JOURNAL OF GOVENANCE AND INTEGRITY (JGI)
ISSN: 2600-7479 e-ISSN: 2600-786X
VOL. 5, ISSUE 1, 141 – 154
DOI: https://doi.org/10.15282/jgi.5.1.2021.6619

ORIGINAL ARTICLE

SUPERVISOR SELECTION FOR POSTGRADUATE RESEARCH PROGRAM IN HIGHER EDUCATION USING DATA ANALYTICS

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ABSTRACT – Research supervision is one of the important aspects of academic quality assurance, especially on academic integrity. Lack of literature reporting strategy for assuring academic integrity in research supervision at higher education is a concern. This study aims to develop a supervisor selection strategy with data analytics based on research project profiles from the institutional research databases. We reviewed the indicator of academic integrity in research supervisory from the standard in masters and doctoral degree by Malaysia Qualification Agency (MQA), international recommendation by UNESCO and Islamic principles with three main aspects: supervisor, administrator and student. This study adopted data analytics and visualization technique using a cloud-based collaborative platform as a research method for data acquisition, processing, and analyzing the data. The researchers acquired the research project profile data registered from a public university in Malaysia. We categorized and mapped the research profile according to the Malaysian Research and Development Classification System (MRDCS) code. The combined data was been analyzed and visualized to a specific online dashboard to indicate the research experience in a fraction of years as a metric. The researchers evaluate the characteristics of the dashboard based on the academic integrity indicators from MQA, UNESCO and Islamic principles. The result shows that there is potential usefulness of the proposed strategy in assuring academic integrity for supervisor selection in post-graduate programs. This novel approach has a potential impact on academic integrity in higher education which can be adopted at a larger scale by higher education institutions in Malaysia.

ARTICLE HISTORY
Received: 1-7-2021
Revised: 3-7-2021
Accepted: 28-8-2021

KEYWORDS
Supervisor selection
Academic integrity
Quality assurance
Data analytics

INTRODUCTION

Qualified researcher is very important human resource in order to progress either from economy, social and political aspects for sustainable development goal. Qualified researcher at the moment only can be produced through post-graduate research program at accredited institution. One of the important aspect related to post-graduate research program is research supervision. It is part of academic quality assurance in higher education and typically associated with accreditation process. The significant of good supervision also applicable to the undergraduate program especially when there are specialized research activities. Poor clarity of criteria in appointing a supervisor for research-based post-graduate program not only directly affect the future of the post-graduate student themselves but also the scholars' integrity(Gray & Jordan, 2012). For example, it is the role of supervisor to evaluate and anticipate students under his supervision to conduct the research in proper and ethical manner according to the disciplines and code of honour. But when supervisor is lack of research experience in the related field of disiplines, there are tendency for poor supervision proces. At the micro level, this incompetency may lead to poor guidance, irrelevant advices and lack of constructive feedbacks for the students. While at the macro level which is more critical, it may affect the integrity of knowledge or science itself as a primer reference for many aspect of human life jeopardizing reliability and loss of public trust(Robishaw, DeMets, Wood, Boiselle, & Hennekens, 2020) on science. This issue is like a time-bomb that waiting to explode the higher education sector when there are already various issues on corruption and academic fraud in higher education as critically addressed by UNESCO(Poisson, 2016). Based on the number of literatures on "*academic integrity*" in SCOPUS database, there is an obvious lack of attention on the supervisor while many of them focus on the students' context. Table 1 shows the summary of the SCOPUS search results.

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Table 1: Literatures from SCOPUS research database (19 June 2021)

Search Keywords	Document results
TITLE-ABS-KEY ("academic integrity")	1200
(TITLE-ABS-KEY ("academic integrity") AND ("student"))	1013
(TITLE-ABS-KEY (" academic integrity") AND ("supervisor"))	21

The issue of academic integrity has been addressed in research for almost 80 years oriented on student characteristics(James, 1933), yet there is still a gap in term of practice particularly on quality assurance aspect on supervisor's criteria related with research practice. On the practice point of view, the call to re-evaluate all related criteria by refering to the criteria of supervisor in post-graduate program which have been addressed by national accreditation body (MQA, 2021). However, the standard do not specify how to appoint the qualified supervisor. Currently there is lack of data-driven decision making to facilitate faculty to identify qualified supervisors based on research areas. Futhermore, the needs for faculty to have their autonomy in decision making related with their disciplines create the situation become more challenging.

Realising the important of academic integrity in higher education from the aspect of supervisor research credibility, this study aims to propose a data-driven decision making with research supervisory matrix based on research experience which being mapped together with the latest Malaysian Research and Development Classification System (MRDCS), MQA, UNESCO and Islām.

LITERATURE REVIEW

Academic integrity in higher education

As post-graduate research program prepares student to become a competence researcher, the supervisors' research credibility and issue like mismatches have been known are significance factors affecting the quality of the program (Almusaed & Almssad, 2020; Cardilini, Risely, & Richardson, 2021; Orellana, Darder, Pérez, & Salinas, 2016). With the latest MQA standards for master and doctoral degree (MQA, 2021), it mentions clearly the duration of research experience for qualified supervisors. Table 2 shows the criteria of supervisor from the MQA standards.

Table 2: Supervisor criteria from MQA Standard (MQA, 2021).

