justification.The Design

Science Research Methodology is relatively a new approach as a methodology in the field of Computing because of it prominence rapid growth in

the discipline.By using this methodology one can creates and evaluates IT artifacts intended to solve identified organizational problems.so

The Knoweledge based system recommends you to use :-

Design Science Research
=======================
```

Figure 4. 8 How to use added new design option

In addition, the system can learn the operation under process, the recently performed operation is remembered by asking whether the researcher plan to design knowledge based system as depicted in the above figure. This shows as the developed system is learning using structural learning when the new fact is added to fact base and using memorization learning when remembering the newly added fact.

In this section in order to prevent an authorized user, the system provides authentication system which only allows knowledge editor to update the KB.

4.7 Inference Engine

Since the knowledge base is designed using prolog, the prototype system uses backward chaining reasoning mechanism. During the reasoning process, the inference engine starts from the consequence (From the possible student faced difficulties or weakness in proposal section) and checks the reasons for the difficulties or common mistakes to provide suggestions or to give advice for the problem. If certain antecedents (facts) are evaluated as true, then it logically follows the consequent are proved, and then clarification about the problem, cases and support for the problems are provided. As the conceptual model indicated in the decision tree of figure, during the time of supporting proposal writing weakness the system first asks the possible reason or cases for the difficulties. Next the KBS tries to prove whether these cases are match with the cases in the knowledge base or not. Then the system provides support to the novice researcher depending on the cases feed to the system. The inference engine of the rule-based system follows similar procedures like the domain expert(s). The inference engine sequentially searches each rule and then draws the conclusion for the difficulties. For example

The following section demonstrates how the inference engine identify the possible novice researcher difficulties in writing problem statement. In this proposal section; most students did not easily understand the necessary conventions to write problem statement. Due to this, students came up with a problem that didn't clearly communicate to the audience. So in order to identify the most possible reason or difficulties for the problem the following rules can be used. The rules that used to debug statement of the problem writing difficulties are represented as indicated below.

Rule 1: Poorly written problem statement, if

There is insufficient problem context

The precise issue to be addressed is not indicated

Significance of the problem is not or insufficiently discussed

There is no project aim

4.8 Explanation Facility

In addition to offering the end results, the prototype system can explain **"what"** a request to repeat for clarification before it reached on its conclusions. This ability is usually important since the type of questions asked as a possible problems to which knowledge-based systems are carried out need an explanation of the result delivered to the end-users. It has also the ability of justifying "why" a certain problem is being questioned. For example, the following figure 4.6 illustrates the "what" and **"why"** explanation facility that is used to make the results easily understandable by the end-users and build a good communication between the end-users and the system.

For example, the system gives the command to the user to insert the answer to understand whether he/she identified both *what has been done and not done research work relating to their motivating issue* then finally to give a support based on the researcher response.

In this case the user may request to repeat for clarification before it reached on its conclusions." hence, the user asks to the system by saying **"what".** Then the system responds by saying *"This is to mean: Have you identified the specific point or area where previous research got stuck or has still scope for improvement in its results?* "Consequently, the user asks for another question **"why"** being interested to know why the need of asking the question. Finally, the system tries to understand the user by saying *"Because any research is conducted based on the research gap someone identified so, you are expected to formulate a research problem by identifying a research gap that your study will address". So, do you clearly identify both what has been done and not done research work relating to your motivating issue?* And the system proceeds for another command.

1: Can you easily define the following questions about your research problems?(yes/no):

-Where and when does the problem arise?

-Who does the problem affect?

-What attempts have been made to solve the problem?

ANSWER:yes.

2: Do you clearly identify both what has been done and not done research work relating to

your motivating issue (yes/no/what):

ANSWER:what.

This is to mean,

Have you identified the specific point or area where previous got stuck or has still scope for improvemnt in its result(why/no)?

ANSWER:why.

Because any research is conducted based on the research gap someone identified so,

you are expected to formulate a research problem by identifying a research gap that your study will address

So,Do you clearly identify both what has been done and not done research work relating to

your motivating issue(yes/no)

ANSWER:yes.

3: Do you have adequate answers to the following questions about your research problem ?(yes/no):

-What will happen if the problem is not solved?

-Who will feel the consequences?

-Does the problem have wider relevance (e.g. are similar issues found in other contexts)?

Figure 4. 9 The system explanation facilities for the what and why question

Once the prototype KBS system is developed and checked for its validity, the next task is demonstration and evaluation of the performance of the prototype to see to what extent the system performs and has been accepted by researchers and instructors. The detail is presented in the next chapter.

CHAPTER FIVE
DEMONSTRATION AND EVALUATION

The prototype system is designed and implemented to provide a significant support for the observed novice researchers' common mistakes and difficulties. The system provides a support when students have encountered challenges during proposal writing. Novice users are able to interact with the system through a yes or no response and by using a query term. Based on the user's response the system draws a conclusion using the knowledge base.

This chapter focuses on issues regarding to demonstration of the new prototype system on how the new artifact interact with novice researcher and infer a solution to the observed student challenges and common mistakes. This chapter provides some practical sample selected screen shot of the different section of proposal input and output. This is followed by evaluating and testing the usability of the prototype system so as to know the extent to which it has achieved the objective of the research.

5.1 Prototype Demonistration

The end-user of the system can start the support by inserting the word "start" then full stop "." and press "enter" using the SWI-Prolog Editor window. The welcome window will be displayed in order to help the end-users to interact easily with the system. This is shown in figure 5.1 as follows:

.

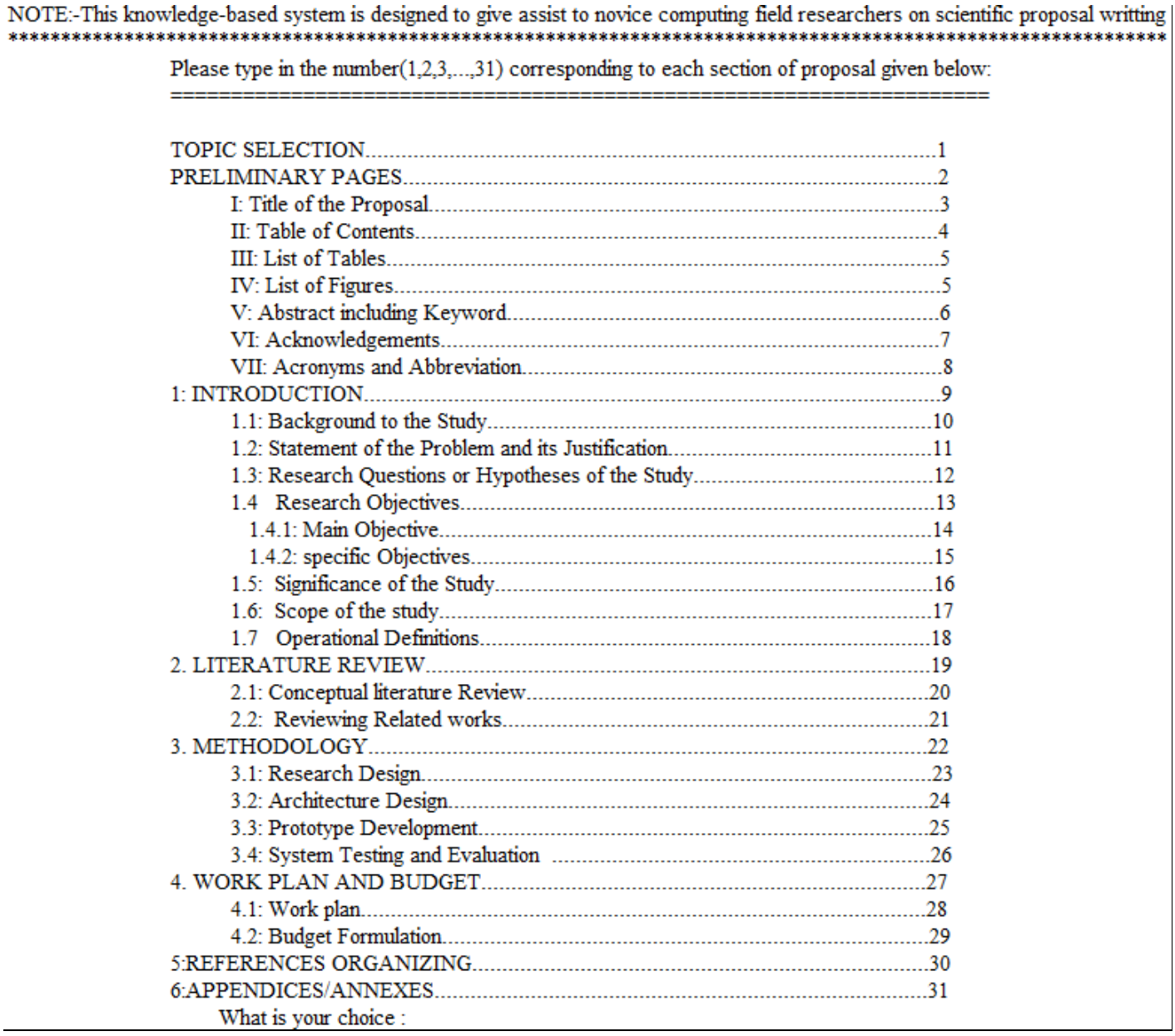

Figure 5. 1 The system user interface

In figure 5.1 above the designed prototypes contained 6 main menu: Topic selection, Preliminary page, introduction, literature review, methodology, work plan and budget, reference organizing and appendix/appendices. Under each main menu there are subsection section with a total of 31option.

Once the welcome window of the KB-RPWSS user interface is displayed as shown in the above section in figure 5.1 the user can interact with the system by choosing the proposal section which the user has need a support. The system allows the user to input a number range (1-31) associated with which proposal section he or she has faced difficulties or need help. If the response for this request is not given, the system does not allow

the user to proceed. However, if the user gives the specified choice then it gives first general information if the end-user needs to know about the section. Next depending on the selected proposal section from the user interface, the system can support the novice by asking a question so as to enable the system to decide whether the novice need a support or not. For example, to support student in writing statement of the problem, the system asks lots of questions which might be the most possible cause of novice researcher common mistakes or difficulties that impede them from writing well formulated problem statement. If novice has doubt to the question, the 'no' option provide a support for that specific questions. In addition to this, if the student need clarification for the questions, the user can use what and why request.

This study also noted that most novice researcher faced difficulties in selecting appropriate research methodology and research topic area.To solve such a difficulties the system provide a list of available research topic area related to information science, information technology and computer networking specialization field to be chosen depend on the student interest. For research design selection the system also takes some planed action information from the researcher to suggest appropriate research design methodology.

The study also noted that some writing mistakes are very common and frequently seen in the novice researcher writing. So, the most common mistakes frequently done by the novice can be easily avoidable by learning to recognize such errors such that, the researcher can improve their proposal writing skills and they avoid common writing mistakes. For such a case the system allows user to input a query term like advice, example, steps, and explanation. So by using the term advice, they can easily get advice and understand the common mistakes, by using explanation they can get more detail information related to the selected section of proposal, by using example and steps student can best understand the concept behind the specific proposal writing section and enable the researcher to follow worked examples and steps.

The standard common proposal format suggested by the domain expert which also serve as a user interface for the proposed system helps graduate student to structure and compile their proposal report writing and mitigate the confusion and tension student suffer from the absence of proposal format. Since existence of research advisor are not always available, with the help of KB-RPWSS that addresses the needs of novice Researcher.

Generally the more specific support from the KB-RPSWS help students to become better researcher in future in terms of mitigating mistakes and difficulties and writing well scoped research proposal by improving their scientific research writing comprehension skills and giving them good writing experience. The following section illustrates how the system gives a support for the different section of the proposal section.

The next figure 5.2 shows How the KBS support Novice Researcher in providing Research Topic under information science discipline.

For the research topic selection, the KBS provides the following support. In the following figure 5.2, once the user selects the research topic selection, The KBS first gives a general information about the research topic. Then followed a request for a help in selecting research topic. If the user select yes, the system allow the user to enter research topic based on their interest. Based on user choice the system lists available research topic.

