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Blockchain Framework of UiTM Postgraduate Tracking System (UPTrackS) for Good Governance Practice

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Abstract

Traditional bureaucracy in universities deters good governance. Moving to digital bureaucracy, like digital governance that uses blockchain technology, improves transparency, accountability, and efficiency. A digital architecture called UiTM Postgraduate Tracking System (UPTrackS) leverages blockchain technology to manage governance procedures. According to a poll on UPTrackS deployment, the system delivers sound governance, with a confidence rating of 7.9 out of 10. Enhancing the computer literacy skills of administrative employees and improving the user interface of the system they use are necessary steps to enhance efficiency. Additionally, implementing these changes can lead to better administrative practices that adhere to good governance principles.

Keywords: Digital Bureaucracy; Good Governance; Postgraduate Governance, Blockchain

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1.0 Introduction

Postgraduate research programmes have a substantial impact on the standing of universities. The Malaysian University Research Assessment (MyRA) score for UiTM from 2014 to 2018 is given in Fig. 1. Section D of Fig. 1 shows the quantity and calibre of postgraduate students who have contributed more than 20% of the total MyRA scores for UiTM. The management of academic procedures across UiTM's 27 postgraduate study centres is operated manually. The number of new students enrolled at UiTM has increased steadily between 2000 and 2021. The new student enrolment in 2021 has increased compared to enrollment in 2000, with 5026 and 821 new students, respectively. Although postgraduate students have played a significant role in UiTM's ranking, the university still employs traditional bureaucratic procedures for academic governance, such as appointing supervisors, defending research proposals, and submitting theses. The processes required students to submit application forms to the appropriate postgraduate academic office. Students and supervisors expressed their dissatisfaction with the conventional bureaucratic governance procedures.

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Some of the problems include unclear decision-making procedures, inefficiency, and insufficient monitoring of the status of applications. The processes require a significant amount of time, resulting in indirect increases in costs and the need for thorough monitoring.



Fig. 1: UiTM's MyRA Score Performance from 2014 to 2018

The governance process is consistent with blockchain procedures, as the procedures consist of a digital ledger of reports for each transaction. The blockchain is a decentralized and immutable digital ledger that records transactions chronologically and securely. It consists of a blockchain, each containing a set of procedures. These blocks are linked using algorithm techniques, creating a continuous and unchangeable history of transactions and procedures. This technology ensures transparency, security, and trust without a central authority, making it valuable for applications beyond cryptocurrencies, such as supply chain management, voting systems, and governance procedures. Implementing blockchain through the Information and Communication Technologies (ICT) can create a transparent and tamper-proof record of governance actions, decisions, and transactions. Each step of the governance process can be recorded on the blockchain, ensuring a publicly accessible and immutable audit trail.

This paper aims to demonstrate the integration of blockchain technology in the digital postgraduate bureaucracy for effective governance. The paper includes a framework of the system and a detailed discussion of its components for the postgraduate governance process at Universiti Teknologi MARA. Then, the user's feedback for good governance, such as (1) User-friendly, (2) Process transparency, (3) Standard practice, and (4) accountability perception, are analyzed and discussed.

Nomenclature

ANOVA	Analysis of Variance
CPS	Centre for Postgraduate Studies
df	Degree of Freedom
ICT	Information and Communication Technologies
IRES	Research Information
LNPT	Academic Staff Annual Report
MyRA	Malaysian University Research Assessment
MS	Means Square
MQA	Malaysia Qualification Agency
PRISMA	Publications Repository Information System Management
SIMS	Students Information Management System
SS	Sum of Squares
UiTM	Universiti Teknologi MARA
UPTrackS	UiTM Postgraduate Tracking System

2.0 Literature Review

To improve the delivery of public services, policymakers and governing bodies need to transform the governance and administrative processes. The bureaucracy, which includes hierarchical roles, work selection, human resource division, and standard operating procedures, is essential in governing public services (Jamaluddin, 2018). However, poor governance has led to a negative perception of the bureaucracy, making it necessary for policymakers to improve public service performance. The utilization of ICT in public services is essential to transition from a conventional paper-based administration to a completely digital one that effectively utilizes ICT, and this is necessary to accomplish the objective. By doing so, a new governance and administrative process can be developed that leverages digital technology. ICTs have already been utilized by government and corporate sectors to transform their services from traditional

delivery methods to digital governance and e-governance. (Saldanha, Dias, and Guillaumon 2022, 2; Misuraca, Broster, and Centeno 2012).