Level	Supervisor	Co-supervisor
Master degree	i. The principal supervisor must have a doctoral degree. ii. Where the principal supervisor has a master's degree in the field, the principal supervisor must; a. Have at least 5 years' experience in teaching and research; AND b. Has co-supervised master's candidate. iii. The supervisors must go through structured supervisor training. iv. The HEP Senate may impose other criteria it deems necessary.	i. Co-supervisor must have a doctoral degree. ii. Where the co-supervisor has only a master's degree in the field, the co-supervisor must have at least 1 year experience in teaching AND research. iii. A co-supervisor from the industry or practitioner must at least a bachelor's degree and have at least 5 years of experience in the field at a level appropriate for the dissertation. iv. The supervisors must go through structured supervisor training. v. The HEP Senate may impose other criteria it deems necessary.
Doctoral degree	i. The principal supervisor must have a doctoral degree, and	i. Co-supervisor must have a doctoral degree.

	a. have at least 2 years of teaching experience and research; AND b. has supervised master's or doctoral research candidate to completion. ii. Where a principal supervisor has only a master's degree, extensive experience in research is required in addition to conditions in (i)(a) and (i)(b), and subject to approval by the Senate of the HEP.	ii. Where a co-supervisor has only a master's degree, extensive experience in research is required and subject to the approval of the Senate of the HEP. iii. A co-supervisor from the industry or practitioner must at least a master's degree and at least 10 years of experience in the field at a level appropriate for the thesis. iv. The supervisors must go through structured supervisor training.

While there is no mention about the specific field of research in Table 2, it has stated the standards for the Item 4.1.11: "*The research skills, experience and specialisations of a supervisor must be aligned with the research area of the candidate."*

Based on Table 2, a supervisor is required to have teaching and research experience in the related field of the proposed topic of the candidate with specific duration time. From the international point of view, there are variation of view on academic integrity in higher education. Based on literatures, some scholars relate the issue on academic integrity as academic dishonesty(Archibong, 2013), academic fraud(Lewellyn & Rodriguez, 2015) and academic corruption (Nabaho & Turyasingura, 2019). This global issues have been addressed by UNESCO specifically by International Institute for Educational Planning (IIEP) to develop strategies in supporting countries to improve university admissions and create university charts of ethics(UNESCO, 2021). According to IIEP, there are six recommendations how to address the issue related with academic integrity in higher education as shown in Table 3. This paper however, limits the review from the context of supervisory in research program. Therefore, these six recommendations later will be used as evaluation items of our proposal since the recommendation are addressing the academic integrity in general, which might and might not applicable to our context of the proposed method in supervisor selection.

Table 3: Recontextualization of IIEP recommendation

	Misconduct Behaviour(UNESCO, 2021)	**Relevance to Research Supervision**
1.	Regulating the market with transparent criteria	No
2.	Reducing the risk of conflicts of interest	No
3.	Developing standards and codes of conduct of academic integrity	No
4.	Using more effective and transparent management tools	Yes
5.	Facilitating public access to information	Yes
6.	Establishing and using awareness indicators, i.e., 'red flags'	No

Archibong has listed 21 examples of the form of dishonesty or academic misconduct asscociated with academic staff as shown in Table 4. Our study synthesize the list of misconduct from the list by evaluate its' relevency to the context of research supervisory. Based on that synthesis, all the context of supervision misconduct happens after the appointment of supervisor and none of them focuses on the issue related with qualifying supervisor appointment. This is the limitation of the existing literature(Archibong, 2013) that our study attempt to address.

Table 4: Mapping academic staffs' misconduct with research supervision

	Misconduct Behaviour(Archibong, 2013)	**Relevance to Research Supervision**
1.	Forcing students to buy textbooks with assignments attached	No
2.	Forceful/compulsory sale of substandard text to students	No
3.	Collection of money to change grades for students	No
4.	Exchange of grades for sex	No
5.	Extortion of money as typing fee	Yes
6.	Writing project and seminar papers of students for money	Yes
7.	Leakage of examination question	No

8.	Swapping of names for publication in order to take credit	Yes
9.	Plagiarism/ use of student's ideas	Yes
10.	Inclusion of name to publish paper one did not contribute to	Yes
11.	Falsification of data/research finding	Yes
12.	Taking adjunct lectureship in more than one place at a time	No
13.	Absenteeism from work	No
14.	Giving students exam without teaching	No
15.	Allowing students to cheat in examination hall through poor supervision	No
16.	Covering up exam malpractice cases	No
17.	Awarding undeserved scores to students/arbitrary award of continuous assessment scores	No
18.	Falsification of exam record	Yes
19.	Allowing students to mark students' scripts	No
20.	Victimization of students who do not "cooperate"	Yes
21.	Delay in preparing students results	Yes

A literature(Tiong, Kho, Mai, Lau, & Hasan, 2018) which studied the academic dishonesty among academicians in Malaysia founds that around 52.5% of the academics (n=141) responded having personally encountered at least one case of academic dishonesty involving their peers. The study has identified the predisposing factors that lead to academic dishonesty cases as shown in Figure 1. From their study, the factors were scored from 1 to 3 where, 1 = Low significance; 2 = Moderate significance; 3 = High significance. The results in the figure were ranked based on their average score starting with *lack of integrity* (average score = 2.55), *desperation for promotion* (average score = 2.34), *excessive workload* (average score = 2.28), *lack of commitment* (average score = 2.28), *greed for money* (average score = 2.24), *lack of research skill* (average score = 2.11), *poor supervision by superior* (average score = 2.00), *wanting to be popular among students* (average score = 1.82), *lack of feedback from students* (average score = 1.67) and *pressure from students and parents* (average score = 1.59). Although the *lack of research skill* which can be measured from research experience is just scored nearly moderate significance, this factor is directly affect the quality of good supervision. This argument is aligned with another literature(Mitchell & Carroll, 2008) which highlighted the lack of supervisor familiarity with the rules of research might be one of the reason that links to data falsification, data fabrication, deception and misreprensetation as well as plagiarism. Yet, these factors although provide insightful direction for our research, it is not addressing the aspect of matching the research area between student and prospect supervisor, in evident-based and transparent manner.