```
This is General information about Research Topic selection
---------------------------------------------------------------
For most novice computing field researcher finding and selecting  ressearch topic is one of the challenging tasks. Based on this

Do you want a support in listing you a list of current research topic(yes/no)?

|: yes.
For a research topic in the field of information science press..... 1

For a research topic in the field of information technology press..... 2

For a research topic in the field of computer networking press..... 3

What is your choice :

|: 1.
```

RESEARCH AREA

Archives and Preservation

Protecting and maintaining collections and materials in archives

Artificial Intelligence and Machine Learning

Researching the models, methods, uses, and impact of intelligent systems design for processing data and information

Digital Libraries

Studying how to most effectively store, structure, retrieve, interpret and preserve collections of digital objects to serve a particular community or communities

Community Informatics

Understanding how local communities and people in their everyday lives use and might use information technology, in libraries and elsewhere

Computational Social Science, Social Computing

Using computational methods to study and model social systems and user behaviors

Computing for Social Good

Understanding computing s potential for good (and harm), including the role of computing and technology in responding to social, ecological, political, and other challenges

Cultural Informatics and Heritage

Understanding the role of information technology in preserving, transmitting, and shaping human culture and heritage

Data Analytics and Human Centered Data

Using computational methods to transform both structured and unstructured data into actionable knowledge; and to understand and enable humans to explore and gain insight from vast data sets

Cultural Informatics and Heritage

Understanding the role of information technology in preserving, transmitting, and shaping human culture and heritage

Data Analytics and Human Centered Data

Using computational methods to transform both structured and unstructured data into actionable knowledge; and to understand and enable humans to explore and gain insight from vast data sets

[Type any one key to continue]

[Dont forget to put dot(.) after typing the key]

|: y.

Data Curation

Active and on-going management of data through its lifecycle of interest and usefulness to scholarship, science, and education

Design and Evaluation of Information Systems and Services

Understanding the problems with existing information systems and services, and making them more effective and easier to use

Digital Humanities

Applying computing or using digital media in the humanities disciplines

Digital Libraries

Studying how to most effectively store, structure, retrieve, interpret and preserve collections of digital objects to serve a particular community or communities

Diversity and Social Justice

Addressing challenging, but necessary, topics such as racism, privilege, power, etc., and coupling them with critical theory in an effort to develop compassionate, proactive, and culturally competent information professionals

Figure 5. 2 Sample support for topic selection

For the proposal title section the KBS provides the following support. In the following figure 5.3, once the user selects the title proposal section, the KBS first give a general information about proposal title, then followed by asking a user willingness if they want proceed for further detail. If the user answer yes the system suggests the user to give a query from the provided options. Based on the user response, the system reaches to conclusion and present a supportive information as shown in the following figure.

```
                                What is your choice :3.


This is General information about Proposal Title
========================================

The title is a window into your research proposal report that tells the readers, what it is all about in a few words

It should be clear and precise and not very long. It should clearly state the topic exactly in the smallest

number of words.

1:Do you want a support to formulate good proposal Title?(yes/no):

ANSWER:yes.

The following information might help you to avoid common mistakes in formulating Title.

TYPE THE FOLLOWING WORD IN SMALL LETTER TO GET A SUPPORT

[explanation | step| advice |example| ]       NOTE:  Put dot(.) after typing the word:
=========================================================

|: advice.