Good governance plays a crucial role in improving the quality of higher education. Universities must practise good governance practices to provide better services and create a positive learning environment for their students (Muhsin et al., 2020). The importance of good university governance cannot be overstated, as it takes precedence over the transformation of institutions, functions, and social roles (Croucher et al., 2020). When combined with accountability and transparency, good governance assures the quality of decision-making, ensuring the long-term viability of the university (Ruiz et al., 2020). It also serves as an entry point to enhance institutional performance and the delivery of education services (Lewis & Pettersson, 2009) and to balance autonomy and accountability (Fabrice & Mitterle, 2010).

Blockchain is a popular topic of conversation across industries. Adopting blockchain technology in the teaching and learning process will benefit the university in improving existing processes and mechanisms. Several higher education institutions have used blockchain technology to develop various higher education solutions and methods. Studies have been carried out in the library process (Hoy, 2017), study loan process (Gazali et al., 2017), academic certificate authenticity (A. Gayathri et al., 2020; Jha, S.K. 2022), university student record (D. Tapscott et al., 2017) and grading system (M. Turkanović et al.,2018). Fig. 2 shows the EduCTX framework for European credit transfer. The blockchain system enables credit transfer between universities to become more reliable and transparent. Because the blockchain system is transparent, effective and accountable, higher education institutions focus on implementing blockchain technology to boost productivity. Paper-based or manual transaction processing can be replaced with blockchain technology. It also reduces administrative costs and spares much paperwork. Students and institutions benefit from blockchain technology because it provides a more concentrated and particular understanding of how students interact with the university. Blockchain technology allows students to track their progress from application to course registration and postgraduate research progress (T.J. Gopane, 2019).

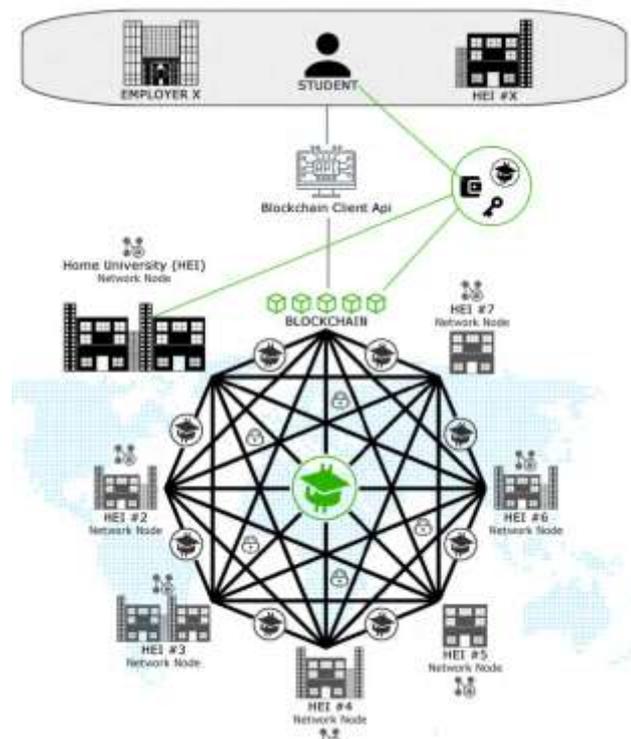


Fig. 2: EduCTX Blockchain Framework for Education Credit Platform (M. Turkanović et al.,2018)

In the current era of globalisation, ranking methods have reshaped the geopolitics and geoeconomics of higher education, elevating them to an international level (Jons & Hoyler, 2013). Universities must ensure that their teaching and learning quality meets the standard requirements specified by the relevant qualification agencies to comply with global education frameworks such as the Washington Accord and Sydney Accord. Good university governance practices ensure that the institution's programs are recognised worldwide (Bajunid, 2011). In Malaysia, the Malaysian Qualification Agency (MQA) is a government-appointed quality assurance agency responsible for ensuring that all academic programs offered by Malaysian institutions meet the requisite standards. The MQA provides academic qualification standards for both undergraduate and postgraduate programs and outlines the requirements for each program.