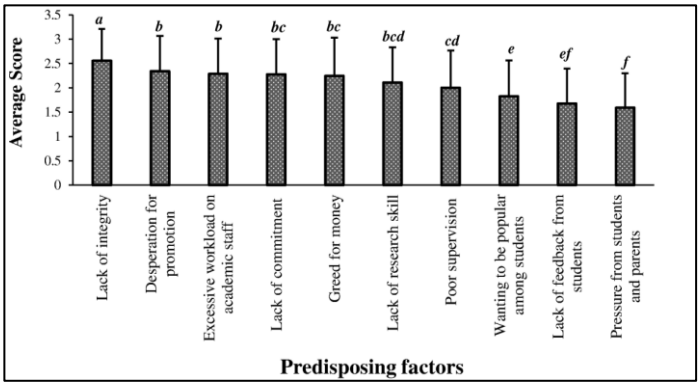

Figure 1: Predisposing factors of academic dishonesty in Malaysia (Tiong et al., 2018)

In general, skill is the ability to do something well or also refer to expertise. For example, publishing a high quality research paper required a certain and specific skills not only in writing but also crafting a good problem in research into an article that worth to pay attention on. A supervisor without such skills who look for promotion or annual appraisal of job performance may desperately or intentionally act to swap the names in research publication for credit. Although the student might agree due to unequal power of relationship with possibility of exploitation(Oberlander & Spencer, 2006), such act did not conform the code of practice in authorship. Nevertheless, publication is just one of the outcomes of the research project and it comes with a good research skills in scientific manner. This intangible aspect can be measure with verified academic qualifications and research experience. Academic qualification is compulsory but research is the field that always evolve, therefore evidence of research experience from the research project is more appropriate to be used as a basis to measure research skills. This review has lead to the following research questions:

RQ1: how to match the research field of supervisor with the candidate?

RQ2: how to measure the research skills competency of potential supervisor in objective and transparent way?

Research experience indicator: *h*-index vs research project

With the use of digital system, many scholar used *h-index* when it come to measuring research works. For some institution, the use of Google Scholar, SCOPUS and Web of Science (WoS) to measure the research impact of individual scholar has become a norm either for appointment as supervisor or examiner(Rizal et al., 2020) as well as for tenure and promotion(Dehnad, Abdekhoda, & Atatalab, 2019) in higher education. It is an index formulated by Hirsch to quantify the research output based on the number of publication and citation(Aoun, Bendok, Rahme, Dacey, & Batjer, 2013). While it is useful in some cases, still the index alone does not encompass the overall cycle of research competency required for supervising candidate in post-graduate program. This complete cycle of research requirement become more critical when coming to match the research area as highlighted by the latest MQA's requirements. Therefore, a more comprehensive mechanism to measure research competency of supervisor is critically required. One of the potential approach is by reviewing the input, process and output (system approach) of the research itself since the purpose of post-graduate program is to train the candidate to become a qualified researcher. More comprehensive useful information to measure research experience is the record of research projects or received research grants that been conducted by the academic staff or potential supervisor. In Table 5, we illustrate the system and argue *h-index* alone is not sufficient to measure research competency for conducting research supervision. The table highlights the context of *h-index* is useful for measuring research competency compared to experience in research projects.

Table 5: System approach of research process in post-graduate program

System Component	Research competency	*h-index*	Research project/grant
Input	Write research proposal		X
	Defence research proposal		X
	Secure research funding		X
Process	Encourage research collaboration		X
	Conducting data collection		X
	Performing data analysis		X
	Supervise post-graduate student		X
	Write report		X
Output	Knowledge: Publish findings in journal/conference	X	X
	Knowledge: Publish thesis		X
	Technology: Register intellectual property (IP)		X
	Creative works (e.g poster or digital contents for exhibition)		X

Other reasons why research project information is more reliable to be used as the reference in evaluating research experience of a scholar are: (1) the research project require proper registration with proper assessment especially when it is financially funded, and (2) there are data about the timeframe or project duration which useful for complying MQA requirements on the duration of research experience. By classifying the research project into the cluster that already been identified in the MRDCS catalogue, the needs to match the research area of supervisor and student become more feasible. Furthermore, the risk of misrepresentation of qualification and credentials(Mattar, 2021) as academic malpractice which is one of the issue in academic integrity can be minimized during supervisor appointment. Thus, the next research question is:

RQ3: how to organize these data to facilitate faculty in making decision in appointing the qualified supervisor?

Malaysian Resarch and Development System (MRDCS)

The Malaysian Research and Development Classification System (MRDCS) is a system that under Ministry of Science, Technology and Innovation to classify and describe research activities in Malaysia to the highest detail and accuracy (MOSTI, 2021). It works as a basis for the measurement and analysis of R&D activities for the government policy makers, industrialists and researchers. There are two type of classifications in the MRDCS version 6.0 which are Field of Research (FOR) and Socio-Economic Objective (SEO). FOR is used to classify the R&D activities according to their scientific and academic disciplines which is highly relevance with the context of our study. While SEO is used to categorize the sectoral benefits as perceived by the researchers. This part however is less significance to be reviewed in the context of this study on research supervision.

According to MOSTI, the coding system of MRDCS is been designed in hierarchal structure. There are four hierarchal levels for FOR, starting at the *Division* (broadest level), *Category*, *Group* and *Area*. The *Area* is the finest indicator and where research project is allocated or registered. For every level, a unique number or code can be assigned so it can be easily referred. Based on MRDCS, the format to represent the code of research project can be illustrated as in Figure 2.

