

Advances in Intelligent Systems and Computing 1321

Wida Susanty Haji Suhaili

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Somnuk Phon-Amuaisuk *Editors*

Computational Intelligence in Information Systems

Proceedings of the Computational
Intelligence in Information Systems
Conference (CIIS 2020)

 Springer

Advances in Intelligent Systems and Computing

Volume 1321

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ISSN 2194-5357

ISSN 2194-5365 (electronic)

Advances in Intelligent Systems and Computing

ISBN 978-3-030-68132-6

ISBN 978-3-030-68133-3 (eBook)

<https://doi.org/10.1007/978-3-030-68133-3>

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The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

This book contains the proceedings of the 4th Computational Intelligence in Information Systems (CIIS 2020) Conference held during 25–27 January 2021.

Due to the COVID-19 pandemic, this conference which was initially planned in 2020 has to run in 2021 to accommodate all the uncertainties, and with the travel restriction for our international participants, we have to opt to conduct the conference virtually. Despite this situation, we are pleased to have received 64 submitted articles from 18 countries including countries such as Canada, Bulgaria, Brazil, Uganda and a bigger number from Asia including ASEAN Member States, Japan, Taiwan, Pakistan, Sri Lanka, India, Bangladesh and from the middle east, from Saudi Arabia and Iraq and finally from Uganda. Fifty-five go through the review process while nine have to be omitted due to the negligence of the submission which did not fulfil the requirements of the conference paper requirements. These papers have gone through a double-blind review with reviewers coming from 12 countries with some from the USA, South Korea and Australia. Out of these 55 submissions, 23 paper submission (49%) have been selected to be included in this book.

This year's theme highlights the digital transformation towards Sustainable Development Goals where we have papers on digital transformation, computational intelligence in application, networking domain and paper on COVID-19. We are also pleased that we have a number of young researchers that have chosen our platform to elevate their publication profile. We would like to thank all authors for submitting their papers and finally completing the process for publication and gratefully acknowledging our reviewers for their time in reviewing these submissions on time. We will look forward for more collaboration with other research communities in the next event.

We would like to express our sincere gratitude to AUN/SEED-NET JICA for their involvement and contribution in introducing us to both of our distinguished keynote speakers, Prof. Kenji Araki and Prof. Kazuhiko Hamamoto, from Japan and to AITI for connecting us to two other distinguished speakers: Dr. Afif Osseiran from Ericsson and Dr. Ksiuk Kweon from Samsung Electronics. Most importantly, we would like to convey our deepest appreciation to all members of the working

committee for their relentless effort in ensuring the success of this conference despite the current pandemic situation that affects most of the planning that requires us to work outside our norms. We thank the publisher for publishing the proceedings, members of the steering committee for their valuable advice and last but not least, Hjh Zohrah binti Haji Sulaiman, our Vice Chancellor.

We would also like to acknowledge our respective sponsors for their assistance indirectly making CIIS 2020 a smooth one despite the pandemic.

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Digital Innovation Towards Sustainable Development Goals



Innovation Development and R&D Project Management in Science Organizations and Universities - Data-Driven Model and Analysis

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Abstract. This study examines the scope and manifestation of innovation development and R&D projects management in science organizations and universities from project and innovation management perspective. For the purposes of the research, a data-driven model is developed in Qlik application by applying datasets from Scopus database (an Advanced Analytical Literature Review-AALR is used). The data-driven model is based on the principles of systematic literature review method and steps on data from more than 360 science articles, included in Scopus database.

Based on the results, provided by the data-driven model and application, analyses conclude the scope of the researched topic and some knowledge gaps. The findings and contributions of the research are: 1) New insights to the topic of innovation development and R&D projects management in science organizations and universities from project and innovation management perspective and 2) Data-driven model and application for systematic literature review (based on word and context analysis).