The governance for postgraduate study by research in Malaysian universities applies a bureaucratic process. The ecosystem in postgraduate research involves supervisor nomination and appointment, defence of research proposal, and thesis assessment. A traditional bureaucracy in postgraduate management uses numerous paperwork and needs to be more transparent, effective, and efficient. This paper discusses the application of a digital framework that fills the gap of the blockchain application to provide a good governance digital ecosystem in the postgraduate governance process.

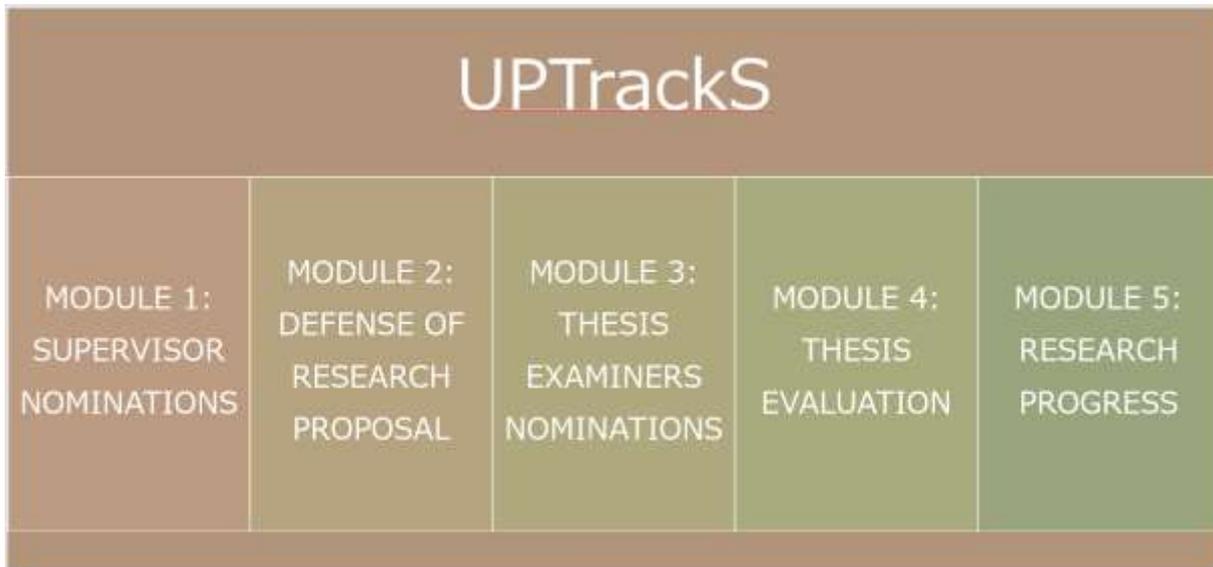


Fig. 3: UPTrackS Modules Framework

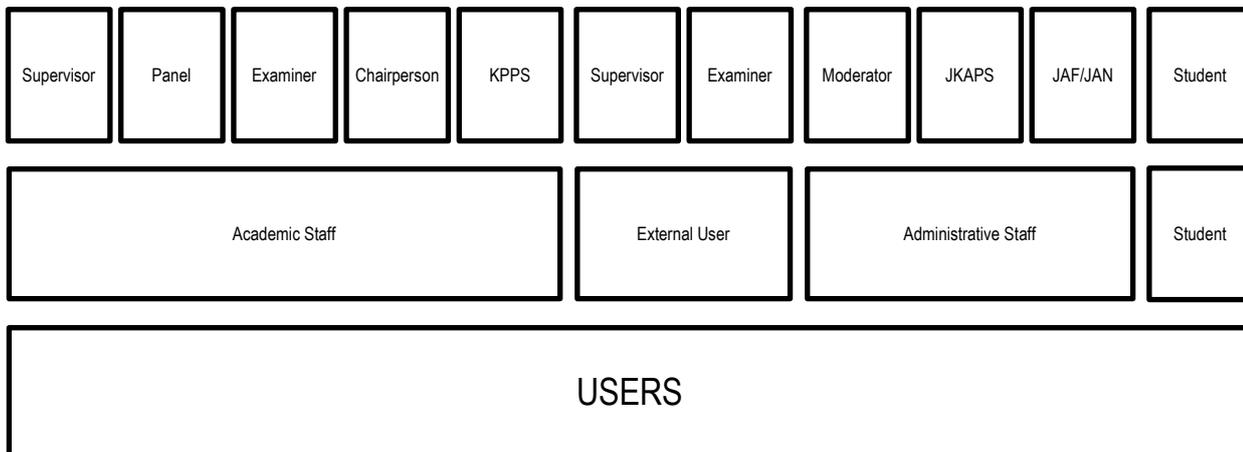


Fig. 4: UPTrackS Users Framework

3.0 Digital Framework

A digital governance platform ecosystem called UPTrackS was built by the Institute of Graduate Studies and the Infostructure Department of UiTM for postgraduate academic management. The main objective is establishing postgraduate processes and procedures in UiTM under open, accountable, effective, and efficient governance. As indicated in Fig. 4, it comprises five main modules: supervisor nominations, DRP, examiner nominations for the thesis, thesis evaluation, and research progress. Users of the system are identified by their roles, including academic staff, administrative staff, and postgraduate students. The system aligns with blockchain technology because the authorized users verify each governance procedure, and the activities are recorded. They cannot be amended after the approval. The system's user framework is illustrated in Fig. 4. These framework procedures are similar to the system used in the library process (Hoy, 2017), study loan process (Gazali et al., 2017), academic certificate authenticity (A. Gayathri et al., 2020; Jha, S.K. 2022), university student record (D. Tapscott et al., 2017) and grading system (M. Turkanović et al., 2018). Fig. 5 demonstrates the decentralized nature of the UPTrackS database and how it interacts with other UiTM database systems like SIMS, IRES, STARS HRMS, and PRISMA. Potential students and administrators for the Center of Postgraduate Studies can access and read the information for

supervisors on the platform, which enables external users to be included in the system. To ensure that each module meets the application's requirements, the moderators and KPPS can view the details and status of each module.