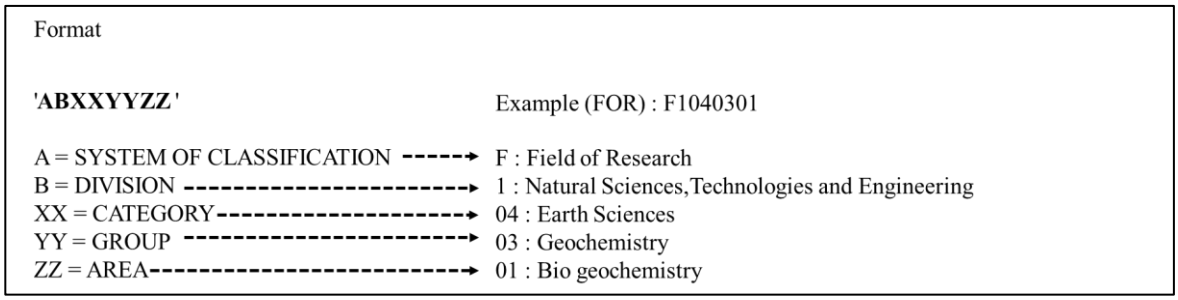

Figure 2: MRDCS format

In MRDCS version 6, there are 9 research divisions have been identified in which there are more sub-clusters which known as FOR. The summary of number of FOR for each division is summarized in Table 6. Based on the total number of FOR in MRDCS, it is quite overwhelming for a scholar to select one of them in order to match with the research project.

Table 6: Division and number of field of research (FOR) in MRDCS ver 6.0

	DIVISION	FIELD OF RESEARCH (FOR)
1.	NATURAL SCIENCE	969
2.	ENGINEERING AND TECHNOLOGY	435
3.	MEDICAL AND HEALTH SCIENCES	424
4.	SOCIAL SCIENCE	376
5.	ECONOMIC, BUSINESS AND MANAGEMENT	360
6.	AGRICULTURE AND FORESTRY	244
7.	INFORMATION, COMPUTER AND COMMUNICATION TECHNOLOGY	219
8.	HUMANITIES	165
9.	BIOTECHNOLOGY	127
	TOTAL	**3319**

Currently, there is lack of literature related to the integration of MRDCS in the context of post-graduate supervision selection process. This is where our study is positioning at, i.e. to evaluate the usefulness of MRDCS classification in quantifying the research experience. Theferore, the next research question is:

RQ4: How relevent the inclusion of MRDCS in the decision making of research supervisory in post-graduate program?

Islamic principles in supervision

In this study, the researchers also review the academic integrity based on Islāmic principles whereby three main individuals in a research are being analyzed. They are: 1- supervisor, 2- administrator and 3- student. From the role of prospective supervisor, the individual must have sufficient knowledge and practice in the related research in order to make him/ her eligible to become the supervisor. But what is more important is the honesty and saying the truth when there is a mismatch of the research topic between the supervisor and student. Action to honour the people who know the subject matter is one of the principles in Islām. Yet to admit own self lack of knowledge in the topic that is not within his knowledge is also an act of honour with the truth. It is a normal practice in Islām to say "I dont know", which even the Angels did not feel ashamed to admit in such a way based on what been mentioned in al-Quran as follow:

قَالُوا۟ سُبْحَٰنَكَ لَا عِلْمَ لَنَآ إِلَّا مَا عَلَّمْتَنَآ ۖ إِنَّكَ أَنتَ ٱلْعَلِيمُ ٱلْحَكِيمُ ﴿٣٢﴾

"*We do not have any knowledge except that which You (Allāh) have taught us*" (Al-Qur'ān, 2:32).

While for the administrator or managerial team, they must make sure that the research supervision is appointed to the qualified supervisor. Doing research is about seeking new knowledge, it is critically important to assign a supervisee to a supervisor who is knowledgeable in that particular field of research. The decision to give the trust must be conducted with duly assessment, just and high integrity. This is significant in order to assure the reliability of decision and avoiding unjustice or corrupted research supervision practice. This principle complies with the verse of al-Qur`ān as follow:

۞ إِنَّ ٱللَّهَ يَأۡمُرُكُمۡ أَن تُؤَدُّواْ ٱلۡأَمَٰنَٰتِ إِلَىٰٓ أَهۡلِهَا وَإِذَا حَكَمۡتُم بَيۡنَ ٱلنَّاسِ أَن تَحۡكُمُواْ بِٱلۡعَدۡلِۚ
إِنَّ ٱللَّهَ نِعِمَّا يَعِظُكُم بِهِۦٓۗ إِنَّ ٱللَّهَ كَانَ سَمِيعَۢا بَصِيرٗا ٥٨

"*Indeed, Allāh commands you to render trusts to whom they are due and when you judge between people to judge with justice. Surely is that which Allāh instructs you. Indeed, Allāh is ever Hearing and Seeing*" (Al-Qur'ān, 4:58).

Meanwhile as for a student, the individual should find the right supervisor of the research area based on his/ her belief based on the knowledge and practice of the supervisor, in the respective research area. Its not acceptable in Islām for a student just merely choose any supervisor he/ she finds without assessing the supervisor's eligibility and credibility. This is inline with Islamic principle based on the story of two prophets, from the context of learner and teacher which narrated as follow:

قَالَ لَهُۥ مُوسَىٰ هَلۡ أَتَّبِعُكَ عَلَىٰٓ أَن تُعَلِّمَنِ مِمَّا عُلِّمۡتَ رُشۡدٗا ٦٦

"*Moses said to him (prophet Khidr), "May I follow you on the condition that you teach me the right knowledge of what you have been taught?"* (Al-Qur'ān, 18:66).

All Islamic principles reviewed from the context of research supervision are directly related with the aspect of academic integrity. Speaking the truth, rendering trusts to the right supervisor and finding the right supervisor, are all related with information transparency. One should not claim what is not when there is a transparent information of what is and what is not. So our last research question is:

RQ5: how the mentioned Islamic principles for the supervisor, administrator and student can be compliment with modern data-driven decision making strategy?

Summary

In summary, there are many parameters or indicators to represent academic integrity in research supervisory. It could be overwhelm to review all of them, and may not assist for practical implementation for our study. Based on the reviewed literature, we summarize the indicators of academic integrity in post-graduate research supervisory as in Table 7.

