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Factors that contribute to the sustainability of graduate education in Malaysian research-based universities

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ABSTRACT

Today, research is a crucial agenda of universities, and graduate education plays an important role in producing research, publications, and innovation. Thus, the quality of graduate education among Malaysian research universities must be enhanced by exploring the factors that contribute to the sustainability of graduate education. This is done systematically based on relevant literatures and experts' opinions in graduate education. Therefore, the objective of this study is to identify factors that contribute to the sustainability of graduate education among Malaysian research-based universities (RUs). Findings demonstrate that the factors are governance of graduate education, quality of supervision, quality of programs, quality of students, research facilities, research ecosystem, and financial assistance.

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1. INTRODUCTION

A research-based universities (RUs) is devoted to research and graduate studies. In accomplishing the task of discovering new knowledge, RUs are in the privileged position of securing higher research funding. However, recent cuts in public expenditure have affected the allocation to RUs. With higher expectations and less funding, RUs face various challenges in maintaining their status [1]. The biggest challenge is limited funds to ensure high performance in research and teaching in the RUs. Indeed, reducing government funding to the RUs seems to be an emerging pattern globally.

The idea of RUs spread across the globe fuelled by their benefits, which rest on four primary impact domains which are knowledge expansion, economic development, enhanced capabilities of human capital, and societal well-being and quality of life. These four domains are distributed across other functional impact areas. In relation to this, Rhodes [2] claimed that today's universities combine higher education and advanced research and scholarship to serve the public good [3]. The balance between education, research, and services varies greatly between institutions and countries.

In Malaysia, the government supports the original idea of RUs, which normally provides funding in addition to the annual budget allocated to public higher education institutions. Besides having extra financial advantages, RUs have become a magnet for talented students, academicians, collaborators, and industries wanting to reap the benefits of the competitive research environment. Research collaboration with other institutions and industries will further benefit all involved parties economically or socially. The selection of an RUs is based on eight criteria: i) the quantity and quality of the researchers that involved as principal

investigators of research projects; ii) the quantity and quality of the research; iii) the quantity of the graduate students; iv) the quality of the graduate students; v) innovation; vi) the professional service and reward system; vii) networking and collaboration; and viii) the support services [4], [5]. In general, graduate education is a substantial component in evaluating RUs. In order to sustain the RU status, the following aspects are considered for the delivery of graduate education: the curriculum and delivery elements of the program, research and publication, teaching and learning facilities, financial assistance, scholarship and grants, and the support service [6]. To maintain their RU status, universities are moving forward to improve the service delivery and the quality performance of graduate education.

Despite the growing recognition of the critical role that RUs play in advancing knowledge which are fostering innovation, and contributing to societal development, these institutions face numerous challenges in maintaining their status. Recent reductions in public funding for higher education have intensified these challenges, requiring RUs to seek alternative means of sustaining their graduate education programs. The sustainability of graduate education in RUs is of paramount importance, not only for these institutions themselves but also for the broader community that relies on their contributions to knowledge and society. However, a comprehensive understanding of the specific factors contributing to the sustainability of graduate education in Malaysian RUs remains an essential but unaddressed aspect. This knowledge gap presents a significant impediment to the effective planning and management of these institutions. Therefore, this study aims to fill this void by investigating the research university models and concepts across countries and identifying the factors that contribute to the sustainability of graduate education in Malaysian RUs. The research questions for this study are:

i) What are the research university models and concepts across countries?
ii) What factors contribute to the sustainability of graduate education in Malaysian RUs?

This study makes a significant contribution by adopting a holistic approach that incorporates both expert opinions and a comprehensive literature review of research university models in other countries. This distinctive methodology offers a fresh and inclusive perspective on identifying factors for sustaining graduate education in the future. In this study, the University Research System Model (URSM) by Frischmann [7] has been identified as the model that is suitable to be expanded in this study. Therefore, seven components of graduate education dimensions have been suggested based on Frischmann [7] and other research university concepts that frequently practices by other countries. The dimensions are governance of graduate education, quality of supervision, quality of students, quality of program, research facilities, research ecosystem, and financial assistance.

2. METHOD

This study includes two parts: a systematic literature review as a first part and interviews with experts as the second part. The systematic review provides an overview of the critical analysis of completed studies. Through the systematic review process, 130 relevant articles from the year 2000 to 2018 were analyzed to identify the appropriate components of graduate education in sustaining the RUs culture. The inclusion criteria for selecting the articles are articles published from 2000 to 2018 which were mainly on research university and graduate education, articles published in English or Malay, and full-text articles were available for download.