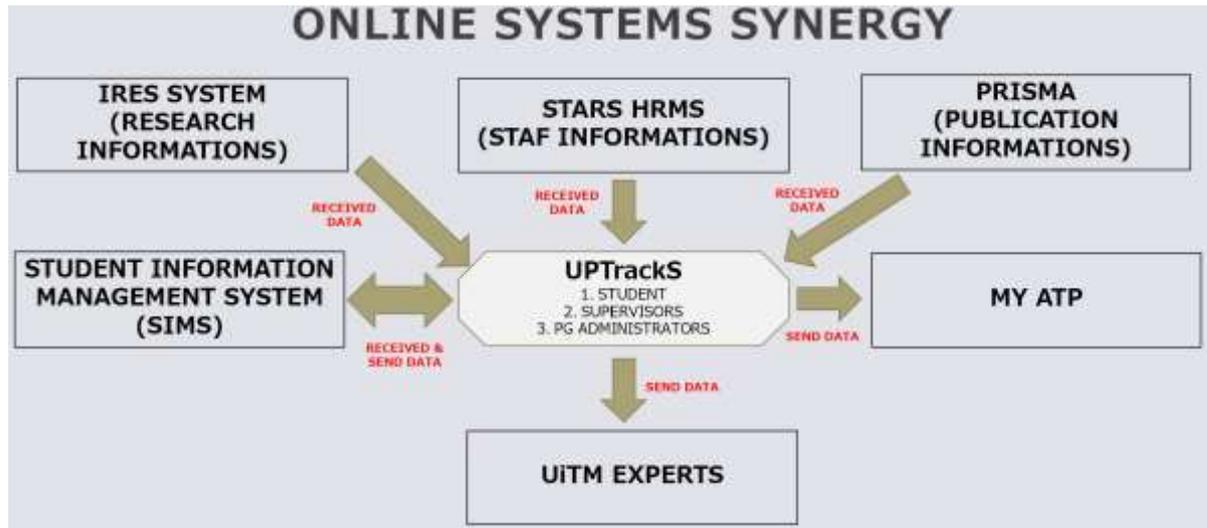


Fig. 5: UPTrackS Blockchain Framework

4.0 User Feedback Survey

User feedback refers to the observations, details, problems, and suggestions that users have made regarding our services available through the UPTrackS system. As a qualitative instrument, we employed a survey to collect user input. To reflect sound governance practice, we ask the users to rate the following feedback on a scale of 0 to 10, with ten being the most agreeable.

- i. User-friendly.
- ii. Process transparency.
- iii. Standard practice.
- iv. Monitor and trace the procedures for the accountability decision.

To enhance the overall performance of the UPTrackS system, feedback and suggestions were solicited from users. The survey questions were developed by a team comprising research, academic, and administrative employees actively involved in UiTM's postgraduate ecosystem. These questions were then disseminated to all postgraduate students via a Google form. The feedback received was subsequently analyzed using the Excel program to identify trends in user input related to good governance practices. The analysis was based on user demographics, including students, academic personnel, and administrative employees. To confirm if UPTrackS satisfied the good governance criteria from the user's perspective, the ANOVA analysis was performed using the ToolPak add-in tool in Excel. This analysis was critical in assessing the system's overall performance and identifying areas that require improvement.

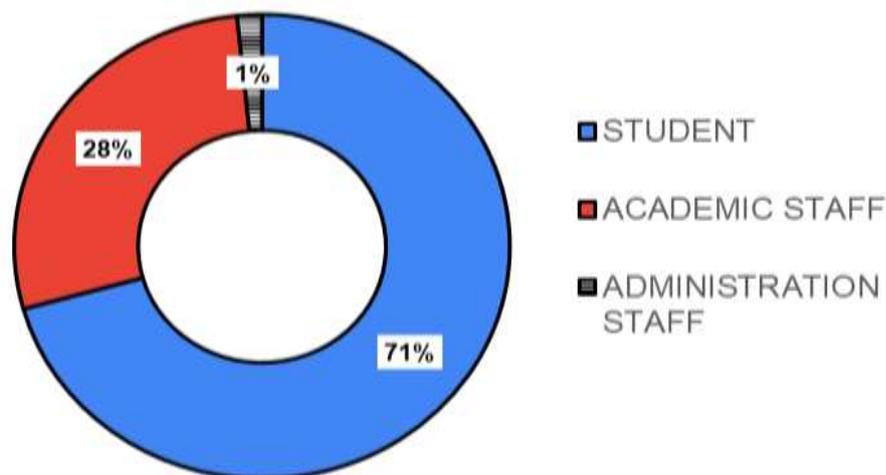


Fig. 6: Users Feedback Demography

4.1 Demographic

The user feedback demographics are shown in Fig. 6, with 433 feedback provided by the targeted respondents. The largest group, comprising 306 respondents or 71% of all respondents, were postgraduate research students. Academic staff accounted for 120 respondents or 28% of the total, while administrative staff members who serve as moderators for the UPTrackS system contributed seven respondents or 1%.

4.2 Users' Feedback

A qualitative feedback survey was used to assess the UPTrackS system's effectiveness. The good governance criteria and user demographic findings were analyzed using the Mean value, \bar{y} and Standard Deviation, σ . The results of the analysis of user feedback are presented in Table 1 and respectively. Table 2 shows the ANOVA analysis of the sources of variation in the user input for the four (4) good governance criteria. The following section will explore and present the feedback patterns for each user demographic.