Keywords: Innovation development · Project management · Science management · University management · Data-driven · Innovation projects

1 Introduction

The current research is motivated by the increasing trend of unsuccessful science projects related to innovation development [1]; [2], ready for commercialization and an extending gap between science and market needs [3]. Previous researches have already revealed insufficient project management skills in science organizations [4], weak knowledge about the full cycle of innovation development [5], absence of practical approach for developing innovations which solve real problems [6] and lack of knowledge for developing innovations with fast product-to-market innovation management approaches [7].

The current paper aims at analyzing through a systematic literature review and application of a specially developed advanced analytics tool for word and context analysis the scope of innovation development and R&D projects management in science organizations and universities. The tool is Advanced Analytical Literature Review (AALR) built on Qlik software and performs a word and context analysis on words and combination of words within science papers title, abstracts and author key words. The systematic literature analysis covers 360 science papers based on different advanced searches in the Scopus database as: “project management”, “science projects”, “innovation management”, “science”, “university”, “science organization”, “R&D projects”, “innovation”, and “innovation projects”.

The structure of the paper starts from reviewing the theoretical background of the innovation development and R&D in science organizations and universities and project management in this kind of organizations. Then a research design is presented and the results from performing the systematic literature review for stating the art of innovation development and R&D projects management in science organizations and universities. The relevance of the research is associated with an increasing need of new innovation developments based on scientific research results as well as the decreasing lifetime of innovation products [8] which additionally extend the need for more effective innovation development and management in science organizations and universities.

2 Theoretical Background

2.1 Innovation Development and R&D in Science Organizations and Universities

Rogers [9] defines the innovation-development process as all the decisions, activities, and their impacts that occur from recognition of a need or problem, through research, development, and commercialization of an innovation through diffusion and adoption of the innovation by users, to its consequences. Back in the 80s of the 20th century, still innovation development has not been largely analyzed and researched [10]. Since then, innovation development is amongst the hottest and most research innovation-related topics.

Innovation development in science organizations and universities has extended scope. The most recent research from 2019 and 2020 focus on the development of innovation capabilities, challenges and future research trend in the UAE high education [11], science and education as reliable segments for the diffusion of innovations and the functioning of technology parks as the most effective organizational and economic form of integration of science and production among all other innovative structures in the world (case of Ukraine) [12], university–industrial relations as the main factor in the development of education (case of polytechnic education) [13], the role of scientific and industrial cooperation in assessing the innovative potential of an industrial enterprise and the approach to evaluation through joint patent and licensing activities [14], etc. This paper proves the need to include an assessment of the level of scientific and industrial cooperation in the analysis of the industrial enterprise innovative potential. Innovation development in universities is also seen as a mean for leveraging social capital in university–industry knowledge transfer strategies [15] by understanding how social capital in university–industry partnerships affect knowledge transfer strategies, which

impacts on collaborative innovation developments. In other research sources, the link between innovation development and science organizations and universities is generally limited to the establishment of an innovation ecosystem [16] and regions development. Especially for the role of universities in the regional development, this role has been seen in the emergence of a third role of universities that has re-shaped and transformed their two traditional functions of teaching and research [17].

Research and Development (R&D) is a common activity in science organizations and in some universities as well. A review of the latest literature reveals some case studies as those of the University of Oulu, Finland which purpose was to examine knowledge-creating interaction in developing an innovation in a multidisciplinary research community with hermeneutic phenomenology, to understand how previous experiences and future prospects shape the process and to examine the circumstances; which support or limit knowledge creation [18]. Most of the R&D research is discussing concrete science activities outside of the management. However, there are few science articles in the literature analyzing the management side of these processes and they are generally related to project management.

