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Faculty of Social Sciences and Languages, Sabaragamuwa University of Sri Lanka is pleased to present volume 6 issue 2 of the Sri Lanka Journal of Social Sciences and Humanities (SLJSSH) to provide the national and international scholars with an intellectual platform for the publication of a quality journal. This multi-disciplinary bi-annual international journal in English aims to promote studies in Social Sciences and Humanities and thereby cater to the needs of all researchers and academics looking forward to contributing their knowledge, skills, and abilities to the field of Social Sciences and Humanities. All articles in this journal are subject to a rigorous double-blind peer-review process followed by thorough scrutiny by the Editorial Board to ensure high academic and research standards before final publication.

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EDITORIAL NOTE

We are pleased to inform you that the second issue for Volume 6 of the Sri Lanka Journal of Social Sciences and Humanities (SLJSSH) has now been published. SLJSSH is a bi-annual journal that boosts research in the field of social sciences and humanities. We invite researchers to contribute their research articles based on theoretical, empirical, policy-oriented, and practitioner studies that contribute to global academic discourse. Our aim is to promote diverse research prospers in the domains of social science and humanities. We have a strict policy to ensure the quality of research /review papers published by following a double-blind peer-review policy. This journal is included in the Sri Lanka Journals Online (SLJOL) database with a sound base of readers, submissions, and citations. This reflects our commitment to SLJSSH to quality research.

This issue brings together a various collection of scholarly contributions that explore contemporary economic, technological, cultural, academic, and governance-related issues from diverse disciplinary perspectives. The issue opens with an empirical study examining the factors associated with digital financial inclusion using the World Bank Global Findex data and that highlights the determinants that shape individuals' access and use of digital financial services. The second paper introduces an innovative Invisible Version Control Technique designed to reduce cognitive load and improve the efficiency of research workflows with a practical contribution to the organization and management of academic workflow. The third paper moves into the field of music and cultural studies, examining Indian music, the use of statistics in *Tabla* accompaniment, and the individual characteristics of *Khyal* and *Thumri* traditions through a comparative perspective. The fourth contribution presents a systematic review of the literature on digital workloads, well-being, and professional identity among academics. It pays attention to the changing nature of academic work in increasingly digital environments. The fifth paper explores the role of translation errors in international relations, illustrating their potential implications through selected historical events and contexts. The sixth contribution focuses on a governance-driven framework for student evaluation with important insights into approaches to establishment of evaluation processes within educational institutions. The seventh paper elaborates with a review of migration, with emphasis on developing countries, examining major patterns, challenges, and implications associated with mobility through systematic literature review. The final paper examines the relationship between Foreign Direct Investment, external debt, and poverty in Sub-Saharan African countries, providing an important policy orientation in developing economies. Collectively, these studies demonstrate the scope of contemporary social science research and highlight the importance of interdisciplinary perspectives in understanding complex economic, technological, cultural, educational, and global issues.

As the Editor-in-Chief of SLJSSH, I would like to take this opportunity to express our heartfelt appreciation and gratitude to the Coordinating Editor, Editors, Reviewers, Text Editors, and Editorial Assistant for their dedication and expertise in making this journal a success. Most importantly, the support we get from the Dean of the Faculty of Social Sciences and Languages at Sabaragamuwa University of Sri Lanka has been instrumental in the success of the journal. We would like to extend our appreciation and gratitude to our authors for their valuable contributions to the journal and look forward to your continued support in our pursuit of achieving greater heights in the success of the journal. Thank you for your dedication and commitment to SLJSSH, and we wish you all the best in your continued contributions.

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CONTENTS

Drivers of Digital Financial Inclusion in Sri Lanka: Insights from the Global Findex Database (2025) *De Mel, L.V.S.K.*	01
Exploring an Invisible Version Control Technique to Reduce Cognitive Load of Research Workflows *Dilan Gomas, A.S. and Rathnayake, R.M.N.B.*	11
Contrasting Rhythmic Aesthetics in *Tabla* Accompaniment: A Comparative Study of *Khyal* and *Thumri* *Ranga Perera, K.A.D.*	23
Digital Workload, Well-Being and Professional Identity of University Academics: A Systematic Literature Review *Bamunawita, K.M. and Priyanath, H.M.S.*	32
The Impact of Translation Errors on International Relations: An Analysis of Historical Diplomatic Events *Karunasena, A.N.*	41
A Rule Ontology and Rule Enforcement Framework for Governance-Driven Student Evaluation Lifecycle in high education in Sri Lanka *Rathnayake, R.M.N.B. and Jayaweera Prasad, M.*	52
A Review on Return Migration: Systematic Review and Bibliometric Analysis *Ravindra Deyshappriya, N.P., Pradeep Uluwaduge, Bandara, W. M. A. H. and Carlos Mendez*	65
Foreign Direct Investment, External Debts, and Poverty Reduction in Sub-Saharan African Countries *ABDULRAHMAN Idris Abdulganiyu and ABDULSALAM Abdulquddus Adewale*	79

Drivers of Digital Financial Inclusion in Sri Lanka: Insights from the Global Findex Database - 2025

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De Mel, L.V.S.K.[1*]

[1*]Department of Economics and Statistics, Sabaragamuwa University of Sri Lanka, Sri Lanka

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Abstract

Digital financial inclusion improves the lives of marginalized people, enhances economic growth, and reduces poverty by ensuring sustainable development. It is important to study the key drivers of digital financial inclusion, as financial inclusion and digital gaps exist in Sri Lanka's socio-economic context and can limit equal access to and use of digital financial services. Therefore, the study intends to identify the key determinants of access and usage of digital financial services in Sri Lanka. To attain this objective, the study collected secondary data employing the Global Findex Database 2025. Data analysis was performed using binary logistic regressions by compiling two dimensions of access and usage of digital financial inclusion, and eight models were derived representing different indicators of these two dimensions. Thus, results revealed that females are less likely to have access to certain digital financial services, while no significant relationship is observed between gender and the usage of digital financial services. Furthermore, the findings indicate that age has a negative and statistically significant effect on both access to and usage of digital financial services. Moreover, higher educational attainment and participation in the economically active population (workforce) increase the likelihood of accessing and using digital financial services. However, the results also show that residing in the rural sector has a significant negative relationship only with access to a digitally enabled account and the use of digital merchant payments, whereas its relationship with accessing and using debit and credit cards, as well as making or receiving digital payments, is statistically insignificant. Accordingly, the present study has generated new empirical findings for the academic literature by providing key strategies to advance digital financial inclusion in Sri Lanka.

Keywords: Digital Financial Inclusion, Digital Financial Services, Digital Gender Gap in Financial Inclusion, Economic Growth and Poverty Reduction, The Global Findex Database

INTRODUCTION

The financial sector is critical as it contributes to the economic growth of a country (Bathula & Gupta, 2021). In the past few years, the digital financial sector has recorded a substantial change that has challenged the use of traditional financial services (Ismael & Ali, 2021). Digital finance plays a crucial role in the lives of people from all walks of life, and it enhances financial inclusion by improving economic growth and stability (Durai & Stella, 2019). Financial inclusion provides people and businesses with greater access and use of cost-effective financial services that are delivered in a responsible and sustainable manner (World Bank, 2025). It enables sustainable development, mitigates poverty, and promotes high living standards and well-being among people (Central Bank of Sri Lanka, 2021), facilitates businesses, and enhances investment more (Gamage & Kumudumali, 2019). Digital financial inclusion is the newest version of financial inclusion in the evolution of the financial system (Tay et al., 2022), and it provides a pathway for financially excluded individuals to access and use formal financial services by utilizing digitally enabled tools and platforms (Ozili, 2018). Moreover, digital financial inclusion enhances economic participation, promotes credit and savings access (Ozili, 2022), reduces costs and queues by allowing efficient access (Narmadha, 2021), while alleviating rural-urban income disparities (Ji et al., 2021).

However, the World Bank (2024) points out that in Sri Lanka, account ownership declined by 7% in 2024 compared to 2021, and only 3% of them have a mobile money account, indicating limited access and usage of digital financial services. Additionally, it highlights a gender gap in the usage of digital financial services in Sri Lanka, revealing that women have limited access to and usage of digital financial services compared to men. These findings directly reflect the key issue of insufficient digital financial inclusion in Sri Lanka. Moreover, as indicated by the Department of Census and Statistics (2024), the digital literacy rate of Sri Lankans is 65%, but this shows that more than 30% of them still lack digital literacy. The annual financial literacy survey conducted by the Central Bank of Sri Lanka (2021) reports that only 57.9% of adults are financially literate, and more than 40% adults have a low level of financial literacy. Institute of Policy Studies of Sri Lanka (2025) signified that there is an urgent need to reduce the digital divide, enhance digital and financial literacy among all segments of the population, and incorporate digital payment systems for essential services. These results collectively imply that in Sri Lanka, there are

* **Corresponding author:** Tel.: +94 (76) 998 0817; Email: shahandemel@gmail.com
https://orcid.org/0009-0007-4467-6861

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still digital, financial literacy, and socioeconomic gaps in digital financial inclusion, and individuals face different obstacles when they access and use digital financial services.

De Mel and Priyanath (2023) emphasize that individuals, mostly among underprivileged or rural individuals, face barriers when they are using and accessing digital tools, platforms, and infrastructure to fulfill their financial goals. Moreover, De Mel and Shantha (2025) elaborated that due to barriers, women are struggling to utilize digital financial services. Furthermore, Nizam and Rashidi (2025) reveal that barriers to digital financial services limit the usage and adoption of digital financial services. Furthermore, there are significant knowledge gaps that exist in digital financial inclusion studies, such as insufficient focus on digital finance, limited research in the Sri Lankan context, limited use of globally accepted datasets, and a lack of separate examination of access and usage dimensions of digital financial inclusion. Thus, studying key drivers of digital financial inclusion is important as it facilitates economic and social outcomes among marginalized individuals. Therefore, the present study aims to identify how socio-economic determinants impact digital financial inclusion in Sri Lanka, utilizing the Global Findex database 2025 to identify the current level of Sri Lanka, facilitating policymakers, while filling knowledge gaps.

LITERATURE REVIEW

Financial Inclusion

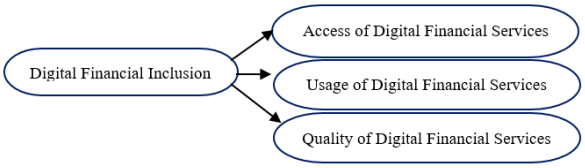
Financial Inclusion (FI) refers to meeting individuals and businesses' needs; they can have access to cost-effective financial products and services, and it contributes to employment, economic growth, women's empowerment, and reducing poverty (World Bank, 2025). It is also called inclusive finance, and it seeks to reduce obstacles among businesses and individuals providing formal financial products and services to achieve economic outcomes while improving living standards (Central Bank of Sri Lanka, 2021).

Digital Financial Inclusion

As digital technologies play a vital role in the context of the global economy, digital financial inclusion serves a crucial role in economic development among developing economies (Becha et al., 2025). Ozili (2018) highlighted that digital financial inclusion refers to delivering digital financial services to financially excluded or marginalized people by utilizing digital devices and tools. Also, Saxena and Thakur (2022) reveal that it provides convenient access to people to use formal financial services. The use of digital financial services to promote financial inclusion can be considered digital financial inclusion. Digital financial inclusion leads to mitigating poverty, enhancing sustainable development, and facilitating the use and access to digital financial services through digital channels and tools (Ozili, 2022). Moreover, Ozili (2022) demonstrates that digital financial inclusion generates benefits such as empowering marginalized people of society, enhancing women's participation in economic activities, and promoting the economic growth of any economy. Furthermore, Becha et al. (2025) mentioned that digital financial inclusion facilitates the management of resources efficiently and sustainable production practices.

There are three dimensions of digital financial inclusion: access to digital financial services, usage of digital financial services, and quality of digital financial services (Goh et al., 2023; Ismael & Ali, 2021; Khera et al., 2022). Access means how people interact with financial services, and it can be measured by using the holding of mobile phones, credit cards, debit cards, access infrastructure, etc. (Goh et al., 2023). Also, usage refers to the extent to which consumers utilize financial services. (Central Bank of Sri Lanka, 2021), and it can be measured using the use of a mobile money account and making different payments by using devices, etc. Moreover, quality refers to the standards of financial services to fulfill the financial needs of individuals. (Central Bank of Sri Lanka, 2021).

Figure 1: Digital Financial Inclusion Dimensions



Source: Ismael & Ali, 2021; Khera et al., 2022; Goh et al., 2023

Digital Agent Theory of Financial Inclusion

Digital agent theory has broad relevance to digital financial inclusion, and it defines how digital financial services providers connect with their users to help them with digital financial services usage and adoption of digital financial services (Ozili, 2024). The present study is framed with this theory, and it also discusses that financial inclusion not only depends on digital services but also on the abilities of digital agents to enhance financial education, minimize barriers to access, and build trust in the digital system. Thus, based on digital agent theory, individual characteristics influence how people interact with digital agents. Therefore, socio-economic determinants such as age, employment status, education, gender, and residential sector are used to identify differences in people's ability to use and access digital financial services via digital agents. Ozili (2024) identifies the relationship between the principles of financial inclusion and digital agents, which explains how incorporating suitable digital technologies is explained in this theory related to financial inclusion. Accordingly, via this perspective, the current study examines the drivers (economic and demographic factors) of access to and use dimensions of digital financial inclusion.

Empirical Evidence: Determinants of Digital Financial Inclusion

Nandru et al. (2021) revealed that socio-demographic factors, especially employment status, age, education, gender, and income, significantly impacted the access dimensions of digital financial inclusion. Also, Alvarez-Franco et al. (2025) highlighted that these socio-demographic factors significantly influence digital financial inclusion. Mugume and Bulime (2022) show that those who trust mobile money agents have more access to and use of digital financial platforms, and they discussed that male digital users who belong to the middle-aged group have higher digital financial inclusion. Moreover, Bathula and Gupta (2021) point out that being poor and female is less likely to use mobile banking, but they are more likely to use traditional banking. Also, they mention that workforce participation and education level have a

positive association with access and usage of digital financial services. Wandeda et al. (2023) demonstrate that in Kenya, the usage of digital finance is more financially stable among women. Ali and Ghildiyal (2023) suggest that among adult persons in India, higher education, age, income, and employment status are associated with a higher likelihood of using digital financial services. Kandari et al. (2021) imply that among rural households in India, compared with men, women have less usage of mobile phones. The study by Kumar and Vasuki (2023) provides evidence of a positive impact of digital financial services among working women. Conrad et al. (2019) show that individuals in urban areas, having a higher education, being more digitally literate, and younger are more likely to engage in the use of internet banking. Thus, these findings highlight that results are not always the same. Typically, factors such as employment status and education have a positive impact, while age and gender yield mixed results. Moreover, past studies have not clearly identified the access and usage dimension as a factor affecting. Accordingly, it can be hypothesized that there is a relationship between economic and demographic factors such as age, education, employment status, gender, and residential sector with the access to and use dimensions of digital financial inclusion.

H1: There is a relationship between age, education, employment status, gender, and residential sector with access to digital financial services.

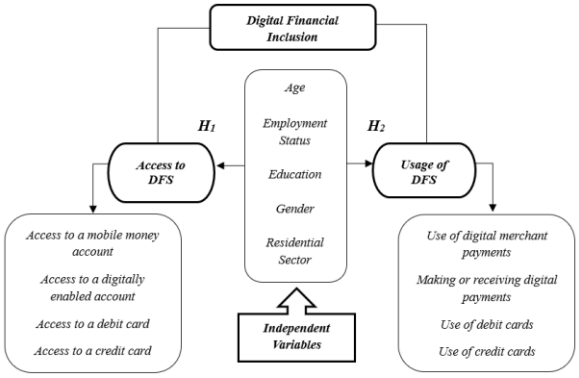
H2: There is a relationship between age, education, employment status, gender, and residential sector with the usage of digital financial services.

Research Gaps

Different scholars observed and found different determinants or drivers for digital financial inclusion (Nandru et al., 2021; Alvarez-Franco et al., 2025; Mugume & Bulime, 2022; Bathula & Gupta, 2021; Wandeda et al., 2023; Ali & Ghildiyal, 2023; Kandari et al., 2021) in various countries, such as Kenya (Wandeda et al., 2023), India (Nandru et al., 2021; Ali & Ghildiyal, 2023), Uganda (Mugume & Bulime, 2022). Although knowledge about digital financial inclusion and its determinants is growing in different countries, several knowledge gaps can be identified. First, as per the researcher's best understanding, there is limited empirical knowledge in the Sri Lankan context. Second, most scholars have studied formal finance or financial inclusion without considering digital finance or digital financial inclusion in their studies. Although some authors have utilized primary data collection method in related to the current study (Narmadha, 2021; Saxena & Thakur, 2022; De Mel & Priyanath, 2023; Kandari et al., 2021), different scholars have employed secondary data collection methods in their studies such as the Central Statistics Agency (BPS) & Indonesian Family Life Survey (IFLS) (Alwahidin et al., 2023) the China Household Financial Survey (CHFS) (Li & Liu, 2023) which is leading to third gap of limited usage of globally comparable datasets such as the Global Findex database to identify the determinants of digital financial inclusion. In addition to these gaps, previous studies do not explain and analyze the access and usage dimensions of digital financial inclusion separately to gain clear insights. Therefore, the present study fills these knowledge gaps to generate new empirical findings for academic literature.

Thus, incorporating literature, the study constructed a conceptual model, as shown in Figure 02 below. According to the model, the explanatory variables are education, age, employment status, gender, and residential sector, while the dependent variable is digital financial inclusion. Accordingly, the study analyzes eight models using the items of different dependent variables of two dimensions of digital financial inclusion, such as access to digital financial services (access to a mobile money account, access to a digitally enabled account, access to a debit card, access to a credit card) and usage of digital financial services (use of digital merchant payments, making or receiving digital payments, use of debit cards, use of credit cards) (Goh et al., 2023; Ismael & Ali, 2021; Khera et al., 2022).

Figure 2: Conceptual Model of the Study



Source: Developed by the Researcher, 2026

MATERIALS AND METHODS

The ontology or nature of reality of the research problem of the current study is objective meaning that it can be justify the problem of the study using theories and concepts. Accordingly, it belongs to the positivist philosophy, and utilizing a deductive approach, the present study is performed with quantitative methods. Thus, this study collected secondary data from the 2025 Global Findex database conducted by Gallup, Inc., which consists of 144,090 adults from 141 economies collected through face-to-face interviews. This survey collected a sample size of 1000 from Sri Lanka utilizing multi-stage sampling by selecting units by geography or population size or using random sampling methods, which was used in this study. The variable description of the study is indicated in Table 01 below.

Table 1: Variable Description of the Study

Dependent variable: Access	***Y***	Access to a mobile money account	Dummy	1 = Yes, 0 = No
		Access to a digitally enabled account	Dummy	1 = Yes, 0 = No
		Access to a debit	Dummy	1 = Yes, 0 = No
		Access to a credit card	Dummy	1 = Yes, 0 = No

Dependent variable: Usage		Use of digital merchant payments	Dummy	1 = Yes, 0 = No
		Making or receiving digital payments	Dummy	1 = Yes, 0 = No
		Use of debit cards	Dummy	1 = Yes, 0 = No
		Use of credit cards	Dummy	1 = Yes, 0 = No
Independents Variables	*X1*	Gender	Dummy	Female = 1, Male = 0
	X2	Age		Continuous
	X3	Education	Dummy	Secondary education or more = 1 Primary education or less = 0
	X4	Employment Status	Dummy	In the workforce = 1 Not in the workforce = 0
	X5	Residential Sector	Dummy	Rural = 1 Urban = 0

Source: Global Findex Database, 2025

Note: As per the above Table 01, the variables "access to a credit card," "use of debit cards," and "use of credit cards" were originally recorded with four response categories: "Yes," "No," "Don't know," and "Refused." For the analysis, the responses "Don't know" and "Refused" were recoded as "No.".

Econometric Model: The study analyzes eight binary logistic regression models using items from two dimensions of digital financial inclusion. To assess access to digital financial services, the study used indicators such as access to a mobile money account, access to a digitally enabled account, access to a debit card, and access to a credit card. To examine the usage of digital financial services, the study employed items such as use of digital merchant payments, making or receiving digital payments, use of debit cards, and use of credit cards.

$$\text{Logit}(y) = \ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5$$

Multicollinearity was tested by using Variance Inflation Factors (VIF) and Tolerance values, while using the pseudo-R^2 tested the goodness-of-fit of models.

RESULTS AND DISCUSSION

Table 02 below highlights the descriptive statistics of the variables of the study. It reveals that the average age of the sample is about 48 years. Most of the sample units are moderately educated, and most of them are females, while approximately more than 42% them are included in the economically active segment. However, this indicates that more than 55% of sample units are unemployed, even though they are in the working population, highlighting a critical issue. Furthermore, the table indicates a digital financial inclusion gap, revealing lower mobile money access and moderate digital access, while having limited digital payment usage.

Table 2: Descriptive Statistics Table

Variables	Observation	Mean	Std. dev.	Min	Max
Explanatory Variables					
Gender	1,000	.597	.4907462	0	1
Age	1,000	48.135	19.06658	15	100
Education	1,000	.666	.4718757	0	1
Employment Status	1,000	.427	.4948898	0	1
Residential Sector	1,000	.63	.4830459	0	1
Access					
Access to a mobile money account	1,000	.027	.1621644	0	1
Access to a digitally enabled account	1,000	.32	.4667096	0	1
Access to a debit card	1,000	.408	.491709	0	1
Access to a credit card	1,000	.073	.2602667	0	1
Usage					
Use of digital merchant payments	1,000	.131	.3375692	0	1
Making or receiving digital payments	1,000	.479	.4998088	0	1
Use of debit cards	1,000	.305	.4606378	0	1
Use of credit cards	1,000	.047	.2117447	0	1

Source: Developed by the Researcher based on Findex data, 2025

Table 3: Factors Affecting Access to a Mobile Money Account

Access: Model 01					
Number of obs	= 1,000	Pseudo R2			= 0.1728
LR chi2(5)	= 42.90	Log likelihood			= -102.70636
Prob > chi2	= 0.0000				
Variable		*Odds Ratio*	*Coefficient of Marginal Effect*	*Probability Value -P>|z|*	*Std. Err.*
Dependent Variable - *Access to a mobile money account (dummy)*					
Explanatory Variables					
Being female(dummy)		.1740135	-.0432251	0.002	.0897534
Age (continuous)		.9648358	-.0008849	0.012	.0128474
Having secondary education or more(dummy)		3.783151	.0328907	0.096	2.919493
Being in the workforce (dummy)		2.217693	.0196883	0.087	1.00097
Being rural(dummy)		.8226305	-.0048264	0.633	.3360674
Cons		.0560762	-	0.005	.0576247

Source: Developed by the Researcher based on Findex data, 2025

Note: Base category / Reference category: A person who is a male, having primary education or less, out of the workforce, and lives in a rural area.

Significant level: 5%

According to Table 03 above, the overall model is statistically significant (LR chi2(5) = 42.90, $p < 0.05$). Results also reveal that only being female and age are significant variables at the 5% level. Based on the marginal effect, being female reduces the probability of accessing a mobile money account by 4.3 percentage points, indicating that being females are less likely to have access compared with males to a mobile money account. Moreover, it highlights that age has a negative and statistically significant effect, and with every additional age, the likelihood of having access to a mobile money account decreases by about 0.088 percentage points, indicating older people are slightly less likely to have access to a mobile money account.

Table 4: Factors Affecting Access to a Digitally Enabled Account

Access: Model 02					
Number of obs	= 1,000	Pseudo R2			= 0.1425
LR chi2(5)	= 178.70	Log likelihood			= -537.51713
Prob > chi2	= 0.0000				
Variable		*Odds Ratio*	*Coefficient of Marginal Effect*	*Probability Value - P>|z|*	*Std. Err.*
Dependent Variable - *Access to a digitally enabled account(dummy)*					
Explanatory Variables					
Being female (dummy)		.7363461	-.0555029	0.049	.1151099
Age (continuous)		.9752351	-.0045476	0.000	.0042376
Having secondary education or more (dummy)		3.704274	.2374747	0.000	.734527
Being in the workforce (dummy)		2.257568	.1476706	0.000	.3508083
Being rural (dummy)		.7157491	-.0606479	0.028	.1100478
Cons		.5630842	-	0.088	.1894975

Source: Developed by the Researcher based on Findex data, 2025

Note: Base category/ Reference category: A person who is a male, having primary education or less, out of the workforce, and lives in a rural area.

Significant level:5%

As per Table 04 above, the overall model is statistically significant (LR chi2(5) = 178.70, $p < 0.05$) and highlights that all explanatory variables are significant at the 5% level. Based on the marginal effect, being female reduces the probability of accessing a digital-enabled account by about 5.55 percentage points, indicating that being female are less likely to have access compared with males.

Also, when age increases by one year, the probability of having access to a digitally enabled account reduces by about 0.45 percentage points, suggesting that when people get older, their access to a digitally enabled account decreases. Moreover, it highlights that having secondary education or more increases the probability of access to a digitally enabled account by about 23.74 percentage points, showing that when people are educated, it leads to more access rather than those who have primary education or less. Furthermore, being in the workforce increases the probability of accessing a digitally enabled account by 14.76 percentage points, showing that economically active individuals are likely to have access to digitally enabled accounts. Additionally, the results demonstrate that being rural reduces the likelihood of having access to a digitally enabled account by about 6.06 percentage points, implying that rural people are less likely to have access compared to urban individuals.

Table 5: Factors Affecting Access to a Debit Card

Access: Model 03					
Number of obs	= 1,000	Pseudo R2			= 0.1108
LR chi2(5)	= 149.83	Log likelihood			= -601.20492
Prob > chi2	= 0.0000				
Variable		*Odds Ratio*	*Coefficient of Marginal Effect*	*Probability Value - P>|z|*	*Std. Err.*
Dependent Variable - *Access to a debit card(dummy)*					
Explanatory Variables					
Being female (dummy)		.8197442	-.0412497	0.176	.120847
Age (continuous)		.9802726	-.004135	0.000	.003914
Having secondary education or more (dummy)		2.964889	.2255542	0.000	.5012002
Being in the workforce (dummy)		2.10314	.1542859	0.000	.307067
Being rural (dummy)		.8458017	-.0347555	0.246	.1225035
Cons		.732787	-	0.319	.2286985

Source: Developed by the Researcher based on Findex data, 2025

Note: Base category/ Reference category: A person who is a male, having primary education or less, out of the workforce, and lives in a rural area.

Significant level:5%

Based on the results in Table 05, the overall model is statistically significant (LR chi2(5) = 149.83, p < 0.05) and reveals that age, having secondary education or more, and being in the workforce are significant at the 5% level. Based on the marginal effect, when age increases by one year, the probability of access to a debit card decreases by about 0.41 percentage points, implying that older people are less likely to have access to a debit card. Also, having secondary education or more increases the probability of access to a debit card by about 22.55 percentage points, indicating higher education improves access more. Moreover, being in the workforce increases the probability of access to a debit card by about 15.42 percentage points, highlighting that being in the economically active segment enhances access.

Table 6: Factors Affecting Access to a Credit Card

Access: Model 04					
Number of obs	= 1,000	Pseudo R2			= 0.0823
LR chi2(5)	= 43.00	Log likelihood			= -239.83177
Prob > chi2	= 0.0000				
Variable		*Odds Ratio*	*Coefficient of Marginal Effect*	*Probability Value - P>|z|*	*Std. Err.*
Dependent Variable - *Access to a credit card(dummy)*					
Explanatory Variables					
Being female (dummy)		.8457219	-.0108754	0.518	.2192793
Age (continuous)		.9793231	-.0013561	0.007	.0074793
Having secondary education or more (dummy)		4.52628	.0979963	0.001	2.030515
Being in the workforce (dummy)		1.745637	.0361584	0.034	.4552503
Being rural (dummy)		1.22525	.0131846	0.439	.3213577
Cons		.0419938	-	0.000	.0268617

Source: Developed by the Researcher based on Findex data, 2025

Note: Base category/ Reference category: A person who is a male, having primary education or less, out of the workforce, and lives in a rural area.

Significant level:5%

As reported in Table 06, the overall model is statistically significant (LR chi2(5) = 43.00, p < 0.05) and shows that age, having secondary education or more, and being in the workforce are significant at the 5% level. Based on the marginal effect, when age increases by one year, the probability of access to a credit card decreases by about 0.13 percentage points, implying that older people are less likely to have access to a credit card. Also, having secondary education or more increases the probability of access to a credit card by about 9.79 percentage points, indicating higher education improves access more. Moreover, being in the workforce increases the probability of access to a credit card by about 3.61 percentage points, highlighting that being in the economically active segment enhances access.