-The title should be new or its questions were not answered previously

-The proposal title should be concise, engaging, descriptive and explanatory without being informal or cute.

-Avoid too much jargon, abbreviations, initials, acronyms and redundant words unless the requirements specify it.

-Capitalize all the necessary words, including all nouns, pronouns, adjectives, verbs, and adverbs.

-It should capture and reflect the content of the research proposal.

-The title should enable readers to understand the concepts, methodologies and output of the study.

TYPE THE REMAINING WORD TO GET MORE SUPPORT
```

TYPE THE REMAINING WORD TO GET MORE SUPPORT
==========

|: example.

Examples of clear and concise titles:

- A hybrid noise removal approach from web pages: towards enhancing quality of web content mining

- Character Recognition from Formatted Amharic Printed Documents

- Web-based GIS application to Land and House Management for Ministry of National Defense of Ethiopia

- A Model for Mobile Payment in the Context of Ethiopia

- Predictive Modeling for Coffee Trading at Ethiopian Commodity Exchange: a machine learning approach

- Data Mining for Cement manufacturing process Optimization

TYPE THE FOLLOWING WORD IN SMALL LETTER TO GET A SUPPORT

[explanation | step| advice |example|] NOTE: Put dot(.) after typing the word:
==========

|: explanation.

Titles are important for your reader(s) An informative title summarizes the entire document in one phrase. It├ s a big job, but a vital one. The reader should understand, at a high level, the actual benefits the proposal offers once they read it. An intriguing title pulls the reader in. This briefest summary must also appeal to the audience. Take the time to consider your audience. Contextualizing the reader will help you draft a title that would appeal to their interests.

TYPE THE REMAINING WORD TO GET MORE SUPPORT
==========

|: step.

You can avoid common mistakes in title formulation by focusing on:

- Purpose of the study

- Scope of the study

- Techniques used for the study

- Tone of the study

Figure 5. 3 Sample selected query to get a support for title formulation

The next figure 5.4 shows a dialogue between user and the system on supporting student difficulties in selecting design science research guidelines. Once the user select the research design section from the user interface menu, the system first ask a user, whether they needs a help in selecting a research design, if a user response is 'no', the system again asks a user, whether he or she need a support in how they set up their research, if the user response is yes, the system further ask a research design they select, based on the selected research design type the system provide a support.

This section is utilized to describe how you will set up your study to observe the hypothesized relationship so,describe the steps you will take to address the hypotheses or the research question you raised in operational terms.Answer the following question inorder to get support in this section of the proposal.

Do you want a support in how you will set up your study(yes/no)?
|: yes.
Is your research design is: experimental_research ?

|: no.

Is your research design is: design_science_research ?

|: yes.

DSR
****
The Design Science Research Methodology is relatively a new approach as a methodology in the field of Computing because of it prominence rapid growth in the discipline.By using this methodology one can creates and evaluates IT artifacts intended to solve identified organizational problems.many IT researchers also ,utilize a survy study or expermental study research extensively with Design Science Research.

This indicate that researchers who utilize a survy study or expermental research as a research method to gather relevant qualitative data or to test a hyphothesis that the study is targeting Therefore, the output of your survy study or expermental study would be an input for the design science research methodology.

The Major Steps in Design and Development Research

****

A number of researchers, both in and outside of the IS discipline, have sought to provide some guidance to define design science research.so you must follow one of the guidlines

Examples of different researcher guidelines

****

Peffers et al. identified six major mile stone

.....

a) identify the problem motivating the research;
b) describe the objectives;
c) design and develop the artifact;
d) subject the artifact to testing;
e) evaluate the results of testing; and
f) communicate those results

Hevner R. et al.,(2004) proposed a guideline

.....

Guideline 1: Design as an Artifact:
Guideline 2: The Relevance of Problem:
Guideline 3: The Design Evaluation:
Guideline 4: Research Contribution:
Guideline 5: Research Rigo:
Guideline 6: Design as a Search Process: Guideline 7: Communication of Research:

Hear some advice are listed below

****

After a researcher select the appropriate Design science Research Guideline they can use the following steps in the appropriate place according to the researcher requirement or recommendation

-Study Population
-Determination of the Sample size
-Sampling techniques and procedure
-Data collection instruments
-Pre-testing (Validity and reliability)
-Data Collection Procedure
-Data Analysis

*Explain each phase briefly according to the guideline requirement
*For each of the phases additional search into the literature will be necessary.
*The designed artifact should contribute to the body of knowledge
*Give reason about on what base you chose the guideline or the millstone

Figure 5. 4 Sample support for research design section

5.2 Evaluation of the Prototype

In this section the approach used to evaluate the prototype, system performance evaluation and user acceptance test result are discussed. A system, as a prototype/model artifact, needs to be evaluated in order to demonstrate its quality, utility and efficiency. This helps to improve the prototype in an iterative manner to ensure the quality of the proposed solution so that it can solve real world business problems (Hevner et al., 2004). Accordingly, in this study the performance of the prototype is measured using accuracy. This is followed by user acceptance testing to see to what extent users are motivated to use the system.

5.2.1 System Performance Testing

In this section the performance of the system was tested and validated using test cases. The test cases were used to measure the accuracy of the system. For the purpose of validation process, a total of 14 open-ended cases were selected based on the issues novice researcher and experts ask frequently. Five domain experts are purposively selected for the purposes of preparing test cases to evaluate the performance of the prototype system. The criteria for selecting the domain experts were based on their field specialty, experience in teaching and learning research method course and experience in research advising.

For knowing the expected answers for the test cases, the questions are distributed to all domain experts. Since the questions are open-ended to answer, many repeated suggestion were given by the domain experts. So, by looking the answer, the researcher summarizes the suggestion of the expert by removing all the redundant and related suggestions. All unique suggestions given by the expert are taken as the expected solution for the test case by the prototype. Then, the system is supplied with similar inputs and its outputs are compared with those decided by human experts to validate system performance.

System performance validation by Domain experts and novice researchers

To measure whether the system incorporates sufficient knowledge to support novice for their common errors and challenges during research proposal preparation, a total of 50 summarized suggestions are collected from domain experts. Table 5.1 presents summary of the accuracy of the prototype KBS by domain expert and Novice Researchers

Table 5. 1 Domain experts' and novice researchers' evaluation of the accuracy of the prototype

Most problematic section of proposal	Total suggested answer	Domain experts and Novice Researchers evaluation		
		Included suggestion	Excluded suggestion	Accuracy
Topic selection	9	7	2	77.8
Title of proposal	5	5	0	100
Statement of the problem	7	6	1	85.7
Research design	4	3	1	75
Research questions	5	4	1	80.0
Objective of the study	6	5	1	83.3
Scope of the study	5	5	0	100
Literature review	9	7	2	77.8
Average accuracy				85.0

As shown in the above table 5.1, on average for "topic selection difficulties" from the total 9 suggested solutions, 77.8% of them are correctly suggested. Whereas, 22.8% are topics are not acquired from different sources which the designed prototype system doesn't incorporate in its knowledge base.

Similarly, for proposal title section a total of 5 suggested idea were collected from domain expert; out of which 100% are included in the system as the human expert suggest. Out of 4 presented suggestion for research design section 75 % of them are suggested by the system are accurate. On the other hand, 25 % are not identified by the system. In addition to this for the statement of the problem section the included suggestion were 85.7 %. "Research questions" registered as 80 % accurate and 83.3% for objectives of the study and 100 % for Scope of the study. Out of total collected 9 presented suggestion for literature review section 7 of them are also were suggested by the system which means the system is 77.8 % accurate. Finally, the result indicated that all the cases are directly similar with knowledge incorporated in the knowledge base and average performance of the KBS is 86.3%.