Interviews were conducted with six experts in graduate education and research who were purposively selected based on their academic administrative roles in research or graduate education, experience in supervising and graduating Ph.D. students, and active academic staff positions. The purpose of conducting interviews with experts is to triangulate the findings from the critical analysis of the literature review. The interviews were done face to face and online. The transcriptions of the interviews were analyzed using thematic analysis through NVivo 12. The transcriptions of the interviews were systematically analyzed to uncover themes and patterns within the data. This analysis was conducted using deductive thematic analysis, a method that allows for the identification of predetermined themes guided by established frameworks. To facilitate this process, we employed NVivo 12, a qualitative data analysis software, which streamlined the management and retrieval of coded data segments. The coding approach was deductive, aligning with the seven components of graduate education dimensions outlined by Frischmann [7]. These seven predefined codes served as the foundation for our coding scheme, which was systematically applied to the interview data. Coding was an iterative process, with each transcript reviewed multiple times to ensure accuracy and consistency in code application. This approach facilitated a comprehensive exploration of the data, allowing us to extract meaningful insights and patterns in alignment with our research objectives.

3. RESULTS AND DISCUSSION

3.1. Findings from critical analysis

The research university model and concept has been taken from various studies and categorized according to country, model, and concept, and the context is categorized according to country, model, and concept, and the context is supported and practiced in the RUs. Furthermore, the researcher has identified that the contexts shown tend to emphasize graduate education. Graduate education is one of the important components in RUs whereby it supports the research ecosystem and can become one of the factors sustaining the RUs. There are several research university models, such as The University Research System [7] [8], World Class University Model [9], [10], New American University Model [11], models based on countries; Peru [12], [13], China [14]–[17], Hong Kong [17]–[19], Taiwan [20], [21], Korea [22], Brazil [23], [24], Germany [23], [25], Japan [9], [26], [27], and Singapore [19], [28], [29].

The university model and concept were categorized, and the similarities between them were analyzed according to 10 indicators which were funding (FD), industrial partnership (INP), publication (PB), quality measure performance (QMP), enrolment, student experience and talent (ENR), management, governance and HR (MGH), internationalization and globalization (IG), technology, infrastructure and facilities (TIF), academic, teaching and research (ATR), and financial (FIN). Table 1 shows the matrix of the RUs concept with the ten indicators across countries. Subsequently, Table 2 shows the mapping of graduate education dimensions by Frischmann [7] with the ten indicators of RUs. The mapping provides valuable insights into how graduate education dimensions relate to the broader context of research universities, enriching understanding of their significance.

Table 1. Matrix of research universities with 10 indicators

Country	FD	MGH	ATR	ENR	QMP	IG	TIF	INP	PB	FIN
Malaysia	/	/	/	/	/			/	/	
Korea	/	/	/	/						
India	/	/		/	/		/	/		
China	/	/	/		/	/	/			
Japan	/	/		/		/				
Taiwan	/	/	/						/	
UK	/	/		/		/	/			/
US	/	/	/		/					
Germany	/	/	/	/		/				/
Australia	/	/	/				/	/		
Singapore	/	/								
Brazil	/				/	/	/			
	12	11	7	6	5	5	5	3	2	2

Table 2. Mapping of graduate education dimensions with 10 indicators of research universities

Graduate education dimensions	FD	INP	PB	QMP	ENR	MGH	IG	TIF	ATR	FIN
Governance of graduate management		-				/	-			
Quality of supervision									/	
Quality of students			/	/	/					
Quality of program			/	/					/	
Research facilities								/		
Research ecosystem					/			/	/	
Financial assistance	/									/

3.2. Findings from interviews

3.2.1. Dimension of graduate education

The findings from the interviews align with and corroborate the critical analysis of previous research on the factors influencing sustainable graduate education. The results of the interviews are shown in Figure 1. According to the interviews, all six experts verified the dimensions of graduate education to be: i) governance of graduate education; ii) quality of supervision; iii) quality of programs; iv) quality of students; v) research facilities; vi) research ecosystem; and vii) financial assistance. Each interviewee elaborated upon and verified the seven dimensions of graduate education based on their background and experiences as an administrator in research, in graduate academic management, in graduate student affairs, or as an academician who had recently received a Ph.D. and undertaken the graduate education journey in a Malaysian RUs.