Table 7: Factors Affecting the Use of Digital Merchant Payments

Usage: Model 01					
Number of obs	= 1,000	Pseudo R2			= 0.1913
LR chi2(5)	= 148.54	Log likelihood			= -314.01283
Prob > chi2	= 0.0000				
Variable		*Odds Ratio*	*Coefficient of Marginal Effect*	*Probability Value - P>|z|*	*Std. Err.*
Dependent Variable - *Use of digital merchant payments (dummy)*					
Explanatory Variables					
Being female (dummy)		.7171155	-.032092	0.112	.1509244
Age (continuous)		.9674048	-.0031982	0.000	.0061964
Having secondary education or more (dummy)		9.28959	.215115	0.000	4.389363
Being in the workforce (dummy)		2.515447	.0890275	0.000	.5421391
Being rural (dummy)		.4286374	-.0817595	0.000	.0880386
Cons		.1121616	-	0.000	.0655516

Source: Developed by the Researcher based on Findex data, 2025

Note: Base category/ Reference category: A person who is a male, having primary education or less, out of the workforce, and lives in a rural area.

Significant level:5%

Evidence from Table 07 suggests that the overall model is significant (LR chi2(5) = 148.54, p < 0.05) and reveals that, except for being female, other explanatory variables are statistically significant. As reflected in the marginal effect, when age increases by one year, the probability of making digital merchant payments decreases by about 0.31 percentage points, indicating that when individuals become older, the likelihood of using digital merchant payments decreases. The results also show that having secondary or higher education increases the probability of making digital merchant payments by about 21.51 percentage points, suggesting higher education leads to more usage of digital merchant payments. Moreover, being in the economically active segment increases the probability of making digital merchant payments by about 8.90 percentage points, demonstrating that when individuals are in the workforce, usage improves more. Additionally, being in the rural area, the probability of making digital merchant payments decreases by about 8.17 percentage points, reporting that there is less usage among rural individuals.

Table 8: Factors Affecting Making or Receiving Digital Payments

Usage: Model 02					
Number of obs	= 1,000	Pseudo R2			= 0.0484
LR chi2(5)	= 66.96	Log likelihood			= -658.78549
Prob > chi2	= 0.0000				
Variable		*Odds Ratio*	*Coefficient of Marginal Effect*	*Probability Value - P>|z|*	*Std. Err.*
Dependent Variable - *Making or receiving digital payments (dummy)*					
Explanatory Variables					
Being female (dummy)		.8023588	-.0513535	0.112	.1115949
Age (continuous)		.992861	-.0016709	0.055	.0037254
Having secondary education or more (dummy)		1.616532	.1120086	0.001	.2465835
Being in the workforce (dummy)		2.144774	.17795	0.000	.2965893
Being rural (dummy)		1.061427	.0139029	0.664	.145604
Cons		.7430726	-	0.317	.2204433

Source: Developed by the Researcher based on Findex data, 2025

Note: Base category/ Reference category: A person who is a male, having primary education or less, out of the workforce, and lives in a rural area.

Significant level:5%

As shown in Table 08, the overall model is significant (LR chi2(5) = 66.96, p < 0.05), and having secondary education or more and being in the work force are statistically significant. The marginal effect reflects that having secondary education or more increases the probability of making or receiving digital payment by about 11.20 percentage points. Moreover, being in the workforce increases the probability of making or receiving digital payment by about 17.79 percentage points. These results imply that having higher education and being in the economically active segment lead to the use of more digital payments.

Table 9: Factors Affecting the Use of Debit Cards

Usage: Model 03					
Number of obs	= 1,000	Pseudo R2			= 0.1314
LR chi2(5)	= 161.67	Log likelihood			= -534.20732
Prob > chi2	= 0.0000				
Variable		*Odds Ratio*	*Coefficient of Marginal Effect*	*Probability Value - P>|z|*	*Std. Err.*
Dependent Variable - U*se of debit cards (dummy)*					
Explanatory Variables					
Being female (dummy)		.7545072	-.0506663	0.071	.1184016
Age (continuous)		.9753253	-.0044938	0.000	.0042676
Having secondary education or more (dummy)		3.456974	.2231036	0.000	.6910366
Being in the workforce (dummy)		2.126355	.1356919	0.000	.3315327
Being rural (dummy)		.7543983	-.0506923	0.066	.1164012
Cons		.5371344	-	0.066	.181692

Source: Developed by the Researcher based on Findex data, 2025

Note: Base category/ Reference category: A person who is a male, having primary education or less, out of the workforce, and lives in a rural area.

Significant level:5%

As presented in Table 09, the overall model is significant (LR chi2(5) = 161.67, p < 0.05), and age, having secondary education or more, and being in the work force are statistically significant. The marginal effect shows that when age increases by one year, the probability of using debit cards decreases by about 0.44 percentage points, implying that older people are less likely to use debit cards. Also, having secondary education or more increases the probability of use of debit cards by about 22.31 percentage points, and being in the workforce increases the probability of use of debit cards by about 13.56 percentage points. These are highlight that having higher education and being in the economically active segment lead to the use of debit cards.

Table 10: Factors Affecting the Use of Credit Cards

Usage: Model 04					
Number of obs	= 1,000	Pseudo R2			= 0.1082
LR chi2(5)	= 41.02	Log likelihood			= -169.07513
Prob > chi2	= 0.0000				
Variable		*Odds Ratio*	*Coefficient of Marginal Effect*	*Probability Value - P>|z|*	*Std. Err.*
Dependent Variable - *Use of credit card(dummy)*					
Explanatory Variables					
Being female (dummy)		.7219319	-.0140055	0.306	.2288124
Age (continuous)		.9753768	-.0010717	0.013	.0094952
Having secondary education or more (dummy)		8.556274	.0922737	0.006	6.347345
Being in the workforce (dummy)		1.987574	.0295268	0.039	.6465443
Being rural (dummy)		1.395786	.0143336	0.311	.4568531
Cons		.0153179	-	0.000	.0142331

Source: Developed by the Researcher based on Findex data, 2025

Note: Base category/ Reference category: A person who is a male, having primary education or less, out of the workforce, and lives in a rural area.

Significant level:5%

As displayed in Table 10, the overall model is significant (LR chi2(5) = 41.02, p < 0.05), and age, having secondary education or more, and being in the work force are statistically significant. The marginal effect indicates that when age increases by one year, the probability of using credit cards decreases by about 0.10 percentage points, implying that when people get older, they are less likely to use credit cards. Also, having secondary education or more increases the probability of use of credit cards by about 9.22 percentage points, and being in the workforce increases the probability of use of credit cards by about 2.95 percentage points. These results reveal that having higher education and being in the economically active segment are likely to use debit cards.

Table 11: Multicollinear for Explanatory Variables

Variable	**VIF**	**1/VIF**
Age	1.20	0.832450
Education	1.20	0.834018
Employment Status	1.11	0.900054
Gender	1.09	0.913608
Urbanicity	1.02	0.979045
Mean VIF	1.13	-

Source: Developed by the Researcher based on Findex data, 2025

The study tested multicollinearity among explanatory variables using VIF (Variance of Inflation Factor) and Tolerance value, and as per Table 11, indicates that all values less than 5 reveal that there is no multicollinearity among variables.

Discussion

Access: Accordingly, the above four models related to the access dimension of digital financial inclusion reveal that being female is less likely to have access to digital financial services, such as access to a digitally enabled account and a mobile money account. These results were also confirmed by Nandru et al. (2021) and Mugume and Bulime (2022), revealing that gender significantly impacts access to digital financial services. Specifically, Bathula and Gupta (2021) in their study mentioned that females are less likely to use mobile banking. However, access to debit and credit cards does not have a significant relationship in the current study, indicating that even women who have debit and credit cards with them face different barriers to access (De Mel & Shantha, 2025). Furthermore, these results collectively indicate that women face various obstacles when engaging with digital financial services, including family responsibilities and care work, limited literacy, a lack of financial control due to social constraints and norms, and reliability issues. The study further reveals that age has a negative and significant impact on access to digital financial services. Aligned with earlier empirical findings (Nandru et al., 2021; Ali & Ghildiyal, 2023; Conrad et al., 2019), also highlighted that age significantly impacts access to digital financial services. Furthermore, the present study found that having a secondary or higher education level and workforce participation increases access to digitally enabled accounts, debit cards, and credit cards. This result corroborates the findings of Nandru et al. (2021), Ali and Ghildiyal (2023), and Conrad et al. (2019). Additionally, the present study demonstrates that being in the rural sector has a significant and negative relationship with access to a digitally enabled account. However, access to a mobile account, debit card, and credit card does not show that significant relationship.

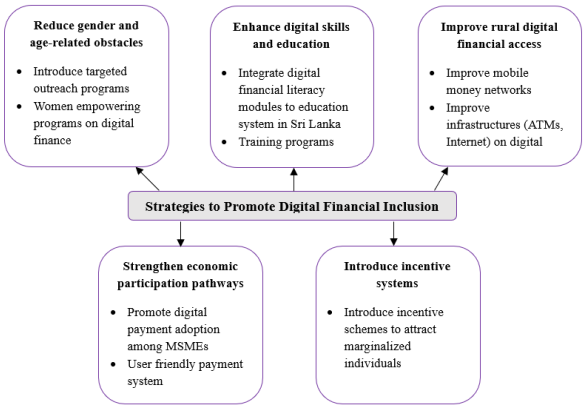
Usage: Digital financial inclusion related to the usage dimension of four models implied that being female is not a statistically significant relationship with the use of digital financial services. However, having secondary or more education levels and workforce participation has a positive and significant relationship with each usage item (use of digital merchant payments, making or receiving digital payments, use of debit cards, and use of credit cards) of digital financial inclusion. These results were also confirmed by Bathula and Gupta (2021) and Ali and Ghildiyal (2023) in their studies. Moreover, the present study found that there is a negative and significant relationship between age and use of digital merchant payments, debit cards, and credit cards, confirming other researchers' findings. In addition to that, the current study demonstrates that only the use of digital merchant payment has a significant and negative relationship with being in the rural sector, while making or receiving digital payments, use of debit cards, and use of credit cards are not statistically significant. These findings were also validated by Liu et al. (2021), revealing that determinants are different for digital financial inclusion in rural and urban sectors, while urban areas have a positive impact on digital financial inclusion compared with the rural sector.

CONCLUSION AND RECOMMENDATIONS

Thus, the eight models assessing the access and usage dimensions of digital financial inclusion reveal that females are less likely to have access to certain digital financial services, while no significant relationship is observed between gender and the usage of digital financial services. Furthermore, the findings indicate that age has a negative and statistically significant impact on both access to and usage of digital financial services. Moreover, higher educational attainment and participation in the economically active population (workforce) increase the likelihood of accessing and using digital financial services. However, the results also show that residing in the rural sector has a significant negative relationship only with access to a digitally enabled account and the use of digital merchant payments, whereas its relationship with access to and use of debit and credit cards, as well as making or receiving digital payments, is statistically insignificant.

Collectively, the findings of the current study suggest that the level of digital financial exclusion in the Sri Lankan context is driven by socioeconomic factors. Based on these findings, the study proposed the following framework to enhance digital financial inclusion among marginalized people in Sri Lanka by promoting access to and use of digital financial services. The framework highlights enhancing digital usage and access via various targeted policy interventions to reduce age and gender related constraints, developing digital and financial literacy, encouraging workforce participation, and finally addressing the rural digital access gap in Sri Lanka.

Figure 3: Framework to Promote Digital Financial Inclusion



Source: Developed by the Researcher, 2026

Even though the present study generated new empirical findings to academic literature, future researchers can use mixed methods compiling quantitative and qualitative data, examining more and different dimensions including all three dimensions of digital financial inclusion such as access, usage and quality of digital financial services and different items theses dimensions of digital financial inclusion and determinants employing a larger sample size in the Sri Lankan context to fill present research gaps and limitations.

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of the World Bank. (Ref: WLD_2024_FINDEX_v02_M), downloaded from [https://microdata.worldbank.org/catalog/7860/get-microdata] on [2/20/2026].

Disclosure

The study used Grammarly to correct grammatical errors and appropriateness.

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Exploring an Invisible Version Control Technique to Reduce the Cognitive Load of Research Workflows

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Dilan Gomas, A.S.[1*] and Rathnayake, R.M.N.B.[2]

[1*2]Department of Information Technology, Sabaragamuwa University of Sri Lanka, Sri Lanka

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Abstract

Despite the cognitive demands of research workflow, a critical gap exists in research tools: they force a trade-off between usability and robust data safety. Consequently, researchers rely on manual file management, creating 'Version Chaos' (e.g., thesis_v1.docx, final_v5.docx) that imposes severe extraneous cognitive load. This friction stems from two systemic failures: a 'Skills Divide,' where secure tools like Git are too technical for non-STEM scholars, and a 'Connectivity Divide,' where unstable cloud platforms force a reliance on vulnerable offline word processors. To address this gap, the study employs a three-phase Design Science Research (DSR) mixed-methods approach. Data was collected via structured surveys (N=48) and open-ended questionnaires (n=15) and was evaluated using descriptive statistics and inductive thematic analysis. First, quantitative results established a baseline of workflow friction, proving that manual file management triggers 'Version Anxiety' and interrupts the Flow State. Second, the study designed a high-fidelity 'Local-First Automated Version Control' (LFAVC) prototype. Finally, qualitative narratives validated the prototype, and the prototype's "Invisible Versioning" successfully shifts the burden of workflow processes from the human to the machine. Then, its 'Velocity Analytics' provides the visual feedback necessary to sustain long-term motivation. The study concludes that future academic tools must provide automatic version control without requiring technical skills. Practically, these findings provide software developers and HCI designers with a clear framework to build accessible, low-stress writing environments that ensure local control over data and reduce researcher burnout.

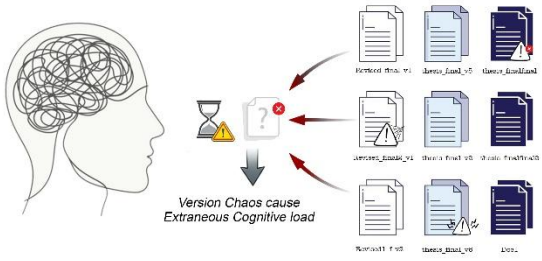
Keywords: Cognitive Load, Digital Divide, Human-Computer Interaction (HCI), Research Workflow, Version Control

INTRODUCTION

The academic writing process of workflow in an academic context needs extreme concentration on the synthesis of ideas. Computer word processors are the main tools that are used for this kind of task. Nevertheless, the management of files as an administrative activity tends to interrupt this creative process. According to Sweller (1988), Cognitive Load Theory states that the human working memory has a cognitive capacity. As a consequence, any additional activity, such as the management of files, uses part of the intellectual capacity needed for conducting research itself. This problem leads to a phenomenon called "Version Chaos." This refers to the confusing practice of manual naming and tracking multiple drafts (e.g., thesis_v1.docx, thesis_final.docx). This manual tracking forces researchers to constantly switch contexts, which reduces productivity (Renom, 2022; Reza et al., 2023). Additionally, the constant fear of losing data creates "Version Anxiety." This state of stress actively breaks a researcher's focus and flow (Gori et al., 2020).

Currently, a significant gap exists in academic research tools. Researchers are forced to choose between usability and data safety. Traditional offline word processors are easy to use but lack reliable version control. Conversely, professional developer tools like Git provide a free, open-source distributed version control system used primarily by software developers to track changes in their source code during development, offering data safety, but requiring complex coding skills (Chacon, 2026). This creates a "Skills Divide" that excludes non-technical scholars from using safe tools. Cloud-based platforms attempt to solve this with automatic saving, but they require a constant internet connection. This creates a "Connectivity Divide." It also raises concerns about data privacy and ownership in the era of AI surveillance (Seran et al., 2025).

Figure 1: Version Chaos and High Cognitive Load



Source: Developed by Researchers, 2026

This research will address these shortcomings by introducing and analysing a new theoretical model named "Local-

* **Corresponding author:** Tel.: +94 (77) 353 2052; Email: dilan@ssl.sab.ac.lk
https://orcid.org/0009-0007-5551-4411

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First Automated Version Control" (LFAVC). Rather than testing a specific software application, this study explores the usefulness of 'Invisible Versioning,' a system that conceives the technical aspects of data preservation from users. Moreover, this model will include "Velocity Analytics," which would provide visual feedback regarding writing consistency (e.g., number of words written vs. number of words deleted). Based on Goal-Setting Theory, this would help researchers stay motivated for the workflow timeline during their academic endeavors (Campion & Lord, 1982).

The key research question of this study explores the influence of "Invisible Versioning" on the researcher's research workflow process. Through the Design Science Research (DSR) approach, the study tests the concept using a combination of qualitative and quantitative analysis. According to the hypothesis, the academic software should be seen as an "invisible agent." By isolating the security aspect from the complexity issue, version anxiety is minimized, and it also gives the researcher room to focus on developing knowledge and timelines. (MacLeod et al., 2012; Sterman et al., 2022).

LITERATURE REVIEW

The present section explores the challenges faced by researchers in the process of writing. Validation of the theory is based on extant theoretical knowledge derived from HCI, psychology, and information systems. The theory describes "version anxiety" and "extraneous cognitive load" and explains how "invisible versioning" and "velocity analytics" are effective.

Cognitive Load Theory and Administrative Overhead: According to the theory of Cognitive Load proposed by Sweller (1988), the memory of human beings has been said to be bound with strict limits. Although the earlier cognitive theories had distinguished three types of cognitive load, that is, intrinsic, extraneous, and germane; the more recent theories only include two kinds of cognitive load (Debue et al., 2020). In academic settings, Intrinsic Load is contingent upon the complexity inherent in the processing of the information presented. On the other hand, Extraneous Load results from bad task design, such as ineffective writing systems and "administrative drudgery" associated with file management (Akin & MurrellJones, 2018; Oliveira & De Barba, 2022). The burden of extraneous material directly affects the cognitive resources allocated to germane load, which plays a critical role in high-level cognitive activities such as organizing thoughts and making necessary changes to the argumentation process (Li & Zhang, 2021; Zhang et al., 2023). In that case, removing any unnecessary extraneous cognitive load can considerably improve a researcher's ability to conduct productive research.

According to Khan and Suhluli (2025), Generative AI systems are designed to reduce cognitive load; however, when they are not properly incorporated into technology, they can actually induce higher mental pressure. In research studies, manual processes such as repetitive "Save As" operations produce considerable "bad load." They force researchers to use working memory for tracking file states instead of creating knowledge (Akin & MurrellJones, 2018; Noroozi & Karami, 2022). By introducing "Invisible Versioning," researchers no longer consciously manage file states. This frees up limited working memory for the high-level cognitive tasks required for writing (Criado-Perez et al., 2024). This is in line with the need to free up cognitive resources for creativity and critical thinking, a necessary aspect for effective writing development (M. Li & Wilson, 2025).

Hayes and Flower Cognitive Process Model of Writing: The primary theoretical framework for understanding writing as a cognitive process driven by a specific goal is the Hayes and Flower Cognitive Process Model, as explained in Gero et al. (2022). This framework includes three non-linear stages of Planning, Translating, and Reviewing, regulated by an internal monitor, known as the "Monitor" (Karim et al., 2020; Sebit & Yildiz, 2020). In its updated version, a new "Resource Level," which includes physical transcribing media and the task environment, has been added to the framework (Kruse et al., 2023).

Where the "task environment" (software used) does not perform effectively, it results in bottlenecks at the "Control Level," where ideas need to be translated to text form (Kruse et al., 2023). Advocating for the "Local-First" model corresponds to this framework since it guarantees that the "transcribing technology" will always be functional, irrespective of the Internet connection, and hence prevents the "Connectivity Divide" from disrupting the recursive loop of planning and revising (Hofbauer et al., 2023; Jørnø, 2016). This strategy drastically cuts down the mental stress caused by technological limitations, making it easier for writers to maintain concentration on cognitive activities related to writing (Atasoy, 2023).

Self-Regulated Strategy Development and Velocity Analytics: The Self-Regulated Strategy Development model highlights how metacognitive processes like goal-setting and self-monitoring help increase success in writing (Klein & Boscolo, 2016). Studies have found that graphing oneself helps writers become more strategic and motivated in terms of their progress (Graham, 2021). "Velocity Analytics" promotes this through its ability to provide writers with objective feedback about their writing process. It thus facilitates adaptive self-regulation by making one's own progress clear and measurable (Mateo-Girona et al., 2025). Such information may allow writers to reflect on their approach to writing and modify it, improving their skills.

The "Velocity Analytics" tool is being recommended and essentially, for an "Automated Adaptive Scaffold" for SRSD (Fernandez & Guilbert, 2024). Through mapping out the "sprint potential" of a given writing task, akin to an effort estimation, Agile-automated feedback can be provided to researchers even through the prolonged "low feedback periods" encountered when undertaking a research paper (Pasuksmit et al., 2024; Sterman et al., 2022). The introduction of the feedback system converts the vague concept of "completing a paper" into tangible milestones that are easier to achieve and thus reduce the risk of burnout (Aenugu & O'Doherty, 2025; Tondello et al., 2018).

Data Sovereignty and the "Un-territorial" Nature of Research: In the age of cloud computing, academic information has increasingly become "un-territorial" in that it is often housed in several different places, resulting in issues regarding "exclusive authority" as well as confidentiality

(Kushwaha et al., 2020). The term Data Sovereignty can be defined as the capability of researchers to exercise complete authority over their own intellectual property (Kushwaha et al., 2020). Current web-based editors often force a trade-off between the benefits of cloud collaboration and the security of local storage (Hofbauer et al., 2023). By focusing on a "Local-First" approach, scientists can ensure the realization of "Invisible Versioning," yet still maintain total control of their data, reducing their fear of "AI Surveillance." (Kushwaha et al., 2020; Perzanowski, 2010). Such an approach will not only make the data protection procedure better but also lead to greater confidence and autonomy in using the online research system, especially since the research that scholars perform requires special attention because of its sensitive nature. The emphasis on the importance of local management and the ownership of data becomes very helpful in solving diverse problems faced by academic researchers, who need efficient systems to receive useful information (Xu et al., 2024). Additionally, combining such solutions with pedagogical approaches, including metacognitive strategies and self-efficacy, can increase their efficiency in enhancing writing performance (Stofiana et al., 2025).

Flow Theory and Version Anxiety: Flow Theory identifies "Deep Work" as an optimal state in which individuals are engaged in tasks that require a high level of concentration and experience a distorted sense of time (Kotler et al., 2022). Such a state is achieved when a balance exists between task difficulty and individual ability (Rampley et al., 2019). However, (International Advances in Writing Research: Cultures, Places, Measures, 2012) highlights that the ability to achieve a state of flow is vulnerable to interference from anxiety or other factors that may cause disorientation and tiredness. "Version Anxiety," which is recognized as a critical barrier to achieving a state of flow in document writing, is characterized as a fear of losing document versions and cognitive difficulties associated with manual version control systems (Henderson, 2011). The constant state of anxiety and concern over the possibility of overwriting a document or not having access to previous versions of a document takes the mind off the creative analysis of the subject matter and creates a disruption that breaks up the concentration required for high-level intellectual production (Gori et al., 2020; Ritonummi et al., 2024). Inefficient data management also contributes to this by creating a lack of trust in one's own data archives (Hunt & Bakker, 2018). Research has proven that secure settings allow people to remain engaged in their cognitive tasks because there is no fear of losing their data. The "just-in-case" approach makes researchers keep multiple versions of files just in case, leading to more confusion while searching for relevant data in the future. Such an approach creates a "hodgepodge of file names," and it becomes hard to determine which one is the latest or most appropriate version (Cohen-Adad, 2024; Gori et al., 2020).

Task-Technology Fit (TTF) theory suggests that technology has a positive effect on individual performance only when the fit between technological features and task specifications is high (Abdulrab, 2025; Khumalo, 2022). "Fit" will lead to better use of technologies and increase productivity, while "mismatch" means low efficiency and dissatisfaction (Iversen & Eierman, 2018; Shishakly et al., 2021). But the process itself has its problems. As an illustration, a word processor is made for general office use rather than for writing papers, and its version control features are too weak to enable more than one draft (Hofbauer et al., 2023). In particular, Git used by programmers is very complicated and hard to be used by those researchers who do not have any programming knowledge (Hofbauer et al., 2023). Besides, it is evident that it is an example of a misfit between the application and the software. In other words, it is necessary to find a solution that would help improve version control and facilitate software installation. This way, it would be possible for technology to work effectively and guarantee that the researcher concentrates on his work and not technology (Iversen & Eierman, 2018). As a result, technology would support research activities without causing any interference; hence, there would be no technostress (Vendramin et al., 2021).

Goal-Setting Theory: According to the Goal-Setting Theory, if people have a clear and challenging goal along with good feedback, they tend to improve their performance. This contrasts with the performance of people who have unclear goals. This theory also emphasizes the importance of feedback in improving performance. Feedback helps people see the progress they have made towards their goal, stay motivated, and change their strategies to reach the goal (Şenormancı, 2018). The process of writing a thesis is a long-term process that requires a lot of time. Sometimes, people who write them may not get immediate feedback on their work. This can result in the absence of motivation over time. "Velocity Analytics" that represents the progress of writing the thesis using different graphs, such as the number of words added or deleted daily. It is based on the Goal Setting Theory. This helps researchers become motivated by receiving feedback on their work. This type of analytics helps researchers set their smaller goals and feel a sense of accomplishment by completing small steps in this long writing process (Aenugu & O'Doherty, 2025; Tondello et al., 2018).

However, the combination of the above-mentioned four theories reveals a serious weakness in the workflow used in current research work. First, researchers find themselves at a crossroads between usability and security when using word processors, which leads to Version Anxiety, and using security software that leads to Skills Divide. In addition, the use of cloud computing poses the risk of data sovereignty.

To tackle this complex challenge, the current paper introduces the concept of Local-First Automated Version Control (LFAVC). "Invisible Versioning" operates behind the scenes. It removes the responsibility of organizing files from the human mind to machines, thus guaranteeing ownership over data within an offline context. Meanwhile, "Velocity Analytics" functions as an adaptive support system that applies the principles of goal-setting to supply the necessary visual stimuli required to sustain flow. After defining the theoretical need for such an approach, the next section outlines the method for gauging its desirability among practicing scholars.

MATERIALS AND METHODS

This study employs a mixed-method Design Science Research (DSR) framework in investigating administrative friction in academic processes and creating a feasible technological solution. DSR refers to a scientific problem-solving process aimed at enhancing human understanding through

the creation and testing of new artifacts (Hevner et al., 2004). In order to appropriately identify a problem, create a solution, and evaluate a solution's efficacy, three different yet sequential phases were conducted in this study.

Phase 1: Quantitative Needs Assessment

The goal of the first step was to empirically prove that the problem of workflow friction exists, and to measure "Version Anxiety," "Cognitive Load," and the divides that currently exist in existing software tools. Table 1 below illustrates how the survey questions map to theoretical constructs.

Population and Sampling: The target population involved active academics, who range from undergraduates to tenured professors. A convenient sampling of networks of academics was used to identify participants.

Inclusion Criteria and Stratification: The inclusion criteria for the respondents were that they be engaged in long-form academic writing (thesis/dissertation/journal publication) and, therefore, have issues with their workflows. In order to examine the "Skills Divide" theory, our population was stratified based on the Field of Study.

Instrument: For data collection, we made use of a questionnaire available online via Google Forms. Our instrument contained 14 quantitative questions answered using a five-point Likert scale (1-Strongly Disagree; 5-Strongly Agree).

Table 1: The Survey Items were Designed to Operate the Theoretical Frameworks Established in The Literature Review

Variable	Theoretical Basis	Survey Mapping
Cognitive Load	Cognitive Load Theory	Measured by the rate of manual file management activities (e.g., "Save As" operations).
Version Anxiety	Flow Theory	Measured by the level of stress experienced regarding data loss and/or failure of data retrieval.
Technical Barrier	Digital Divide	Measured by the perceived difficulty of adopting professional tools like Git.
Perceived Usefulness	Task-Technology Fit (TTF)	Measured by the desirability rating of proposed features (Invisible Versioning, Velocity Analytics).

Source: Developed by Researchers, 2026

Analysis Plan: Data cleaning, descriptive statistical computations (Mean μ and Standard Deviation), and gap analysis were conducted using the Python programming language within the Google Colaboratory (Colab) environment using the pandas library. During this phase, Google's Gemini was used as a pair-programming assistant to enhance the development and debugging process for the Python scripts for carrying out the above statistical analysis and visualization. It should be understood that, despite using this AI-enabled technology for efficient coding, all the code and output statistics have undergone rigorous verification by the author before their use in this paper. The proposed LFAVC framework is presented solely in a conceptual manner.

Phase 2: Artifact Design and Prototyping

Considering the empirical gaps identified during the first phase, the second phase consisted of the conceptualization and development of the solution artifact, which is the Local First Automated Version Control (LFAVC) framework. Rather than evaluating the theoretical concept, the researchers developed a high-fidelity software prototype to physically demonstrate the application of psychological theories to the design of the user interface (UI).

The prototype was designed to operate two core features:

- Invisible Versioning (Cognitive Load): Simplifying the process of terminal-based versioning by providing an automatic, visual representation of the version timeline, thus reducing cognitive overload on users.
- Velocity Analytics (Goal Setting Theory): Providing a visual dashboard with graphs for tracking writing velocity, i.e., words written versus words erased, to keep up with motivation.

Phase 3: Qualitative Concept Validation

The final phase evaluated the perceived usefulness and psychological impact of the proposed LFAVC prototype.