Also as discussed in table 5.1 above the decision made by the system have shown slight difference with decision of human expert during test case validation. There are different contributing factors for the variation of decision made by the knowledge based and Domain expert. There are some challenges encountered during

the study which limits the prototype system to register a better performance for supporting purpose. These are discussed as follows.

The performance of the system is affected by factors related to the human knowledge variation. For example, of a variation of research design selection is observed among the different computing field disciplines. For example, for the test case purpose the researcher select two domain experts from the area of computer networking department. During the test case questionnaire time the researcher noted that DSRM is not well known in their discipline for conducting research. Due to this their response and the system suggestion greatly show variation. That is why, the lowest result of 75% accuracy registered, which also influence the overall accuracy level. The variation in experience in teaching learning research course, adviser and motivation are also factors that make the domain experts to respond differently for the same question raised.

5.2.2 User Acceptance Testing

After evaluating the accuracy of the knowledge based system, we also conduct user acceptance testing to evaluate usefulness of the prototype knowledge based system. Due to the pandemic Corona, only 18 novice students from two different set have been selected by purposive sampling technique for system usefulness evaluation test. Ten of the novices are previous students who passed proposal writing phase and the rest are novice researcher which did not start writing proposal. In addition seven domain experts, three of them were Research advisors who already had an interview and questioned for knowledge acquisition and the rest 4 are new from other universities were also participated in evaluating the performance of the prototype system.

The user acceptance evaluation criteria is adopted from Prat et al, (2014). The adopted criteria are modified to some extent to fit the context of this study. The criteria adopted were focusing on easiness, time, efficiency, and accuracy, and completeness, utility and learning ability of the prototype knowledge-based system for novice proposal writing.

For easiness of analyzing the relative performance of the prototype based on the user evaluation after the interaction with the system, the researcher assigned numeric value for each of the options; such as Excellent = 5, Very good = 4, Good = 3, Fair = 2, and Poor = 1. The average performance of user acceptance of the system is measured using weighted mean of user's response as per the rating scale. Table 5.2 below indicates the feedbacks obtained from the domain experts and novice researcher.

Table 5. 2 The Domain expert's and novice researchers' user acceptance feedback

		Novice student's Feedback							**Domain expert's Feedback**						
No	**Criteria of evaluation**	**Poor (1)**	**Fair (2)**	**Good (3)**	**Very good (4)**	**Excellent (5)**	**Average**	**Percent**	**Poor (1)**	**Fair (2)**	**Good (3)**	**Very good (4)**	**Excellent (5)**	**Average**	**Percent**
1	Is the system more efficient in running time?	0	0	2	4	4	4.2	84	0	0	2	2	3	4.1	82.9
2	Does the system incorporate sufficient knowledge to support on the common errors and challenges which faces you in the proposal writing?	0	0	2	3	5	4.3	86	0	0	1	2	4	4.4	88.6
3	Is the system provide accurate in analyzing facts and decision making?	0	0	3	3	4	4.1	82	0	0	2	2	3	4.1	82.9
4	Is the prototype is easy to use and interact with it?	0	0	1	3	6	4.5	90	0	0	1	2	4	4.4	88.6
5	The ability of the prototype to provide explanation	0	0	2	5	3	4.1	82	0	0	1	2	4	4.4	88.6
6	How do you rate the significance of the system in the domain area?	0	0	1	2	7	4.6	92	0	0	2	2	3	4.1	82.9
7	How do you rate the ability of a prototype system to add new fact to the KB?	0	0	4	3	3	3.9	78	0	0	2	4	1	3.9	77.1
	Average						4.2	84.9						4.2	84.5

As shown in the above tables 5.2 on average, 41.1 % of the evaluators scored the efficiency of the system in time; how efficient the system is while interacting with the prototype system criteria of evaluation as excellent and 34.3% as very good , 24.3 % as good. The second evaluation criteria were how the system incorporates sufficient knowledge to solve the novice researcher common problem and difficulties which faces during proposal writing and it was scored 53.6 % as excellent, 29.3 % as very good, and 17.1% as good. For system accuracy in analyzing facts and decision making, 41.1 % of the evaluators scored as excellent, 29.3 % as very good, and the rest 29.3% as good. The system attractiveness and easy to use and interact is also tested. Accordingly, 58.6% experts are satisfied with the interface which is scored excellent, 29.1% of them selected very good and 12.1% are in good mood with interface attractiveness.

Moreover, 43.6 % of the evaluators gave the prototype system an excellent score with regard to the system provides the right description and suggestion to be followed while supporting and mitigating novice common error and difficulties by human expert ,39.3 % as very good, and 17.1% as good. The significance of the knowledge-based system to support proposal writing for novices was rated by 56.4 % of respondents as excellent while 24.3 % rated the prototype system as very good and 19.3 % as good. Finally, for the question "rate the ability of a prototype system to add new fact to the KB, 43.3% of them marked as very good and 22.1% of them evaluated as excellent and 34.3% rated as good. Finally, the average performance of the prototype system according to the evaluation results filled by the domain experts is 4.2 out of 5, 4.2 by novice students out of 5 and total average is 4.2 which is 84.6 %.

In addition to the closed ended questions, the evaluators were provided with open ended questions to forward their suggestions and opinions for (Group I, II). These questions focus on how the KBS is different from human expert, proposal guideline, Research method course in in supporting the researcher common problem and difficulties. Furthermore the open ended questions help evaluators to provide their feedbacks on the contributions of the system, the uncovered knowledge issues, knowledge content of the system, the limitations and strength of the knowledge based system.

The *first* open-ended question the respondents were asked was to know *how the prototype KBS is different from the human proposal advisor, the Guideline provided by the university, the Research method course strategy in supporting for the problem student face during proposal writing*. The system evaluators responded that the KBS solve problems based on the stored knowledge in the knowledge base with in time and cost wise. Another difference in between the system and human expert is that human intervention cannot be 24/7 or in the time they practice their own writing skill personally. So, this kind of supportive system helps novices to get involved with it for their problems concerning to proposal writing and there are also a shortage of advisor

due to this one advisor can be allocated to follow up many student which consequently result that student lack appropriate follow up. In such a case the KBS system can give support for many students where there are shortage of advisor.

The respondent also raised that, most human expert only indicate a problem as a comment on the proposal report without indicating detail information on how to tackle the comment and the comment sometime ambiguous and can't easily understandable by most novice researcher. Also, the guidelines, as would be expected, do not go into the depth of technical details. As such, the proposal writing at the detailed technical level is unguided by the university guidelines. In addition, Due to in appropriate time allocation for Research Method course student did not cover all the necessary skill to conduct research so Incompletion of research course method could limiting their potential from applying scientific research method, which also impede them from writing a good research work. But in case of the KBS system the system mitigates those challenges, the system also provides a guidance to each section of the proposal section this makes the student understand the prerequisite condition to formulate or to write each section. It also asks lots of questions which are the most possible cause of novice researcher to determine a support need for the single section of proposal so that novices can learn from the questions for the specific section of the proposal. In addition, in each section there are menu like Advice, explanation, steps and examples which facilitates good understanding of the section so, the system covers or contains what a research method course were unable to cover .