Table 1. Mean and Standard Deviation of User Feedback of UPTrackS System

Category	Statistical Value	Administration Staff	Academic Staff	Student	Overall
User Friendly	Mean, \bar{y}	6.57	7.17	7.83	7.63
	Standard Deviation, σ	3.22	2.66	1.98	2.21
Transparency	Mean, \bar{y}	7.29	7.85	7.95	7.91
	Standard Deviation, σ	2.63	2.30	1.86	2.00
Standard	Mean, \bar{y}	7.71	8.12	8.04	8.05
	Standard Deviation, σ	1.80	1.83	1.93	1.90
Accountability	Mean, \bar{y}	7.43	7.74	8.08	7.98
	Standard Deviation, σ	1.62	2.08	1.87	1.93
Overall	Mean, \bar{y}	7.25	7.72	8.00	7.91
	Standard Deviation, σ	1.96	2.22	1.91	2.01

4.2.1 User Friendly

The UPTrackS system aimed to simplify the academic application procedures for postgraduate studies, involving all stakeholders, including students, academic staff (supervisors), and administrative staff. Table 2 provides the user feedback we received under the User-Friendly category. User-Friendly \bar{y} for the overall user response is 7.63, and σ is 2.20. The students responded a higher \bar{y} with 7.83 and a smaller σ at 1.98. The Academic Staff responded a lower \bar{y} at 6.57 and σ at 1.81. The result shows that the administration staff, who have a role as moderators in the system, agree that the interface of the UPTracks system is not user-friendly enough and can be upgraded to improve the user-friendliness level, such as the user interface and generate the report from the system.

The ANOVA analysis for the User-Friendly criteria shows that the variabilities between the demographic group and within the demographic group, or Sums of Squares (SS), are 32.53 and 1429.05, respectively. The total SS is 1461.58. The value for the SS is high due to the significant variance found in the administrative staff's feedback. The degree of freedom (df) refers to the number of groups minus 1, equal to 2 between the groups. The mean variation (MS) between the group and the control is 16.27 and 5.86, respectively. The MS value is high because of the big SS value. The ratio of the MS value between the groups to the MS value within the groups is 2.78. The value indicates a significant difference in user feedback between the demographic groups. The p-value for the user-friendliness criterion is 0.06, slightly higher than 0.05. Therefore, there is no significant difference between the groups, and we can accept the null hypothesis that UPTracks is user-friendly to all groups of respondents. However, the P-value for this criterion is small due to the feedback from the administration staff demographic group. Therefore, a significant improvement, such as upskilling digital literacy among the administrative staff, is required.

Table 2. Analysis of Variance

Feedback	Source of Variation	SS	df	MS	F	P-value	F crit
User Friendly	Between Groups	32.53	2	16.27	2.78	0.06	3.03
	Within Groups	1429.05	244	5.86			

Feedback	Source of Variation	SS	df	MS	F	P-value	F crit
	Total	1461.58	246				
Transparency	Between Groups	2.60	2	1.30	0.27	0.76	3.03
	Within Groups	1154.72	244	4.73			
	Total	1157.32	246				
Standard	Between Groups	1.13	2	0.56	0.15	0.86	3.03
	Within Groups	906.92	244	3.72			
	Total	908.05	246				
Accountability	Between Groups	8.23	2	4.12	1.02	0.36	3.03
	Within Groups	987.03	244	4.05			
	Total	995.26	246				
Overall	Between Groups	6.73	2	3.37	0.88	0.42	3.03
	Within Groups	936.48	244	3.84			
	Total	943.21	246				

4.2.2 Transparency

A transparent process is crucial in governance procedures. The \bar{y} for all transparency ratings is 7.91, and σ is 2.00. Most students believe the UPTrackS system can provide a transparent process with \bar{y} of 7.95 and a standard deviation of 1.86. The academic staff's transparency rating is 7.85 with σ of 2.3. The \bar{y} and σ for the transparency rating response by the administration staff are 7.28 and 2.63, respectively. The transparency ANOVA analysis shows that the SS value between and within the demographic groups is 2.60 and 1154.72, respectively. The MS value for the transparency criteria is 1.30 between the groups and 4.73 within the groups. This value shows that there is a difference in the user feedback in terms of the transparency perception in UPTracks. This is verified by the P-value for this criterion, which is 0.76. Therefore, the null hypothesis that the system can provide transparency to all processes is acceptable.