- Data Collection: A subset of the original survey participants (n=15) opted to complete an extended qualitative narrative questionnaire. Participants were presented with the conceptual mechanisms of the prototype and asked to describe how such a system would impact their daily writing routine and anxiety levels.
- Analysis: The open-ended narrative responses were evaluated using inductive thematic analysis (Braun & Clarke, 2006). This qualitative stage extracted core themes regarding information overwhelm and validated how the automated architecture successfully mitigates the friction identified in Phase 1.

Methodological Limitations: The study relies on self-reported data, which may be subject to recall bias regarding the frequency of past data loss events. Furthermore, as a concept validation study within a DSR framework, the qualitative results reflect the perceived usefulness of the high-fidelity prototype rather than post-implementation user metrics from a live, long-term software deployment.

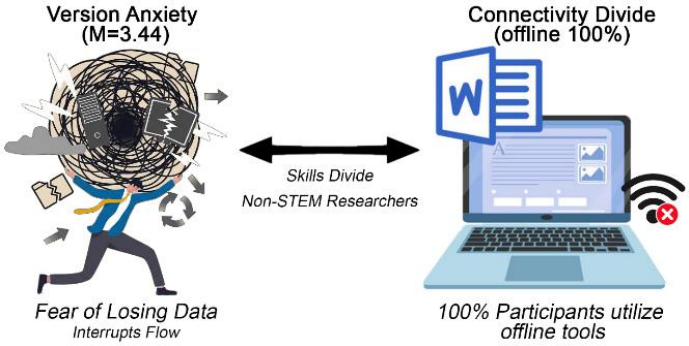
RESULTS AND DISCUSSION

Results

The findings from the mixed-methods survey were conducted with academic researchers. The quantitative phase (N=48) measured the pervasiveness of administrative friction and evaluated the desirability of the proposed framework. The qualitative phase (n=15) utilised open-ended narratives to provide a deeper context. The results are structured to identify the nature of workflow friction, the systemic infrastructure limitations causing it, and the validation of the conceptual framework designed to resolve it (see Figure 2).

Phase 1: Quantitative Needs Assessment

Figure 2: Conceptual Mapping of Workflow Frictions and Systemic Divides

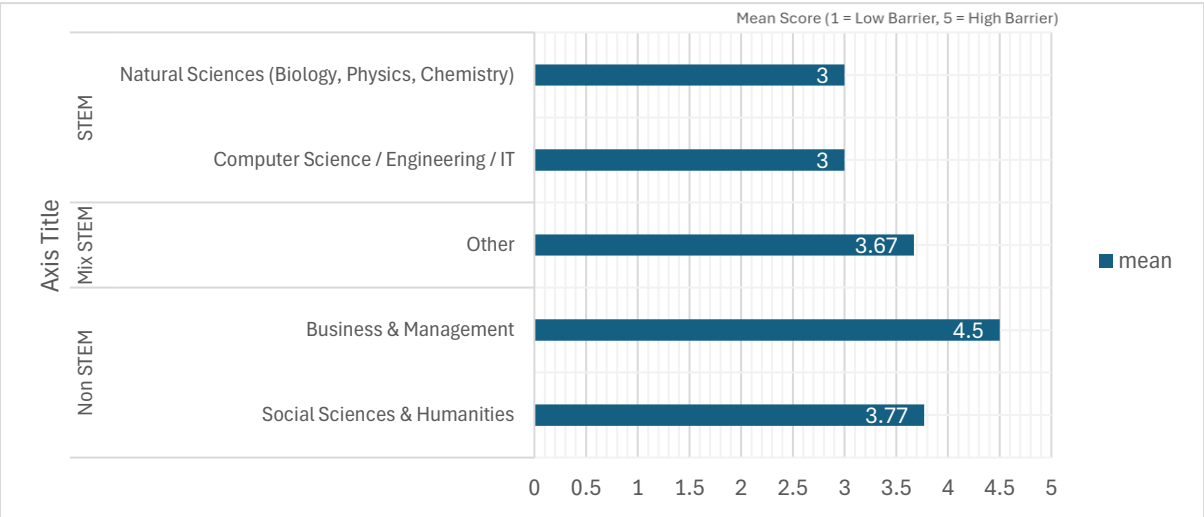


Source: Developed by Researchers, 2026

The "Skills Divide" and Task-Technology Fit: To test the hypothesis of the "Skills Divide" in academic tooling, the researchers were grouped according to their field of research and asked to rate the level of technical difficulty of industry-standard version control systems such as Git.

The data indicate strong evidence of the existence of a 'Skills Divide' in the field of academics in a technical sense. There was significant agreement among researchers from Business ($\mu = 4.50$) and Social Sciences ($\mu = 3.77$) disciplines regarding the issue that 'the tool was too technical or distracting' in the area of 'creative writing.' Researchers from Computer Science/Information Technology and Natural Sciences disciplines gave neutral responses ($\mu = 3.00$). As evident from the illustration in Figure 3, there is strong support for the existence of "Skills Divide."

Figure 3: Mean Technical Barrier Scores by Academic Discipline.

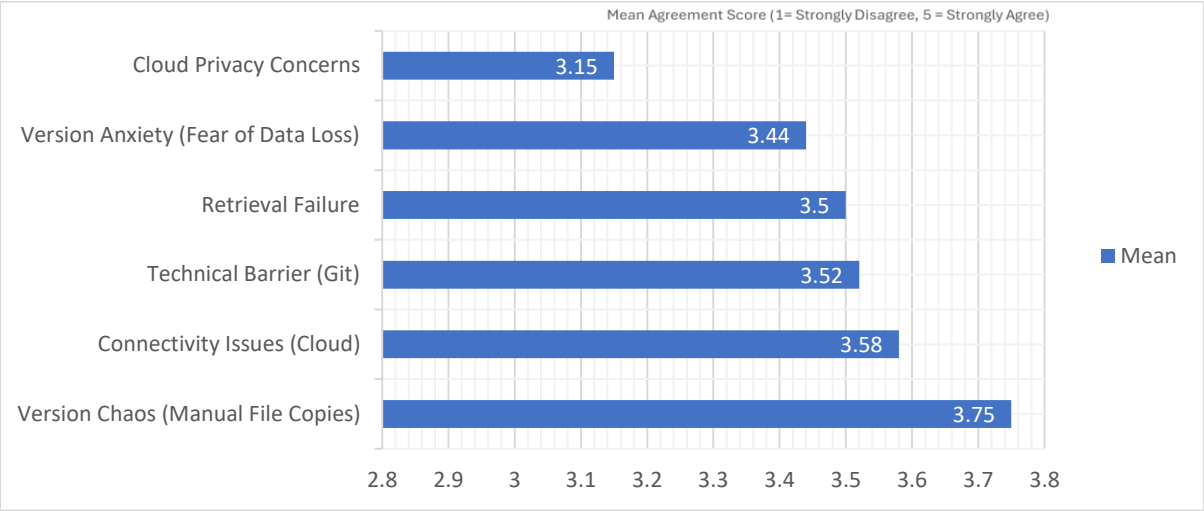


Source: Developed by Researchers based on Survey Data, 2026

This serves to confirm the task-technology fit (TTF) hypothesis. While Git offers effective data security features, the technology is poorly suited for use by non-technical academics who focus primarily on writing texts rather than coding. The mental strain associated with using command-line interfaces prevents academics from focusing on their work, emphasizing the need for visual interfaces once more.

Quantification of Workflow Friction and Cognitive Load: In order to measure the constructs of Cognitive Load and Version Anxiety, the entire sample (N = 48) evaluated their existing workflow difficulties (see Figure 4)

Figure 4: Severity of Workflow Friction Points



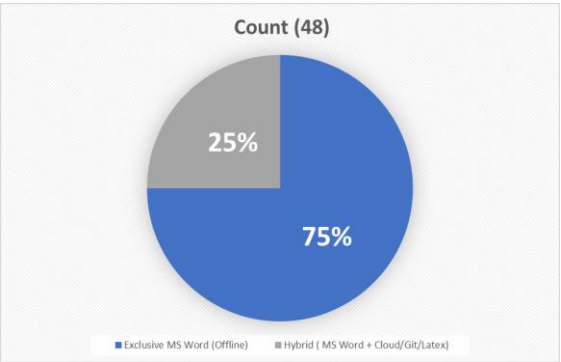
Source: Developed by Researchers based on Survey Data, 2026

The Nature of Workflow Friction: This finding highlights the prevalence of manual handling of files as one of the main sources of friction in the workflow. Researchers rated "Version Chaos" the manual copying and renaming of files (e.g., thesis_final_v2.docx) - as the highest friction point in their workflow (μ=3.75). This administrative burden was strongly correlated with "Version Anxiety" (μ=3.44), representing a constant fear of data loss.

The Systemic Tooling Divides: According to the results from the surveys, it is evident that researchers fall victim to these suboptimal workflows because of the huge disparity in tools available. There appear to be two types of divides here – the Skills Divide and the Connectivity Divide.

Statistically, non-STEM scholars (Business μ=4.50; Social Sciences μ=3.77) found professional software development tools such as Git to be a significant technical hurdle. Moreover, all respondents admitted that they relied on offline word processors such as Microsoft Word due to the challenges associated with accessing the cloud (Figure 5).

Figure 5: Primary Text Editor Usage Among Participants



Source: Developed by Researchers based on Survey Data, 2026

The high mean value in internet-related problems (μ = 3.58) indicates that the cloud dependency problem is one of the "Connectivity Divide" issues among many researchers. When the use of intellectual properties depends on a stable internet connection, it generates lots of stress and worry. In addition, the medium value concerning the fear about data privacy in commercial clouds (μ = 3.15) indicates the necessity of Data Sovereignty.

Phase 2: Artifact Design and Prototyping (The LFAVC Framework)

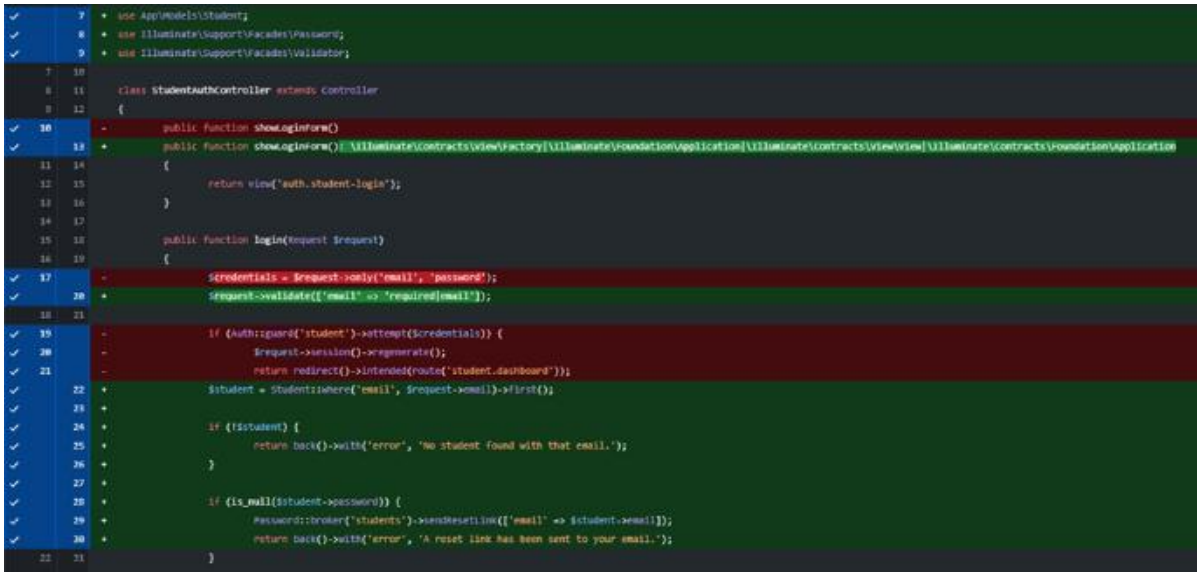
To address the issues identified in Phase 1 concerning workflow friction and institutional divides, the researchers created a high-fidelity conceptual prototype. The prototype serves as an implementation of the LFAVC model, providing an actual space in which to test whether particular UI design considerations can help overcome the underlying psychological barriers associated with academic writing.

The prototype's technical structure was built based on the psychological requirements identified through the literature review.

Abstraction of Complexity, "Invisible Versioning" and Cognitive Overhead: It was clear from the numerical results presented above that the use of professional tools such as Git would make the attainment of an "Invisible Skills Divide" inevitable for non-STEM researchers. As mentioned before, version control in its traditional format involves the manual entry of command-line commands into a terminal window interface.

In order to address this, the LFAVC prototype has developed the concept of "Invisible Versioning." It is designed to function completely in the background, allowing the program to take detailed snapshots of the document every time the user pauses typing. In essence, the extraneous cognitive load will be managed by the program and left to the execution by machines, enabling the individual to concentrate on 100% of the intrinsic cognitive load associated with the writing process. The visual representation of how the Extraneous Cognitive Load decreases using the Git interface and an automated sidebar is shown below (Figure 6 & Figure 7).

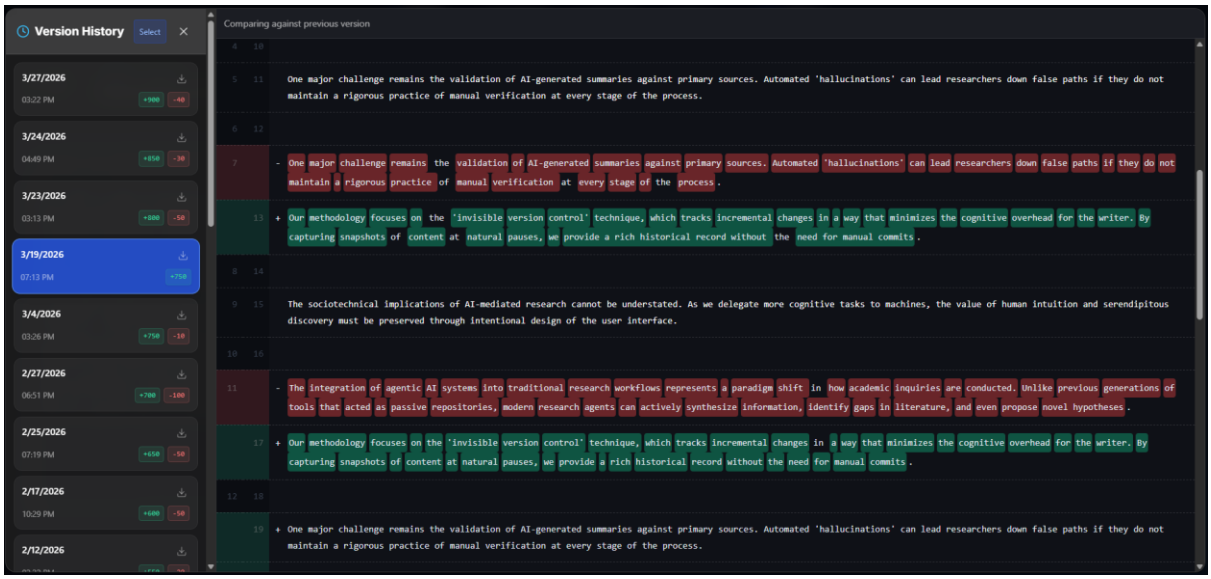
Figure 6: Traditional Git Interface



```
+ use App\Models\Student;
+ use Illuminate\Support\Facades\Password;
+ use Illuminate\Support\Facades\Validator;

class StudentAuthController extends Controller
{
-       public function showLoginForm()
+       public function showLoginForm(): \Illuminate\Contracts\View\Factory|\Illuminate\Foundation\Application|\Illuminate\Contracts\View\View|\Illuminate\Contracts\Foundation\Application
        {
                return view('auth.student-login');
        }

        public function login(Request $request)
        {
-               $credentials = $request->only('email', 'password');
+               $request->validate(['email' => 'required|email']);

-               if (Auth::guard('student')->attempt($credentials)) {
-                       $request->session()->regenerate();
-                       return redirect()->intended(route('student.dashboard'));
+               $student = Student::where('email', $request->email)->first();

+               if (!$student) {
+                       return back()->with('error', 'No student found with that email.');
+               }

+               if (is_null($student->password)) {
+                       Password::broker('students')->sendResetLink(['email' => $student->email]);
+                       return back()->with('error', 'A reset link has been sent to your email.');
                }
```

Source: Developed by Researchers based on Programming Code, 2026

Figure 7: The Proposed LFAVC "Visual Time Machine" Interface



Source: Developed by Researchers, 2026

The Visual Timeline - Mitigating Version Anxiety to Re-establish the Flow: In order to overcome this problem, the LFAVC interface abandons the practice of storing individual files separately and adopts a central "Visual Time Machine."

As shown in Figure 8 below, the contributions made by the researcher are displayed using a holistic contribution graph that keeps track of the researcher's daily writings for an overview of the entire year (for instance, displaying 2855 contributions in 2026).

Figure 8: The LFAVC Prototype's Automated "Visual Time Machine" Interface



Source: Developed by Researchers, 2026

The Visual Timeline - Reducing Version Anxiety to Enable Flow: During Phase 1 of the assessment, it was found that manual file naming protocols (such as thesis_final_v2.docx) lead to a "Version Anxiety," which effectively breaks the Flow State from a psychological perspective. In order to solve this problem, the LFAVC UI avoids individual file keep-

ing and instead opts for a more integrated "Visual Time Machine". As seen in Figure 1 above, older versions of the text are not kept individually, but are instead displayed within a consistent chronological timeline right next to the text editor itself. This is what enables the researcher to feel completely confident knowing that everything will be recorded, and nothing will be lost – giving complete psychological protection against any version anxiety. As a result, the researcher's mental effort to preserve data integrity is minimized, making it possible to continue working through "Deep Work" necessary for maintaining a Flow State.

Velocity Analytics, Operationalizing Goal-Setting Theory: Scholarly writing is a lengthy process that often faces the challenge of having no instant feedback, thus causing burnout. To counteract this problem, the prototype uses "Velocity Analytics," which is an interactive dashboard that has been developed based on Goal Setting Theory (Campion & Lord, 1982). Figure 9 depicts how the dashboard offers instant visual feedback regarding the flow of writing on a daily basis.

Figure 9: The "Velocity Analytics" Dashboard within the LFAVC Prototype, Providing Daily Visual Feedback on Writing Momentum



Source: Developed by Researchers, 2026

In order to decompose this momentum even more, the system offers a very detailed breakdown in terms of manuscript creation. As depicted in Figure 10, the analytics engine is able to break down word counts and percentage breakdowns at the chapter level.

Figure 10: Chapter Distribution with Word Count and Percentage (%)



Source: Developed by Researchers, 2026

Moreover, the software tool is not simply a passive text editor but also an active motivational agent that tracks the consistency in writing. This is shown in Figure 11, where the interface motivates through objective real-time feedback in terms of how many "words added" and "words deleted."

Figure 11: The Writing Consistency/Words Added vs. Deleted



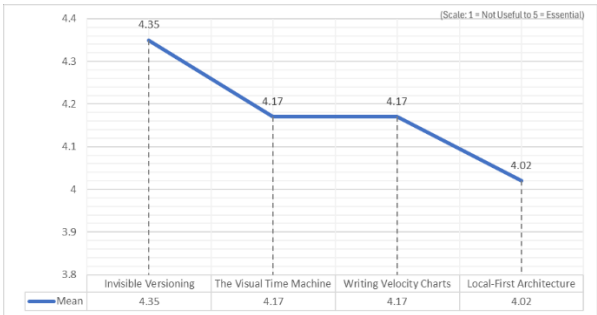
Source: Developed by Researchers, 2026

As compared to the software functioning as a passive text editor, the LFAVC framework serves as a motivating entity for the researchers. The analysis of the data through the dashboard helps the researchers in getting objective feedback on their progress, classifying their data into two categories: "words added" and "words deleted." With the visualization of their sprint capability, the daunting task of "completing a thesis" turns into an easily accomplishable daily target for the researcher.

Validation of the Conceptual Framework: To overcome these divisions, a discussion regarding the acceptability of the "Local-First Automated Version Control" (LFAVC) framework was conducted by the respondents. The quantitative

data showed overwhelmingly high validation for the proposed features: "Invisible Versioning" (μ=4.35), "Velocity Analytics" (μ=4.17), and "Local-First Architecture" (μ=4.02) as summarized in Figure 12.

Figure 12: Perceived Usefulness of Proposed System Concepts



Source: Developed by Researchers based on Survey Data, 2026

The feedback on the proposed conceptual framework was overwhelmingly positive. The most pressing need was for "Invisible Versioning" (μ = 4.35), which illustrates the need for researchers to have one source of truth that can safely automate their data, without the need for them to ever touch it technically. Moreover, the high validation of "Writing Velocity Charts" (μ = 4.17) has a direct correlation with the proposed Goal-Setting Theory. The proposed conceptual framework will give the researcher a much-needed feedback mechanism that will keep the researcher motivated, as with capacity management in Agile software development methodologies. The high validation for "Local-First Architecture" (μ = 4.02) answers the researcher's need for connectivity and privacy, showing how much this feature is needed for the new academia.

Phase 3: Qualitative Concept Validation

The final phase of the results aimed to validate the efficacy of the artifact, as conceptualised with the LFAVC prototype. The open-ended survey responses received (n = 15) were analyzed through an inductive thematic analysis approach (Braun & Clarke, 2006) to determine the perceptions of the researchers regarding the proposed features regarding the friction in the researchers' workflow. Three dominant themes were found, validating the design choices made with the prototype.

The qualitative thematic analysis of Question 1 corroborated the statistical results. Respondents consistently highlighted that manual versioning creates an interference in their work. The next four quotations support this view:

Researcher 01:

"I normally save these as either file1, file2, or final1, final2. There were cases, however, when I had encountered a problem using these versions. This is because if, by any means, I conduct an urgent search where the wrong file is used, then there will be a need to search again for my files separately. This would be a hassle! Imagine doing a submission where the wrong file should be submitted during a deadline; surely this is risky."

Researcher 02:

"There is a challenge that comes from working with multiple files that have similar names, as it can be difficult to locate the right version. This may result in delays in my work process, and I may end up working on the wrong file by mistake."

Researcher 03:

"Rather than concentrating on what I have been writing, I end up stopping to check if I have the right file name or even the right folder to save it in."

Researcher 04:

"I've found myself having trouble making versions such as 'draft_v1', 'draft_final', 'final_revised', and 'final_final'. There were instances where I would open a different version and modify it before saving the updated version. Thus, some crucial modifications were not saved."

The stories proved the need to develop the artifact on a Local-First platform compared to cloud-based autosave (such as Google Docs). The participants continuously pointed out the "Connectivity Divide." They believe that true peace of mind is achievable offline.

Researcher 01:

"I personally use MS word office package offline to type using Word because it is installed on my computer. This is why I use it. Never heard of 'Git' before. I don't usually use apps like Google Docs because sometimes my internet connection isn't that good. In those cases, it's convenient for me to type on the computer at some point. I've used Google Docs a few times. But I find the offline MS Word application more convenient."

Researcher 02:

"I choose Microsoft Word for academic writing since it can function without any internet connectivity and also has easy accessibility. I just need to open it, and I can start writing without any internet connectivity. On the other hand, applications such as Google Docs require good internet connectivity, and at times, it takes time to connect to the internet. Moreover, I do not know about Git or its working."

Researcher 03:

"Nevertheless, it comes with its weaknesses like no real-time backup facility, restricted access through other gadgets, and at times, there might be a problem with file corruption."

Researcher 04:

"A key issue is the inability to access documents from different locations, along with the difficulty of recovering files if they are accidentally lost."

Psychological Relief with "Invisible Versioning": While assessing the prototype's automated background operation, all research participants unambiguously stated that abstracting version control from direct human interaction will drastically decrease their Extraneous Cognitive Load. There was a clear feeling of psychological relief when "Save As" cycles were no longer necessary.

Researcher 01:

"An automatic local saving feature will enhance my trust while typing."

Researcher 02:

"Not only will it save me from possible risks like sudden power failure and computer breakdown, but it will also free me up to think more about my ideas rather than saving documents."

Researcher 03:

"An automatic background saving function will be safer and less stressful for writing."

Researcher 04:

"Besides preventing the loss of data and minimizing worries while creating and comprehending the document."

There was also strong qualitative support for incorporating the visual analytics dashboard in the prototype design. The Goal-Setting Theory hypothesis was validated by participants, who believed that the visualization of their "sprint capacity" would revolutionize their attitude towards long-term academic papers.

Researcher 01:

"In case these options were made available to me, they might assist me in tracking my productivity, learning about my own writing styles, and remaining motivated because of the tangible progress I have seen."

Researcher 02:

"To know about my modifications, including deletions and insertions of any text, might make my revisions easier for me. And since I am writing a thesis, it means that I have to document my thesis in the long run."

Researcher 03:

"Motivation will go up (I will see my progress visually), I will develop good habits of writing, and I will procrastinate less because when I read, 'I wrote 500 words today,' I can then set a goal for tomorrow."

Researcher 04:

"If my writing software had any visual analytics on how much I have edited in each writing session, that would make it easier for me to analyze my work, read it, and go back to particular points in time."

Discussion

The present research focuses on examining the administrative challenges that exist within academic activities. Additionally, there is an evaluation of LFAVC. In this connection, the use of manual methods to manage data hinders academic pursuits; but psychological designing of the user interface would enable the process of writing to resume.

Cognitive Load and the Cost of "Version Chaos": These results provide strong evidence in favor of Sweller's (1988), Cognitive Load Theory, which is known as Cognitive Load Theory. Indeed, the extent of "Version Chaos" was evaluated as severe (μ = 3.75). The examples of confusion provided by the interviewed researchers while using such file names as "draft_v1," "final_revised" indicate a significant misallocation of working memory resources. This supports the latest research conducted by Akin and MurrellJones (2018) and Cohen-Adad (2024), which suggests that the improper strategy for the digital management of academic papers triggers researcher burnout. Indeed, current digital writing tools compel researchers to focus on administrative actions while trying to synthesize complex academic arguments. An overwhelming support of "Invisible Versioning" (μ = 4.35) indicates that developers should strive to create software that will make data management tasks invisible in the background of knowledge creation. Contrary to earlier research, which proposed improving manual strategies for folder organization (Criado-Perez et al., 2024; Li & Wilson, 2025), this study shows that eliminating extraneous cognitive load will allow researchers to dedicate 100% of their working memory to knowledge production.

Task-Technology Fit and the Systemic Divides: The results provide stark evidence of a poor Task-Technology Fit (TTF) in current academic tooling. The data revealed two distinct systemic failures that trap researchers in inefficient workflows.

The Skills Divide: While contemporary literature frequently advocates for the adoption of Git-based workflows to enhance academic reproducibility (Hofbauer et al., 2023), empirical data contradict this as a universal solution. Although Git offers absolute data security, it poses a technical barrier that is impossible to surmount for non-STEM scholars (Business μ=4.50; Social Sciences μ=3.77). Essentially, this divide serves to marginalize a huge segment of the academic community, who are forced to use insecure manual approaches.

The Connectivity Divide: Moreover, the fact that 100% of the participants use offline word processors due to internet instability (μ=3.58) reveals a major weakness in the current trend of moving towards a cloud-based architecture.

The high desirability of the "Local-First Architecture" (μ =4.02) proves that researchers require the safety of developer tools without technical complexity, and the automation of the cloud without internet dependency. The LFAVC framework successfully bridges both divides, proving that data sovereignty must be decoupled from technical skill.

"Goal-Setting Theory and "Velocity Analytics": Thesis and dissertation writing is a lengthy process, which is well known for its absence of immediate feedback and often results in a decline in motivation levels. The high level of endorsement given to "Velocity Analytics" (μ=4.17) provides direct evidence in favor of Goal-Setting Theory proposed by Campion and Lord in 1982. The qualitative stories indicated that seeing the amount of work done each day in terms of adding and deleting words made it easy to break down a massive task into daily achievable goals (see Figure 13).

Figure 13: Invisible Versioning and Velocity Analytics



Source: Developed by Researchers, 2026

CONCLUSION

The academic research process is an activity that requires extremely high levels of cognitive engagement in terms of constant focus and attention. Nevertheless, it is the aim of this research to illustrate how scholars are forced to interrupt the cognitive process for engaging in tedious administrative work in terms of manually organizing their data. This multi-perspective research on the topic has demonstrated that the current trend of manually performing file naming tasks, like thesis_final_v2.docx, leads to a phenomenon called "Version Chaos," which unnecessarily increases the cognitive effort required, creating anxiety and disrupting the "Flow State." Furthermore, the problem is accentuated by infrastructure issues, such as the "Skills Divide", making non-technical scholars unable to use developer software, and the "Connectivity Divide", making cloud storage impossible.

This paper explored the feasibility of LFAVC (Local First Automated Version Control). It is a general understanding within academia that the software utilized within software should be similar to "invisible agents". This framework places the responsibility of data security and labor away from humans and onto machines via "Invisible Versioning," hence eliminating unnecessary mental stress. "Velocity Analytics" has been included to enable the use of Goal Setting Theory, hence enabling visual feedback, which will fuel the motivation to conduct long-term research.

It is clear that the future of academic software lies in separating the ownership of the data from its technical complexities. The fact that the program works offline and automatically manages versions gives researchers the freedom to liberate people from the fear of data loss. Ensuring that effective data management is made available to everyone is essential, both from a technical standpoint and from the standpoint of reducing researcher fatigue.