Generally, one of the interesting part of the system is that, it provides hot research topic, gives a support in selecting a Research design and Gives additional information for the student, that information can't be easily found in teaching learning research method course so, the KBS system can be seen as an all in one approach or can be considered as a handy solution for novice researcher and providing a real time support.

The *second* open ended question raised was *"what makes the KBS different from websites available or previous proposal report to consult and to get a support on the proposal writing*, respondents answered this question by raising the problems of those available sources. One of the big problems for most website is there is no much focus on the specific novice researcher common problem and challenges but rather on the general concepts. Browsing websites sometimes time consuming and characterized by information overload to get a support and it also needs internet connection and brings irrelevant data.

The *third* question was *"Does the system have any significance in the domain area"* and accordingly respondents answered it as the system has significance in the domain area. All the system evaluator's responded that the system add value in the domain area. Therefore, the application of new technology simplifies the working environment teaching learning of scientific research writing. In addition, the system also can reduce

the burden of human expert by sharing their responsibility and energy. And also the student can get self-learn from the system. Finally, the system can be used as teaching and learning instrument for academic purpose.

The *fourth* question was about the significant strength of the system and accordingly all respondents agreed that the system can really assist novices in writing process and motivate them well in their proposal writing skill, but it might need further development because the errors which is committed by novices are very complicated and too much. It is also mentioned by the respondent the system also saves the users and Advisor time and energy. The perceived limitations of the system are that the types of support limitation like language and user interface of the system needs improvement to make the system more attractive to users. Another limitation raise was since the system interacts with the user using only 'yes' or 'no 'replies. Therefore, it lacks some flexibility.

5.2.3 Usefulness of the KBS

To test the system usefulness the study adopts the evaluation criteria from Ramaswamy (2012). This section elaborates about the approach undertaken to evaluate the usage of the prototype system. A questionnaire with 14 questions prepared for assessing the usefulness of the prototype KBS system. Quantitative data were collected from 18 users who participated in the evaluation. The participants in the evaluation consisted of novice researcher who did not start writing proposal or concept note and students who passed proposal writing phase. All the participants in the study were novice students at Jimma University. Following that, the prototype system and other data collection instruments is explained. Data was also collected using Likert-scale surveys, which provided more quantitative analysis of the tool. The results that were obtained from the two type participant and analyses are explained in the following section.

Table 5. 3 Novice researchers' response concerning the usefulness of the prototype

What do you think the usefulness of the system		Strongly Disagree(1)		Disagree(2)		Agree(3)		Strongly agree(4)		Group II mean	Group III mean
		Group II	Group III	Group II	Group III	Group II	Group III	Group II	Group III		
1	The topic selection section is interesting and helps in selecting topic for conducting future research	0%	0%	0%	0%	77.78 %	66.67 %	22.22 %	33.33 %	3.2	3.3
2	The provided proposal format will minimize the confusion and tensions among students and also used to sequence and develop the parts of a proposal	0%	0%	0%	0%	0.0%	0.0%	100.0%	100.0%	4.0	4.0
3	The system can provide technical support for difficulties in addition to simple explanations and guide	0%	0%	0%	0%	55.6%	44.4%	44.4%	55.6%	3.4	3.6
4	The system helps to write effective proposal based on the expected scientific requirement	0%	0%	0%	0%	33.3%	22.2%	66.7%	77.8%	3.7	3.8
5	The explanation facility helps to understand the most common mistakes frequently done by the novice and reduce the mistakes by learning to recognize such errors	0%	0%	0%	0%	44.4%	33.3%	55.6%	66.7%	3.6	3.7
6	Explanation facility like example, steps and explanation for each sections makes me better understand the concept behind proposal writing skills	0%	0%	0%	0%	33.3%	22.2%	66.7%	77.8%	3.7	3.8
7	The system will support me by Facilitating self-aid teaching	0%	0%	0%	0%	55.6%	44.4%	44.4%	55.6%	3.4	3.6
8	It covers what research course uncover and can bring a great change in my writing skill	0%	0%	0%	0%	66.7%	66.7%	33.3%	33.3%	3.3	3.3
9	The system will facilitate to timely complete the research as per academic requirement	0%	0%	0%	0%	66.7%	55.6%	33.3%	44.4%	3.3	3.4
10	I would like to use this system frequently during proposal writing time	0%	0%	0%	0%	33.3%	22.2%	66.7%	77.8%	3.7	3.8
11	The system will be very useful for the student like me	0%	0%	0%	0%	22.2%	11.1%	77.8%	88.9%	3.8	3.9

12	The system is efficient in providing advice in proposal writing	0%	0%	0%	0%	33.3%	22.2%	66.7%	77.8%	3.7	3.8
13	The system is fast in providing the necessary result	0%	0%	0%	0%	44.4%	33.3%	55.6%	66.7%	3.6	3.7
14	The system is easy to use	0%	0%	0%	0%	66.7%	55.6%	33.3%	44.4%	3.3	3.4

From the above table On average, 72.22% of the users agreed that the topic selection section is interesting which will help them in selecting topic for their future research and 100% of user Strongly agreed that the provided proposal format minimize the confusion and tensions among students including the respondent and also will use to sequence and develop the parts of a proposal. 50% of novice researcher strongly agreed that the facility like example, steps and explanation for each sections makes them better understand the concept behind proposal writing. 61.1% of the student strongly agrees that the advice explanation facility helped them to understand the most common mistakes frequently done by the novice so, they can reduce the mistakes by learning to recognize such errors. 72.25 % of the users have a strong believes that the system provide technical support for their difficulties in addition to simple explanations and guide .50% agree that the system facilitates a self-aid learn. 66.7% of them also thought that it covers what research course uncover and can bring a great change in their writing skill. 77.9% of the users felt this system will be very useful to the students like them and 72.2% of them would like to use the prototype system again. 78.8% student also express their feeling that they trust the tools to write effective proposal based on the expected scientific requirement. In general 61.1% of the user believe the system facilitate timely completion of their research studies based on the stipulated time with the required academic requirement.

Out of the 14 question, three questions were used to answer the research question about usability. None of the users strongly disagreed and disagree with the questions about usability. Based on this 39.8% of the users believes the prototype system easy to use, 72.2% efficient in providing advice and 61.1% fast in providing the necessary result with a strong agreement.

Figure 5.5 compares the mean of the responses for the questions on usability of the prototype system between Group II and III.

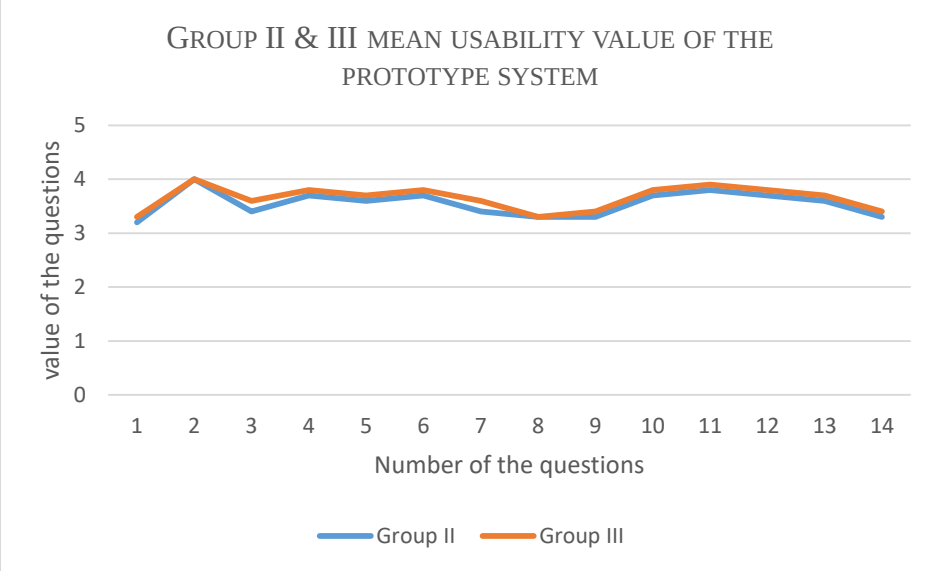

Figure 5. 5 Group II & III mean usability value of the prototype system

The responses for the questions on usability of the prototype system between group II and III as shown in the above table show that group II has a better response than group III. The results for group II and III is as shown in the figure above that, it shows a slight different. Overall the group II gave better user reviews than the groups III. This could be because group two are well aware about the most common mistakes and difficulties they commit and faced better than group one since they passed the proposal writing phase so, the situation make them easily understand the usefulness of the prototype system in relation to their past problem. Also both the groups had a positive response about the usability of the prototype system.

5.3 Discussion

The purpose of this study is to develop a KBS that support scientific research proposal writing for computing discipline postgraduate novice researchers. The accuracy of the prototype system using test cases is 85.0% and the User acceptance testing result is 84.6%, respectively. To show the contribution of the study, table 5.4 below presents a comparison of the current research with previous related work in terms of approach used, result achieved and the gap identified.

A number of studies were conducted to address questions on the accuracy of the scores generated, the efficiency of the feedback, the utility of the tool, and the negative impact of automated writing evaluator systems on writing. Researchers are also keen on knowing if the AWE systems actually improve students' writing or not, and how they are used (Warschauer & Ware, 2006). There are results that indicate these systems could help in improving writing skills.