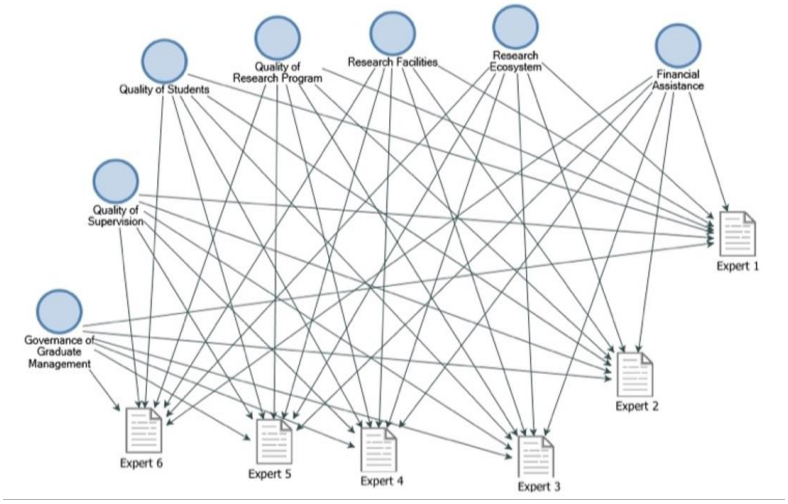

Figure 1. NVivo analysis – seven dimensions of graduate education

3.2.2. Governance of graduate education

According to the interviews, for the first dimension, governance of graduate education, the highlighted items are structure, custodian, budget, strategic communication, research institutes and centers, scope, standard operating procedure, code of practice, and policy. Four experts commented on governance structure (Expert 2, Expert 4, Expert 5 and Expert 6), but their comments differ from one another. The following are their comments:

> Expert 4: "*Since graduate research students work towards the goals of the Deputy Vice Chancellor Research, it is more appropriate for the graduate school to be part of this portfolio. But I suggest that the institution should have a clear governance structure.*"
> Expert 2: "*Governance of the university is dependent on the resources and organizational structure of the university. At the end of the day, there is no right or wrong model for it.*"

From the comments and suggestions, it has been discovered that the governance structure is very important to accomplish the mission and goal of the institution. Besides, this structure also determines the operational efficiency of the institution. Figure 2 shows how the connections between the responses from expert's link with the sub-factors of the governance dimension.

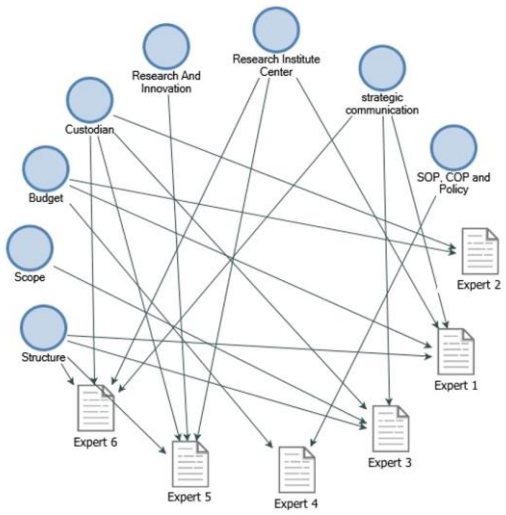

Figure 2. NVivo analysis – governance of graduate education

Several research [30]–[32] have proposed that governance encompasses various aspects, such as the implementation of university curricula, the operational processes for student selection, the appointment procedures for professors, budget approval, and arrangements related to institutional strategic planning and implementation. In line with their findings, this study has gathered data from experts who highlighted key elements in the governance of graduate management, including organizational structure, custodianship, budgeting, strategic communication, research institutes and centers, scope, standard operating procedures, codes of practice, and policies. These findings indicate alignment between the Governance of Graduate Management factors proposed by the experts and those suggested by Aghion *et al*. [30].

3.2.3. Quality of supervision

Based on Figure 3, all the experts have agreed on the need for competent and good quality supervision for the second dimension (quality of supervision). Thus, the supervisor must undergo a specific training course to prepare them to supervise graduate research students. There were four out of the six experts (Expert 1, Expert 3, Expert 2, and Expert 5) pointed out that to be a supervisor, it is suggested the potential supervisor attend specific publication courses and obtain a research grant to supervise research students with the current demand of publication and the nature of research that needs financial assistance to fund the research activities.