Implications for Future Research Tools in Academia: Too long have we made the academic researcher make a choice between user-friendly word processors, which are unsecured, or powerful developer tools, which are secured yet extremely difficult to learn. The results indicate that powerful version control systems can be entirely transparent, intuitive, and available to all branches of academia. The LFAVC approach is nothing less than a paradigm change in Human-Computer Interaction: future software architectures must break free from the shackles of data management and allow academics to dedicate their full attention to research.

Limitations and Areas for Future Research: Despite the advantages provided by the use of the mixed-methods design, there are certain limitations associated with it, especially the relatively small sample size involving 48 quantitative and 15 qualitative observations according to perceived value. Being a type of concept validation within the Design Science Research paradigm, this study is concerned with the degree of desire associated with the artifact rather than the actual post-implementation performance. The future work will involve developing and testing a prototype of the proposed LFAVC in order to determine its effects on improving productivity, reducing errors, and eliminating anxiety.

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Generative AI & AI-assisted Technologies Declaration: While developing this paper, the researchers employed Google Gemini, which is a pair programming platform, to enhance, improve, and debug Python code for statistical analysis and data visualization through Google Colab. While the researchers used this technology, the author would like to clarify that the author checked all codes and statistical findings before publishing this paper. This paper only presents a theoretical discussion about the LFAV framework.

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Contrasting Rhythmic Aesthetics in *Tabla* Accompaniment: A Comparative Study of *Khyal* and *Thumri*

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Ranga Perera K.A.D.[1*]

[1*]Department of North Indian Music, University of the Visual & Performing Arts, Sri Lanka

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Abstract

The rhythmic elements of *Tabla* accompaniment play a vital role in both musical traditions. Yet researchers have devoted most of their studies to the melodic and lyrical elements of *Khyal* and *Thumri* while ignoring the rhythmic aspects. The research investigates how *Tabla* accompaniment functions in *Khyal* and *Thumri*, which represent two essential Hindustani vocal music genres, while showing their different artistic approaches and teaching methods. The research collected data through active musical components as recorded data, interviews with practitioners, and institutional curriculum assessment, which were analyzed through comparative transcription analysis and thematic coding, revealing their impact on musician identity formation. The *Tabla* accompaniment in *Khyal* music maintains rhythmic order while following a structured pattern, which enables the vocalist to discover raga through controlled improvisation. The musical style of *Thumri* enables musicians to express themselves through their delivery of sensitive lyrics and their creative rhythmic exchanges, which they accomplish through *laggi* and modification techniques. The research shows *Khyal* achieves intellectual complexity through its organised stage performance structure, yet *Thumri* demonstrates complete musical freedom because of its natural playing approach, although both musical styles need performers to collaborate during their improvisational segments. The research reveals two main institutional pedagogical weaknesses because educational programs lack proper accompaniment training, yet experts confirm that this content should exist to maintain teamwork competencies. The research establishes a better comprehension of Hindustani music through its analysis of accompaniment within cultural, pedagogical, and theoretical frameworks, which reveals its dual nature between structured and expressive elements.

Keywords: Hindustani Music, Improvisation, *Khyal*, *Tabla* Accompaniment, *Thumri*

INTRODUCTION

Khyal and *Thumri* are two of the principal genres or musical traditions within the two traditions of Indian art music; together, these two make up the genre known as Hindustani classical music (Manuel, 1989). The *Khyal* is the more 'intellectual' of the two genres of music, the artist making use of complex pieces from a particular raga to create his own unique improvisations. The artist sustains a consistent rhythm throughout his music within a set cycle of time, known as a cycle or *tarana* (Wade, 1984). Music is essentially of great feelings expressed with the help of musical modes and ragas, and not by sticking to the rules of any style of music (Manuel, 1989). In both genres, the main percussion used is the *Tabla*. The *Tabla* forms the backbone of any music in the form of a rhythmic cycle, which gets synchronized with the vocals (Stewart, 1990). The *Tabla* enables the creation of Hindustani music aesthetic through its ability to link musical structure with artistic freedom and precise playing techniques with musical expression (Manuel, 1989). The instrument determines how musicians create their music and how audience members perceive musical elements (Stewart, 1990).

The historical development of *Tabla* accompaniment has been shaped by the broader cultural and artistic transformations of the Indian subcontinent (Wade, 1984). Mughal-era innovations to rhythmic practice were brought about by *Khyal* music that utilised the *Tabla* instead of the traditional Pakhawaj found in other parts of the Indian subcontinent (Wade, 1984). The *Tabla* produced a wide variety of different sounds, many more than were available from other percussion instruments of the time. The *Tabla* was highly adaptable and thus became the perfect accompaniment for the *Khyal* vocalist. The vocalist would be able to engage in long periods of improvisation, while the *Tabla* player maintained the *tala* of the piece and provided the vocalist with a framework within which he could create his own unique composition within the given rhythm. The *Thumri* of the 18th and 19th centuries developed under the influence of several *Tabla* players in the courts of Lucknow and Banaras. Often enough, they worked in teams with the *Kathak* dancers and the courtesans of the time, and the musical interactions on the stage provided the *Thumri* with its emotional content. The *laggi* and other forms that evolved in interaction with

* **Corresponding author:** Tel.: +94 (77) 383 9309; Email: ranga.p@vpa.ac.lk
https://orcid.org/0000-0003-3830-0896

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Khyal and *Thumri*, respectively, went beyond the basic function of a timekeeper and brought out the inherent syncopated character of the *Tabla* (Manuel, 1989). Subsequently, the role of the *Tabla* changed as it came to terms with the opposing demands of *Khyal* and *Thumri* music and, in the process, evolved its own distinct musical approaches (Stewart, 1990).

Though the *Tabla* is the main instrument used to render both *Khyal* and *Thumri*, the two genres have very different musical concepts, but there is, yet no study on the aspects of accompaniment and rhythmic feel peculiar to each. To address this lack, papers that investigate accompaniment from differing styles are brought together to encourage cross-generic understanding. In addition, contributions that present computational models of rhythm are encouraged, particularly those that acknowledge the cultural complexity of the phenomenon as perceived by musicians and listeners. Finally, papers that deal with methods for encouraging students to develop skills as accompanists are treated within a single genre, rather than in genre-specific isolation. Currently, no research approaches all these areas. This study investigates *Tabla* accompaniment in *Khyal* and *Thumri* within the parameters of performance practice, pedagogy, and the traditional music system of the Hindustani classical tradition.

The principal goals of this work are fivefold: after providing a historical account of the development of *Tabla* accompaniment in *Khyal* and *Thumri*, a comparison and contrast of the roles that *Tabla* accompaniment plays in terms of structure, improvisation, and aesthetics in both genres will be presented and discussed. This research presents a comparative structural analysis of the surface and deep structures of *Tabla* accompaniment in *Dhrupad*, *Khyal*, and *Thumri*. A second objective is to make a detailed comparative study of the expressive potential of the *Tabla* in different micro-sections of these genres. The third aim is to describe and discuss specific improvisatory techniques of the *Tabla* player and their effect on the rhythmic content. The fourth aspect of the research aims to explore the methods of passing on accompaniment techniques through the traditional *guru-shishya parampara* as well as through formal music education systems of India and the West. This study is relevant to issues of performance practice, cultural identity, and the pedagogy of the Indian classical tradition of music, particularly the *Tabla* part. The objectives of this study are to focus mainly on the study of *Tabla* accompaniment and to compare the rhythmic aspects and accompaniments of *Khyal* and *Thumri* songs from a cultural as well as pedagogical point of view.

This study will produce positive results for multiple fields, including ethnomusicology, performance studies, and pedagogy. The research compares *Khyal* and *Thumri* to show how different musical genres handle rhythm and improvisation, which expands our knowledge of Hindustani music. Furthermore, the study carries cultural significance by demonstrating how rhythmic accompaniment practices embody the contrasting aesthetic values of discipline and emotional expression that define Hindustani music as a living tradition (Stewart, 1990). The research study expands academic knowledge and proves that *Tabla* accompaniment continues to play a vital role in defining Hindustani classical music identity.

LITERATURE REVIEW

Research on the accompaniment of *Tabla* in Hindustani classical music has been done through historical research, analytical studies, and pedagogical approaches. However, most of the research already conducted focuses on the melodic aspect of music or vocal music rather than researching the rhythmic aspect of music and techniques of accompaniment. There is a considerable amount of research that already exists on *Khyal*, one of the major genres of vocal music in the system. Research within this genre focuses on the intricate system of improvisation and adoption of the elements of raga music in *Khyal* compositions. Wade (1984) explains the fundamental rules of *Khyal* performance practice through his research, which shows musicians generate new musical content by following predefined musical structures. The *Tabla* functions as an essential musical element that sustains the *tala* pattern and creates musical patterns that enable the vocalist to create spontaneous musical lines. Upadhye (2015) examines the core elements of *Tabla* support in *Khyal* music performances, which shows that the singer leads the performance, yet the quality of accompaniment determines the success of the performance. The author describes that accompaniment to the singer cannot be learned, as the singer follows written rules, because traditionally, accompaniment to song follows the age-old *guru-shishya parampara* of oral transmission. Upadhye (2015) carried out research into the pedagogy of *Khyal* accompaniment, but the research did not proceed to a systematic analytical comparison of the various techniques employed for the rhythmic support of the vocals. In investigating further into *Khyal* music aesthetics, in his paper, Vishwaroop (2019) particularly explores Agra gharana *laya* and *taal*. However, interesting observations from one gharana viewpoint are mainly restricted to that tradition, and there is a paucity of comparison with other musical traditions within *Khyal* or even a comparative perspective with other semi-classical genres like *Thumri*. Although the present study may confirm the pivotal role of the *Tabla* in *Khyal* performances, there is a considerable lack in current research in terms of comparative study of various traditions of accompaniment that have not yet been explored in musicological research. This study seeks to address this gap in the field by presenting an in-depth examination and analysis of accompaniment in *Khyal*.

Unlike other semi-classical melodies, much thought and discussion have gone into the singing melody and emotions of *Thumri* as opposed to the association of *Thumri* with the Tatleem (Courtesan) and *Kathak* Dance. *Thumri* needs poets to create lyrics for it and singers/ musicians to express and encompass the total range of emotions while rendering it. This very quality of *Thumri*, perhaps, is the reason for much thought and study of the genre. Though *Tabla* has been discussed at places where *Thumri* documentation is concerned, especially with reference to its expressive elements, the subject has not been fully explored. In this study, we shall focus on Purab ang *Thumri* and discuss the musical stylisations of various maestros in incorporating flexible elements of *Tabla* playing, such as *laggi* and even light-hearted exchange of material in their *Thumri* renditions. In his paper, Manuel (1993) examines the contemporary *Thumri* from two different perspectives, namely the musical changes that have taken place in *Thumri* over the last 150 years or so and the performance practices of various accompanists in respect of supporting the vocalist. Although Manuel (1989, 1993) brings a wealth of information concerning the very lyrical

and cultural bases of *Thumri*, a detailed study of the specific rhythmic techniques that a *Tabla* player employs in accompanying a vocalist performing in the *Thumri* style has not been undertaken. Though Roy and Ghosh (2019) offered some insight into the dynamics of *laggi* and rhythmic exchanges in a specific regional tradition of *Thumri* known as Purab ang *Thumri*, their study was confined to that tradition, and no comparisons were drawn with *Khyal* music. This research aims to discuss how *Tabla* performs in creating musical freedom in *Thumri* performances, and this analysis is not compared with *Khyal* music. In addition to analysis of recorded audio, there is a growing body of research applying computational and corpus-based methods to the study of aspects of Hindustani music, including rhythm and the structure of musical improvisation. In this talk, we present some initial findings from a study of expressiveness in live *Tabla* accompaniment, focusing particularly on how individual strokes are conveyed through variations in amplitude and timing.

While Rohit and Rao (2021) and Srinivasamurthy et al. (2017) conducted computational analyses of aspects of *Tabla* performance, including tempo and rhythmic elaboration based on a corpus analyses of stress patterns within a metrical cycle, their approaches ignore patterns outside of the cycle and fail to address aesthetics and culture-specific aspects influencing different forms of accompaniment in *Khyal* and *Thumri*. A quantitative approach to the aesthetics of rhythm has been developed and applied to the study of *Khyal* and *Thumri* accompaniments. McNeil (2017). This research examines how Hindustani raga music utilises improvisation through a detailed and insightful analysis of *badhat* (development) and *upaj* (spontaneous creation). McNeil (2017) treated structured improvisation and spontaneous improvisation as contrasting categories, applying them to a comparison of the structured accompaniment of *Khyal* singing with the spontaneous accompaniment found in *Thumri*. However, he did not explore the rhythmic dimension of the *Tabla* in relation to either genre. Research on rhythm as a category has grown in recent years, yet comparative analysis of the rhythms of *Khyal* and *Thumri* has so far not been undertaken.

The research includes a descriptive and thematic study of the music from the pedagogical standpoint of the student. The thesis outlines that this music is best learned by students through demonstration and imitation, within a traditional teaching studio environment, utilising the studio pedagogy model prevalent in South Asia and strictly within the *Tabla* tradition. The study investigates contemporary methods of training within formal music institutions of South Asia, focusing on the aspect of accompaniment and attempting to formulate a systematic approach to the teaching and performance of this aspect of music. Although such an approach can yield consistent results, it cannot account for the variation and spontaneity inherent in the creative expression of the *Thumri* performer. Rajveer Singh (2018) explores the *Tabla* as both an independent musical composition and a musical companion, drawing upon diverse musical genres and creating performances appropriate to each style. In contrast, the author's earlier research (2010, 2012, 2014, 2015 & 2016) addressed specific aspects of *Tabla* as a musical accompaniment in particular vocal traditions of *Khyal* and *Thumri*. However, there is an absence of comparative analysis between the two differing pedagogies of *Tabla* training and their relative institutional outcomes.

Research into teaching methods is prevalent, and the accompaniment of *Tabla* in *Khyal* and *Thumri* compositions presents its own set of difficulties. A notable gap in the existing pedagogical discourse is the absence of methods by which to foster these aspects as opposed to *layakari* and *dhrupad* accompaniments, which currently dominate music teaching institutions. This ethnomusicological study of the realms of rhythm and improvisation examines their origins and aesthetics within particular cultures and contexts. Stewart's study of North Indian music rhythmic patterns culminated in the development of several theoretical models that elucidate both the methods and techniques that musicians use in solo improvisation and within the context of a particular *tala* cycle. This work is currently being furthered in Stewart's ongoing research. The study of rhythm, as these studies have shown, is one of the most basic cultural elements that shape a nation's concept of self.

Although Stewart (1990) provided a theoretical framework in which to 'think' rhythm as culture, and although he linked general ideas about rhythm with observations on South Asian music, his model is not of much use in distinguishing the very different rhythmic 'aesthetics' that are characterised by *Khyal* and *Thumri* respectively, nor in explaining differing accompaniment strategies. The study of rhythm has relevance to many disciplines because rhythm affects mental processes as well as evokes emotion. Music studies require live music with *Tabla* accompaniment so that the understanding and experience of rhythm can be fully appreciated. While Stewart (1990) presented the complexities of Hindustani rhythm as a single entity, this study aims to separate and describe individual aspects within different musical contexts. This research is related to the role of *Tabla* in the performance of *Khyal* and *Thumri* songs, dealing with their music as well as the scientific aspects of rhythm and methods of improvisation.

There are two gaps in the existing literature-one theoretical and the other empirical. The theoretical gap pertains to the two possible ways of perceiving the rhythmic aesthetics of *Khyal* and *Thumri* as either structured musicality or expressive musicality. The empirical gap pertains to genres and/or broad rhythmic categories, as opposed to comparing specific *Tabla* accompaniments within both traditions. Although the literature on accompaniment techniques of *Tabla* deals with various aspects, there is a third gap in the existing literature, i.e., a comprehensive study which incorporates performance transcription, practitioners' interviews, and pedagogical approach in one framework. This study explores the techniques of *Tabla* accompaniment for two genres of classical music in South Asia, namely *Khyal* and *Thumri*. These two genres have not been dealt with in a scientific manner to an adequate extent. A comparative study approach has been utilized for this purpose.

MATERIALS AND METHODS

This research study applies a qualitative and comparative ethnomusicological perspective to an examination and analysis of the various strategies of *Tabla* accompaniment as found in performances of *Khyal* and *Thumri*. A qualitative approach to the study of the aesthetic and improvisational

aspects of *Tabla* accompaniment is most appropriate since these aspects cannot be fully quantified, and an interpretive analysis grounded in the music's cultural and musical context is therefore required (Stewart, 1990). In order to compare the design of more dominant rhythms between genres, their patterns, differences, and relationships are examined and contrasted in order to gain a greater understanding of two genres of human movement.

The study is based upon primary data, recorded performances of *Khyal* and *Thumri* sung by the most prominent vocalists and accompanists belonging to various famous *gharanas* of the country. There are fifty recorded performances; 25 of them are of *Khyal*, and 25 are of *Thumri*. These performances have been recorded and analyzed through a purposive sampling plan. Recordings of the most prominent vocalists and accompanists belonging to various famous *gharanas* have been included in the study. Recordings of performances of various musical forms from the beginning of the 20th century up to the present have been studied. The *Khyal* recordings feature four prominent vocalists representing distinct gharana traditions: Pandit Bhimsen Joshi (Kirana gharana), Ustad Rashid Khan (Rampur-Sahaswan gharana), Kishori Amonkar (Jaipur-Atrauli gharana), and Veena Sahasrabuddhe (Gwalior gharana). This new *Thumri* recording features four of India's most celebrated vocalists today, including *Girija Devi* (*Benares gharana*) and two others singing from the traditions of Banaras and Lucknow: Siddheshwari Devi and Begum Akhtar/Shobha Gurtu, respectively. In addition, six of India's most noted *Tabla* accompanists participate in the recording, including Zakir Hussain, Alla Rakha, Anindo Chatterjee, Swapan Chaudhuri, Kumar Bose, and Yogesh Samsi. All are highly respected in the field of *Khyal* and *Thumri* accompaniment.

These files were sourced from YouTube as archived performance material for the research. The research used both All India Radio recordings and commercially released recordings as archival material to explore the development of accompaniment techniques amongst the musicians studied, including the students. These archival materials were analysed by creating transcription files of the *Tabla* patterns. These files enabled comparison between a range of musical elements, including *bol* variations/*thihai* structures and *laggi* sequences/syncopated improvisations. The research gathered data through recordings and interviews with musical practitioners, including *Tabla* players, vocalists, and teaching professionals, which were significant. A total of fifteen participants were carefully interviewed for this study, comprising four *Tabla* players, four vocal artists, and seven highly experienced vocal educators. The participants for this research study were approached via purposive snowball sampling. Initially, the researcher's contacts from his music background referred more participants with relevant expertise from their professional circle of music teaching, learning, and performing. The researcher's connections from Indirakala Sangeet University (India) and also from Bhatkhande University of Music, Lucknow (India), and the University of Visual and Performing Arts (Sri Lanka) were approached for this research. All the participants had experiential knowledge of either *Khyal* singing practices or *Thumri* accompaniment practices or both. The interviews offered further proof of the opposition between the musicians' attitudes to accompaniment as an aspect of improvisation that does not lend itself to fixed rules, and the views of the analysts as expressed through their frameworks of analysis. The interviews with the practitioners were especially important, for it was through their views on these matters that it was possible to find a connection between the analytical findings and the musicians' practical experiences as professionals.

The research uses ethnomusicological theory together with performance analysis as its analytical framework. The research studied rhythmic methods because they serve two purposes in music composition: they organise musical structure, and they express emotional content according to Stewart's (1990) theoretical framework of *tala* and improvisation. The present research coded and organized improvisational methods, which included *bol* variations, *tihai*, *laggi* and syncopation to study their distribution between *Khyal* and *Thumri* performances. The research investigated how *Khyal* music composers used rhythmic elements to show their musical discipline, and *Thumri* musicians used their musical compositions to express their emotional sensitivity. The research compared different elements to show their similarities and differences while placing musical accompaniment practices in their social and temporal environments.

This research work studied pedagogical tools and current methods of teaching accompaniment through the material provided by institutions and books. The curricula of three universities were studied: Indira Kala Sangeet University of India, Lucknow Bhatkhande University of India, and the University of Visual and Performing Arts of Sri Lanka. As pointed out by Upadhye (2015), the accompaniment of *Khyal* musicians is learnt through musical experience. In *Thumri*, accompaniment is based on the style of the song and the musician's ability to react to the words of the song (2019). In the previous section, we discussed human perspectives on evaluating performance skills that music students need to learn to play well. Here, we explore the potential of computational methods to analyze and study such performance skills. While previous work analyzed tempo and rhythmic elaboration for this purpose (Srinivasamurthy et al. 2017; Rohit and Rao 2021), we utilize their findings to structure an analysis of the skills involved in playing in rhythm and in improvisation.

The research analysis needed multiple playback sessions of recorded material and complete documentation of *Tabla* musical support and systematic identification of free playing elements. The data analysis followed a three-stage process, commencing with a transcription analysis of the *Tabla* patterns from the 50 audio recordings of *Tabla* lessons, identifying and analysing the rhythmic material within the *bol* variations, *thihai* structures, *laggi* sequences, and the syncopated sections. The second stage of the analysis involved deductive thematic coding of the large amounts of transcription data and interview data. Several primary categories were derived from a wealth of literature and contemporary practice, which highlighted aspects of the structured accompaniment and expressive freedom in improvisation, and the various *Tabla* improvisation techniques and methods of pedagogical transmission were utilized within the coding process. The third method used for this analysis is comparative. This method was applied between two genres of North Indian classical music-*Khyal* and *Thumri*-identifying some of the patterns, contrasts, and relationships that emerge be-

tween the two genres when comparing the practices of accompaniment within them. These will be presented in the form of tables in the results section.

To establish the trustworthiness of this qualitative study, strategies were addressed to ensure the criteria of credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). Credibility was addressed through two methods of prolonged engagement and member checking. Prolonged engagement involved both multiple playback sessions over time and the researcher's analytical focus being on specific aspects of individual teaching performances. Member checking involved sharing the key findings and analytical interpretations with some of the practitioner participants in the study and gaining their agreement about the accuracy of the interpretation. Credibility is increased by data source triangulation, i.e., using more than one source of data (e.g., performance recordings, expert interviews, and institutional pedagogical materials) and verifying findings from each source. Transferability is increased by providing thick descriptions of the different musical environments and of the specific *gharana* traditions and performance settings that have been studied. An analysis of 50 recordings and transcripts of interviews was conducted using the same method for reliability. The confirmability was ensured by continually referring to the data, recordings, and statements of actual practitioners. The interpretations were grounded in the observations.

RESULTS AND DISCUSSION

Results

This study examines the modes by which accompanists structure their performances of *Khyal* and *Thumri* songs. The findings from the study are presented under the four deductive coding categories drawn from the analytical framework: structured accompaniment, expressive freedom, improvisational techniques, and pedagogical transmission. The findings are organized under two headings: the findings from the study of *Khyal* accompaniment and the findings from the study of *Thumri* accompaniment. A comparative discussion between the two genres is also included. The four categories provide an organizational framework that outlines the different approaches to accompaniment evident within the studied performances.

Khyal Accompaniment: An attempt has been made in this work to analyze and study the accompaniment of *Tabla* in *Khyal* performances. The various elements of rhythmic discipline and structure have been studied to understand how they contribute to the aesthetic features of *Khyal*. The highly improvisatory nature of *Khyal* requires the vocalist and the *Tabla* player to display at the same time the highest degree of creativity and strict adherence to structure. The current research shows that *Khyal* reaches its deep improvisational potential because it needs *tala* cycles, which the accompanist uses to keep the vocalist's musical extensions within rhythmic structure. The research results confirm this observation because *Tabla* musicians maintain the *tala* structure through their precise *bol* pattern execution and their strategic improvisational methods, which enable them to create musical dialogues with the singer.

This paper draws upon recorded material from the author's fieldwork. It explores the way accompaniment to *Khyal* is rendered in performance and reveals that it is largely determined by the *theka*, or basic rhythm of a cycle of *tala*. The *theka* is here shown to be repeated exactly by all performing musicians throughout a piece, thus providing the basic rhythm for the strokes of the accompanying *Tabla* player and allowing the vocalist to deliver freely improvised melodic passages whilst remaining on track. The *Tabla* plays an essential part in *vilambit* (slow tempo) *Khyal* performances because the accompanist needs to maintain the *tala* cycle throughout the long improvisational sections. The research of vocal recordings from Agra and Gwalior *gharanas* demonstrates that accompanists use small adjustments in *bol* placement to indicate *tala* progression, which helps vocalists during their improvisational performances. The results show how *gharana*-based musical approaches to rhythm and time create unique musical rhythms, and this research verifies that accompanists modify their performance to match the musical tastes of their *gharana*.

Tihai - accompanists use this musical technique in the last sections of *Khyal* improvisations. The *tihai* section forms a complete musical cycle. This is repeated three times in total, and the third time ends on the same, i.e., the first beat of the cycle. The *tihai* provides strong rhythmic closure and brings the most intense emotions of the musical cycle to the surface. It signals a change of sections to the vocalist. The bold variations of the accompaniment create interest in the transcription analysis. The accompaniment plays a major role in musical development, while the open and closed strokes of the accompanist's drumming create different musical effects and therefore stay within the discipline of the genre.

The research proved that tempo stands as a core musical element that plays an essential part in *Khyal* accompaniment. The *Tabla* player needs to control his or her play during *vilambit Khyal* because the slow tempo demands that he or she play the *theka* with precision while keeping their improvisations minimal to let the vocalist discover the raga. While the accompanist has little scope for elaboration in the slow sections of *Khyal*, the situation is entirely reversed in the fast sections. Within the framework of the *drut* provided by the main singer, the *Tabla* player can, and indeed does, introduce much syncopation and may even elaborate a *bol* in considerable detail. A study of the various patterns of *Tabla* used as accompaniment to examples of *Khyal* performances confirms the point made earlier that musicians make use of tempo and of rhythmic elaboration to create their performance techniques. In addition, the function of the accompanist is to provide stability to the main singer, and at the same time to introduce many of the dynamic elements that are a feature of so many *Khyal* performances.

Musicians who practice *Khyal* accompaniment show their performance methods by directly observing musical performances. *Tabla* musicians emphasized that musicians should concentrate on the vocalist's sounds while they attempt to forecast the vocalist's improvisational notes. The accompanist explained that the *Tabla* player needs to match their breathing with the singer instead of fighting against their rhythm during performance. If the instrumentalists are playing a steady rhythm, the singer has complete freedom in the rest of his or her creative thinking.

The lack of training for *Khyal* accompaniment through real-life experience was also noted by the practitioner interviews. Even highly established pedagogical programs within established music and dance institutions primarily train students to play the *Tabla* as a solo instrument and do not supply sufficient experience within the program framework for *Khyal* accompaniment. The practitioners worried that students who learn in institutional environments would not gain sufficient practical experience to perform effective accompaniment.

Thumri Accompaniment: This research investigates the other pole of *Khyal* music on the opposite side of structured musicality, in the light of its application in the accompaniment of *Thumri*. *Thumri* is one of the semi-classical genres of Indian music and is characterized by improvisation, yet with retention of fine musical details and playfulness. This study explores the role of *Tabla* accompaniment in the creation of such a unique musical aesthetic and reveals the essence of *Thumri* music and poetry through it. The *Tabla* in *Thumri* performs two functions: keeping the *tala* cycle active and using its musical components to create stronger emotional effects through its reactions to vocal content and the singer's physical movements.

A more in-depth exploration of expressive freedom in *Thumri* through the study of recorded performances by musicians using the principal accompaniment technique of *laggi*. This will examine the complex and fast rhythms that the performer uses to heighten the emotional response of the listener in a live performance.

In the research study, the recorded performances of *Thumri* have been analyzed. The major accompaniment technique that musicians of *Thumri* use is *laggi*. With *laggi*, the musician generates fast-moving patterns and depth of emotion in the performance. The study further elucidates how a *Tabla* player creates a complex musical line, a *laggi* sequence within the confines of a piece of music set to a *drut* tempo to create a powerful dialogue with the fundamental component of *laggi* of a singer's rendition of a Purab ang *Thumri*. The present investigation, therefore, confirms the earlier findings of Ghosh (2019).

Unlike the more regular *bol* variations typical of *Khyal*, in this instance, the accompaniment to the *Thumri* is used as an improvisation, and the *bol* variations are played differently by all the musicians at various points in the song. Roy and Ghosh (2019) observe that in *Thumri* accompaniment, the musicians follow the vocalist's interpretation of the lyrics of the song being sung. Here, the rhythms of the song correlate with the musical content of the lyrics.

While in *Khyal*, *thihai* is a structural marker marking the ends of songs or structural sections within a composition, the *Thumri* accompanist uses the same unit for greater expressive purposes at almost any point in the song. This paper examines the role of and use of *thihai* in performances of *Thumri* from the perspectives of composers and accompanists. Examples from recordings by leading exponents are discussed. The *thihai* at cadences, as well as at what could be called the 'song sections' of *Thumri*, creates more expressive music than the same unit would in *Khyal*. The composer uses the *tihai* for playful expression, generating a highly lyrical feeling.