Table 7: Academic integrity indicators

Source	Indicators
MQA	Aligning research experience of the supervisor with the research area of the student.
	Enough years of experience in the research.
UNESCO	Using more effective and transparent management tools
	Facilitating public access for the information
Islamic Principles	Supervising research that he/ she has experience with.
	Rendering trust to the right supervisor based on evidence.
	Seeking supervisor that has experience with the specific research area.

METHODOLOGY

In order to seek the answers of all the research questions, we develop an online dashboard based on the sample data of research project conducted in one of public university in Malaysia. The overall our research design is represented with Figure 3.

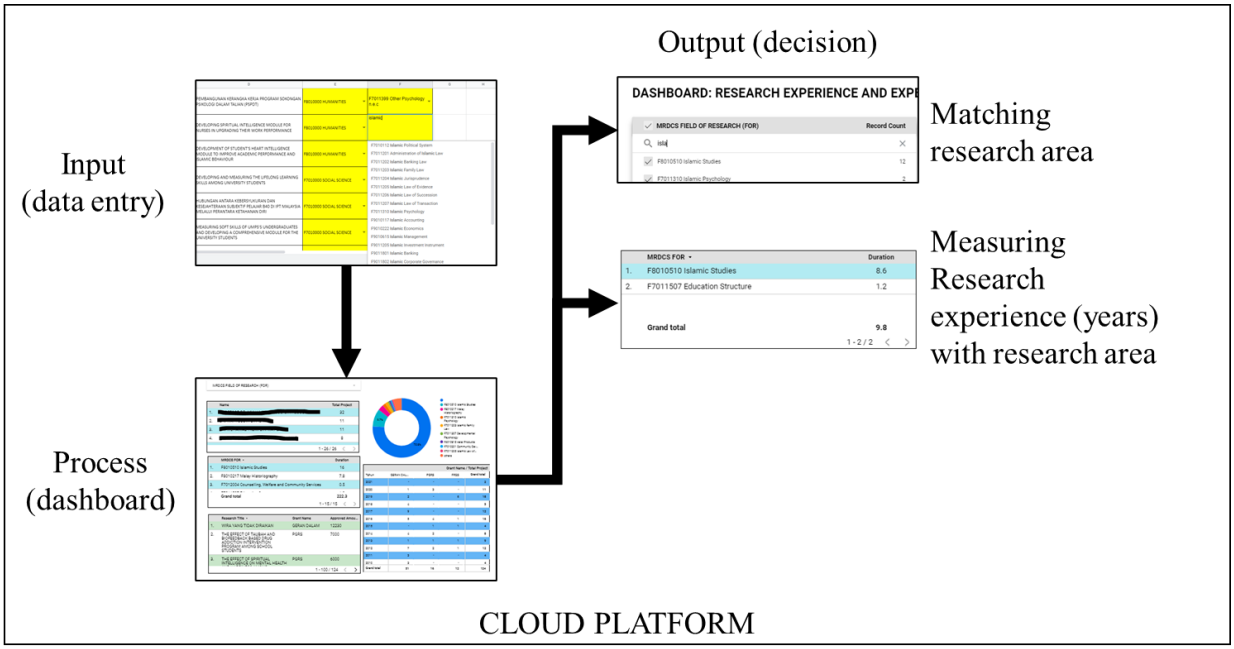

Figure 3: Research design

The method for the dashboard development in this study is illustrated as follow:

1. Acquiring raw data from Department of Research Management.
2. Organizing data in cloud-based collaboration platform (Google Sheet).
3. Creating error-free (drop-down list) user-entered selection of research area classification from MRDCS for each registered research project.
4. Sharing the URL to the respective academic staffs.
5. Filling up the most relevance research area for each project associated as principal investigator (PI).
6. Pre-processing data for project duration.
7. Creating online dashboard for analyzing the dataset.
8. Performing an evaluation of the dashboard by in appointing supervisor.
9. Evaluating dashboard characteristics compliance status with MQA, UNESCO and Islamic principles.

All the data acquired from the respective department are general information which could be seen in the university's website; no personal information is disclosed in this study. The cloud-based collaboration data acquisition platform used in this study is also known as Google Sheets. This method of acquring data require no special skills in software development as it is commonly been used and practiced in higher education community either for teaching and research(Almache Granda & Ramirez-Avila, 2020; Kunicki et al., 2019; Rideout et al., 2016). To avoid user from scrolling down one by one all the list of FOR which consist of more than three thousands selection, we implement the autocomplete technique in FOR selection as illustrated in Figure 4. It is based on the concept of human computer interaction that minimize the effort and time of the user to complete the task. This effective strategy is useful for selecting one FOR associated with the nature of the research project in the dataset. This technique enable users to quickly find and select from a pre-populated list of values, combining task of searching and filtering in one single interaction. This auto-complete technique is not only been widely applied in software design process on improving user experience(Jensen, Hansen, Eika, & Sandnes, 2020), but also been adopted in research as well(Ward, Hahn, & Feist, 2012). In other words, it increases the efficiency of data entry process.