2.2 Projects Management in Science Organizations and Universities

Organizations are becoming more project-oriented [19], and projects are the preferred management instrument especially for implementation of new activities [20]. These statements also apply to research organizations and universities. Science and educational institutions usually use a traditional approach for project management (PM). The main knowledge sources of these kind of project management methodologies are the International Project Management Association (IPMA), the Project Management Institute (PMI) which publishes a book on the areas of knowledge in project management (A Guide to the Project Management Body of Knowledge, PMBOK Guide), European Project Management Organizations (EPMO), Association of project management (APM), etc. Most recognized methodology for project management in universities is reported to be PMBOK by PMI [21]. In the literature are also known some attempts for developing and evaluating a project management methodology for university-industry collaborative projects [22] but still they are based on traditional approaches. However, since university-industry projects face specific challenges in understanding and expressing the values required of project management in delivering stakeholder benefits, a framework for understanding, identifying and managing the values of project management in major university-industry R&D projects has been developed by Fernandes et al. [23]. The value of this framework is the provided stakeholders' perspective by identifying the respective PM values for each of six stakeholders' types/collaborations: university-industry consortium; university; industry; R&D external entities; funding entity and society. In the latest years, extensive processes for adapting some flexible project management methodologies and methods have also happening. Consecutively, an Agile project management in university-industry collaboration projects is more and more of the interests of researchers and some case studies are already presented in the literature [24].

Management of performance, leadership and communication are also part of some research papers recently as part of the project management in science organizations and universities. The topic of a professional project manager leading R&D projects instead of scientists is also part of the discussions. Still, most of these projects are managed by principal researchers which hypothesis is analyzed in a research by Cassanelli, Fernandez-Sanchez and Guiridlian emphasizing that the coordinator or project manager is carrying out the search for financing and to manage contracts, resources, cost, time, scope, risk and uncertainty, communication, stakeholders and so on, in addition to internal research activities [25].

3 Research Design

The research design of the paper for achieving data-driven analysis on the topic of innovation development and R&D projects management in science organizations and universities is based on a systematic literature review and the use of a specially developed model and analytical tool for data analytics.

3.1 Systematic Literature Review

For the purpose of defining comparatively wide and still focused scope of the research, an advanced search in Scopus database was first undertaken. It aimed at scoping science papers which are relevant to innovation development, R&D and project management in science organizations and universities. The dataset of science papers received by these searches has been cleaned (by removing duplicates) and uploaded in the Advances Analytical Literature Review software by designing model for their common and generic analysis.

3.2 Model and Tool for Advanced Analytical Literature Review (AALR)

A special model and a tool have been designed and developed to serve the research. The tool is based on Qlik Sense application, which is amongst the best recognized business intelligence tools for data analytics. It is basically used for enterprise data analysis and its application in the current research through AALR is indeed an innovative method for deeper word and contextual analyzing of the topic. It aims at revealing hidden connections between science papers with different focus and different source which are usually misunderstood by the traditional approaches of literature analysis and review. AALR is very useful and extremely appropriate for interdisciplinary research in which the analysis includes literature from diverse science fields.

The tool AALR integrates all the results from the Scopus searches showed in the first step of the research design. AALR is configured with various filters by which the researcher can search and combine different words in order to compare and collate the use of different words within large amount of research papers in their titles, author keywords and abstracts. By doing this, the researcher is able to reveal hidden context, to discuss and analyze the use of words in their context, to make comparison and to identify links between different research. It might be also useful for defining knowledge