The theme of pedagogical transmission from the practitioner interviews suggested that *Thumri* accompaniment is transmitted almost entirely through oral tradition, ie, through live encounters with a teacher or through less formal tutorial situations, etc. Although there is as yet no established methodology towards the teaching of *Thumri* accompaniment, this is in marked contrast with the increasing formalization evident within the pedagogy of *Khyal*.

Comparative Overview - Usage of Rhythmic Elements: Table 1 presents a systematic comparison of the rhythmic elements identified across the 50 recordings, organized according to the deductive coding categories applied in this study.

Table 1: Usage of Rhythmic Elements

Major Element	Use in *Khayal*	Use in *Thumri*	Method of analysis
Taal Theka	Repetition in *Taal* for stability and support improvisation in *Vilambit* Khayal	Minimum use of *Theka*	Play back multiple times and use the transcriptions
***Thihai* phrase**	Used for ending or for the closure of a section.	Used to stress the lyrics and emotion	Documentation of the patterns
Variations and compositions	Used in *Kula* (open) and Bandh(close) textures while maintaining the discipline	Likely but less highlighted	Thematic coding from recordings
***Laggi* variety**	Rare; limited to the end part of *Chota Khayal* (Medium tempo) sections	Core and compulsory at the end of the *Thumri*	Identification of free-playing elements
Syncopation or Modification	Only minor tempo-based short variation or ornamentation elaboration	Stroke displacement for tension and lyrics	Ethnographic archival comparison

Source: Author's own analysis (2024-2025) of 50 recorded performances, drawn from Air India archival recordings, commercial releases, and YouTube-hosted archival material

Discussion

Interpretation of Khyal Findings: In *Khyal* music, the *Tabla* accompaniment serves to realize musical aspects like physical control, a format, and musical intelligence. This paper highlights how *Tabla* accompaniment is used to realize these aspects in *Khyal* music. It further supports Wade's (1984) observation that *Khyal* reaches its highest point of improvisation using *tala* cycles and outlines the ways in which accompanists realise this through accurate *theka* playing and *bol* variations. From the singer's point of view, *tala* offers enormous freedom in terms of setting up a melody line, while at the same time keeping the singer locked on the *tala*'s rhythm. Looking at *tala* this way means that we are looking at music in terms of structures and rules that the musician must follow.

These musicians are not only skilled practitioners of musical compositions that include organised artistic improvisation in the context of *Khyal*, but they can also apply further aspects of controlled improvisation at the end of a musical piece. *Thihai* is a musical structure that gives a finality and accent to a song and is frequently performed by musicians. The accompanist typically employs *tihai* as a cue for musical transitions and coordinates the coincident musical development of the vocalist. The performer may utilize controlled improvisation in collaboration with the vocalist to support the vocalist's creative ideas within the framework of the performance.

Tempo is another important aspect of an effective *Khyal* accompaniment. The *Tabla* player tries to keep the *theka* in the correct places with minimal improvisations so that the vocalist can render the raga as he desired in a *vilambit Khyal*. In contrast, the *drut Khyal* has further enhanced greater excitement through patterns and *bol* variations that uplift the tempo of the composition. This study deals with how a *Tabla* accompanist strikes a balance between holding on to the form and being flexible in both the tempos, and seeks to delve into the same.

The findings from the practitioner interviews supported these analyses. The musicians spoke about the interactive nature of *Tabla* performance for this type of music. They described how they must match the breath of the singer and respond by creating organized musical exchanges with other performers. The vocalists spoke about the importance of having a good rhythmic foundation so that they could then develop and embellish their improvisations. The findings also support the traditional methods of pedagogy in Indian music that stem from demonstration and imitation by the teacher. However, the need for the accompanist to enter into musical exchanges with the singer requires more than just technical facility.

Interpretation of Thumri Findings: The research results show that *Tabla* accompaniment in *Thumri* music expresses three essential musical values: expressive freedom, lyrical sensitivity, and playful rhythmic dialogue - values which stand in contrast to the structured aesthetic of *Khyal*. Manuel (1989) established *Thumri* as a semi-classical musical style that emphasises poetic and emotional elements, and the current research shows that the *Tabla* instrument serves as the primary vehicle to achieve this musical style. The *Tabla* player is also actively involved in expressing emotions during the performance of *Thumri* by following the physical expression of the vocalist in relation to the expressive aspects of the performance. The main characteristic of the *Thumri* accompaniment, i.e. *laggi*, forms a fast-moving cycle of the core element, and thus it is Purab ang *Thumri*. Parts of *Thumri* sung in fast tempo (*drut*), the *Tabla* player performs *laggi* for sequences. These sequences of rhythmic cycles are in dynamic dialogue with elaborations created by the vocalist. The method of performance of accompanists at these places is a model of performance by *Thumri* musicians. A musician (vocalist or accompanist) performs according to the feelings of other musicians, and as such, no fixed rhythm can be played by the singer and accompanist together.

When appealingly played, *Thihai* forms part of the *Thumri* structure. *Thihai* in *Khyal* refers to the end of a song, but a *Thumri* performer can highlight a verse or emphasize a poem through *Thihai*. The above-stated research findings are further supported by the comments of practitioners. *Tabla* players comment that they respond to word-oriented songs, whereas vocalists require musical accompaniment that can follow their expression.

Pedagogical Implications: The research results have important consequences for how teachers should teach *Tabla* accompaniment for *Khyal* and *Thumri* performances. The educational programs at institutions fail to provide sufficient training for students who need to learn accompaniment skills. Studio pedagogy in the traditional *guru-shishya parampara*, as Singh (2010) states, teaches students accompaniment skills through demonstration, imitation, and hands-on experience while practicing with vocalists.

The educational system of *Khyal* focuses on teaching students to play *Tabla* alone because they learn to play accompaniment only after mastering solo *Tabla* performance. Upadhye (2015), in his qualitative research with *Khyal* musicians, developed an approach to teaching *Khyal* that would go beyond the common educational models. The principal objective of the approach is to help the musician learn to anticipate and react in an appropriate manner to the singer's improvisations in real time during a public performance.

Some of the biggest challenges facing the education of the accompaniment to free-form emotive music, such as *Thumri*, within Indian musical traditions are the lack of documentation of the accompaniment for many forms of Indian music as they are passed down verbally from generation to generation. For *Thumri*, however, learning the accompaniment is mostly done by the observation of the musicians in informal settings, such as the sangeet sansad or the home of a senior musician. Thus, the apprenticeship model of learning is one of the most characteristic features of the performance practice of *Thumri*. Therefore, any program of education for the performance of *Thumri* would require the student to learn to make appropriate sounds and to be a competent musician, able to function in a collaborative situation, and to be studied as a core part of the curriculum of such a program. This aspect of learning would enable the student to play music with others as well as to learn to sing *Thumri* on his/her own.

Cultural and Theoretical Significance: The cultural and theoretical values expressed through rhythmic forms of musical identity, aesthetics, and improvisation. Studies on Hindustani music rhythms from an ethnomusicological perspective reveal that three main musical values are embedded in them: discipline, emotional expression, and teamwork (Stewart, 1990). This research examines the practices of accompaniment to *Khyal* and *Thumri* pieces through two different artistic strategies. While *Khyal* pieces are explored through complex intellectual structures, *Thumri* pieces are explored through structures that allow for deeper emotional expression.

Thumri is often employed by musicians to create the most unstructured of improvisations to heighten the emotion of a song. Thus, two approaches to improvisation in Hindustani music provide the reader with an understanding of the improvisational philosophy as well as how the same ideas can be utilized to create vastly different artistic values.

Each of the major musical traditions, whether *gharanas* or regional in character, uses accompaniment in performance in characteristic ways. Methods of playing *laya* and *taal* within *Khyal* songs, as illustrated by Vishwaroop (2019), or Manuel's (1993) tracing of the development of the instrumental support for *Thumri*. The current research confirms that musical accompaniment traditions exist as cultural elements that stem from historical development and local traditions of different areas.

CONCLUSION

The research investigates how *Tabla* accompaniment affects *Khyal* and *Thumri* performances through its analysis of their opposing musical values within cultural, educational, and theoretical contexts. The research shows that accompaniment functions as an active musical element that determines the musical identity of Hindustani music. The research analyzed recordings together with practitioner interviews and pedagogical settings to show that *Tabla* accompaniment contains both disciplinary and expressive aspects - structured and unstructured components which represent the dual nature of Hindustani musical tradition.

Khyal music performers need to play their instruments with exact rhythm while following set musical arrangements. And calculated changes in the *bol* section, and precise placement of the *tihai*. As previously noted, research findings from the current study reveal that *Khyal* singers utilize fixed methods for improvisation within the genre and require the highest level of musical ability within the structure of the accompaniment. From the practitioner's point of view, the music of *Khyal* vocal pieces requires total collaboration between the singer and accompanists to create music. A *Tabla* player must coordinate his breath with that of the singer. The vocalist requires his/her accompaniment to create space for his/her improvisation. Thus, the *Khyal* accompaniment demands extreme self-control, mental focus, and musical knowledge from the musicians practicing this genre of music.

The performer demonstrates controlled self-expression, while at the same time, he can respond to the musical words in his rendition. *Thumri* accompaniment is generally so simple that it provides a background to the performer's uniqueness. The accompanist, by using various musical techniques like *laggi*, syncopation, and *tihai* based on musical discovery, related to the emotional and musical values of this genre. Based on the perceptions of practitioners, a *Tabla* player has to produce musical sounds while uttering words of accompaniment, and a vocalist has to guide the musical accompaniment with their feelings and emotions. Thus, the practices related to *Thumri* accompaniment are based on principles of spontaneity, sensitivity, and complete musical freedom as opposed to *Khyal*.

A study of two main forms of Indian music, *Khyal* and *Thumri*, played with accompaniment, has revealed that they have their roots in common. *Khyal* is characterized by disciplined improvisation within set limits, whereas *Thumri* is played with completely free improvisation. Research into the *Tabla* accompaniment to these two forms has yielded a large amount of structured material as well as a vast amount of completely free music, and it is this which is at the core of the full beauty of the Hindustani classical musical traditions. The dual nature of Indian classical music becomes evident through the analysis of *gharana* and regional musical traditions, which influence *Khyal* through *gharana*-based *laya* and *taal* methods and *Thumri* through its connection to Banaras and Lucknow musical traditions.

The research results reveal multiple educational consequences. The research shows that educational institutions do not provide enough training for accompaniment because their students mainly learn to play alone. The practitioners expressed concern that insufficient focus would block the development of collaborative sensibility, which accompanies success. The research findings show that educational institutions should make accompaniment training part of their regular curriculum to teach students who have musical talent and natural performance abilities. The recommendation holds special importance for Sri Lanka because the country has growing institutional music education systems, which need accompaniment training to enhance their Hindustani music education programs.

This study develops knowledge in three principal areas. First, a conceptual framework to outline the contrastive structures of accompaniment for *Khyal* and *Thumri*, between structure (discipline) and freedom, 50 performances from a wide variety of musicians are presented. This contrasts greatly with current research, which is elaborated. Secondly, an empirical comparative study of accompaniment on the *Tabla* in while extremely wide, is largely non-systematic and confined to within genres, rather than across genres.

Third is *Tabla* accompaniment and the pedagogical investigation of the demands of such accompaniment for teaching students how to accompany songs sung with *Tabla*. So far, the issue of the accompaniment of songs sung with *Tabla* has not yet been addressed by research, and the paper sets up a comparison of the two genres in terms of teaching and learning. What is required for the institutional music education system is *Tabla* accompaniment, as a rich site for future interdisciplinary research in ethnomusicology, music pedagogy, and other fields.

Limitations and Future Directions: However, the study cannot possibly cover all the ways a musician might accompany a song. Research into people's perceptions, using practitioner interviews as data here, provides a solid foundation for the multiple methods of verification of data that are not available for teaching accompaniment to songs.

The research method unites historical context studies with performance evaluation and recording techniques, expert opinions, and educational research to study *Tabla* musical support in *Khyal* and *Thumri* performances. The research study uses ethnomusicological theoretical models to analyse practical data, which shows how different rhythmic methods express conflicting musical and improvisational perspectives to improve our knowledge of Hindustani music and educational approaches.[SP1.1]

In future studies on rhythm, a more systematic analysis could be provided by means of a computational analysis. For future studies on curriculum development in Sri Lanka and India, it will be important to set up an institutional framework for the accompaniment training of musicians. This should enable the musician not only to develop his technical skills to perfection, but also to develop into a good performer in an accompanying function. A comparative analysis of more *gharanas* and semi-classical genres can further develop and refine the framework of analysis established so far.

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Digital Workload, Well-Being, and Professional Identity of University Academics: A Systematic Literature Review

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Bamunawita K.M.[1*] and Priyanath H.M.S.[2]

[1*]Faculty of Postgraduate Studies and Professional Advancement, NSBM Green University, Sri Lanka

[2] Department of Economics and Statistics, Sabaragamuwa University of Sri Lanka, Sri Lanka

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Abstract

Despite digital technology having improved accessibility and flexibility, scholars highlighted that it has intensified workload pressure and changed professional experiences, particularly for university academics. This paper aims to review how university academics' professional identities and well-being are affected by their digital workload. The study used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to determine the connection between university academics' digital workload and their professional identities and well-being. The initial search gave 1258 records. After removing duplicates and screening titles and abstracts, 1068 records were excluded. 190 full-text articles were screened, resulting in an exclusion of 150 studies that did not use Job Demands-Resources (JD-R). Finally, 40 studies met all inclusion criteria. Results revealed a negative relationship between digital workload and well-being, and some of them view digital workload as a source of stress. The connection between well-being and professional identity has been found to differ, and some authors believe that professional identity is a stable construct that is impacted by digitalisation indirectly through well-being outcomes. Thus, the study contributes to the existing body of knowledge by integrating existing research findings on the interconnected impact of digital workload on the well-being and professional identity of university academics. The findings provide an inclusive framework for understanding the consequences of digital transformation in higher education and suggest that more mixed-method research is required on digital transformation to improve the well-being and professional identity of university academics.

Keywords: Academic Well-being, Digital Workload, Higher Education Institutes, Professional Identity, University Academics.

INTRODUCTION

As noted, the digital workload was created through the digital revolution in work settings. As defined by Scholze and Hecker (2023), "digitalized workload is the technical process of converting analogy [A1.1]signals into a digital form" (p.1). In other words, digitalized workload is the intensity, volume, and complexity of technology-incorporated tasks that employees perform (Buda & Kovács, 2024). Volume is the amount of work given to an employee within a fixed timeframe (Bakker & Demerouti, 2007). Complexity is defined as the cognitive demands required to perform intellectually demanding tasks (Lepine et al., 2005). Intensity is the effort required to fulfil the tasks within the set timeframe (Bakker & Demerouti, 2007). Thus, digital workload differs from traditional workload in its digitalized nature, which blurs work boundaries.

Applying the phenomenon to university academics, it has now become a significant prevailing issue in Higher Education Institutions (HEIs). The shift has altered the workload as it is now emotionally and cognitively challenging (Wang & Yao, 2025). Thus, given the considerations presented by scholars, it is necessary to evaluate an academic's digital workload to understand experiences and outcomes. The well-being of academics directly affects how they present themselves in the multiple roles they play. Beijaard et al. (2004) interpret professional identity as a sense of purpose developed by a professional within their role in an organization. Findings suggest that when academics consider digital workload as an interference, it can result in weakened professional identity, diminished job satisfaction, and role tension (Wang & Yao, 2025).

Despite the existing body of knowledge, research integrating professional identity, digital workload, and well-being is rare (Wang & Yao, 2025; Wang & Li, 2019). Further, JD-R could be used to show that digital workload is not only a job demand but also influences professional identity (Beijaard et al., 2004). The dearth of evidence-based investigations shows a significant gap in literature. Little is known about how an academic's digital workload affects their professional identity and well-being (Celebi & Eraldemir-Tuyan, 2022; Wang & Li, 2019). According to other studies, a digital workload lowers academic well-being and causes stress (Kinman & Johnson, 2019; Sharma et al., 2023).

* **Corresponding author:** Tel.: +94 (77) 742 8916 ; Email: kmbamunawita@students.nsbm.ac.lk
https://orcid.org/0009-0005-0207-2424

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According to Bakker and Demerouti (2007), JD-R offers a theoretical viewpoint that highlights two crucial concepts: demands and resources. According to the JD-R theory, if demands associated with digital workloads are not accompanied by sufficient resources, they may result in stress and burnout. HEIs may have something to do with this. For example, excessive digital workloads can result in burnout. JD-R theory is supported by this theory. However, there is a gap in the application of JD-R theory in digital workloads in HEIs (Bakker & Demerouti, 2007; Naidoo-Chetty & du Plessis, 2021). Another untested theory is that HEI employees' professional identities may be impacted by digital workloads (Beijaard et al., 2004). Many studies focused on engagement or stress that builds with digital workload and turn a blind eye to its effect on professional identity (Wang & Yao, 2025). A better insight could be provided by studying both aspects. Accordingly, the study aims to systematically review digital workload and its effects on the academic well-being and professional identity of university academics in HEIs.

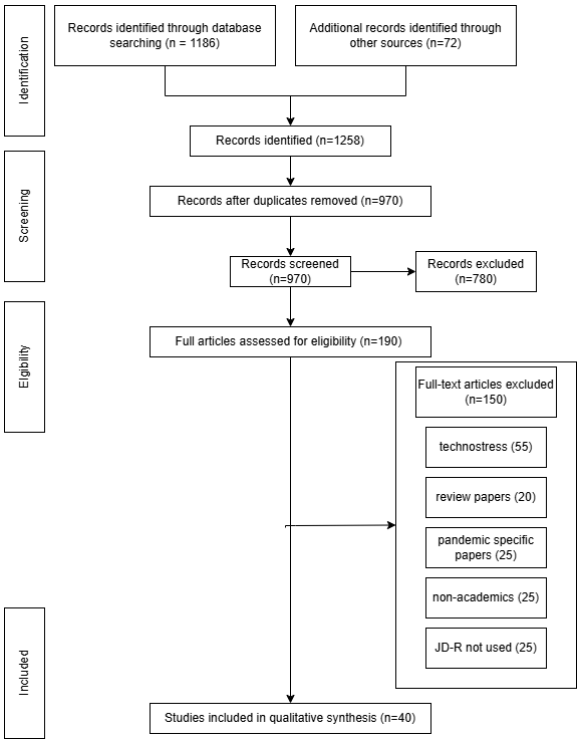
REVIEW METHODOLOGY

The study, a systematic literature review, adopted the Population, Intervention, Comparison, Outcome (PICO) framework (What Is PICO in Research? The Framework Explained, 2026) to define the inclusion criteria and search scope. The population (P) is non-state university academics in HEIs of Sri Lanka. Intervention (I) focuses on the dimensions of digital workload. The comparison (C) includes the types of workloads. Outcomes (O) include the mediator, academic well-being, and the dependent variable, professional identity. The key terms of the study were identified, including population keywords such as “academic staff”, “faculty”, “university staff”, intervention keywords like “workload”, “online workload”, “digital work”, “technology-mediated workload”, and outcome keywords such as “academic identity”, “academic well-being”, “professional identity”, etc. The PRISMA 2020 methodology (Page et al., 2021) was used for the selection of studies to investigate the digital workload, professional identity, and academic well-being. Figure 2 presents the PRISMA flow of records through the identification, screening, eligibility, and inclusion stages. The PRISMA approach was selected to ensure transparency in identifying, screening, and selecting empirical studies for systematic analysis. The review is based on research that was published between 2015 and 2025, a decade of transformation (Jandrić et al., 2018). In keeping with the study’s goal, which is "to investigate digital workload and its impact on academics’ well-being and professional identity," the review starts with a description of the study questions and objectives. A systematic review was conducted using Google Scholar, Scopus, Web of Science, Emerald, and Elsevier. The selection of databases for the systematic review was guided by the interdisciplinary nature of the study. Since the study analyses the relationships between professional identity, academic well-being, and digital workload, it was necessary to include databases that cover literature in areas of social science, education, and management. Google Scholar (Google Scholar, n.d.) was selected since it provides greater coverage of a wide range of publications, including those that may not yet have been indexed on traditional databases. Scopus (Scopus, n.d.) provides indexing of high-quality peer-reviewed journals in education, management, social sciences, and information technology. Web of Science (Web of Science, n.d.) allows highly cited literature in digital transformation, academic work, and academic well-being. Emerald Publishing (Emerald Publishing, n.d.) was utilized since it contained literature in human resource management, higher education, and organizational behaviour, and finally, Elsevier (Elsevier, n.d.) databases were selected since they contain work in education, psychology, and social science research.

The eligibility criterion was established through inclusion and exclusion criteria. Empirical studies, those that focused on academics in HEIs, professional identity, digitalized workload, and well-being, were selected. To ensure credibility, quantitative studies were evaluated based on the sampling, measurement instruments, and data analysis mechanisms. The qualitative studies were assessed according to credibility, trustworthiness, and reflexivity. For mixed-method studies, both were examined. The initial search gave 1258 records. The review included English-language work due to the researcher’s language proficiency and the accessibility of papers. English was selected since it is the dominant language in academic publishing (Swales, 1985). Peer-reviewed journal articles were mainly considered; however, selected conference papers were also used since they provided relevant insight into contemporary higher education. 288 duplicates were removed, leaving 970 records. After screening titles and abstracts, 780 records were removed since they were non-empirical, not relevant, or focused on a different population, like non-academics or students. 190 full-text articles were screened, resulting in an exclusion of 150 studies that had technostress, review papers, non-academics, pandemic-specific studies, or those that did not use JD-R. Finally, 40 studies (presented in Figure 1) met all inclusion criteria. A narrative synthesis approach integrated the findings from the studies included. Although quantitative studies were found, variations existed across the designs, measurement instruments, and outcome variables, due to which statistical meta-analysis was considered unsuitable. Narrative synthesis was used since the literature showed a greater diversity of methods, covering qualitative, quantitative, and mixed-methods research designs. The studies were organized based on characteristics like the region, research design, and population. The papers were then grouped into themes, including Digitalization and Well-being, Job Demands, Resources, and the JD-R Model, Professional Identity with Digitalization, and Constant Connectivity and Work-Life Balance. Of the 40 studies reviewed, 13 focused on developing regions, with a few focusing on developing nations. The rest focused on developed regions. From a population perspective, most studies focused on academic staff at a broader level. Contextually, most studies have been conducted within the US and Europe (Buda & Kovács, 2024; Celebi & Eraldemir-Tuyan, 2022; Civil et al., 2025; Douglas et al., 2025; Fernández-Arias et al., 2024; Gorrell, 2023; Heiden et al., 2021; Karatuna et al., 2022; Mitev et al., 2024; Niewiadomski et al., 2025; Szromek & Wolniak, 2020). Non-state HEIs in the Global South are under-researched (Halal Orfali et al., 2024; Sharma et al., 2023; Sun & Yoon, 2025; Trillo et al., 2025). Qualitative studies have also highlighted and suggested how digitalization reshapes the professional identity of academics (Ruiner et al., 2023; Watermeyer et al., 2021). Studies have utilized non-probability sampling methods (Enakrire et al., 2025; Fernández-Arias et al., 2024). Methodologically, most studies rely on cross-sectional questionnaire data collection designs (Adha Hafit et al., 2025; Barkhuizen & Rothmann, 2008; du Plessis, 2020; Fernández-Arias et al., 2024; Heiden et al., 2021; Mitev et al., 2024; Mosleh et al., 2022; Shange & Nyide, 2025; Sun & Yoon, 2025; Vizcarra et

al., 2024), yet only a handful of the others combine a qualitative analysis to get a better deeper understanding (Celebi & Eraldemir-Tuyan, 2022; Enakrire et al., 2025). Across the reviewed studies, digital workload was an independent variable, and academic well-being was the most common outcome variable. Professional identity was less frequently directly available and was studied indirectly across the literature. Overall, the review highlights a fragmented body of research.

Figure 1: PRISMA Framework for the Study



Source: Developed by Researchers, 2026

REVIEW RESULTS AND THEMATIC DISCUSSIONS

The study critically reviews and discusses the related theories that provide a base for digital workload, well-being, and professional identity, together with definitions and dimensions of each variable. Then, the study assesses empirical and contextual literature relating to the variables and finally reviews and confers the methodology applied by related literature. The following section exhibits review results.

Theoretical Integration

This section reviews the theoretical base for the conceptualization of the digital workload, professional identity, and well-being. It defines the variables, explains how they are linked, and discusses their treatment in the existing literature.

Digital Workload: The concept of workload is fundamental to organizational and occupational research. Scholars define workload in multiple ways. Workload "encompasses the quantity and intricacy of work that a single worker takes on over a particular duration of time" (Adha Hafit et al., 2025, p. 2). With the digital revolution, the concept of digitalization emerged. As defined by Scholze and Hecker (2023), "digitalized workload is the technical process of converting analog signals into a digital form" (p.1). The definitions advanced by scholars came from different perspectives, despite having common attributes. The cognitive demand is implicit in several definitions and includes intensity or volume as a core element. In literature, workload is the growing demands given to individuals. The term digital adds meaning, referring to technology-driven tasks or demands placed in an individual's hands. Holistically describing, the term digital workload highlights cognitive load and intensity as core elements. However, there are differences. Scholze and Hecker (2023) focus on the technical process. A few others bring in a human touch to the definition and bring meaning to the term digital workload (Buda & Kovács, 2024; Wang & Yao, 2025). Unlike other definitions on the list, the definition by Gnugesser et al. (2025) directly links the definition to the JD-R model. It brings digital into the term and seems a reasonable definition for the study conducted. Adha Hafit et al. (2025) and Zacher and Rudolph (2024) convey similar meanings.

The JD-R model defines work as a balance between job demands and job resources (Bakker & Demerouti, 2007). From the perspective of a digitalised workload, job demands could be linked to digital work, and job resources could be linked to the assistance given to the employee's digital work. The Workload Theory / NASA Task Load Index (NASA-TLX) brings in the core idea that workload is the physical, emotional, and mental effort that is required to perform tasks (Hart & Staveland, 1988). The theory provides clear measurement tools and dimensions, including effort, frustration, and physical demand, alongside the dimensions mentioned above. Similarly, Cognitive Load Theory describes the mental effort that arises from carrying out complex tasks but does not consider emotional or time demands (Sweller, 1988). Siegrist (1996) highlights the stress that arises when the effort does not match the reward given. The Multitasking/ Task Switching Concept (Monsell, 2003) addresses the cognitive costs of switching between tasks.

Although several established theories and concepts discuss workload and stress, they each only explain aspects of digital workload. Among the reviewed, the JD-R model gives the most comprehensive framework to understand workload (Bakker & Demerouti, 2007). While the model was originally introduced for the general work environment, scholars emphasize that with digitalization, new categories of job demands have arisen, which put additional strain on an employee, and this could not be captured by traditional workload definitions or models (Belanger et al., 2001; Mazmanian et al., 2013). Although the model has been validated across occupations, it has historically not been applied to digital workload across HEIs (Molino et al., 2020). Recent scholars have emphasized that HEIs have transformed due to digitization (Bond et al., 2021). Therefore, the model could be aligned with HEIs, and the adaptation of this model to HEIs and digital workload forms the theoretical gap for the current study. Complexity, volume, and intensity can be considered the dimensions of digital workload. Volume is the amount of work assigned within a given timeframe (Bakker & Demerouti, 2007). Complexity is the cognitive demands required to perform intellectually demanding tasks (Lepine et al., 2005). Intensity is the effort required to fulfil tasks within a timeframe (Bakker & Demerouti, 2007).

Volume is the amount and frequency of online activities that are required to be completed within a given time (Bakker &

Demerouti, 2007). HEI research shows that digitalization has expanded volume by integrating technology into multiple aspects (Hans Schuetze et al., 2024). From the JD-R point of view, a high volume of tasks presents a job demand that takes up time and energy (Bakker & Demerouti, 2007). The second dimension of digital workload is complexity. It is the effort required to perform digital work (Demerouti et al., 2001; Sweller, 1988; Tarafdar et al., 2015). In HEIs, the complexity of integrating digital tools into teaching, administration, and research could be categorized as complexity. The final dimension is intensity. Intensity is the speed, time pressure, and urgency required to fulfil work-related tasks (Bakker & Demerouti, 2007; Hart & Staveland, 1988). Digital technologies have intensified this, with research demonstrating that online tools have increased this pressure and have reduced recovery time for knowledge workers (Mazmanian et al., 2013).

Collectively, intensity, volume, and complexity would clarify the digital workload in HEIs. Using these dimensions, the study aims to capture how digital technologies reshape academia. A digital workload is characterized as requiring substantial cognitive/applicable input when completing work digitally and requires a significant amount of time when performing technologically enabled task(s) or completing these task(s) with a high level of cognitive difficulty.