As shown in the table 5.4 below different systems have been developed over the years, to support or to evaluate the user academic writing. Accordingly the following section compares those systems with the current study based on the approach used, result achieved and the gap that the researcher identified and the major issues they criticized by researchers.

An automated paper drafting bot is developed using prebuilt python libraries and text classification algorithms. Use of real time software tools makes this project highly scalable and compatible for wide range of users. The Intelligent Academic Discourse Evaluator (IADE) is a Web based system. The system used Hypertext Preprocessor (PHP) module to accept student article for analysis in the web browser. Accordingly, the users believed that the interaction with IADE and its feedback helped them to learn article introduction writing moves. The system design of the Online Research writing tutor (RWT) used Corpus-based machine-learning approach and consists of programming logic and modules for the web browser and the web server. The system has gained User acceptance.

To design the current prototype knowledge based system, the current study used the Design Science Research Methodology (DSRM) approach to asses and identify the real problem in research proposal writing and a Rule based approach to represent the knowledge acquired to solve the problem. Based on this the system achieved good user acceptance and registered good accuracy as shown in the table below.

Generally those privious study are designed to give a support for finished writing work which only do content analysis. In contrast to this, the current study focused to give a support before student finished their wring report based on the identified novice common mistakes and difficulties. This is because, there are unexpected problem and difficulties student faced when they start writing their research report. Due to this, they commit common mistakes. So the current system is designed to give an immediate support when student faced a problem during their proposal writing time. Also in the privious system, there is no a kind of user-system interaction to receive immediate support or request for clarification. They didn't take into account to asses' user's knowledge level and skills to reach on decision consequently, to adapt a supportive presentation to the needs and abilities of individual users. To fill such a gap, the current system designed a user interfaces to the different novice proposal writing needs. So novice who came with a different levels of knowledge, interest and skills will be served based on their interest, skills and knowledge. So the current study fills this issues or gaps.

Finally, the previous system gives a support to user by analyzing the student writing work or they do content analysis to guide graduate students. This means then that the system only see the content to provide a feedback to the student for their poor structuring issues, which includes missing linking words or transition sentences, informal language selection, too many quotes, and ineffective paraphrasing and allows user to edit the content.
The current study helps novice researcher to mitigate their proposal writing common mistakes and difficulties. For this purpose the study have explored different common errors and difficulties that novices are experiencing. To solve those issues the study also explored the Knowledge which exists in proposal writing. Since, it is a first attempt according to the researcher, this study brings an advancement in the area of scientific writing and this research study also bring a change to some extent in proposal writing from the current worse condition. The following section deal with the major contribution of the study.

Table 5. 4 Comparison of the current study with the previous research works

AUTHOR	TITLE	APPROACH	RESULT /SUCCESS	GAP
(Aakanksha et al.,2019)	Automatic Research Paper Drafting Bot	The bot is developed by using basic low weight Python libraries PyAutoGUI and Speech Recognition.	Use of real time software tools makes this project highly scalable and compatible for wide range of users.	1. They didn't give adequate attention to find a real problem 2. The system doesn't help novice to get support for frequently committed common mistakes and difficulties. 3. Doesn't consider the student knowledge/skill level to give a support 4. Support is only is given based on content analysis. 5. Criticized for their over-reliance on surface features of responses/only give support for finished writing work.
(Cotos, 2010)	The Intelligent Academic Discourse Evaluator (IADE)	Web based system	The users believed that the interaction with IADE and its feedback helped them learn about moves.	
(Ramaswamy, Nandhini,2012)	Online Research writing tutor(RWT)	Corpus-based machine-learning approach	The system has gained User acceptance.	
The current study	Developing a learning knowledge based research proposal writing supportive system for Novice Researchers	Design Science Research methodology and Rule based Approach	84.6% user acceptance and 85.6% accuracy performance	6. It does not update the knowledge once it is developed without the involvement of knowledge engineer.

5.4 Contribution of the Study

A study which is conducted to Identify novice researcher common mistakes and difficulties which student faced during proposal writing and representing the solution by using a KBS is not attempted by any research previously. So, this study will have a great contribution to enhance novice researcher writing by capacitating them to have the required research proposal writing skill and competency and enabling to prepare acceptable research proposal. As a matter of fact a well-designed proposal promises success in the study and create initiation for further future work.

This study also conduct survey to identify the real problem in research proposal writing. This helps the study to explore the most common novice researcher common mistakes and difficulties. Based on this problem, the study also acquire a knowledge from domain expert to find appropriate solution to the problem. In regard to this, the survey result had its own contribution to provide real solution for real student's problem. Because, the solution was made based on the survey result. In addition to this survey, there will be a contribution to the body of knowledge in the already existing literature and thus it will provide important information on benchmarking which is an important tool for reviewing and comparing practices of other institutions.

In addition to the above contribution, the designed system have practical contribution in the following way, Since research advisor are not always available for consultation, with the help of **KB-RPWSS**, knowledge based, research proposal writing supportive system, novice can get real time advice for their common mistakes and get a support for their difficulties. In addition, students are no more be depressed by the various challenges they face when producing their master's research proposal, such as unfriendly supervisors, absence of proposal format, lack of poor advisor motivation, unavailability of advisor, inadequate experiences on research,
So, the prototype knowledge based supportive system for proposal writing can be concluded as promising and applicable in the domain area.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The thesis proposal writing has been recognized as a great challenge and not an easy understandable task, especially for those students who has no experience before. In our country Quality of student's research proposal writing is affected by academic, institutional, psychological, social and personal interwoven factors that has been recognized as a great challenge for novice researcher. Because of this challenge, novice researchers start proposal work without adequately prepared and gets the necessary skill to review literature, define statement of the problem and formulate research methodology, among others. This situation makes novice to frequently commit common mistakes and faced difficulties. This finally leads some students' proposal have taken long to be approved because they have been found to be problematic and Even worse, seriously compromising the standards expected of a Postgraduate Student thesis.

Hence, in this study an effort has been made to design and develop a prototype knowledge based system that can provide a significant support for novice researchers in research proposal writing. This will have a great contribution to enhance the student writing skill by mitigating the common mistakes and difficulties they commit or encountered and facilitate a timely completion of graduate studies with a desired academic qualification