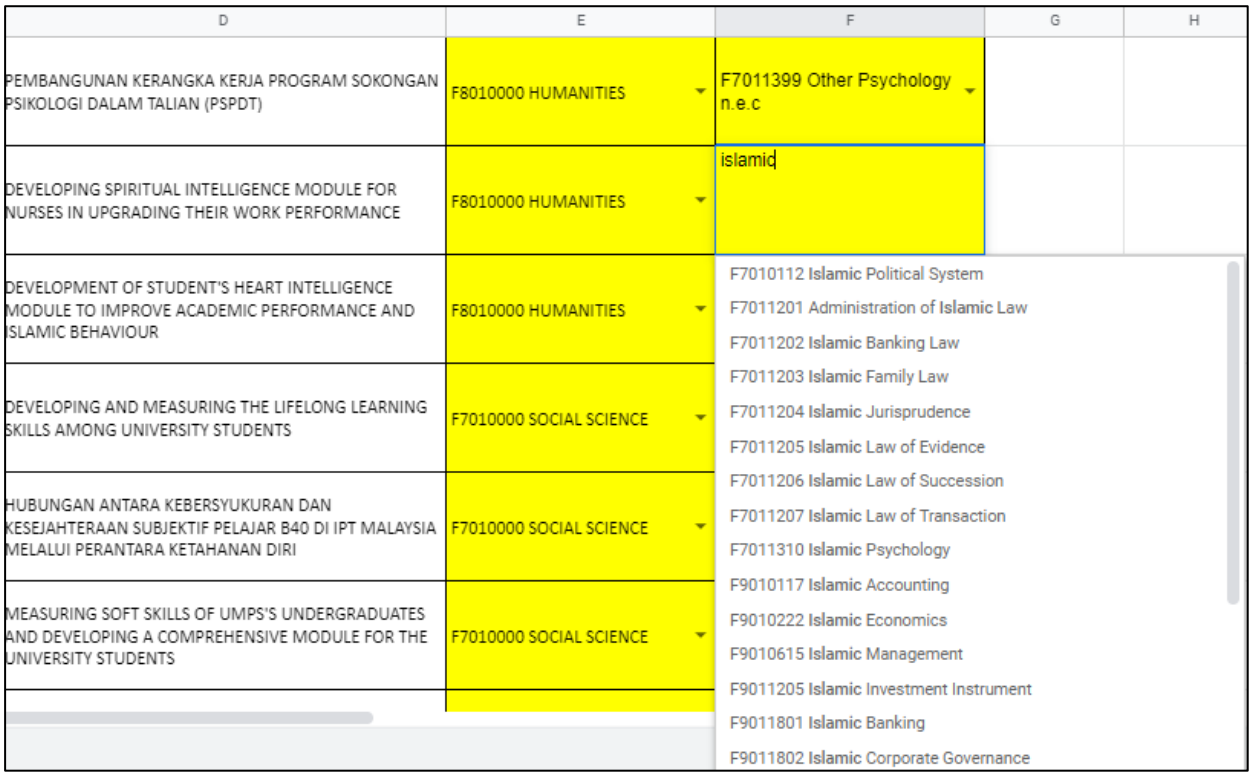

Figure 4: Efficient data entry strategy in cloud-based collaboration platform

While the acquired data is still in the form of raw data, there is no summary or analysis yet can be used to assist faculty in measuring research experience of potential supervisor. In this stage, we adopt the cloud-based business analytics tool for creating dashboard based on the acquired data in the Google Sheets. The name of tool is Google Data Studio, which is free to use, it requires no high performance computer for analysis. The data we acquired from the university department of research are consist of project ID, staff ID, staff name (principle investigator), research title, start date, end date, extension date (if any), faculty, approved amount, research sponsor and sponsor category. Based on the start date and end date values, we generate a new field of data to represent the duration of research in fraction year unit by using spreadsheet formula to calculate number of days between two dates. Finally, the dashboard is created based on the dataset as shown in Figure 5.

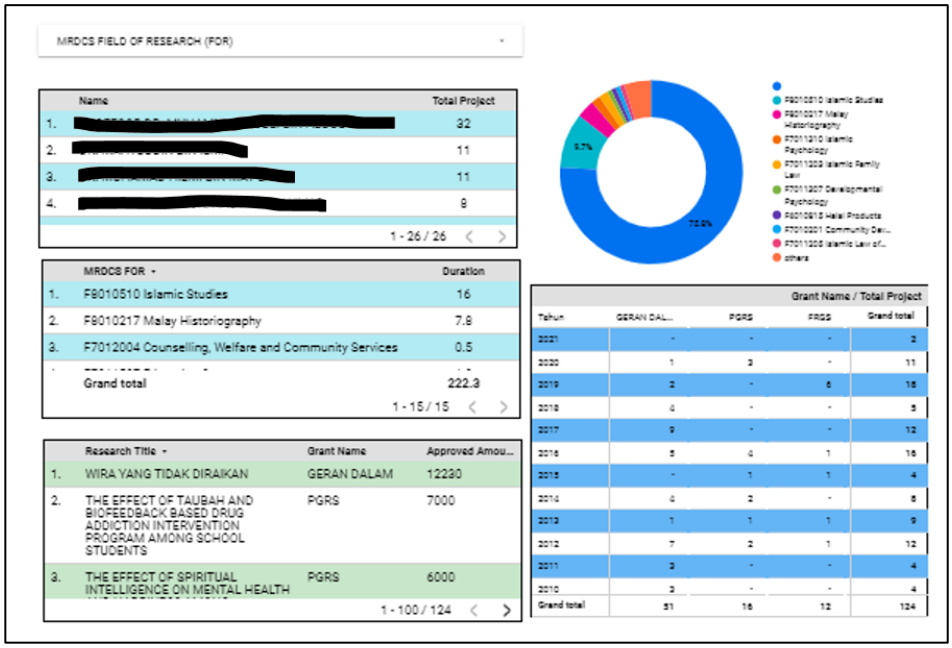

Figure 5: Dashboard for research supervisory expertise

RESULTS AND DISCUSSION

There are five research questions that been developed when we reviewed the existing literatures oriented the issue of academic integrity which related to supervisory appointment in higher education. All those research questions are been discussed based on the findings in the following sub-sections.

RQ1: How to match the research field of supervisor with the candidate?