Academic Well-being: Despite the common traits in definitions for well-being, they vary in scope. Bautista et al. (2023) states that there are multiple parts within the term well-being, but do not state what they are. The definition is too general but could be applied to the current study domain since it does not mention a specific domain. Danna & Griffin (1999) define well-being as "comprising the various life/non-work satisfactions enjoyed by individuals (i.e., satisfaction and/or dissatisfaction with social life, family life, recreation, spirituality, and so forth), work/job-related satisfactions (i.e., satisfaction and/or dissatisfaction with pay, promotion opportunities, the job itself, co-workers, and so forth), and general health" (p. 359). The authors give a comprehensive definition, defining the emotional and work/job aspects. However, this definition is too broad to be applied to digital workload alone, which is the basis of the current study. Occupational well-being defined by Aryanti et al. (2020), highlights the emotional aspect at work. However, it does not address work pressures.

Theoretical models explain occupational well-being. Three models were compared for this study: the JD-R model (Bakker & Demerouti, 2007), Job Demand-Control (JDC) model (Karasek, 1979), and Effort-Reward Imbalance (ERI) model (Siegrist, 1996) to describe the relationship between demand, control, and support. The JD-R model describes the relationship between differing levels of demand and well-being, as well as what resources contribute to employee well-being (Bakker & Demerouti, 2007), while the Demand-Control model describes the level of job-related control provided by an employer (Karasek, 1979). The model states that high demands combined with low decision latitude lead to psychological strain. The ERI model discusses the mismatch between the efforts of employees and what they receive in return (Siegrist, 2017). While the models share common traits, they differ in variables examined and depth of explanation. The Demand-Control model does not capture emotional and cognitive aspects, which are an important part of well-being (Karasek, 1979). The ERI model discusses unfairness and dissatisfaction in jobs, and not how the workload affects the well-being of an employee (Siegrist, 2017). In contrast, the JD-R model incorporates demands and resources and thus could be adjusted and mapped into the current context more flexibly than the others (Bakker & Demerouti, 2007). Therefore, JD-R is better suited to explain the effect of digital workload on academic well-being.

Academic well-being is how academics think, feel, and act within their roles and within the work environment, reflected through their psychological, emotional, and professional well-being. A seminal work emphasizes workplace psychological well-being (Dagenais-Desmarais & Savoie, 2012). Applied to academia, psychological well-being could reflect an academic's competence in managing tasks and organizing their work. The increasing digital workload could influence this. A second dimension of academic well-being is the aspect of emotional well-being. From an organizational perspective, it is how individuals experience their job roles emotionally (Danna & Griffin, 1999). Research shows that emotional well-being influences the overall quality of the environment (Chang, 2009; Jennings & Greenberg, 2009). The third and final dimension is professional well-being. Across professions, professional well-being has been identified as a key predictor of various aspects, including organizational commitment, employee engagement, and career sustainability (Bakker & Oerlemans, 2011). From an academic perspective, managing their digital workload could become tedious, thus leading to negative job satisfaction and engagement.

Building on the context of the current study, academic well-being can be defined as the work-related emotional and cognitive state of academics, shaped by the functions within academic roles, alongside the management of digital workload and available resources.

Professional Identity: Professional identity captures how a person defines themselves within a professional role. Professional identity shows a dynamic balance between a person's image and the professional roles they perform (Volkmann & Anderson, 1998). Durakovic and Aznavoorian (2024) define professional identity as a "multidimensional phenomenon with subjective and objective experiences" (p. 188). Definitions state that professional identity is shaped by personal identity (Ibarra, 1999) and external factors, including the roles played and interactions within a work environment (Volkmann & Anderson, 1998; Winter, 2009). Another common factor identified is that professional identity involves a balance of multiple factors (Volkmann & Anderson, 1998; Winter, 2009). Overall, the definitions state that professional identity is constructed through an interconnection of individual and organizational factors.

However, each scholar provides a different scope of definition. Volkmann and Anderson (1998) show how academics balance multiple roles. It highlights the term equilibrium, which is an important aspect as an academic. The definition provided by Winter (2009) shows that professional identity is a mix of personal and professional selves. It is somewhat like the definition provided by (Volkmann & Anderson, 1998) since it brings out a social aspect, but it purely highlights professional identity from an academic perspective. Durakovic and Aznavoorian (2024) state that professional identity is a

fusion of subjective (self-constructs within the job) and objective (role norms) aspects. Considering the definitions above and the current study context, it is possible to define professional identity as the sense of self that an academic develops in terms of their professional roles, which include the understanding of their obligations, the adherence to professional values, the confidence demonstrated when performing digital-related tasks, and a sense of belonging.

Two related theories were identified. The Social Identity Theory explains how groups and belonging influence professional identity (Tajfel & Turner, 1979). However, the model has a limited focus on individual role conflicts. The Role Identity Theory, on the other hand, identifies role clarity and conflict with digital workload (Burke & Stets, 2009). It emphasizes how individuals maintain their professional identity through the dimensions. However, the model might not be useful to study the organizational influence.

Several dimensions can be identified within professional identity. The first is role perception. Van der Meer (2024) defines role perceptions as "cognitive beliefs rather than affective reactions such as job satisfaction and affective commitment" (p. 1612). From an academic perspective, effective role perception would help academics manage professional responsibilities while adapting to demands such as the digital workload, thereby making role perception an important dimension of professional identity. The second dimension is professional values. Values are "an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence" (Rokeach, 1973,p. 5). With the increase of digital workload, professional values could be challenged or reshaped. Thus, professional values stand as a critical dimension for understanding professional identity. Professional confidence is the third dimension. It is the dynamic personal belief (Holland et al., 2012). From an academic's perspective, when work becomes digitalized, their confidence in getting the job done may be strengthened by skill development or weakened by the increasing workload. Therefore, professional confidence is used to explain how an academic would face digital workload pressures. The sense of belonging is the final dimension and is defined as the need for frequent interactions within ongoing relationships (Baumeister & Leary, 1995). Hagerty et al. (1992) define sense of belonging as "the experience of personal involvement in a system or environment so that persons feel themselves to be an integral part of the system of environment" (p. 173). Within academia, as the use of digital platforms increases, the methods of communication and interaction alter, making sense of belonging an important aspect to be considered.

Theoretical literature provides a foundation to understand the effect of digital workload on professional identity and academic well-being. JD-R emerged as the most suitable model for the current study since it discusses how demands affect the well-being of an individual and, in turn, their attitudes towards work-related tasks. The current study extends the JD-R model by integrating professional identity as the outcome variable and mediated by academic well-being. This is expected to provide an understanding of how digital workload affects academics in contemporary HEIs.

Empirical Insights

This section synthesizes empirical studies on HEIs and digitalization. The synthesis discusses the key empirical findings, frameworks, and methodologies of existing studies.

Digitalization and Well-being: Research spanning different geographies shows that digital workload is a universal phenomenon rather than limited to a certain region or country (Enakrire et al., 2025; Szromek & Wolniak, 2020). Initially, researchers learned how digital technologies can produce empowering impacts on people. Now, however, more than a decade later, researchers are concentrating on ways in which excessive use of digital workloads can hinder the well-being of an academic (Sharma et al., 2023). Increased digitalization has occurred over time, especially during the period following COVID-19 (Sharma et al., 2023). The movement towards using a great deal of digital technology has contributed to creating high levels of potential for stress amongst academics (Mosleh et al., 2022; Sharma et al., 2023). Not only has digitalization resulted in significant amounts of ambiguity regarding the work-life balance of an academic (Mitev et al., 2024; Mosleh et al., 2022; Niewiadomski et al., 2025). The academic research literature is filled with multiple studies documenting the positive consequences of using digital technology, which exist through the provision of substantial levels of support for academics through digital competencies and through regulating digital workloads (Fernández-Arias et al., 2024; Kelder et al., 2025; Ruiner et al., 2023). Without these forms of support, academics will experience emotional exhaustion and reduced well-being because of the actions associated with digitalization (Sun & Yoon, 2025).

Job Demands, Resources, and the JD-R Model: The studies that applied the JD-R model have provided empirical evidence that academic well-being is affected by the relationship between demands and resources (Bakker & Demerouti, 2018; Heiden et al., 2021; Trillo et al., 2025). The research conducted on different continents has also supported the association between high demands causing stress resulting in decreased job satisfaction (Barkhuizen & Rothmann, 2008; du Plessis, 2020; Janib et al., 2021; Vizcarra et al., 2024). When an employee lacks resources and has to fulfil excessively high demands or workloads, they soon become emotionally exhausted (Pakdee et al., 2025) . Several qualitative studies have found that digital ways of working increase the employee's workload and disrupt boundaries, as employees are frequently expected to be available at all times (Douglas et al., 2025; Karatuna et al., 2022; Shange & Nyide, 2025), and more recent studies have supported this finding (Aldhilan et al., 2025). Using the JD-R Model, research has demonstrated that digital technologies can be considered as resources when there is institutional support. When academics have access to infrastructure, training, and support, then digital technologies can enhance their effectiveness and flexibility (Karatuna et al., 2022). However, in many academic institutions, digitalization is being implemented without adequate infrastructure or support, converting digital technologies into demands as opposed to resources (Douglas et al., 2025).

Professional Identity with Digitalization: Constant Connectivity and Work-Life Balance: Research undertaken in the context of digital environments has found that a factor that

blurs the boundaries of work and life is constant connectivity (Farivar et al., 2024; Rosero-Ordóñez, 2025). Researchers have found that digitalization (Rosero-Ordóñez, 2025) and the normalization of being on "standby" (Arantes & Vicars, 2024) have diminished academic well-being and blurred the boundaries of work and life. However, connectivity has been viewed as a collaborative opportunity, as well as a hindrance to work-life balance (Farivar et al., 2024).

Contextual Insights

Digital technologies form a key component of the work of academics. Global research evidence indicates that digital workloads are a global phenomenon experienced by academics and are not limited to one country or geographic region (Enakrire et al., 2025). Many academic researchers have evaluated the concept of digital workload during and after the pandemic. Academics from various nation-states have reported an increase in their role expectations and workload (Watermeyer et al., 2021). Studies indicate that having clear institutional structures to support, develop, and train staff with respect to the use of digital technologies can help reduce any negative association with digital workloads (Douglas et al., 2025; Enakrire et al., 2025; Fernández-Arias et al., 2024; Gorrell, 2023; Kelder et al., 2025).

Researchers have also discussed how digitalization influences a person's academic identity as well as the nature of their work. The digitalization of work has blurred some of the boundaries between a person's work and personal lives (Adha Hafit et al., 2025b; Buda & Kovács, 2024; Mosleh et al., 2022b; Niewiadomski et al., 2025; Rosero-Ordóñez, 2025; Shange & Nyide, 2025). As a result, researchers have reported that academic workers experience an increase in their family/work conflicts, particularly those who are starting their careers, for those who are parents, and women; as such, digitalization has had an increasing effect of creating and/or exacerbating inequalities (Barkhuizen & Rothmann, 2008; Mosleh et al., 2022).

Methodological Patterns

Several theoretical models attempt to explain how variables interact with one another. The JD-R is consistently the most frequently cited (Adha Hafit et al., 2025b; Civil et al., 2025; Karatuna et al., 2022b; Ruiner et al., 2023; Scholze & Hecker, 2023; Shange & Nyide, 2025). For example, Leavitt's Diamond Model, Bridges' Transition Theory (Mitev et al., 2024), and the Task-Fit Theory (Sun & Yoon, 2025) are some of the most noted models.

The dominant type of study design utilized in the articles was cross-sectional surveys utilizing quantitative methods, whereas the researchers referenced (Aldhilan et al., 2025; Douglas et al., 2025; El-Soussi, 2022; Farivar et al., 2024; Halal Orfali et al., 2024; Karatuna et al., 2022; Kimwere & Mwanzia, 2025; Naidoo-Chetty & du Plessis, 2021) also employed qualitative techniques to conduct their research. Researchers also used scales and/or rating systems to collect information (Adha Hafit et al., 2025b; Barkhuizen & Rothmann, 2008; du Plessis, 2020; Fernández-Arias et al., 2024; Heiden et al., 2021; Mitev et al., 2024; Mosleh et al., 2022; Shange & Nyide, 2025; Sun & Yoon, 2025; Vizcarra et al., 2024) . Mixed methods were utilized by a small number of studies (Celebi & Eraldemir-Tuyan, 2022a; Enakrire et al., 2025) and represented an underutilized approach. Finally, non-probability sampling was noted as being another underrepresented aspect of these studies (Enakrire et al., 2025; Fernández-Arias et al., 2024). Although these techniques allow for faster gathering of data, there are response and representational type biases that come into play as well. The majority of the studies that were analyzed utilized a cross-sectional method (Barkhuizen & Rothmann, 2008; du Plessis, 2020; Fernández-Arias et al., 2024; Heiden et al., 2021; Janib et al., 2021; Mitev et al., 2024; Mosleh et al., 2022b; Pakdee et al., 2025; Ruiner et al., 2023; Sharma et al., 2023). This method restricts any evaluation that might occur over a longer time frame for the potential of long-term adaptations. The JD-R was also the most frequently used method in this group of studies. Most were performed within one institution, region, or country. All of these studies have been beneficially informative; however, there exist certain limitations regarding their geographic distribution, causation, and responses within these studies.

CONCLUSION AND FUTURE RESEARCH

The systematic review synthesized existing research on digitalization in HEIs with attention to digital workload, professional identity, and academic well-being of university academics. The study critically reviewed and discussed the related theories that provide a base for digital workload, well-being, and professional identity, assessed the empirical and contextual literature relating to the variables, and finally reviewed the methodology applied by related literature. Review results showed a negative relationship between academic well-being and digital workload in most studies. Some of them conceptualize digital workload as a stress creator. Some other authors state that the effects of digital workload are context-dependent rather than negative in general. There were differences identified in the relationship between professional identity and academic well-being. Some authors treat professional identity as a stable construct that is indirectly influenced by digitalization through the outcomes of well-being. Others argue that professional identity is directly reshaped by role expectations of digital workload. This shows a contrast between the views, raising doubts as to whether digital workload directly influences professional identity or if well-being mediates this relationship.

The review helped identify the knowledge gaps that need to be filled within the domain of university academics in HEIs. Conceptually, the review showed that the JD-R model gives a strong foundation to explain the nature of digital workload and academic well-being, while professional identity can be explained based on social identity theory. Previous scholars have rarely integrated the JD-R model and social identity theory to study how digital workload affects professional identity and well-being. Review results further revealed that the relationships among well-being, digital workload, and professional identity have not been studied empirically. Meanwhile, most studies have been conducted in Western contexts, and Global South HEIs are under-researched. However, studies in South Asia and university academics have not been adequately studied.

The reviewed literature shows important implications for institutions. Digitalization in HEIs has prioritized performance metrics and has often overlooked its impact on the professional identity and well-being of university academics. Review results show a need for university academics to recognize digital workload as a demand and implement policies to

guide the use and boundaries. Accordingly, systematic studies are required to investigate the effects of digital workload on professional identity, with this relationship mediated by the well-being of academics in HEIs, with the theoretical basis of the JD-R framework, particularly in the context of Sri Lanka.

The review, however, had its limitations. The review was limited to English-based sources, which could have excluded research conducted in Sinhala and Tamil, and could be a major limitation, especially because the study aims to capture data from Sri Lankan non-state HEIs. The reviewed papers showed variations in research designs and methodological approaches, thus limiting the feasibility of conducting a statistical meta-analysis. Therefore, a narrative synthesis approach was used. It was also based only on secondary data. Also, the findings of the review were dependent on the scope of the study. The review also focused only on empirical literature, which could have knowingly or unknowingly excluded any hidden or grey areas identified in systematic reviews done by scholars. Future studies could adopt sequential mixed-method research designs and theoretically grounded approaches to understand the stress levels and burnout caused by digital workload in HEIs. Studies could also investigate the effects of the dimensions on different faculties and academic levels in universities. This could give a clearer picture and understanding of how digital workload impacts different stages and fields in HEIs.

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The Impact of Translation Errors on International Relations: An Analysis of Historical Diplomatic Events

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Karunasena A.N.[1*]

[1*]Department of Languages, Sabaragamuwa University of Sri Lanka, Sri Lanka

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Abstract

International relations rely on a communication mode that surpasses geographical and cultural barriers. Translation works as a fundamental means in international diplomacy as it bridges the gap between actors in international relations. Translating political communications has been a challenging process for the translator, as varied linguistic, cultural, and ideological norms may lead to distortions in the original intent. In the nineteenth and twentieth centuries, a period known for lasting global political tensions due to world wars, colonization and decolonization, and the Cold War, diplomatic communications were understood and interpreted in ways that shaped the entire international relations system. Hence, the study is aimed at examining the role of translation errors in shaping international relations with regard to the nineteenth and twentieth centuries. The study follows a qualitative content analysis and case study approach to investigate the phenomenon and examines three selected historical events in the said time period, namely, the Potsdam Declaration, which is known as the "Mokusatsu" incident, United Nations Security Council Resolution 242, and the Treaty of Waitangi. The findings of the study elaborate that translation errors result not only from the incompetence of the translator but also from the ambiguity of lexical units, differences in cultural connotations, diverse language conventions in different linguistic communities, and political context. Thus, the study suggests several measures to be taken by future translators to mitigate such translation errors, including paraphrasing, borrowing, explanations, and imitation, as history witnesses severe incidents in global politics due to mistrust and misguidance caused by meaning distortions.

Keywords: Ambiguity, Diplomacy, International Relations, Translation, Translation errors

INTRODUCTION

Ever since the emergence of mankind, language has always been the primary tool for disseminating ideas, perspectives, and views, as it enables effective communication between people and groups. According to the American linguists Bernard Bloch and George L. Trager, "A language is a system of arbitrary vocal symbols by means of which a social group cooperates." (David & Robins, n.d.). While a language acts as the core medium through which a person communicates in the personal, professional, and cognitive contexts - in formulating thoughts and ideas - it enables humankind to express their perspectives and engage with others in international settings. Language plays a crucial role in facilitating the transmission of vivid perspectives among states, societies, and individuals on diplomacy, the economy and trade, peace, and other global issues such as climate change, power dynamics, and human rights. Thus, it may be argued that language is a key instrument in International Relations (IR) as well, as it facilitates the engagement of involved groups, the negotiation of meanings, and the communication of thoughts and views across geographical borders. According to Jindal Global University, IR is "the study of the relationships between nations, states, and other actors on the global stage" (2025). Further, Jindal Global University (2025) explains that,

It involves analyzing the interactions between sovereign entities, intergovernmental organizations, non-state actors, and multinational corporations. IR is concerned with understanding the dynamics of power, cooperation, and conflict among these actors, and how they shape international institutions, norms, and laws.

Therefore, it can be said that a language provides the foundation for the treaties, agreements, and warnings made by countries and global organisations and becomes the mediator in transmitting their core meaning for many decades to come. However, as we live in a highly globalised and competitive world, countries and their leaders, as well as international organisations, are exposed to communication despite cultural and linguistic boundaries. In other words, these parties experience the challenge of being unable to effectively reach a particular segment of the population due to their use of languages that are not common to the speaker/listener. As each language has its exclusive set of characters, vocabulary, and pronunciation, the comprehension of such a language and its contextual meaning becomes challenging to outsiders of such a linguistic community. In order to overcome this issue, translators act as coordinators between two linguistically distant backgrounds.

* **Corresponding author:** Tel.: +94 (76) 006 7864; Email: ashenikarunasena@gmail.com
https://orcid.org/0009-0006-4538-357X

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Translation can be identified as the process of reorganizing a text written in one language into another language in order to maintain the original intent and to enable cross-language communication. According to Peter Newmark, “it is a craft consisting in the attempt to replace a written message or statement in one language by the same message or statement in another language” (Newmark, 1981). While a translator assists in successful written communication, they bridge the gap between contradictory linguistic settings and link the source text (ST) writer and target text (TT) reader, allowing multilingual communication. As Julian House states, "translation is replacement of a text in the source language (SL) by a semantically and pragmatically equivalent text in the target language (TL)" (House, 1997, p. 31). He suggests that the translator ensures the preservation of contextual meaning, facts, and information presented in the ST, taking into account the tone, targeted population, and intention.

While translators play a crucial role in shaping global affairs by disseminating written intentions to the target audience, it can be said that history records several incidents that emerged as a result of translation errors. Especially the time during the nineteenth to twentieth centuries, the period post-Second World War marks a highly sensitive period of time in history, which laid the foundation for major substantial events that have an impact even to date. During this era, global politics were shaped by ideological rivalry, nuclear tensions, and a rapidly growing diplomatic structure. Notwithstanding the importance of precise communication during such periods, a range of historical incidents reveals how translation errors affect diplomatic affairs and internal stability.

Therefore, this study aims to investigate the research problem of how translation errors impacted shaping international relations through an analysis of selected historical events spanning the nineteenth to twentieth centuries. By focusing on this phenomenon, the researcher intends to provide insights into how translation failures contribute to global tensions, misjudgments, and other major repercussions. Despite the importance of the role of translators in global settings, the existing scholarly writings and studies about translators’ contributions in global politics remain insufficient. Most studies focus on the historical, contemporary, and future application of translation in IR, while several other studies examine the strategies utilised by translators in global politics to enable communication between different languages. Thus, the studies examining the historical events that underwent tensions and challenges due to errors in translations remain underexplored. Further, the existing studies lack a theoretical base in investigating the types of translation errors that contributed to the emergence of particular negative influences in the history of IR. While such studies explore the causes, challenges, and repercussions of translators’ failure to deliver a faithful and accessible outcome, studies in which a thorough investigation into the types of translation errors remain inadequate, as they lack a clear translation error classification or pattern identification. This gap urges a comprehensive approach, for which the researcher provides a theoretical foundation and examines the broader impact of historical events, which depict the failed translation attempts, on IR. This study will therefore intend to address the existing gap in the literature and aim to provide sufficient understanding of the role of translators and translation errors in global political affairs. In studying the role of translation errors in shaping IR, the researcher addresses the issue through four dimensions: the role of pragmatic, cultural, linguistic, and text-specific translation errors in shaping global political processes.

Consequently, the findings of the study will be beneficial for identifying the nature of the translation errors made in selected major historical events that occurred during the nineteenth to twentieth centuries, contributing to both translation and IR subject areas. Such findings may assist in understanding the importance of utilising language in a way to mitigate the possible negative outcomes on different levels; pragmatically, culturally, linguistically, and textually, thus encouraging translators and diplomats for an error-free and responsible engagement in global politics. The present study is limited to examining the role of translation errors in shaping IR only during the period of the nineteenth and twentieth centuries, which was highly sensitive in the history of world politics, and does not consider other instances outside the selected time frame. Further, the study does not investigate how misinterpretations, i.e., the errors made by the interpreter in rendering the contextual meaning of a spoken utterance from one language into another. The following section of this paper reviews the previous studies related to this phenomenon. The third section provides a comprehensive analysis of the methodology, while the fourth and fifth sections present results and discussion, and conclusions made, respectively.

LITERATURE REVIEW

Translation

Translation can be identified as the primary tool for bridging the gap between linguistically distinct backgrounds, which have their own specific set of grammatical rules, vocabulary, and sentence patterns, to enable effective communication. What is generally understood as translation involves the rendering of a source language (SL) text into the target language (TL) to ensure that (1) the surface meaning of the two will be approximately similar and (2) the structures of the SL will be preserved as closely as possible but not so closely that the TL structures will be seriously distorted (Bassnett, 1994).

As Toury states, “Translation is a kind of activity which inevitably involves at least two languages and two cultural traditions, i.e., at least two sets of norm-systems on each level” (1978). He has further described two major elements to consider in the process of translation as (1) being a text in a certain language, and hence occupying a position, or filling in a slot, in the appropriate culture, or in a certain section thereof; (2) constituting a representation in that language/culture of another, preexisting text in some other language, belonging to some other culture and occupying a definite position within it (Venuti, 2000 , p. 200).

According to House (1997, p. 31), "Translation is replacement of a text in the source language (SL) by a semantically and pragmatically equivalent text in the target language (TL)". He implies that the translator is responsible for maintaining a good balance between preserving contextual meaning and rendering the essence of the information and facts presented in the ST, and for making the output accessible to the target readership through careful consideration

of elements such as the audience, tone, and purpose. House argues that translation is not merely a reformulation of a text from one language into another, but a process of maintaining the core meaning and communicative intention of a text for a linguistically distant population.

William Frawley (1984) views the process of translation as a bidirectional process and a mutual relationship between the SL and TL cultures. He argues that when a translator renders the intended meaning of a matrix code (ST) into a target code (TT), the process involves continuous comparison of the two codes, evaluating differences, and adjusting the target code to preserve the underlying meaning conveyed in the matrix code. The bilateral consideration-vacillating across codes-allows us to consider the capacities of the codes participating in the transfer, and to evaluate those capacities off of one another (Frawley, 1984).

International Relations (IR)

International Relations is the study of the relationships between state and non-state actors at the global scale. It includes the way a country navigates itself in global diplomacy, trade, security, and global issues such as environmental issues, climate change, etc. Gosh (2009, p. 1) describes IR as "The study of foreign affairs and global issues among states, including the roles of states, intergovernmental organizations (IGOs), nongovernmental organizations (NGOs), and multinational corporations (MNCs)". He further argues that there is a tendency to use the terms International Relations and International Politics interchangeably, even though they refer to distinct ideas.

According to Shiraev et al. (2014, p. 4) "International relations is a field of social science in which scholars discuss their ideas, arguments, and theories". Wright says, "International relations include relations between many entities of uncertain sovereignties and that it is not only the nations which international relations take to relate, varied types of groups, nation-states, governments, peoples, regions, alliances, confederations, international organizations, even industrial organizations, cultural organizations, religious organizations must be dealt with in the study of international relations if the treatment is to be realistic" (Wright, 1955). Therefore, it is evident that IR refers to the way in which a country deals with other actors at the global level in diplomacy, trade, and other sectors. It is the manner in which a country represents itself outside its territorial borders to achieve its national interests. Delivering a more comprehensive perspective about IR, Mathiesen says (1965) "International relations embraces all kinds of relations traversing state boundaries, no matter whether they are of an economic, legal, political, or any other character, whether they be private or official, and all human behavior originating on one side of state boundary and affecting human behavior on the other side of the boundary".

As Gosh states (2009, p. 4), IR "may be ascertained that IR is a vast field encompassing the relationships among states in all their dimensions, including interactions with various other political and non-political groups, along with the study of international history, international law, international society, and international political economy". Therefore, it can be said that IR is a field in which the actors, including states, NGOs, IGOs, and individuals, behave in a certain way to maintain their relationship with each other. It is the study of how a country utilises dominance in terms of military, economy, and politics to establish itself among other states and continue its own identity and legacy in a competitive world.

IR is grounded in communication and diplomacy. Translation acts as a means of facilitating diplomatic dialogue, negotiations and discussions, and cross-cultural communication. It can be said that translation is inevitably a tool that determines the consequences of diplomatic discussions, as it holds the power to influence in such contexts. Thus, the researcher reviews the role of translation and translation errors in IR in its communication and diplomatic ties in the following sections.

Translation errors

Throughout the history of translation studies, many scholars have attempted to present multiple classifications and taxonomies of translation errors. As Saridaki (2023) says, "Translation errors are those that occur in the translated text resulting from a failure to apply translation principles, rules, and techniques as well as from misinterpretation of a source text segment". She further explains a range of translation errors, including incorrect meaning, barbarism, overtranslation, etc. Liao (2010) introduced a classification of error types, including the types, namely rendition, language, and miscellaneous. Rendition errors refer to the failure of the translator in conveying the exact meaning of the source text. Language errors refer to problematic expressions in the target text. Miscellaneous errors refer to omissions (Soltani, Nemati, & Yamini, 2020). Soltani et al. (2020)further state that "Hurtado suggested a model for the translation quality assessment that is based on error analysis. The model is categorised under three headings: translation mistakes, translation minor errors, and translation major errors. Further, the American Translators' Association (n.d.) presents an error categorisation including the types of 1) Addition, 2) Ambiguity, 3) Capitalization, 4) Cohesion, 5) Diacritical marks/Accents, 6) Faithfulness, 7) Faux ami,, 8) Grammar, 9) Illegibility, 10) Indecision, 11) Literalness, 12) Mistranslation, 13) Misunderstanding, 14) Omission, 15) Punctuation, 16) Register, 17) spelling/ character, 18) Style, 19) Syntax, 20) Terminology, 21) Text Type, 22) Unfinished, 23) Usage, 24) Verb Tense, 25) Word form/Part of speech 26) Other Errors.

As cited in Saridaki (2023), Nord defines translation error as a breach of: The function of the text, the consistency of the text, the text-type, or the form of the text, the language conventions, and the specific conventions and conditions that are related to different civilizations and circumstances. Further, Rahmatillah (Rahmatillah, 2016) cites that Suksaeresup and Tipa Thep-Ackrapong divided errors in translation into two categories: miscue and the translator's wrong assumption of the background knowledge.

Translation, Translation Errors, and IR

Translation has always played a crucial role in IR, and translation errors have shaped global diplomatic events both in positive and negative ways. Translation of treaties, agreements, declarations, and other various types of texts facilitates communication between states and other actors in the diplomatic world. Shahmerdanova states that "In the 20th century, translation underwent significant institutionalization with the establishment of global organizations such as the United Nations (UN) and the European Union (EU)"

(2025). This showcases that translation became a key element in the diplomatic world as it is a primary tool to enable effective communication between states and other actors involved, despite their linguistic and border differences. As cited by Shahmerdanova (2025, p. 4), "Yan (2024) highlights the critical role of translators in ensuring that international agreements and treaties are linguistically consistent and free from ambiguities". Consistency and being free of ambiguity play a crucial role in translating international texts, as they facilitate a smoother and more effective translation process through which the target readership gains a clear and direct idea about what the ST intends to convey.