> Expert 1: "*All supervisors, in order to supervise, need a research grant, especially for those who are in science and technology, as it requires a lot of funds to do analyses and so on. Even in the field of social science, some allocation and funding for data collection is needed.*"

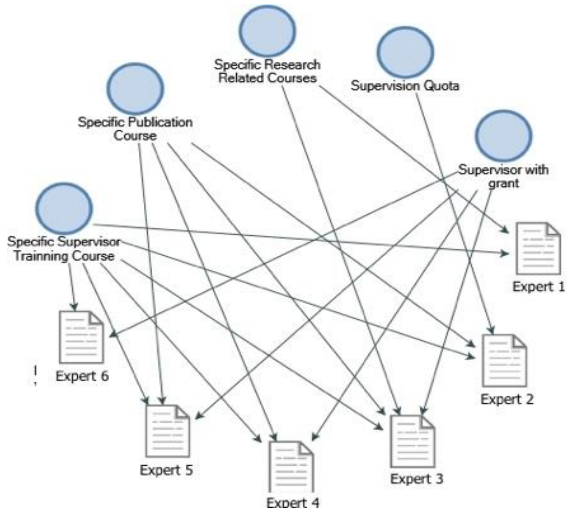

Figure 3. NVivo analysis – quality of supervision

All the interviewees have agreed that supervision training is compulsory to prepare the supervisor with adequate training in supervision skills to set standards and requirements for quality supervision. Their consensus underscores the pivotal role that supervision training plays in preparing effective supervisors, ensuring the delivery of high-quality supervision in various educational contexts. The following is an example of Expert 3's comment:

> Expert 3: "*Supervisor training is compulsory for new supervisors because all supervisors must undergo a certain process before qualifying as a supervisor and being fair to students. It is good for supervisors to be prepared to train and guide students.*"

This finding aligns with the previous researches [25], [33], [34], which emphasized the importance of proper training in doctoral supervision and recognized the role of psychological processes of learning in the challenging nature of doctoral training. These earlier studies have highlighted that doctoral training extends beyond research practice and theory-based activities, emphasizing the need for training interventions to enhance the capabilities of academic professionals. In line with this existing literature, the present study

has identified the quality of supervision as a crucial aspect and suggested that potential supervisors should attend specific publication courses and secure research grants to effectively supervise research students.

3.2.4. Quality of student

Quality of students, the third dimension, emphasizes the admission requirements, enrolment of students, skills, publications, and bridging program as presented in Figure 4. Five interviewees elaborated on the enrolment of graduate students and publication. The comments are that the enrolment of graduate students is one of the key components in RUs. Other than that, graduate students play important roles in producing research.

> Expert 4: "*One of the key components of any research-intensive university is a vibrant cohort of graduate research students.*"
> Expert 2: "*To sustain a research university, the priority is to have many students to do research and research grants to finance the research activity.*"
> Expert 5: "*Yes, it should be associated. Besides academicians, the research value chain for the RUs should also definitely involve students.*"

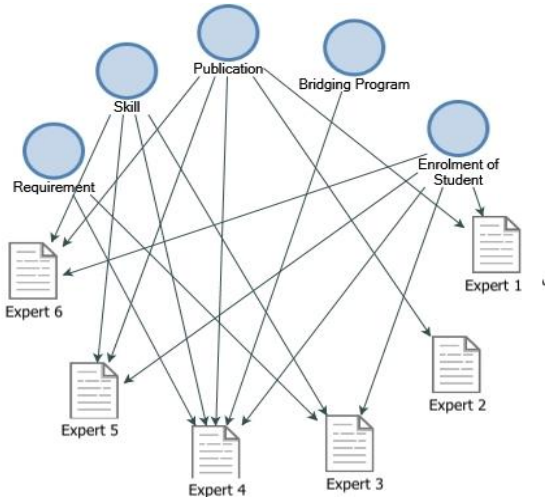

Figure 4. NVivo analysis – quality of students

In this present study, the important indicators identified for assessing the quality of students were skills, publications, and bridging programs. These indicators reflect the capabilities and the quality of the students enrolled in the institution. Although there are no specific requirements for skills upon admission, skills will be developed during the study process. However, if the potential students already have them, this represents added value for the supervisors and institutions to expediate the learning and research to produce superior outcomes. The following is an example of Expert 2's comment:

> Expert 2: "*In terms of skills, before entering Graduate Education, I didn't specify any skill requirement as long as the student had a good attitude to learning during the process of getting their master's degree or Ph.D.*"

On the other hand, one of the experts (Expert 3) emphasized that the system and supervisor must be good and competent in the first place to encourage and develop the graduate students' skills while they are on the program. Furthermore, language is one of the key points for graduate students, as the materials and resources are all in English. In addition, other soft skills are also important while doing research. Grapragasem *et al.* [35] emphasized the significance of English proficiency as a criterion for admission.