By mapping the research experience of academic staff with the list of field of research (FOR) from MRDCS, our developed online dashboard enable users to search and filter information of the research area of the potential supervisor in matching with the student's research area. This function can be used by the administrator and prospect students for searching the potential supervisor through online access since the dashboard is deployed in cloud environment. Through this way, the access of information can facilitate the selection process assuring the match of the field between supervisor and student objectively as shown in Figure 6. Thus, it is possible to match the research field of potential supervisor and the post-graduate candidate or student. In fact, the same method can be used in assigning an internal examiner as well as the external examiner for the thesis.

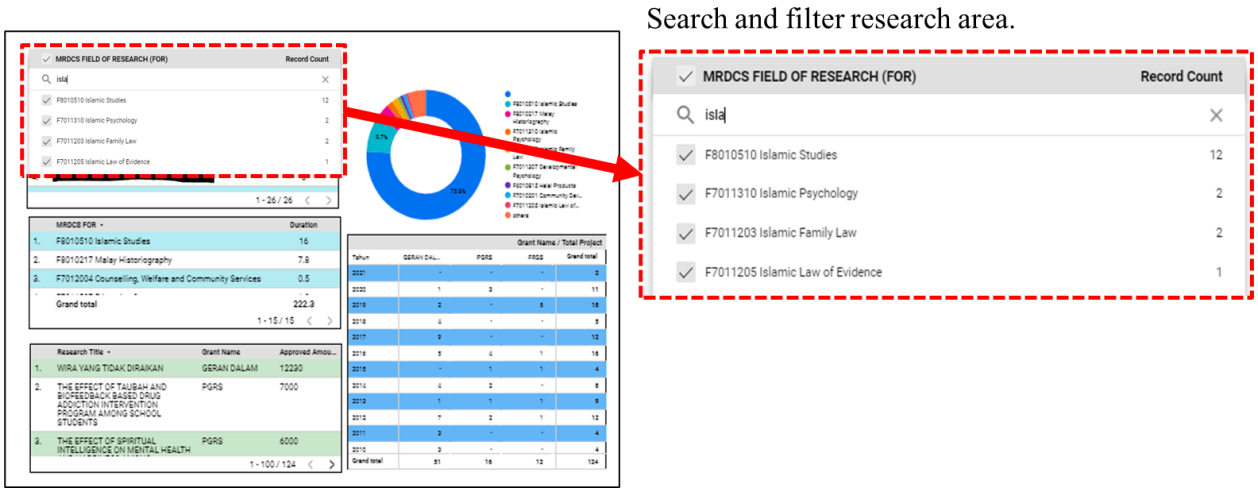

Figure 6: Search and filter to match research area

RQ2: How to measure the research skills competency of potential supervisor in objective and transparent way?

As for research competency, we can measure it based on the years of research experience in specific for field of research. The current challenge is, there is no specific information indicate a quantifation of this experience objectively. The MQA requirement is year of experience, hence we measure it based on exact duration of research project conducted by the potential supervisor. Based on the dashboard, we have quantify the duration of research experience by calculating the fraction of years based on the start date and the end date of the research project as illustrated in Figure 7. This measurement model proves that research experience of potential supervisor can be measured objectively and transparently.

In the case of student who engaged in cross-discipline or multidisciplinary type of research, our proposed method also can be used in finding the qualified supervisors either as a main supervisor or co-supervisor for the respective student. For example, student who studying the aspect of humanity and digital technology can be supervised by one supervisor from human science and another supervisor from computer science. Another case is the pairing of experienced academia who has rich experience in supervision with the junior academia who may lack of supervision experience but pose good research skills in the topic. These could be two scenarios that may exist in higher education which our tool can be useful in assuring good quality of student learning experience in conducting research with good supervision by qualified supervisor or supervisors.

However, our proposal may not applicable for the case of appointing supervisors from industry who may not have proper records of research experience in institutional information system or database. Nevertheless, the evaluation of research experience should be evaluated based on certain high credential data which can be included and structured like in our proposal. Additional data other than research experience can be acquired from potential supervisors in industry is their working experience in certain projects. The projects might relate with research activities indirectly as mentioned by new standards from MQA in Table 2. The use of data from professional online social network like LinkedIn may

compliment the need of additional information of working experience of potential external supervisors from industry. For example, a potential industrial supervisor who works as business analyst may not have similar structure of data or information like our proposal. The working experience is useful and might relevant to the needs for supervisor selection. With the concept of interoperability in web application, the data of working experience can be included in integrated manner in the dashboard as long as the required data is available.

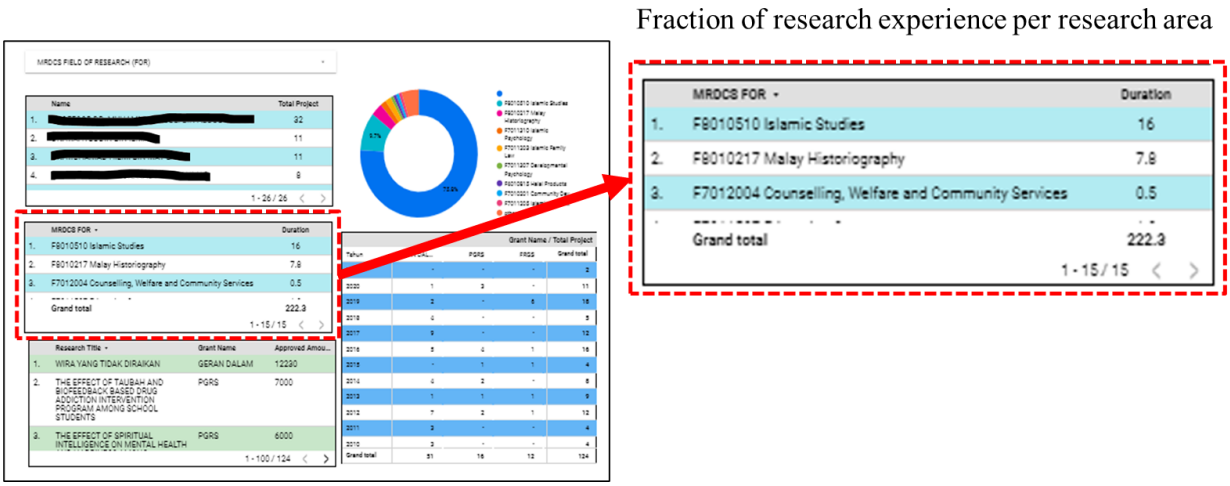

Figure 7: Measuring research experience with fractional year of research project duration

RQ3: How to organize and properly visualize these data to facilitate faculty in making decision in appointing the right supervisor?