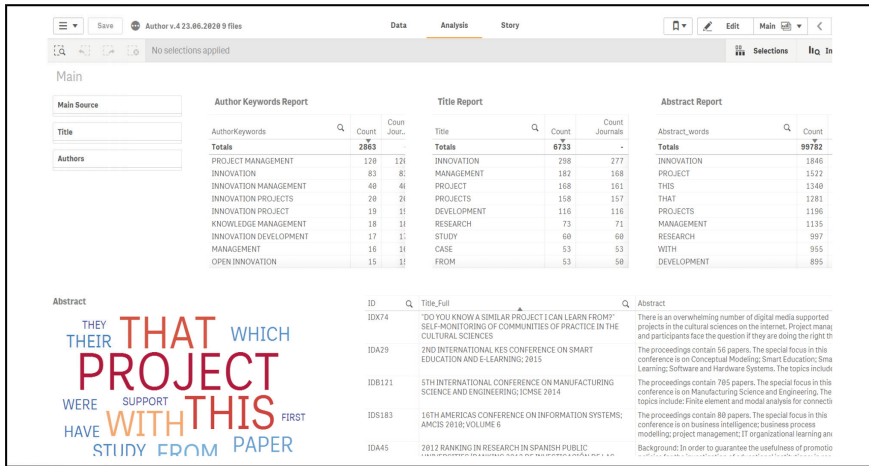


Fig. 1. Data mining tool AALR for word and context analysis of science papers

gaps. In the case of this research and the loaded data in the tool AALR, which is Scopus sourced, the tool has the look presented on Fig. 1.

The tool presents titles, author keywords and abstracts and it decomposes all the words of these components. There are search functionality on each of the sections for titles, author keywords and the abstracts which proposes an advanced search functionality to search by many words or words' fractions. These three filters are combining and the researcher can use three of them independently which will make him/her able to filter science papers on different filtering based on titles, author keywords and the abstracts. In addition, there is an option for the user to select different files from the search and some more features.

3.3 Analyses Performed

First, prior to using the specially developed tool AALR with the uploaded data from Scopus, a simple excel search was performed. An excel filter was added and a search function was started on the base of the titles of the data set. The search was based on science papers, containing the key words, subject of research in this paper. Several more combined searches were undertaken to reveal the work already done on the scope of innovation development and R&D projects management in science organizations and universities.

In the tool AALR, several analyses have been performed, based on word and context analyses. The consequence of the analyses is mainly described on Fig. 2.

The analyses performed with the tool AALR are present in the results' section.

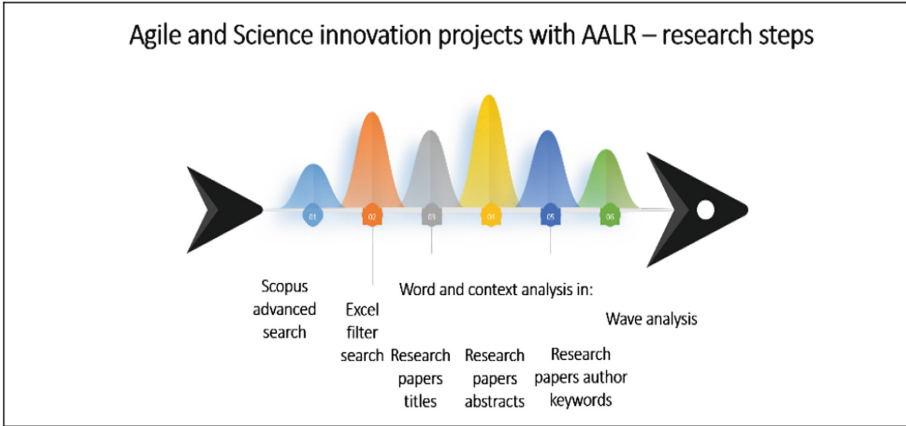


Fig. 2. Research design for a systematic literature review with AALR

4 Results and Discussion

The findings of the research bring insights to audience, interested in innovation development and R&D projects management in science organizations and universities from project and innovation management perspective. The data used is considered reliable since the model and the analyses are based on research papers from Scopus database. First natural exclusion criteria of the data analysis are by excluding any input from the advanced search performed in the Scopus database with these inclusion criteria in it:

TITLE-ABS-KEY (“innovation development”) and TITLE-ABS-KEY (“science projects”)

TITLE-ABS-KEY (“*innovation development*”) AND TITLE-ABS-KEY (“*science organization*”)

It turned out that no one research paper has been published covering the requirements of these two formulas. That means that there is no one research paper, containing simultaneously ‘innovation development’ and ‘science projects’ in title, abstract or authors’ key words. This is also valid for papers, containing ‘innovation development’ and ‘science organization’ together. The research papers meeting the formulas are 839 in total, but because of the close topics within the nine different searches, there are duplicates. After a duplicates remove, the ‘golden source’ for the analyses contains 762 single research papers.