3.2.5. Quality of program

The fourth dimension which is program quality, consists of research output in a program, the impact and output of the program, publication, income generation, research weightage, and the graduate program as displayed in Figure 5. All of the expert interviewees believed that the issue was not about whether the

program should focus more on the taught course or full research, it was about the research output from the program and the publications. Furthermore, the taught course program can also have a master's project, meaning that students conduct research.

The publication has long been a main output for research. Graduate education is no exception to the requirement for students to publish during their study before submitting for examination. Good quality debates and discussions were held about publications according to their research area, whether it was engineering, science and technology, or social science and the humanities.

Expert 1: "*I totally disagree that only certain fields of research can produce high impact publications. According to Scopus, NUS produce 48% of high impact publications from the social science field.*"

Expert 3: "*As for publication, all fields have chances to publish in top journals according to your area. Even though it is less citation it can be a Q1 journal despite of how much the impact factor can be from 0.01 to 60 in natural sciences. But it depends on how good of the research that you did.*"

Figure 5. NVivo analysis – quality of program

3.2.6. Research facilities

The fifth dimension, research facilities, includes services for graduate students offered by the institution providing the graduate education. Figure 6 shows interviewees' responses on all the sub-factors of the fifth dimension. Research facilities include laboratories, equipment, materials, software, workspaces, and access to online material, such as journal articles, to support the learning process of graduate education. The ecosystem can be divided into research equipment, conducive workspaces and research laboratories, collaboration with other research facilities, online resources, research material, and maintenance. Such facilities are essential to expanding graduate education.

Expert 4: "*Having the facilities needed to do the research is definitely a must.*"

Expert 3: "*This is not taken into consideration when we have a lot of students but to queue for the same equipment and do the experiment outside the university.*"

Expert 5: "*Yes. It is a must to have adequate research facilities to relate it to RUs status.*"

A conducive working environment refers to a good place in the RUs simply because such an environment will stimulate calm and creativity to produce good quality research. Even though the nature of research differs from one field to another, the environment can have a positive impact. The following statement captures Expert 3's comment:

Expert 3: "*Other than research facilities and equipment, we also need to provide students with a space for a conducive working environment. For example, universities overseas provide very good workspaces so that the student feels motivated and comfortable to study, and it is better than their home, so they feel they don't want to go back. The great environment will stimulate the student to be creative and calm and helps them to produce a good quality research output.*"

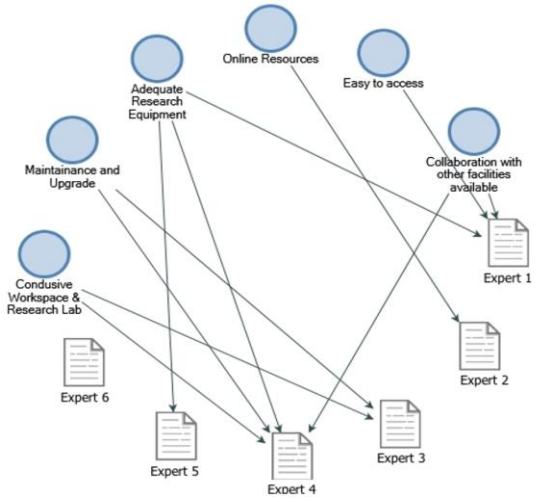

Figure 6. NVivo analysis – research facilities

According to the interviews, three of the six experts (Expert 3, Expert 5 and Expert 6) mentioned that equipment and laboratories are important for graduate students to conduct their research. They normally queued for the same equipment, and at times, students must use other institutions' facilities. In their discussions, these experts emphasized that the limited availability of equipment and laboratory space did not only hamper the efficiency of graduate students' research but the resource allocations for improving the facilities needed to be increased as well.