4.2.3 Standard Process

The highest overall \bar{y} for the good governance rating is achieved by the standard process criteria, where all the values are 8.05 and σ is 1.90. The result indicates that the UPTrackS system can systematise the university's governance of the postgraduate process. The \bar{y} that was given by the academic staff is 8.12, and σ is 1.83. This rating shows higher confidence in the system given by the academic staff. This is an important indicator to increase the trustworthiness process among the academic staff. The administration staff responds with the lowest \bar{y} for the standard process criteria with a value of 7.71, and σ is 1.80. The ANOVA analysis for the standard process shows that the SS value is 1.13 between the demographic groups and 906.92 within the groups. The MS values are 0.56 and 3.72 between and within demographic groups, respectively. The p-value is significant, which is 0.86, and consequently, the null hypothesis that the UPTracks system can provide a standard process for all users is accepted.

4.2.4 Accountability

The accountability process is crucial to the governance process. In the UPTrackS system, the users can monitor the progress of the procedures. The appointment criteria for the supervisors and thesis examiners must follow the stipulated criteria. The users are notified if the meeting rejects the nominations. The users have given \bar{y} and σ for the accountability rating of 7.98 and 1.93, respectively. The students have responded with the highest \bar{y} at 8.08 with σ of 1.87. The SS value from the ANOVA analysis for the accountability criterion is 8.23 and 987.03 between the demographic groups and within the demographic groups, respectively. The MS values between and within the groups are almost similar, at 4.12 and 4.05, respectively. Subsequently, the F factor, the ratio of the MS value between the groups and within the groups, is 1.02. The p-value for the accountability criterion is 0.36, which is higher than 0.05. Therefore, the null hypothesis that UPTracks provides an accountable system is acceptable.

4.3.5 Overall

The overall \bar{y} of good governance rating for the UPTrackS system is 7.91, with σ being 2.01. The student has given a higher \bar{y} at 8.00 and σ of 1.91. The student feedback is higher than that from the academic and administrative staff, where the \bar{y} is 7.72 and 7.25, respectively. In general, the system feedback survey shows that the UPTrackS system has implemented good governance practices for

the postgraduate process and procedures in the university. The analysis of the overall feedback can present the users' feedback towards the good governance implementation by UPTracks. The survey found that the SS value between and within the groups is 6.73 and 936.48, respectively. The MS value within the groups is 3.84, slightly higher than the MS value between the groups, which is 3.37. Thus, the F factor is less than 1.0, which is 0.88. Finally, the p-value for the users' overall perception is 0.42, which is higher than 0.05. Therefore, the null hypothesis that the perception of UPTracks can provide a good governance platform can be acceptable.

5.0 Conclusion

Technology makes university services more effective, efficient, and transparent. Blockchain technology has many benefits and can be applied to facilitating university operational processes and monitoring postgraduate research progress. The UPTrackS is an effective use of a leading-edge system where it embraces the usage of digital technology that allows the following: (1) Paperless; (2) Transparent; (3) Standard practice for all; (4) Monitors research progress; and (5) Records the research achievements. The users' feedback survey has found that the p-value for the overall good governance perception is higher than 0.05. Thus, the null hypothesis can be accepted. The only criterion between 0.06 and slightly higher than 0.05 is the "user-friendly" criterion. Also, it is discovered that the demographic group of the administration staff has the lowest rating for the user-friendliness criterion. This is due to the transformation from a manual system to a fully digital system where all the processes are performed online, and this group needs more digital literacy. Therefore, comprehensive digital training for UPTracks is necessary. Finally, the UPTrackS was built by the UiTM system architect and programmers' expertise, who have integrated all the processes and procedures for postgraduate academic applications. Thus, the development cost for the system has been reduced. The system can be utilized by other universities in Malaysia because all the academic processes there are similar. The system can be integrated with the respective academic rules and regulations of the respective universities. Deploying digital technologies into the postgraduate ecosystem for Education 5.0 is the digital transition of UiTM into becoming a globally renowned university. The user feedback survey has shown that the system can implement good governance practices in the postgraduate university ecosystem. In the next context of continuity, user feedback can be used to improve the articulation of the blockchain for postgraduate governance. This articulation of the transactions will be further improved, and more detailed blockchain procedures will be provided.

6.0 Acknowledgement

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