For making the scope clearer and focused, a filtering option is used to funnel the papers which have ‘project management’ and ‘innovation’ in their author keywords. The results by using the model and application AALR show these two terms have been used in 203 papers within the golden source. The results show that the most used words in abstracts of papers, dealing with ‘project management’ and ‘innovation’ are: development, knowledge, process, science, approach, engineering, model, success, factors.

The papers, referring to ‘university’ are 35 in total, containing 55 times the word ‘university’ in their abstracts (as it is presented in the wave analysis above). These 35 research papers are manually analyzed to summarize the current research activities. Only 3 of these focus on university innovation development presented on Table 1.

Table 1. Innovation in university

Authors	Title	Journal and affiliation	Year of publication
Hansen, Irina-Emily; Mork, Ola Jon; Welo, Torgeir [26]	Exploring framework for university-industry innovation projects: building collaborative knowledge platform	European conference on knowledge management Norwegian university of science and technology	2019
Tan Owee Kowang, Choi Sang Long & Amran Rasli [27]	Innovation management and performance framework for research university in Malaysia	International education studies Universiti Teknologi Malaysia	2015
Indrit Troshani; Giselle Rampersad; Carolin Plewa [28]	Organisational adoption of e-business: the case of an innovation management tool at a university and technology transfer office	International journal of networking and virtual organisations University of Adelaide	2011

By analyzing these three papers, it is turned out that innovation development practices in universities are discussed in the literature only as case studies or developing frameworks.

A next analysis is performed to reveal some project management flexible approaches used in universities for project and innovation management purposes. Within the AALR tool, containing the golden source of 762 papers, word filtering in the abstracts was performed (with the assumption that the abstracts hold the biggest quantity of information and they would indicate the usage of flexible project and innovation methodologies even though their usage is not the main focus of these researches). The used flexible project and innovation methodologies for revealing papers dealing with such are: ‘agile’, ‘scrum’, ‘lean’, ‘six sigma’. In addition, in the author key words are selected ‘innovation’ and ‘project management’ and ‘innovation’ in the title so as to funnel the results at their maximum level to the most relevant ones. The results reveal three papers again which meet the set criteria. These are presented on Table 2.

The years of publication of the most focused research papers show increase in the interest towards innovation and project management in universities and science organizations. Meanwhile, the results also show a literature gap on innovation development in universities and science organizations as these papers are so few in quantity.

Table 2. Flexible project management for innovation in universities and science organizations

Authors	Title	Publishing source	Year of publication
Gregory C. McLaughlin, William R. Kennedy [29]	Innovation project management handbook	New York: productivity press	2016
Yordanova Z., Stoimenov N., Boyanova O., Ivanchev I. [30]	The long way from science to innovation – a research approach for creating an innovation project methodology	Lecture notes in business information processing, springer	2019
Philipp A. Lill, Andreas Wald and Ronald Gleich [31]	Agility and the role of project-internal control systems for innovation project performance	International journal of innovation management	2020

5 Conclusion

In conclusion of the presented analyses by using data model and specially developed advanced analytics tool, few findings might be highlighted:

- Project management in universities and science organizations is analyzed in the literature separately from innovation management and development
- Still very few applications of flexible project management models and approaches are analyzed in the science literature
- There is a knowledge gap in the literature on combining innovation management and project management for the specifics of innovation projects in science organizations and universities.
- Some commonly research topics along with innovation and project management in the context of science organizations and universities are: processes, models, performance, technology, collaboration, data and information.

The future work of the author in the context of this research will be focused developing a special framework/methodology for project management of innovations in science organizations and universities with all specifics of this proper environment and affecting factors. The framework will transfer knowledge from the flexible management approaches as Agile, Scrum, Six sigma, Lean Startup, User-centricity and Design Thinking, which are successfully applying in business projects especially for innovation development and innovation management.

Acknowledgments. The paper is supported by the BG NSF Grant No KP-06 OPR01/3-2018.

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