In developing the prototype system, Knowledge which exists in scientific research proposal writing that supports novice in better understanding in the conceptual difficulties and in mitigating common is acquired using both questioner and semi structured interviews with domain experts and from relevant documents by using documents analysis method to find the solution of the problem. The acquired knowledge is modeled using decision tree that represents concepts and procedures involved in supporting proposal writing. Then, the validated knowledge is represented using rule-based representation technique and codified using SWI-Prolog editor tool for building the knowledge-based system to provide support for novice researcher. Also in testing and evaluation of the prototype system, fifty cases are selected using purposive sampling method in order to test the accuracy of the prototype system. The included and excluded suggestions are identified by comparing decisions made by the domain experts on the cases and with the conclusions of the prototype system. And also the process of ensuring that the prototype system satisfies the requirements of its end-users is performed. This permits end-users to test the prototype system by actually using it and evaluating the benefits received from its use. As the testing result show, the overall performance of the prototype system registers 84.8% and all evaluator proved its usefulness.

The strong side of the prototype system shows that the prototype system has a capability of learning new facts at run time without editing the code by knowledge engineer for some selected section of proposal. In addition, the

system can learn the operation under process. However, it does not update the knowledge once it is developed without the involvement of knowledge engineer.

Applicability of KBS for supporting scientific research writing has been proved. And the prototype knowledge-based system is promising and applicable in the domain area. The feedback and suggestion of domain expert reveals that the knowledge-based system satisfactorily gained user acceptance.

Generally, the prototype system achieves a good performance and meets the objectives of the study. But, to fully provide supporting some types of error especially language related mistakes and a self-learning mechanism need to be incorporated into the current system.

6.2 Recommendations

The prototype knowledge-based system is promising and applicable in the domain area of scientific research writing. The feedback and suggestion of domain expert reveals that the knowledge-based system gained user acceptance and proved its usability and tested its performance so that it is highly recommended for the computing field discipline novice researcher to use the system for improving their scientific writing skill. Based on the findings of the study, the following recommendations are forwarded as a way forward:

- One of the factors that affect the performance of the system is the user interface since it is not well-designed. Hence, there is a need to incorporate a well-designed user interface and an integration of NLP facilities.
- In order to make the system applicable in the domain area for supporting proposal writing, it is critical for the system learn. It is therefore recommended to integrate a mechanism for automatically updating the rules in the knowledge base of the system.
- In the system developed, Novice common writing mistakes and difficulties are handled for the proposal sections which are acquired from domain experts and document analysis. It is recommended that, the scope of the knowledge-based system should be extended to incorporate all aspects of novice researcher problem and difficulties. This includes to give advice on orientation to students at the beginning of the research project about expectations, rules (including plagiarism) and schedules and an advice for encouraging student's self-confidence and to have goal in learning in order to make the system inclusive of all the problem committed and faced by the novice researchers in scientific research proposal writing.
- Most of the common mistakes tried to represent into the knowledge based system are common mistakes in scientific research proposal writing. However, there is a need to further investigate the problem related to English writing skill which is another headache for novice and other experts.
- In this study an attempt is made to apply rule-based systems. Rule based systems solve problems from scratch, while case-based systems use presorted situations to deal with similar new instances. Therefore, the integration of rule-based reasoning with case-based reasoning would solve the limitation when representing knowledge in the form of if then rules unable to draw a conclusion.

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Appendix I

JIMMA UNIVERSITY
JIMMA INSTITUTE OF TECHNOLOGY
FACULTY OF COMPUTING AND INFORMATICS
INFORMATION SCIENCE DEPARTMENT

Questionnaire for the fulfillment of master's program in information science

First of all, I will like to thank you for your cooperativeness to help me in assessing the overall status in conducting research and also, I appreciate your genuine response. Then, kindly I will ask you to fulfill the following requirements.

Direction: *For each of the following questions, please indicate your response by a tick (√) mark or write your possible answers when necessary on the space provided (Question1-12).*

A. Student Background Information

1. Gender

O Male O Female

2. Name of the University _____ Department _____ Program _____

B. The Challenges for Student in Proposal Writing

3. How do you perceive your Satisfaction in terms of being prepared for Proposal Writing?

O Very dissatisfied O Dissatisfied O Very satisfied O Neutral O Satisfied

4. Does the research methodology course provide you the necessary facilities and materials that enables you to understand the major concept of research methods to write proposal?

O Very dissatisfied O Dissatisfied O Very satisfied O Neutral O Satisfied

5. Does the research methodology course have enough practical aspects that will satisfy the student and enable with the necessary skill on how to prepare proposal writing?

O Strongly agree O Agree O Neutral O Disagree O strongly disagree

6. What kind of problem did you observe by research advisor while you communicating for advice?

O Carelessness O Busy O Tiresome/Annoying O Incomprehensible/Difficult to understand O No subject Knowledgeable

7. How often research advisor avail himself to your support request?

O Readily available O not easily available O Never Available

8. Where do you get answers or advice for every question you have in research writing?

O From previous report O from books O from students O from guidelines given by the university O from research advisor

If other specify Click or tap here to enter text.

9. What is the reason for preferring to solve your challenges by the method you already checked for the above questions (question number 8)?

O Easy To Access O Easy To Use O Easy To Understand

10. Which research proposal part has the most challenging to you to understand?

O Research Topic O Introduction O Literature Review O Methodology

O All section of the proposal O time line and budget

11. Suggest one ideas from the response provided on how the performance for student proposal writing can be enhanced?

☐	By Providing more Training or Seminar from the department to the student
☐	By Provision of Literature
☐	By Providing standard guidelines
☐	By Creating knowledge-based system or intelligent system that gives support on discipline specific scientific research proposal writing in the absence of research advisor
☐	Provision of resources
☐	By Improving student-advisor relationship
☐	By Allow for more time to write proposal
☐	If Other specify_____

12. Do you agree that a knowledge-based system that uses the domain experts' knowledge can give additional support to the student on how to write a research proposal and ultimately enhance the research proposal quality?

O Strongly agree O Agree O Neutral O Disagree O strongly disagree

C. Challenging Factors That Affect Research Proposal Quality

Direction: *Below There are Four Factors that impede the students from conducting good research proposal. Under each Factors there are parameter to evaluate whether or not those factors were having a* ***negative*** *impact to your research proposal quality? Please indicate your agreement by ticking (√) mark or circle one of the responses on the provided space.*

Rating Codes: **High**

Medium

Low

Academic Factors		**High**	**Medium**	**Low**
1	Incompletion of research Method course	○	○	○
2	Lack of experience	○	○	○
3	lack of advisor's commitment/inadequate support from supervisor	○	○	○
4	Poor language skill	○	○	○
5	Poor teaching learning Research Methodology Course and Strategy	○	○	○
Institutional Factor		**High**	**Medium**	**Low**
1	Scarcity of reference materials	○	○	○
2	absence of supportive system	○	○	○
3	Absence of Standard Research Writing Guidance	○	○	○
4	Poor service delivery system of library	○	○	○
5	Un-proportional ratios between students and supervisor	○	○	○
Social and Personal Factors		**High**	**Medium**	**Low**
1	Poor advisor-advisee relationship in research supervision	○	○	○
2	Lack of Awareness on Students-Supervisors Responsibilities	○	○	○
3	Lack of goal in learning	○	○	○
4	Poor information sharing culture and relationship between the Researcher	○	○	○
Psychological Factors		**High**	**Medium**	**Low**
1	Absence or unclear of open evaluation method for proposal work	○	○	○
2	Negative comment on proposal	○	○	○
3	Ambiguous comment (difficult to understand)	○	○	○

D. The Conceptual Difficulties for Research Proposal Writing

Please rate the conceptual difficulty in your research proposal writing? Based on the following criterion please, kindly rate the most conceptual difficulty area for your research proposal writing?

Rating Codes: **1 = Easy**

2 = Medium

3 = Hard