Commonly, aspect of tendency in decision making process is influenced by the quality of arguments, perception and belief of those who are accountable to make the decision. This scenario also called as bias, an act of inclination or prejudice for or against one person or group, especially in a way considered to be unfair. In the context of appointing supervisor, this aspect is where a sound judgement can be exercised with data-driven decision making. Based on the quantitative data analysis of years of experience for specific FOR of the research project, the potential of being bias can be minimized as much as possible although it cannot be elimited being in zero bias. With data analytics and visualization, the process of cognitive evaluation could be achieved easily. In addition, the use of cloud-based collaboration platform such as Google Sheets and Google Data Studio enabling convinient and secured data processing and information sharing. So this approach is the answer for the third research question, the used of data analytics and visualization method with cloud-based collaboration technology can facilitate the faculty to share information in transparent manner. Therefore, it make the task for selecting the qualified supervisor easier to be done with data-driven comparative analysis of their research experience in specific FOR.

RQ4: How relevent the inclusion of MRDCS in the decision making of research supervisory in post-graduate program?

Although MRDCS is been developed by Ministry of Science, Technology and Innovation (MOSTI), it is relevance and directly affects the higher education sector. This is because the system for research classification has been mentioned to be used as a basis for the measurement and analysis of R&D activities. Post-graduate research supervision is part of R&D activities based on the boundaries of R&D activities defined by MOSTI(MOSTI, 2021). Therefore, this answer the fourth research question that justify the inclusion of MRDCS is relevent in the context of research supervisory in post-graduate program.

RQ5: how the mentioned Islamic principles for the respective related individuals can be compliment with modern data-driven decision making strategy?

With data-driven decision making strategy, there is a small possibility for a supervisor to claim the expertise of research area that beyond his/ her actual research experience. This means, the chance to lie is very low. When the appointment of supervisor also been practiced by administrator with such strategy, it minimize if not eliminate the grey area in determining the research area of the prospect supervisor. This means that the evaluation of supervisor appointment is been made with just. Since the dashboard can be set to be accessed by public, any students may seek potential supervisors. They can evaluate by themselves either the potential supervisor has the relevent research experience with their research interest. It is clear that, this modern data-driven decision making stategy complies with the Islamic principles.

Overall assessment

The needs for information transparency to supervisor, administrator and student can be evaluate based on the technical criteria how information is accessible. To simplify this information, we illustate it in the form of matrix in Table 8. The information of research experience is not a classified information as it can promote the expertise of the scholar and potential collaboration among scholars. Many scholars have published their research experience online for professional networking. Our data-driven decision making through cloud-based dashboard is the first been reported in research that uses the same data in a new meaningful, transparent and objective situation. Providing easy access are the novel aspect for our study that yet not been explored and highlighted by existing literatures.

Table 8: Qualitative evaluation of the proposed model

Academic Integrity Parameters		Dashboard: Research Experience and Expertise		
		Supervisor	**Administrator**	**Student**
MQA	Aligning research experience of the supervisor with the research area of the student.	Yes	Yes	Yes
	Enough years of experience in the research.	Yes	Yes	Yes
UNESCO	Using more effective and transparent management tools	Yes	Yes	Yes
	Facilitating public access for the information	Yes	Yes	Yes
Islamic Principles	Supervising research that he/ she has experience with.	Yes	Not related	Not related
	Rendering trust to the right supervisor based on evidence.	Not related	Yes	Not related
	Seeking supervisor that has experience with the specific research area.	Not related	Not related	Yes

CONCLUSION AND RECOMMENDATION

This paper reports the first attempt of data analytics can be adopted to measure research experience objectively and transparently for research supervisory appoinment in post-graduate program. This approach compliment with the needs of national standards of academic quality assurance by MQA, UNESCO and Islamic principles. Our adopted methodology utilized cloud-based collaboration platform that can be replicated by academic community in other higher education institution. We believe this work is relevant and adaptable by higher education institutions in Malaysia. The novelty of our work is the proposed method of using data analytics based on MRDCS code for finding the match of the student's research area with the research experience of supervisors. Our evident-based approach can be a promising tool by higher education institution and policy maker how supervisor selection can be improvised with academic integrity assurance in place.

This concept and practice can be further expand towards becoming a standard operating procedures (SOP) or code of conduct at institutional level for academic quality assurance in higher education. As for future research, this study can be expanded to study the feasibility of developing a software agent or middleware with web application programmable interface (API) for profiling scientist and researchers nationwide as prospect supervisors based on existing datasources from national research grant application systems from Ministry of Higher Education and Ministry of Science, Innovation and Technology. It then can become a public dashboard profiling scientist and researchers that accessible by any prospect post-graduate student or higher education institution in finding and appointing prospect supervisor, examiner or collaborator for their post-graduate study.

ACKNOWLEDGEMENT

The authors would like to thank the Department of Research and Innovation, Universiti Malaysia Pahang (UMP) for the data used in our study. Also special thanks to Mrs Ainil Nilam binti Mohd Mokhtar from MQA for the review and feedback of this work.

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