3.2.7. Research ecosystem

Next, Figure 7 shows the NVivo analysis of the sixth dimension, namely, the research ecosystem, which combines the physical and environment of the research education in an institution. The research ecosystem in a university includes an efficient centralized support system, skill development training, organizing workshops and conferences, basic study plans, and research structure and research proposal workshops. Four out of the six interviewees emphasized that an efficient centralized support system is crucial to graduate education simply because students need good support to help them with their studies and research. The support must be centralized so all students can refer to one place to obtain the support. Skills and development training for graduate students must be conducted alongside the program to prepare students with the necessary attributes and skills after graduation. In the interviewees' experience, most RUs provide what the student needs, but further improvement is required. Here are the thoughts they shared:

Expert 2: "*We have a good support program for students compared to where I've been taking my PhD in the UK. But the thing that we need to improve is the quality, and the response time must be quick and appropriate when students require assistance.*"

Expert 3: "*There is general and specific support for expert PG students. We need a good support system for students; for example, if a student needs to use research software such as SPSS, MATLAB, the university should have a one stop center and experts to guide them and conduct training and assistance. One more example - we can also have a one stop center to periodically provide training for writing theses, journal papers, and making presentation slides.*"

Expert 5: "*Yes, the university should initiate more support programs. I believe that these could enhance and nurture the research culture and values.*"

Expert 6: "*Integrated, incorporated, strong support systems... they are a must have.*"

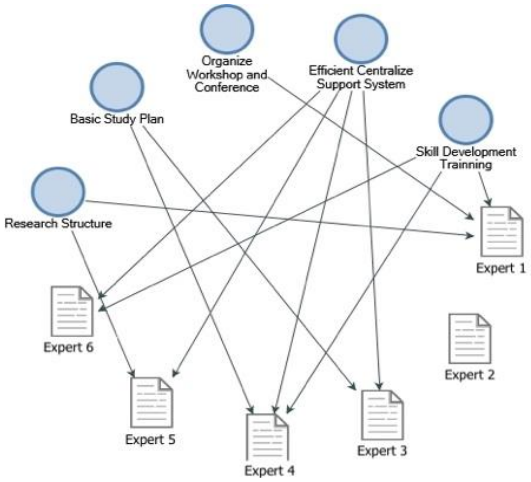

Figure 7. NVivo analysis – research ecosystem

3.2.8. Financial assistance

The seventh and final dimension is financial assistance. Financial assistance is the most important element in graduate education as shown in Figure 8. Without financial assistance, no students will be enrolled to conduct research and follow the program. Thus, RUs must provide monetary support and find allocations for financial assistance. All the interviewees agreed that all supervisors should be provided with a grant to conduct research. In supervising research students, supervisors must be entitled to research grants to offer the students the support they need. However, due to the current economic state, research grants are very limited and competitive for them is fierce.

Effective graduate education expansion requires a sufficient budget, as highlighted in previous study [22], [36], who underscored the resource-intensive nature of RUs that rely on public funding and external sources to support vital elements such as academic governance, talented human resources, and academic culture. The interviews with experts in this study further echoed the challenges posed by limited scholarships, allocations, funding, and research grants due to insufficient internal funds. All the comments from the interviewees show that they viewed it as essential:

Expert 1: "*Social science also needs some allocation and funding for data collection.*"
Expert 2: "*To sustain a research university, the priority is to have many students doing research and research grants to finance the research activity.*"
Expert 3: "*For financial assistance, I feel that we still lack the budget to provide in terms of quantity for students. We provide only a limited quantity of financial assistance as we have a limited budget allocation and research grants.*"
Expert 5: "*Maybe there should be plenty of scholarships and research grants.*"

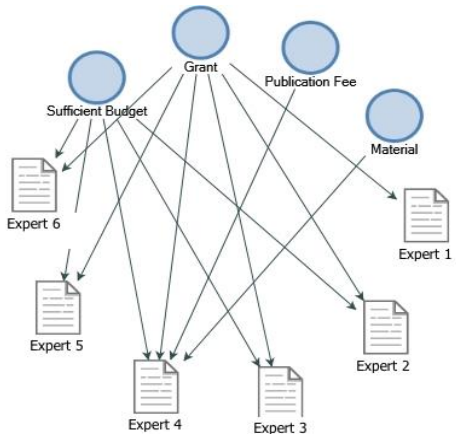

Figure 8. NVivo analysis – financial assistance

4. CONCLUSION

This study draws on the determinants contributing to the sustainability of graduate education in Malaysian universities. Employing the URSM as its foundational framework, it identifies specific factors integral to sustainable graduate education, including governance of graduate education, quality of supervision, quality of research programs, quality of students, research facilities, research ecosystems, and financial assistance. These findings align with prior research and underscore the pivotal role of these factors in upholding the quality and success of graduate education. Moreover, this study extends the URSM theory by introducing two additional dimensions, encapsulating human capital within quality of supervision and quality of students, governance capital within governance of graduate management and quality of research program, physical capital within research facilities, intellectual capital within research ecosystems, and financial capital within financial assistance, providing a comprehensive framework tailored to the context of sustainable graduate education in Malaysia.

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