No.	Criterion	Rating Code		
		Easy	Medium	Hard
Selecting A Research Topic				
1.	Selecting and refining the research topic to make it adequate	○	○	○
Structuring the Content				
2.	Organizing the content structure to make it well organized and sufficient	○	○	○
Introducing the Proposal				
3.	Introducing topic importance	○	○	○
4.	Providing General Background for the topic	○	○	○
5.	Presenting previous related work on the topic area	○	○	○
6.	Providing justification for the study	○	○	○
7.	Stating and presenting the research problem clearly	○	○	○
8.	Identifying and indicating a research Gap	○	○	○
9.	Developing Research question or Hypothesis	○	○	○
10.	Making the research problem important and relevant to target user	○	○	○
11.	Making the objective/s of the research clear and measurable	○	○	○
12.	Setting boundaries for what is the research covers or uncovers	○	○	○
13.	Identifying and defining terms that are unusual or not widely understood or for terms that have meanings unique to the area under study	○	○	○
Reviewing Literature				
14.	Identifying the literature that you will review	○	○	○
15.	Analyzing the literature that you review	○	○	○
16.	Summarizing or paraphrasing the reviewed literature	○	○	○
17.	Ensuring recent resource from reputable (well-known) source	○	○	○

18.	Selecting an appropriate approach to organize and structure a literature review	○	○	○
19.	Ensuring every source is acknowledged and the references contains all vital component	○	○	○
20.	Stating and presenting the review literature clearly	○	○	○
Selecting Methodology				
21.	Selecting the right Research methodology	○	○	○
Planning the Timeline				
22.	Planning the starting and end date of the research	○	○	○
Planning the Budget				
23.	Developing the budget plan	○	○	○

Appendix II

JIMMA UNIVERSITY
JIMMA INSTITUTE OF TECHNOLOGY
FACULTY OF COMPUTING AND INFORMATICS
INFORMATION SCIENCE DEPARTMENT

Questionnaire for the fulfillment of master's program in information science

First of all, I will like to thank you for your cooperativeness to help me in assessing the overall status in conducting research and also, I appreciate your genuine response. Then, kindly I will ask you to fulfill the following requirements.

For Research Advisor in: _____University

1. Sex: - ○ Female ○ Male
2. Name of the university_____
3. Department: _____
4. Educational status
5. PhD holder ○ PhD Candidate ○
6. For how long have you stayed in advising student in scientific research?
   ○ 2-4 years ○ 4-6 years ○ 6-10 years ○ above 10 years
7. Why some students' proposals have taken long to be approved?
8. What are the reasons for student's poor writing problems in their research proposal?
9. Do you believe that the skilled gained from the research course module enable the researcher to fully equip to conduct and write a research proposal?
10. Do you believe that the support from the advisor side is enough?
11. Do you believe that the time given to teach research method course have enough time to capacitate the novice researcher with the required skill?
12. What precondition must be fulfilled to begin to write a research proposal?
13. What proposal format you recommend for computing faculty to assess the validity and usefulness of the proposed study?
14. What are the challenges and common difficulties faced by masters' students when writing each section of the research proposals and how can these problems be solved?
15. What knowledge is required to write each section of the proposal and for what purpose it is written?
16. What kind of consult do you recommend to improve student's research writing skills which can also assist research advisor in the perspective of Technology?

17. What other method can support novice researcher that also facilitate the teaching learning process of research method course?
18. Do you believe that designing a knowledge base system to support research writing will mitigate the common mistakes student experiencing?

Appendix III

Knowledge acquisition form for the fulfillment of master's program in information science First of all, I will like to thank you for your cooperativeness to help me in assessing the overall status in writing research proposal and also, I appreciate your genuine response. Then, kindly I will ask you to fulfill the following requirements.			
Proposal format	Please indicate your agreement by ticking (√) mark or leave	You can ADD or EDIT or DELETE your Own section on the space provided below.	What are the most commonly exhibited difficulties or mistakes of novice researchers from your experience in each section of their proposal report?
PRELIMINARY PAGES	☐		
Title of the thesis:	☐		
Table of content,	☐		
list of tables,	☐		
list of figures	☐		
Abstract including keywords:	☐		
Acronyms and abbreviation:	☐		
INTRODUCTION	☐		
1.1 Background of the study	☐		
1.2 Statement of the problem and its justification	☐		
1.3 Research Questions or Hypotheses of the Study	☐		
1.4 Research objectives:	☐		
1.4.1 Main objective, 1.4.2 Specific objectives	☐		
1.5 Significance of the Study	☐		
1.6 Scope of the study	☐		
1.7 Operational Definitions	☐		
LITERATURE REVIEW	☐		
2.1 Conceptual literature review	☐		
2.2 Reviewing related works	☐		

METHODOLOGY	☐		
3.1 Research Design	☐		
3.2 Architecture design (design science & experimental research)	☐		
3.3 prototype development(design science & experimental research)	☐		
3.4 System Evaluation and/or user acceptance testing (design science & experimental research)	☐		
WORK PLAN AND BUDGET	☐		
4.1 Work plan 4.1.1 GANTT Chart	☐		
4.2 Budget formulation 4.2.1 Budget justification	☐		
REFERENCE ORGANIZING	☐		
APPENDICES/ANNEXES	☐		

1. What are the strength of the proposal format?
2. What are the weakness of the proposal format?
3. If any complaints or confusion you may receive from graduate students regarding proposal format?

Appendix V

User acceptance Evaluation questionnaires

Questionnaire to test and validate the performance of the knowledge base system for novice Researcher:

1. Is the system more efficient in running time?

   ○ Poor ○ Fair ○ Good ○ Very good ○ Excellent

2. Does the system incorporate sufficient knowledge to support you which faces you?

   ○ Poor ○ Fair ○ Good ○ Very good ○ Excellent

3. Is the system accurate in analyzing facts and decision making?

   ○ Poor ○ Fair ○ Good ○ Very good ○ Excellent

4. Is the system easy to use and interact?

   ○ Poor ○ Fair ○ Good ○ Very good ○ Excellent

5. Is the system provides the right description, clarification and suggestion to be followed while supporting

   ○ Poor ○ Fair ○ Good ○ Very good ○ Excellent

6. How do you rate the significance of the system in the domain area?

   ○ Poor ○ Fair ○ Good ○ Very good ○ Excellent

7. How do you rate the ability of a prototype system to add new Fact?

   ○ Poor ○ Fair ○ Good ○ Very good ○ Excellent

Appendix IV

Open Evaluation questionnaires for user acceptance and applicability

1. How the KB- RPWSS is different from the human expert, the Guideline provided by the university, the Research method course strategy in supporting for the problem student face during proposal writing?

_____
_____
_____.

2. What makes KB- RPWSS different from previous research report available to request a support?

_____
_____
_____.

3. Does the system have any significance in the domain area?

_____
_____
_.

4. What is the strength of the KB- RPWSS?

_____
_____
_____.

5. What are the limitations of the KB- RPWSS?

_____
_____
_____

Appendix VI

Open ended questionnaires for domain expert to collect a case question for system accuracy test

Proposal section	Question	Domain expert Suggestion or Answer
Topic selection	What is your suggestion or advice for beginner researcher that needs your support in selecting a research thematic area or any research topics in the field information science?	
	What is your suggestion or advice for beginner researcher that needs your support in selecting a current research topic or technics in the area of computer networking	
	What is your suggestion or advice for beginner researcher that needs your support in selecting a current research topic or technics in the area of information technology	
Title of proposal	What advice you will give on the research proposal title	
Research design	What research design you recommend for novice researcher who plan to conduct a survey	
	What research design you recommend for novice researcher who plan to focus on designing, and/or implementing a model, architecture or framework based on survey or experimentation	
	What research design you recommend for novice researcher who plan to select optimal techniques and algorithms based on simulation and experimentation for constructing a model or system	
Statement of the problem	What major contents you suggest to be included in the statement of the problem	

	What is your advice for the student who doesn't indicate a research gap in his proposal report from a previous work?	
Research questions	What is your advice as to how the researcher has to formulate research questions?	
Objective of the study	What is your suggestion for the researcher as to how to formulate objective of the study?	
Scope of the study	What major components you suggest to be included in the scope of the study	
Literature review	What is your advice to the researcher to consider during literature review?	
	What precondition or steps the researcher must follow to review a literature for proposal report	