İbrahimov comments that (2026, p. 63) there are several error types and "imbalance triggers" that have threatened the diplomatic balance in translating UN documents into Azerbaijani, namely modality shift, tone intensification/mitigation, terminology drift, actor introduction/removal, and unwanted domestication or ideological coloring.

Shahmerdanova (2025, pp. 39-40) identified six key challenges in diplomatic translations. They are,

1. Linguistic Complexity and Nuance
2. Cultural Sensitivity
3. Ethical Dilemmas
4. Political and Strategic Pressures
5. Technological Limitations
6. Impact of Miscommunication

As the study focuses on the role of translation in global diplomacy and international relations, the researcher highlights the importance of translation as a tool for cultural diplomacy (pp. 10-12).

1. Fostering Mutual Understanding
2. Translation in Public Diplomacy
3. Promoting Intercultural Exchange
4. Translation as a Symbol of Respect and Cooperation

Temirbayev investigated the impact of translation and interpretation errors on Cold War diplomacy using a qualitative approach, together with semi-structured interviews with professional translators and interpreters, as the researcher believes that "the collected views and experience of specialists and professionals in translation and interpretation provided better understanding of complex diplomatic language mediation" (2025, p. 3). The study showcases the ability of translators to influence global politics, as he says, "… preliminary insights suggest that translation errors often heightened tensions and influenced political decision-making during the Cold War. It also explores that the translator used several strategies in order to minimize the possibility of occurring miscommunication. They are (2025, p. 11),

1. Proactive clarification – verifying ambiguous statements before translation.
2. Cultural adaptation – ensuring messages retain intended meaning.
3. Cross-checking – using multiple translators to validate interpretations.

He further states that (2025, pp. 5-6), translation became a strategic tool during Cold War diplomacy, and "both U.S.A. and Soviet Union used this tool to spread propaganda and influence public opinion, which showed how language could serve both as a bridge and a battleground in international relations".

Moreover, a study by Benhammadi et al. (2019) investigated the impact of the translator's ideology on shaping international political ties with reference to the Palestinian cause. In the study, the researchers identify strategies used by foreign media platforms such as BBC English, New York Times, Jerusalem Post Newspaper, National Geographic Abu Dhabi, Al Jazeera International, and AFP to translate Arabic texts into the English language, namely (p. 50),

1. Deletion
2. Omission
3. Addition and
4. Substitution

The researchers argue that the use of such strategies causes several miscommunication patterns, such as alterations in the meaning, legitimising political narratives, and meaning distortions, which contribute to tensions between countries and long-term diplomatic strains.

While these studies mainly focus on translation strategies and challenges translators face in diplomacy, the existing literature lacks sufficient studies on how translation errors contributed to the emergence of several diplomatic affairs. Also, such studies lack a theoretical base to investigate the said phenomenon. Therefore, the present study intends to address the issue of the impact of translation errors in global politics and minimize the existing literature gap.

Theoretical Framework

The theoretical framework for the study, as it addresses the problem of how translation errors shape IR, is as follows. Christani Nord's classification of translation errors is accompanied by an examination of the types of translation errors made by translators in the selected events, in dealing with their relations with other states and non-state actors. As cited by Saridaki (2023, p. 28), Nord defines translation errors as "a failure to carry out the instructions implied in the translation brief, that is, failure to achieve the communicative purpose of the translation". The classification includes four types of translation errors, and they are as follows.

Table 1: Theoretical Framework

Pragmatic translation errors	**caused by inadequate solutions to pragmatic translation problems such as a lack of receiver orientations**
Cultural translation errors	They result from an inadequate decision about reproduction or adaptation of culture-specific conventions
Linguistics translations errors	Caused by an inadequate translation when the focus is on language structures
Text-specific translation errors	that are related to a text-specific translation problem. In such cases, the translator has to act creatively since the solutions provided in specific translation problems cannot be

	generalized and applied to similar cases

Source: Evanthia Saridaki, 2023

According to Nord, pragmatic translation errors are classified as the most serious translation errors, as she says, "since the recipients tend not to realize that the piece of information they receive is wrong" (Saridak, 2023). Mona Baker (Baker, 1992) defines pragmatics as "[…] the study of meaning not as generated by the linguistic systems but as conveyed and manipulated by participants in a communicative situation". Marinani et al. (2019, p. 77) say that "This includes the speaker's and addressee's background attitudes and beliefs, their understanding of the context in which a sentence is uttered, and their knowledge of the way in which language is used to communicate information". Thus, pragmatic errors can be identified as errors made by a translator due to their inability to capture the background of the ST and therefore deliver a less coherent output to the target readership. Irodaxon et al. (2025, p. 271) say that pragmatics include Speech acts (e.g., requesting, apologizing, promising), Implicature (suggested meaning not directly stated), Deixis (contextual references such as "here," "you," "now"), Presuppositions, Politeness and indirectness, Cultural references, and idioms. Further, they indicate that (2025, p. 271), "Translating these elements poses challenges because they are highly dependent on context, shared assumptions, and cultural norms". In another study, Saridaki mentions that "Pragmatic problems arise from the differences of circumstances between the two texts and they can be identified by comparing a number of textual factors such as the recipient, medium, time, place, motive, source-text function" (Saridaki, 2025). Thus, pragmatic translation errors occur when the translator is incapable of comprehending the context, purpose, and style of the ST.

Saridak cites that "the seriousness of cultural errors depends on the extent to which cultural conventions of the source text are adjusted to the stereotypes of the target-culture" (Saridak, 2023). If the purpose of the translation task is to test language proficiency (as in foreign-language classes), linguistic errors will perhaps carry more weight than cultural errors (Rahmatillah, 2016). Rahmatillah (2016, p. 18) further states that "If the purpose of the translation task is to test cultural proficiency, cultural translation problems could even be ranked higher than pragmatic errors". Cultural translation errors result from the translator's incompetence in the TT culture and their specific set of norms and conventions, as Saridaki (2025) says, "Cultural problems result from differences in norms and conventions that characterize both the verbal and non-verbal behaviour between the two civilizations involved".

Translation problems can also occur due to structural differences in the vocabulary, syntax, and stylistic features between the two texts (Saridaki, 2025, p. 1). Syntax refers to the structure of a sentence. Mariani et al. (2019, p. 47) depict that syntax is "the arrangement of words and phrases to create well-formed sentences in a language". Further, they argue that (2019, p. 47), "From the other perspective, syntax is defined as the study of arrangements of words into phrases, clauses, and sentences or syntactical constructions". Therefore, the errors that the translator makes in using lexical units, sentence structuring, and using stylistic devices refer to the "linguistic translation errors". As AFLS says (Service, n.d.) "These involve the incorrect use of grammar, punctuation, spelling, or syntax in language translation. It's essentially about the mechanics of the language, and such errors can severely compromise the quality of the translation". It can include the incorrect choice of lexical units, incorrect positioning of Subject (S), Verb (V), and Object (O), false active-passive structure, and other types of structural errors in translation.

The final translation error introduced by Nord, which is text-specific errors, refers to the mistakes that occur due to the lack of familiarity with the subject matter or field-specific jargon (Service, n.d.). In this study, it can be said that the translation errors made by the translator due to her/his lack of proficiency in the field of IR and its concepts have contributed to the occurrence of such errors. Inability to comprehend the text about the field under discussion, false usage of jargon and lexical units, limited knowledge about the related concepts, and ideologies are the main causes for the translator to make text-specific translation errors.

MATERIALS AND METHODS

Research Approach and Research Design

The study follows a qualitative research approach as it intends to examine how translation errors influenced political results in world history through a specific set of incidents. As the study focuses on understanding the nature of linguistic misunderstandings and their repercussions in international politics, no numerical values are taken into account. A qualitative approach, therefore, is appropriate as the study analyzes meaning, context, and interpretation in historical diplomatic communication. The study is designed as a case study analysis of several historical events in order to explore how translation errors shaped world politics. By focusing on several key historical events, the study aims at understanding the patterns that could be identified and, therefore, be able to analyse whether translation has an impact on global affairs or not.

In exploring the role of translation in these three historical events, the study addresses four research questions, which are,

1. How did pragmatic translation errors shape international politics?
2. How did cultural translation errors shape international politics?
3. How did linguistic translation errors shape international politics?
4. How did text-specific translation errors shape international politics?

Data Collection

A textual analysis is used as the method of data collection. The study is based entirely on secondary data sources, as it is aimed at examining three events recorded in the history of world politics. Data are gathered from official websites, academic books, previous journal articles related to the study, and other reliable historical records and information available online. These resources were beneficial in accessing the descriptions of original statements, the translations, and the political reactions that marked the history of diplomacy. The following table indicates the sources from which data are gathered for the textual analysis.

Table 2: Classification of Sources used for Data Collection

Source Type	No. of Sources	No. of Extracts	References
Official websites	05	05	United Nations (1967) New Zealand Human Rights Commission (n.d.) Museum of New Zealand (n.d.) The Encyclopedia of New Zealand (n.d.) National Diet Library (2003)
Online articles and Reference Websites	07	08	Encyclopedia Britannica (2025) Gaijinpot Blog (2014) GK Today (2012) ACT (n.d.) Te AKA Māori Dictionary (n.d.) Denshi Jisho Dictionary (n.d.) Universal Translation Service (2024)
Online Documents	01	01	Claudia Orange (2022)
Journal Articles	02	02	Boris Naimushin (2021) Egamberdiyeva Irodaxon et al. (2025)
Academic Books	01	01	Robert J. C. Butow (1954)

Source: Developed by Researchers, 2026

Sampling Method

For the investigation of how translation errors contributed to the unfolding of several incidents in IR history, the most relevant events that had a relatively severe impact on the world are chosen. Thus, the purposive sampling method is used. The selected incidents have been highly influential in world political events to date and are most appropriate in discussing the role of translation errors in shaping IR. In selecting the historical events to analyze in the study, the following criteria are followed.

1. Time period

The selected events are marked during the nineteenth and twentieth centuries, a period during which a series of intense geopolitical tensions, conflicts, post-war settling, and diplomatic affairs were recorded.

2. Representation of translation errors

The selected events emphasise how written errors resulted in challenges to the political parties in their global affairs, and do not consider misinterpretations that contributed to the challenges in international affairs.

3. Significance

Rather than being viewed as minor communication errors made in history, these incidents have clear political and diplomatic consequences, such as colonization and decolonization, conflicts and war, and have shaped long-term political disputes and rivalries.

Corpus of the Study

Based on the above-mentioned criteria, three historical events are selected to study the role of translation in worldly matters. They are,

1. Potsdam Declaration (The Mokusatsu Incident - 1945)
2. UN Security Council Resolution 242 (1967)
3. Treaty of Waitangi (1840)

The selected events can be identified as incidents in world history that were able to influence global political agendas, alliances among major power blocs, and the stability of countries, even at a contemporary level. Thus, an analysis of the nature of the role of the translator that caused the emergence of these events in history is crucial to navigate a country towards successful diplomatic affairs.

Data Analysis

The collected data are analyzed using a qualitative content analysis method in order to examine their patterns and consequences. Each case is carefully analyzed to examine how pragmatic, cultural, lexical, or textual translation errors resulted in shaping global political affairs. This approach allows researchers to explore whether nonequivalence, cultural differences, ambiguity, and strategic measures have caused such translation errors that impacted world politics on a large scale.

RESULTS AND DISCUSSION

Potsdam Declaration (The Mokusatsu Incident - 1945)

The Potsdam Declaration was issued on 26th July 1945, in the final stages of World War II, by the United States, the United Kingdom, and China, demanding the unconditional surrender of Japan. The leaders outlined their terms of surrender, which included complete disarmament, occupation of certain areas, and the creation of a “responsible government” (Britannica, 2025). Further, as the National Diet Library says (2003), it warned Japan, which was militarily weakened at that time, that non-compliance with the declaration and failure to make an unconditional surrender would cause “prompt and utter destruction”. In response, Japanese Prime Minister Kantaro Suzuki used the term “mokusatsu” to describe their decision, leaving Allied powers to interpret Japan’s stance in a crucial way (Butow, 1954). In the Japanese language, the word “mokusatsu” implies diverse meanings according to the context in which it is used. As Coslett says, “The word is a combination of two kanji: the moku- (黙) [..] combined with -satsu 殺,..” (Coslett, 2014). Denshi Jisho website describes the term “mokusatsu” as “ignoring; disregarding; taking no notice of; refusing to comment on; turning a deaf ear to” (Ahlström, Ahlström, & Plummer, n.d.). The website further provides a Japanese kanji breakdown of the term as follows.

Table 3: Kanji breakdown of the term "Mokusatsu"

黙	殺
SILENCE, BECOME SILENT, STOP SPEAKING, LEAVE AS IS	kill, murder, butcher, slice off, split, diminish, reduce, spoil

Source: Denshi Jisho Website

Among the term's multiple meanings, it can suggest "to withhold comment", "to remain silent", or "to treat with silent contempt".

- 黙 (moku) – meaning "silence" or "to remain silent"
- 殺 (satsu) – meaning "to kill" or "to reject" (gktoday, 2012)

However, in the translation of Kantaro's response, the term "mokusatsu" was translated as "refusing or ignoring the declaration" (Britannica, 2025), leaving the allied powers with the assumption of the Japanese authority's deliberate dismissal of the declaration. As Naimushin says, "The American translator(s) rendered into English the intercepted transmission in Japanese, translating mokusatsu as 'ignore entirely" (2021). Rather than implying it as a strategic delay in responding, translators' attempt to render the meaning of the term as an outright rejection caused utter destruction in Japan, as in August 1945, the U.S. military dropped atomic bombs on Hiroshima and Nagasaki, causing massive destruction to the cities.

Based on the above-mentioned meanings of the term "mokusatsu", the following possible positive/neutral and negative meanings can be rendered.

Table 3: Possible meanings of the term "Mokusatsu"

Positive/Neutral	**Negative**
No comment (for now)	Ignore
Withholding judgement	Treat with silent contempt.
Remain in silence	Deliberately disregard
-	Not worthy of comment
-	Clear rejection

Source: Developed by Researchers, 2026

Therefore, it is evident that the term "mokusatsu" bears semantic ambiguity as it conveys several meanings. The incident showcases the importance of a translator's competence in the careful rendering of a term with multiple possible contextual meanings, and her/his ability to preserve the contextual meaning of a term for which a direct equivalent term is absent. As the translator was unable to comprehend the nuances, tone, style, and context that the ST was conveying due to uncertainty about a correct and direct term in English, the resulting miscommunication falls under Nord's pragmatic translation errors. Failure of the translator to retain the suggested meaning, which Irodaxon et al. (2025, p. 271) identify as Implicature (suggested meaning not directly stated) that falls under pragmatics, led to the delivery of misinformation and an erroneous translation. On the other hand, as the tragic event originates as a result of semantic ambiguity, the mismatch between the intended and the interpreted meanings resulted not solely from the erroneous translation process, but also from a decision-making problem. Rather than framing it as a clear deviation from the ST, it can be said that the multiple plausible interpretations that the translator may choose due to its ambiguity have also contributed to one of the major devastating incidents in history. Thus, the event can be categorized as a pragmatic error that the translator faces due to the challenge of ambiguous political language.

From a political lens, it can be said that the Japanese leadership might utilize such an expression as a strategic move, implying indirectness to take their time for any internal political discussions and decision-making procedures based on the given possible meanings of the term. Moreover, such an expression might have been used to avoid confrontation or as a strategic ambiguity in their diplomatic communication. However, major superpowers at that time interpreted the term literally as a clear rejection of the declaration rather than taking into consideration its possible contextual meaning.

This historical event emphasizes how a single linguistic miscommunication can lay the foundation for wars and conflicts with a massive number of humanitarian consequences. As the Universal Translation Service website states, "Some think that Kantaro Suzuki knew that mokusatsu is an ambiguous word and decided to use it anyway. They believe that the worst incident in the history of Earth could have been avoided if Suzuki had been more apparent in his speech. If he had said that the Cabinet had not arrived at a decision, then the Allied would not have seen his speech as rejecting their terms" (Universal-translation-service, 2024). It showcases the importance of translation, which has the ability to either construct or destroy a nation during critical historical moments.

UN Security Council Resolution 242 (1967)

Following the Six-Day War, the United Nations Security Council adopted Resolution 242 to establish a framework for peace in the Middle East. The resolution included several principles, such as the withdrawal of Israeli forces and the acceptance of all states' right to exist within their secure territorial borders. As the resolution was translated into multiple official UN languages, including English and French, it enabled the UN to communicate its intentions in providing a framework for peacemaking. However, a miscommunication led by a mistranslation in the French version of the resolution led to a long-term diplomatic disagreement in world politics.

The disputes were raised based on the discrepancies in the wording between the English and French versions of the resolution. The following table depicts the differences between the two versions.

Table 4: ENG and French versions of the UN Security Council Resolution's expression

ST	TT
Withdrawal of Israel armed forces from territories occupied in the recent conflict;	Retrait des forces armées israéliennes des territoires occupés lors du récent conflit
(Nations, 1967, p. 8)	(Nations, 1967, p. 8)

Source: Developed by Researchers, 2026

It can be noticed that the English version of the expression does not include the definite article "the" before the lexical unit "territories". Thus, the absence of the definite article "the" before territories left an ambiguous effect on the extent of the withdrawal. It could allude to a partial withdrawal, not the complete action. On the other hand, the French version used the phrase "retrait des forces armées israéliennes des territoires occupés," which can be interpreted as a withdrawal from the occupied territories, indicating all territories. The French definite article "des", which is in its genitive form, clearly expresses the meaning "from the" in this context. This slight yet structural difference between the two versions created disputes and a mismatch in the interpretations regarding the same legal text. While Israel claimed their decision for a partial withdrawal in accordance with the English version, Arab states argued that the resolution demands a more comprehensive and full withdrawal. Both parties adopted interpretations that aligned with their own political motives, which led to long-lasting disputes and negotiations. The event implies the role of a subtle grammatical translation error, which led to significant diplomatic consequences. The precise choice of vocabulary and accurate sentence structure play a crucial role in the construction of an error-free translation, especially in diplomatic affairs.

The translator's improper usage of articles can be viewed as a linguistic translation error, as per the classification by Nord. Such errors expose the TT to structural inaccuracies, implying the failure to construct a successful translation. As the event elaborates, linguistic errors can lead to misinterpretations of the ST's meaning, as such errors may compromise the mechanics of the language. In this instance, failure to use articles properly in the TL led to structural ambiguities as to whether the text implies a full or partial withdrawal of armed forces. Omission, addition, or substitution of definite articles can cause the misinterpretation of references or expressions, thus leading to miscommunication between the ST writer and the TT reader.

However, in the diplomatic field, the issue in Resolution 242 is often debated as an example of intentional diplomatic ambiguity rather than a mistranslation. History argues that drafters used diplomatic language that enables future negotiations. The flexible wording left the opportunity for the involved parties to meet their agendas due to the choice of wording by the drafters. On the other hand, according to translation, such errors can be included as linguistic errors.

Treaty of Waitangi (1840)

Te Tiriti o Waitangi or the Treaty of Waitangi was made between the British Crown and the Māori people in 1840 (Orange, 2022). The Preamble sets out the purpose of the Treaty: to protect Māori rights and taonga, keep peace and order, and establish government (Commision, n.d.). However, the British version and the Māori version showcase differences in the articles included in the agreement. In the text for Māori, which was translated by a British missionary, Article 1 stated that Māori should not cede their sovereignty to the British monarchy. It alluded to self-government and protection from the invaders, but not a complete loss of sovereignty. On the contrary, the version for the British stated that Māori would "cede absolutely and without reservation all the rights and powers of sovereignty to her Majesty the Queen of England (ACT, n.d.). The following table illustrates this incident well.

Table 5: English and te reo Māori texts of Te Tiriti o Waitangi | The Treaty of Waitangi, and a contemporary translation of the te reo Māori

ST	English Version of Māori text	TT
ki te Kuini o Ingarani ake tonu atu - te Kawanatanga katoa o o ratou wenua (Zealand M. o., n.d.)	give absolutely to the Queen of England for ever the complete **government** over their land (Zealand M. o., n.d.)	cede to Her Majesty the Queen of England absolutely and without reservation all the rights and powers of **Sovereignty** (Zealand M. o., n.d.)

Source: Museum of New Zealand Website

According to the Te AKA Māori Dictionary (Dictionary, n.d.), the term "Kawanatanga" in the English language means "government, dominion, rule, authority, governorship, province". However, in the TT, it alludes to the contextual meaning that the British Crown would hold the sovereignty of Māori. Though the Māori version of the treaty refers to a relatively limited administrative authority gained by Britain, the English text refers to the cession of "sovereignty", which indicates a broader idea comparatively.

The translator's choice of words in the text has caused discrepancies in the text, which later led to unrest between the two states in their political relations. Whether it was a strategic effort led by their own political agendas, the translator has committed an error by choosing a non-equivalent lexical unit, which conveys a contradictory meaning to that of the original. Thus, it is evident that, according to Nord, the translator has made a linguistic translation error. As the translator has made a false arrangement of words, this error can be categorized as a linguistic translation error.

On the other hand, some critics argue that the cause for the disparities between the two texts was a result of the absence of a direct equivalent term in Māori for "sovereignty". In the Encyclopedia of New Zealand, Meredith and Higgins say (Meredith & Higgins, n.d.), "There is no exact equivalent in Māori for this word, since traditional Māori society had decentralised forms of leadership, administration and social control that were quite different from the monarchic and bureaucratic systems of government developed in Britain". Therefore, based on such comments, the incident can be categorized as a cultural translation error. As described in the literature review section, this translation error resulted

from the translator's use of vocabulary, as the term did not have an equivalent in the TT culture. The translator's inability to follow the norms and conventions led to a cultural translation error.

Comparative Discussion

When examining the function of translation errors in IR, a range of trends can be identified in the selected three historical events in the nineteenth and twentieth centuries.

The most important factor that could be identified through each of these events is how communication in high-stakes settings is influenced by linguistic conventions, translation errors, and challenges. These events demonstrate the extent of the political significance of an error-free translation, particularly when dealing with other states and an international audience. Each of these events is backed by ongoing political tension, which was worsened by the errors of the translator.

Next, it can be said that different linguistic elements have different political implications. While in the "mokusatsu" incident, the confusion that the translator experiences due to semantic ambiguity could alter the way in which the intent is understood at a global political level, translation errors that occur due to cultural differences, such as in the Waitangi Treaty, can change the perception of the ST writer and foster mistrust between the state and non-state actors. At the same time, confusions occurred due to structural differences, such as in Resolution 242, can also impact diplomatic affairs between states. By looking at the three selected historical events, the reasons for the translation errors can be summarized as follows.

Table 6: Summary of Findings

Historical Event	Translation Error	Cause for the Error
Potsdam Declaration (The Mokusatsu Incident -1945)	Pragmatic	Semantic ambiguity
UN Security Council Resolution 242 (1967)	Linguistic	Structural differences between languages
Treaty of Waitangi (1840)	Linguistic/Cultural	Choice of terms/Lack of awareness of language conventions and norms

Source: Developed by Researchers, 2026

Based on the above-mentioned research findings, the study provides measures that can be taken by translators in the future, in order to mitigate the possibility of such translation errors.

1. Where a translator experiences semantic ambiguity, she/he should avoid resolving the challenge prematurely. In the context of indeterminacy, multiple plausible meanings are available for a particular lexical unit; the preservation of ambiguity and opting for a neutral choice of vocabulary may reduce the risk of pragmatic translation errors. It may reflect the core meaning of the ST with relatively higher coherence, as it does not confuse the target readership due to ambiguous meanings.
2. The translator should have a thorough understanding of the linguistic and syntactic standards of the TL. The sensitivity to the linguistic norms of the target culture helps the translator to produce an accessible output. Adhering to such linguistic standards is crucial, as a seemingly minor error, such as the omission or the addition of a definite article, can alter the whole meaning and convey an unintended meaning to the target readership. Thus, it is the responsibility of the translator to handle linguistic elements, including grammatical and structural norms, precisely.
3. When a translator experiences the absence of a direct lexical equivalent due to cultural differences between the ST and TT, the translator should be able to adapt to and utilize translation strategies such as paraphrasing, borrowing, use of explanations, and careful imitation. Such strategies help the translator to preserve the nuance of the ST while respecting the cultural differences between languages.

Further, the study elaborates that translation is a process which goes beyond being a simple technical task. Its role in a political setting as a means of influencing the decision-making process of a state as well as other non-state actors in IR demonstrates how errors in the translation process can affect the IR system.

CONCLUSION

The study is aimed at providing insights into the role of translation errors in shaping IR and understanding the repercussions that the world experienced due to mistranslations. It mainly focuses on understanding how important the translator is as a mediator who facilitates cross-language communication through an error-free translation that ensures both accessibility and fidelity to the ST.

The three selected historical events in the IR reveal that translation is a potent process that has impacted political realities both in negative and positive ways. Either intentional, unintentional, or context- or culture-bound language choices made by the translators caused meaning shifts and distortions in their translation and hindered the global political procedures. The history records instances in which the choice of word, phrase, or sentence had the ability to influence the TT reader comprehension, highlighting the significant role and responsibility that the translator holds in political contexts.

The key findings of the study showcase that in the history of IR, pragmatic, linguistic, and cultural translation errors had the ability to influence the decision-making system of state and non-state actors. One of the most potent challenges that the translator may experience when rendering the meaning of a political text into another language is the availability of several possible meanings due to ambiguous ST. Further, the findings elaborate that deviation from the linguistic norms of the target culture and incompetence in the language conventions of the TT can challenge the translation process and cause meaning distortions and manipulations. As described in the "mokusatsu" incident, the misunderstandings occurred due to semantic ambiguity and led to one of the greatest destructions in world history. Though the

outcome was relatively less severe in the other two historical events under discussion in the study, such translation errors could also have contributed to more serious results. In the contrary, it is evident that a successful translation in which the translator links two distinct linguistic backgrounds by making their intentions clear, choosing relatively less impactful or neutral vocabulary in the place of ambiguous choice of words, strengthening the proficiency in target culture, and reach better awareness of linguistic and structural standards can lead to both a faithful and an accessible translation, thus making IR, diplomatic affairs and world politics productive and successful. Hence, translation goes beyond a simple language-based task to the extent of a power that influences how global relationships are modeled.

Further, the study also demonstrates the professional aspects of a translator. The above-mentioned examples illustrate that accuracy and fidelity to the ST are not the only driving forces in a translation. Achieving a higher degree of faithfulness while compromising accessibility, thus leading to miscommunication, cannot be considered a professional and ethical translation process. The translator is responsible for understanding the context, scope, purpose, audience, and potential impact of his/her work. Especially, a translator in the political sector is highly exposed to tensions and confusion. Therefore, a translator must be able to adopt a professional and ethical decision-making process, as cultural and contextual awareness is as important as linguistic competence.

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An Ontology-Driven Rule Enforcement Framework for Governing the Student Evaluation Lifecycle in Sri Lankan Higher Education

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Rathnayake R.M.N.B.[1*] and Jayaweera Prasad M.[2]

[1*]Department of Information Technology, Sabaragamuwa University of Sri Lanka, Sri Lanka

[2] Department of Information Systems Engineering and Informatics, University of Sri Jayewardenepura, Sri Lanka

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Abstract

The aspects of governance, regulation, and transparency are essential parts of modern educational service management systems and, especially, of the Student Evaluation Lifecycle (SEL). On the other hand, student evaluation processes in higher education institutions operate with inconsistent policies, humanly understood regulations, inefficient control procedures, and informal enforcement of rules, which can result in inconsistencies, lack of transparency, and non-compliance with the SEL process. There is no study that would explore the problem of integration of governance requirements, ontology-based rule representation, and rule enforcement processes for student evaluation. The ontology of rules and rule-enforcement sub-framework (RORESF) proposed in this study includes institutional governance rules and rule-enforcement of regulations related to SEL. What makes the ontology of rules special is the combination of rule ontology, governance rules, and multilevel business rule enforcement in a reusable framework tailored to evaluate higher education processes. The ontology is developed following a classification of business rules and the use of an action enablement rule paradigm together with various forms of enforcement mechanisms. Business Process Model and Notation (BPMN) is employed to model the rule ontology, governed processes, actors, decision points, and enforcement mechanisms to ensure that the process becomes transparent. A hybrid approach that includes design science research methodology (DSRM) and interpretative phenomenological analysis (IPA) was applied in this research. The results show that ontology systematically identifies and represents governance rules and links institutional regulations with evaluation procedures with the help of transparent BPMN models. Experts evaluated the ontology and found it to be correct, complete, consistent, and comprehensible.

Keywords: Business Rules, Educational Service Management, Governance and Compliance, Student Evaluation Lifecycle (SEL), Rule Ontology, Rule Enforcement

INTRODUCTION

This research addresses the development of an effective Educational Service Management Framework that will enable the achievement of governance policies as well as enforcement of rules in the SEL. Existing studies also lack a formal ontology that represents service rules and stakeholder responsibilities within higher education student evaluation processes. Consequently, universities continue to experience governance, compliance, and coordination challenges, particularly in complex evaluation environments involving multiple stakeholders.

Therefore, persisting inconsistencies in the current SEL continue to create serious difficulties in establishing uniform and fair procedures for final evaluation at the higher education institute. Besides, the lack of adequate monitoring functions and an institutional operating mechanism in the existing SEL limits efforts towards pursuing standardization in the higher education sector. In view of these limitations, this research proposes the development of a rule ontology and a rule enforcement sub-framework for responsible coordination in SEL. Accordingly, the research objective is to design, develop, and validate an educational service management framework by developing a service rule ontology and a rule enforcement sub-framework for the SEL, thereby improving governance, compliance, and stakeholder responsibility coordination.

The research objective of developing a service RORESF for SEL has been achieved. The proposed rules are significant to both designers and developers of intelligent IT-Based systems in the effective management of student evaluation.

The business rule classification guideline recommends a conceptual framework that categorizes business rules for

* **Corresponding author:** Tel.: +94 (71) 993 6541; Email: nevil@ccs.sab.ac.lk
https://orcid.org/0009-0003-5760-4171

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analysis purposes (Eclipse Process Framework. (n.d.). Business Rule Classification (Guideline). There are three major categories, namely structural business rules that define domain terminology and fact-based relationships essential for representing business knowledge, decision logic, which represents a business-rule subset that drives business results by utilizing normative, guiding, enabling, acting, computing, and inferential business rules, and process flow business rules that manage activity execution flow in workflows independently of business decisions' logical reasoning. Finally, business decisions' logical reasoning is categorized under subcategories, namely mandatory constraints that prevent invalid business transactions, business guidelines that indicate undesirables without halting business process execution, Action Enablers that launch further business process execution, Computation business rules that apply computational formulas for calculating new values, and Inferential business rules that produce new facts for business reasoning engines (Eclipse Process Framework. (n.d.). Business Rule Classification (Guideline).

While this classification provides a generic foundation for business rule analysis, it does not explain how these rules can be systematically applied to higher education governance or to SEL. Moreover, existing studies do not identify which business rule categories are most appropriate for coordinating stakeholder responsibilities during student evaluation. Classification of business rules could also cover the following: Action Enablers, Guidelines, Mandatories, Computation, Inferences. Among all the above-mentioned types of business rules, the action enablers type is chosen for use in this research because of its direct contribution to the coordination of the sequence of responsibilities and automatic performance of the activities related to student evaluation. It is one of the distinctive features of the proposed methodology.

The notion of enforcement level captures the degree to which a business rule will be enforced in an organization's operational and information systems, and presents a scale that spans from highly enforced business rules, where violation is disallowed and results in definite prevention or penalty, to rules that are potentially overridable by authorized parties following violation, and finally to guideline business rules that are assessed and perhaps noted but do not prevent execution in case of violation. This also allows a separation between the meaning and implementation mandate of a business rule, such that diverse governance strategies not accompanied by this higher-level framework would fail to meet complex organizational requirements from a control vs flexibility perspective and thus provide guidance in relation to whether rules are encoded in executable logic versus merely tracked in guidance logic in an implementation context (Hinkelmann, n.d.). This serves to provide a better understanding with regard to the expected system behavior and the organizational processes related to rules, hence promoting the management, compliance, and flexibility of business rules in a complex business environment (Business Rules Group, 2010).

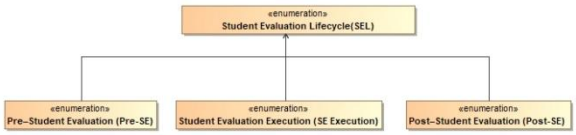
Therefore, compared with existing governance and business rule enforcement approaches, the proposed framework integrates three complementary components: (i) a Service Rule Ontology for formal knowledge representation, (ii) an Action Enabler-based Rule Enforcement Sub-framework for responsibility coordination, and (iii) governance policy enforcement across all phases of the SEL. This integrated approach addresses an important research gap that has not been sufficiently explored in previous studies, particularly within the Sri Lankan higher education context.

Student Evaluation Lifecycle (SEL):

SELs are predominantly used by universities and are known to be very complicated, in that they involve many stakeholders, have interactive relationships between them, and take up a lot of time. Also, in SELs, the assessment process is divided into different stages, and all of them are undertaken for a considerable amount of time. Consequently, it is very hard for the stakeholders to get a holistic view of the entire process. It is a problem in developing ITBS. Due to the complexity of SEL, the problem becomes even more important because the existing information system supports these tasks on an individual basis without having a framework that helps to follow policies during the whole evaluation process. The problem is particularly important within the framework of Sri Lankan universities, where student evaluations should be performed under university rules and multiple parties are involved.

This SEL is divided into three major phases, as depicted in Figure 1, namely Pre-Student Evaluation (Pre-SE), Student Evaluation Execution (SE Execution), and Post-Student Evaluation (Post-SE) phases.

Figure 1: Student Evaluation Lifecycle



Source: Developed by Researchers, 2026

Pre–Student Evaluation (Pre-SE) Phase:

The student evaluation process starts at the Pre-SE Phase of the SEL. This is the first phase of the student evaluation process and involves many important activities, including the development of evaluation criteria, securing all approvals, and the issuance of appointments, which are all important in the initiation of the student evaluation process.

Student Evaluation Execution Phase (SE-Execution):

After the successful completion of the activities in the pre-SE phase, the process continues to the Student Evaluation Execution (SE-Execution) phase. The concern of this phase is the student evaluation process during the period of examination, particularly the execution of the student evaluation activities strictly in accordance with the policies and guidelines of the institution.

Post–Student Evaluation (Post-SE) Phase:

After the process of examination is complete, the Post-Student Evaluation Process starts. This process entails a wide range of post-examination processes such as the evaluation and marking of the examination scripts, preparation of mark sheets, awarding of grades, recording of results, and communicating results of the evaluation process. Moreover, this

process offers a framework whereby students are able to access their results as well as express their inquiries, concerns, and/or appeals regarding their results of the evaluation process. The proposed Educational Service Management Framework supports governance and rule enforcement across all three SEL phases by ensuring that stakeholder responsibilities are coordinated through formal service rules, institutional policies are consistently enforced, and compliance can be systematically monitored throughout the complete SEL.

LITERATURE REVIEW

Moreover, the application of the aforementioned concept has been found to be effective in the management of complex knowledge structures in the context of educational systems, particularly in managing complex situations involving a number of stakeholders and complex interconnected processes. As may be understood from the aforementioned literature, the application of the concept of ontology-based models has been found to be effective in providing a sense of clarity, as well as ensuring the development of interoperability in the context of educational technologies (Chimalakonda & Nori, 2020). According to this concept, the application of rule ontologies has been suggested as a means of providing a platform for the implementation of governance policies and institutional rules. In the context of higher educational institutions, the application of the aforementioned concept may be used for the development of evaluation policies, approval, and compliance constraints. Hence, the application of the aforementioned concept may be identified as an effective means for the development of traceable student evaluation management systems, particularly in the context of centralized educational institutions.

The difference also lies in the level of enforcement, which can be compulsory, guidelines, and others (Hinkelmann, n.d.). This is important since the level of enforcement of the rules provides a structured way of differentiating between institutional rules that are inflexible and institutional rules that are flexible. With regard to higher education institutions, the inclusion of the level of enforcement of the rules in student evaluation management systems is imperative since it ensures that key constraints are encoded. Moreover, enforcing the rules ensures that the evaluation of the institution is done, and this is vital for public universities.

It is evident from the above that the precise specification of formal business rules is an essential factor that ensures consistency and traceability within information systems. As Feuto Njonko et al. (2014) indicate in their study, the use of controlled natural languages with the ability to fill the gap between business logic and formal logic is essential. It is evident from the study that there is a need for precise rules that are understandable. This is an essential part of higher education institutions, where there is a need for specifying policy with regard to system rules. This study has reiterated the need for precise specification of formal business rules with regard to the development of management systems that evaluate students.

In this regard, a detailed discussion regarding the Semantic Web Rule Language (SWRL) and its expressive extensions, particularly regarding the integration of ontologies and rule-based reasoning systems in the Semantic Web, has been provided in research by Lawan and Rakib (2019). The SWRL extends the Web Ontology Language (OWL) through the integration of conditional logic, thereby increasing the expressiveness and computability of the system. All these components might become very useful in the development of knowledge-based systems since it becomes necessary to develop consistent, compatible, and computable rules to develop knowledge-based systems. The SWRL can become very useful in the development of governance systems since it will help to develop semantically accurate and computable rules. Integration of the SWRL with ontologies relating to the field of education will be very useful in developing the student evaluation management system.

The importance of governance aspects in educational information systems is further emphasized in the research conducted by Turnbull, Chugh, and Luck (2022), as it offers a comprehensive analysis of different aspects of various policy factors that affect learning management systems in higher educational institutions. The research has emphasized different aspects of governance, such as access management, content quality, data privacy, integrity of assessments, and maintenance of systems, while highlighting the importance of learning management system policies, which extend beyond technical aspects, playing an essential role in governance, promoting transparency, accountability, and consistency in operations. The research is significant in environments where operational challenges are critical, and it offers significant guidelines on developing governance-based rule enforcement and ontology for student evaluation management systems, especially in Sri Lanka.

The classification of business rules also facilitates the analysis and management of rule-based information systems. Business rules can be classified as structural, decision logic, and process flow business rules, as defined by the Eclipse Process Framework (EPF). The classification of business rules facilitates the separation of the logic of decision-making and the flow of the process (Eclipse Process Framework [EPF], n.d.). The differentiation of business rules, as applicable to the student evaluation management systems, can be used for modeling roles and responsibilities of academics. The differentiation of business rules is also relevant with respect to the development of rule ontologies based on the policies of the governing bodies of higher education institutions.

The lack of visibility in the process has been identified as one of the most significant issues in dealing with the processes associated with evaluation. The need to apply rule-based process models in ensuring process compliance and transparency was highlighted in previous studies (Business Rules Group, 2010). The inclusion of rules in the process of executing workflows makes it easy to monitor the progress of activities and ensures accountability on the part of different stakeholders. This is especially important in dealing with the complexity of student evaluation management processes.

Lastly, ISO 21001 is a standard for a management system that is applicable in educational organizations, with a focus on governance, consistency of processes, as well as satisfaction of stakeholders. By incorporating the ISO 21001 principles, it is possible to have governance requirements integrated into the student evaluation management systems' rule enforcement mechanisms. All the literature reviewed highlights the significance of the rule enforcement mechanisms within educational information systems.

Though research on rule-based approaches and ontology-driven approaches is available, research on the application of rule ontologies and rule enforcement frameworks for student evaluation is lacking in Sri Lanka. This is a research gap, and it is an opportunity to use rule-based approaches for modeling the actors, activities, and processes involved in student evaluation, and for organizing the activities using rule-based approaches.

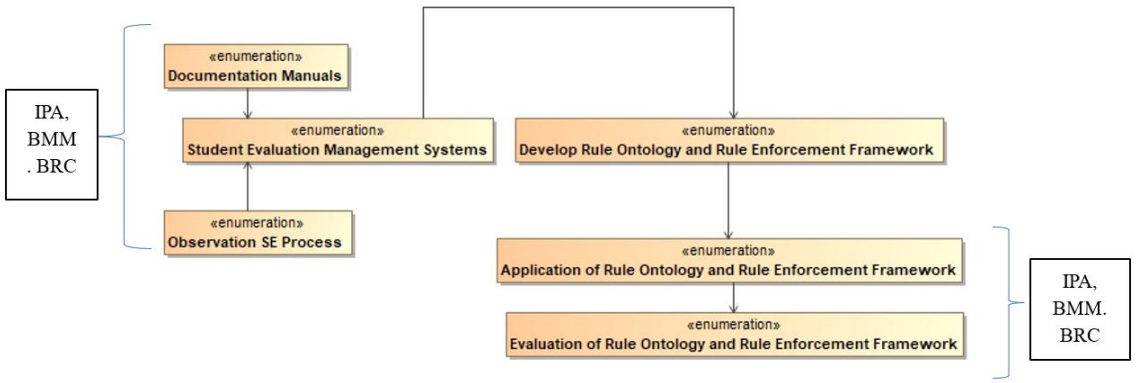
However, no studies have identified an ontology-driven rule enforcement framework in the Sri Lankan context that investigates the SEL. Therefore, a clear research gap exists in this area. By applying a rule-based ontology, the processes and activities associated with the SEL can be systematically identified and analyzed to evaluate responsibility coordination among relevant stakeholders.

MATERIALS AND METHODS

This study employs a mixed-methods research paradigm as depicted in Figure 2 below, which consists of two related methodological approaches: the Design Science Research Methodology (DSRM) and the Interpretative Phenomenological Analysis (IPA). These two methodological approaches were deemed suitable for this research since the research required the design and development of technological artifacts as well as comprehension of the stakeholders' experiences and governance issues in SEL. The focus of design science is on the application of knowledge to create new artifacts that address identified human and organizational needs. Accordingly, DSRM guided the identification of the research problem, the specification of design objectives, and the design, development, demonstration, and evaluation of the proposed Rule Ontology and Rule Enforcement Framework.

This is unlike IPA, which is a qualitative research methodology that is interested in exploring how people make sense of their experiences (Smith et al., 2009). The focus of IPA is based on the theoretical foundations of phenomenology, hermeneutics, and idiography, which try to interpret meanings based on the viewpoints of the participants in particular settings. In this study, IPA was used to examine how university stakeholders understood and experienced governance policies, institutional responsibilities, business rules, and rule-enforcement practices associated with student evaluation management. The findings generated through IPA provided the contextual and experiential knowledge required to define the concepts, relationships, responsibilities, constraints, and rules incorporated into the artefacts developed through DSRM. Therefore, IPA supported the empirical investigation of the problem domain, while DSRM provided the structured process for transforming the findings into practical and evaluable research artefacts.

Figure 2: Hybrid Methodology Process for Pre-Student Evaluation



Source: Developed by Researchers, 2026

Moreover, this research follows the Business Motivation Model (BMM) developed by the Business Rules Group (2010) and the Business Rule Classification (BRC) guideline developed by Olea (n.d.) as its underlying standards.

The integration of DSRM and IPA enabled an iterative relationship between qualitative inquiry and artefact development. The experiences and interpretations obtained from institutional stakeholders were analyzed to identify governance requirements and rule-enforcement problems. These findings informed the development of the rule ontology and rule enforcement framework, while feedback obtained during expert validation was used to refine the proposed artefacts. Hence, methodological integration allowed for the development of artifacts that were theoretically found, contextually meaningful, and consistent with the operational and governance needs of the student evaluation environment at the university level. Data collection was guided by IPA methodology and used semi-structured interviews of 30 carefully chosen domain experts at Sabaragamuwa University of Sri Lanka. These experts comprise the Examination Registrar, Dean, Head of Department, Subject Coordinators, Academic members, Subject Management Assistant, and other officers responsible for student evaluation governance and administration. The participants were selected in accordance with their professional duties, practical experience, decision-making rights, and direct involvement in the development of student evaluation policies and procedures.

Each participant was contacted formally and provided with information regarding the purpose of the study and the interview process. Informed consent was obtained before the interviews were conducted. A semi-structured interview guide containing open-ended questions was used to examine participants' experiences and perceptions concerning

governance policies, stakeholder responsibilities, existing business rules, institutional constraints, coordination practices, and rule-enforcement challenges within the SEL. Follow-up and probing questions were used when clarification or further explanation was required. The interviews were conducted individually face-to-face, lasted approximately 10 minutes, and were audio-recorded with permission for subsequent analysis. The interview data were then examined using IPA procedures to identify significant statements, experiential themes, recurring governance issues, and domain concepts relevant to the development of the proposed artefacts. The process of developing ontology follows guidelines of ontology engineering in terms of extracting concepts of the problem domain from relevant institutional documents and interview data, designing classes and relationships between them, specifying constraints in terms of responsibility-based rules, and validating with subject-matter experts. The ontology rule enforcement framework was developed based on expert feedback to ensure their conceptual accuracy, practical relevance, consistency, and suitability for supporting governance-based SEL.

RESULTS AND DISCUSSION

Rule Ontology and Rule Enforcement Sub-framework for pre- SE

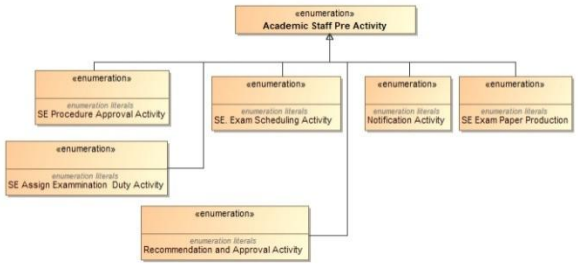
Within the Pre-SE Phases, it is essential to ensure that all prerequisite activities such as recommendations, approvals, and registration procedures are fully completed. These preparatory activities involve multiple actors within the academic domain and are critical to the effective scheduling and organization of the evaluation process. The pre-SE process can be broadly categorized into three primary groups:

1. Academic staff pre-SE activities
2. Non-academic staff pre-SE activities
3. Candidate for pre-SE activities

Academic staff pre-SE activities

During the pre-activity phase in the SE for academic staff, there are six different sub-processes as follows (see Figure 3): SE Procedure Approval, SE Assign Examination Duty, SE Exam Scheduling Activity, Recommendation & Approval, Notification, and SE Exam Paper Production.

Figure 3: SE Academic Staff Pre-Activity ontology



Source: Developed by Researchers, 2026

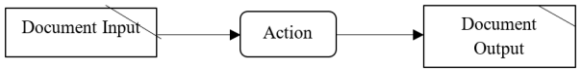
There are two significant sub-processes in the Student Evaluation Procedure Approval process: the Faculty Board Recommendation process and the Senate Approval process. These two sub-processes are responsible for the recommendations and approval of vital academic positions like the Paper Setter, Paper Moderator, First Marker, and Second Marker. As such, this section is devoted to the development of Rule Ontology and rule enforcement on academic positions but restricted to the Pre-Student Evaluation stage.

The Pre-Student Evaluation stage is characterized by certain rules regarding individual activities that provide a smooth progression from one stage to another in the evaluation process. In the case of this research, rules and rule enforcement will be developed for the "Student Evaluation Procedure Approval" process, particularly the pre-SE stage.

Rule Enforcement for Paper Setter

Input-Action-Output approach is followed by business rules to provide consistency and clarity in decision-making processes. Input of a document means the information, facts, or events that are fed into the business system. Forms, requests, or transactions are examples of document inputs. The action is associated with the set of business rules and decision logic, where decision logic evaluates inputs and imposes constraints to determine validity, calculation, or output. The output from such a process is the Document Output, which comprises approvals, rejections, notifications, recommendations, or records generated by the rule. Figure 4 below depicts the classification of business rules.

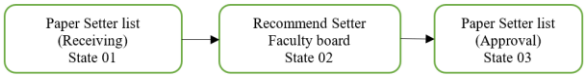
Figure 4: Action enablers business Rule classification



Source: Developed by Researchers, 2026

The Paper Setter is recommended by the Faculty Board, and the details are as follows: [Figure 5]

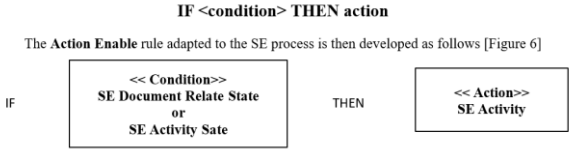
Figure 1: Faculty Board recommended state



Source: Developed by Researchers, 2026

To establish the rule governing the recommendation of the paper setter by the Faculty Board, the "Action Enable Rule" under the Business Rule Classification (Guideline) is adopted. The common format of the action enable rule is defined as follows:

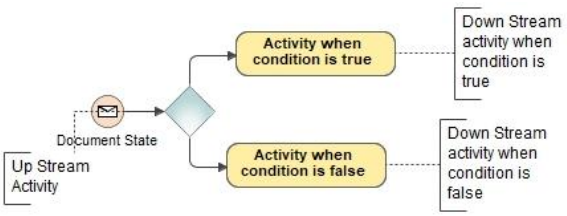
Figure 2: SE Action Enable rule



Source: Developed by Researchers, 2026

The document-based Student Evaluation (SE) rule adopted in this research is conceptualized and articulated through a Business Process Model and Notation (BPMN) diagram, as shown below [Figure 7].

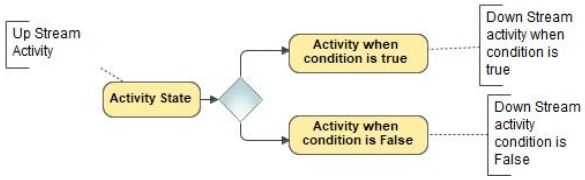
Figure 7: Document-based SE Rule



Source: Developed by Researchers, 2026

The Action-based Student Evaluation (SE) rule adopted in this research is conceptualized and articulated through a Business Process Model and Notation (BPMN) diagram, as shown below [Figure 8].

Figure 8: Action-based SE Rule



Source: Developed by Researchers, 2026

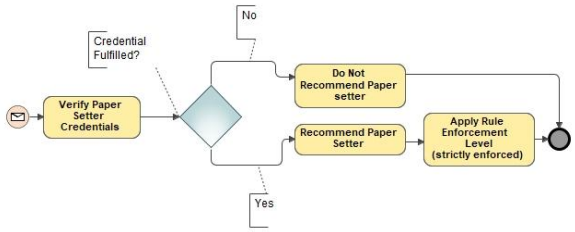
Rule Enforcement for Recommendation of Paper Setter

Accordingly, the above rule is adopted for the recommendation of the paper setter by the Faculty Board.

If <Paper Setter credential> = fulfilled setter requirements THEN recommend. <strictly enforced>

The above rule enforcement ontology can be represented using a BPMN activity diagram, as illustrated below [Figure 9].

Figure 9: Rule Enforcement for Paper Setter recommend



Source: Developed by Researchers, 2026

The condition of this rule requires that the paper setter be a subject lecturer, a visiting lecturer, or another lecturer with relevant subject expertise. When this condition is satisfied, the prescribed action shall be taken, namely the submission of a recommendation to the Faculty Board [Figure 9]. The rule shall be applied only upon receipt of the Faculty Board's recommendation. This rule is designated as strictly enforced, which represents the Business Rule Enforcement Level.

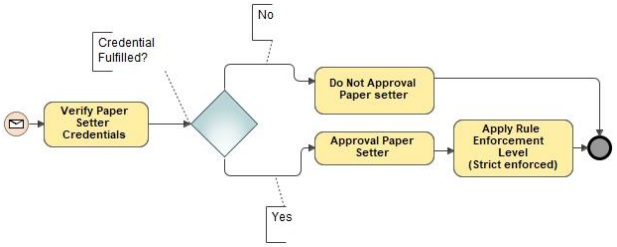
Rule Enforcement for Approval of Paper Setter

Accordingly, the above Action Enable Rule is adopted for the approval of the paper setter by the Senate.

If <Paper Setter credential> = fulfilled setter requirements THEN Approval. <strictly enforced>

The above rule enforcement ontology can be represented using a BPMN activity diagram, as illustrated below [Figure 10].

Figure 10: Rule Enforcement for Paper Setter approval process



Source: Developed by Researchers, 2026

The condition of this rule requires that the paper setter be a subject lecturer, a visiting lecturer, or another lecturer with relevant subject expertise. When this condition is satisfied, the prescribed action shall be taken, namely the submission of a recommendation to the Faculty Board [Figure 10]. The rule shall be applied only upon receipt of the Faculty Board's recommendation. This rule is designated as strictly enforced, which represents the Business Rule Enforcement Level.

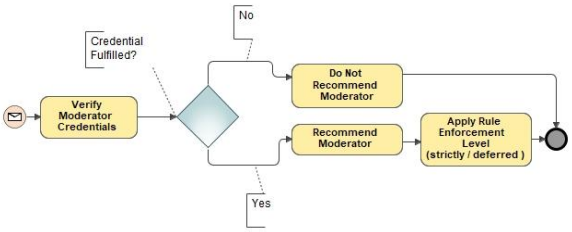
Rule Enforcement for Recommendation of Moderator

Accordingly, the above Action Enable Rule is adopted for the recommendation of the moderator by the Faculty Board.

If <Moderator credential> = fulfilled moderator requirements
THEN recommend. **<strictly enforced> or < deferred enforcement>**

The above rule enforcement ontology can be represented using a BPMN activity diagram, as illustrated below [Figure 11].

Figure 11: Rule Enforcement for moderator recommend process



Source: Developed by Researchers, 2026

The condition of this rule requires that the moderator be a senior academic in the subject area in the same faculty or the other faculty or the university or industrial. When this condition is satisfied, the prescribed action shall be taken, namely the recommendation from the Faculty Board. The

rule shall be applied only upon receipt of the Faculty Board's recommendation [Figure 11]. This rule is designated as strictly enforced or deferred enforcement, which represents the Business Rule Enforcement Level. Here are the deferred enforcement level rules that were applied, along with the senior academic responsible for the task; however, the task was carried out by a junior academic.

Rule Enforcement for Approval of Moderator

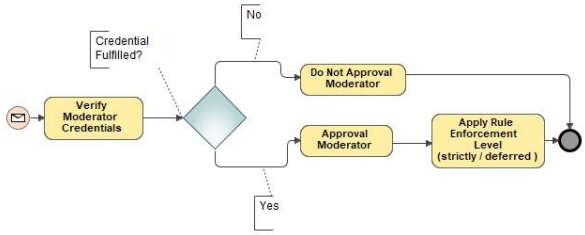
Accordingly, the above Action Enable Rule is adopted for the approval of the moderator by the senate.

If <moderator credential> = fulfilled setter requirements

THEN Approval. <strictly enforced> or < deferred enforcement>

The above rule enforcement ontology can be represented using a BPMN activity diagram, as illustrated below [Figure 12].

Figure 12: Rule Enforcement for Moderator approval process



Source: Developed by Researchers, 2026

The condition of this rule requires that the moderator be a senior academic in the subject area in the same faculty or the other faculty or the university or industrial. When this condition is satisfied, the prescribed action shall be taken, namely an approval from the senate. The rule shall be applied only upon receipt of the approval of the senate [Figure 12]. This rule is designated as strictly enforced or deferred enforcement, which represents the Business Rule Enforcement Level. Here are the deferred enforcement level rules that were applied, along with the senior academic responsible for the task; however, the task was carried out by a junior academic.

Similarly, the ROEESF are defined for the first marking and second marking processes under the SE Procedure Approval phase, encompassing both the Faculty Board's recommendation and the Senate's approval. In addition, the RORESF can be extended to other processes across all Pre–Student Evaluation phases.

Rule Ontology and Rule Enforcement Sub-framework for SE Execution

Under the Student Evaluation (SE) execution process, several sub-evaluation processes are conducted by academic staff members. These processes include execution of summative evaluation, execution of formative evaluation, academic staff attendance, non-academic staff attendance, candidate attendance, and collection of answer scripts. Among these processes in conducting the examination, the researcher develops the RORESF for a selected subset of processes within the SE execution phase, rather than for all identified processes.

Rule Enforcement Sub-framework for staff attendance management

In this context, both academic and non-academic staff are taken into account in the development of the RORESF. Accordingly, a structured and decision-driven workflow is modeled to support systematic rule validation and enforcement.

In this process, staff attendance credentials are initially verified to determine eligibility for entry into the examination hall. If the staff member does not qualify, he/she will not be allowed inside the exam hall. But if the staff member does qualify, his/her presence in the exam will then be recorded by signing his/her attendance on the attendance list. Afterwards, the system will verify if the staff member has multiple entries in his/her attendance. In the event of a duplicate entry, the attendance record is rejected in order to maintain data integrity. If no duplication is detected, the staff member is required to remain in the examination hall until the completion of the examination.

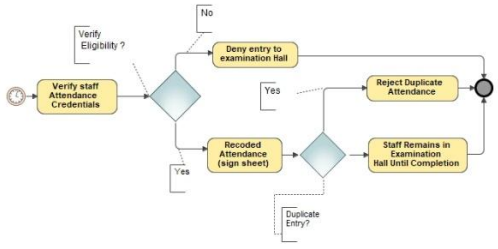
This process ensures controlled access, accurate attendance recording, and compliance with examination supervision requirements. For the staff attendance recording process, both the strictly enforced and post-justified override Business Rule Enforcement Levels are applied. The post-justified override enforcement level is activated in exceptional circumstances, such as the absence of an assigned academic or non-academic staff member, allowing a suitably qualified replacement to be appointed. Such substitutions are subject to approval by the relevant authority after the completion of the examination process.

Accordingly, the above Action Enable Rule is adopted for the recording of the staff attendance in the examination hall.

If <examination staff credential> <> fulfilled attendance requirements
THEN deny entry to examination hall else Approve to entry to examination Hall.
Eles-if < Duplicate staff credential ><> fulfilled attendance requirements
Then rejected entry to examination hall else Staff Remains in Examination Hall Until Completion.
<strictly enforced> and < post-justified override>

The graphical representation of the rule enforcement ontology is presented below [Figure 13].

Figure 13: Rule Enforcement Sub-framework for staff attendance management process



Developed by Researchers, 2026

Rule Enforcement Sub-framework for candidate attendance.

Multiple rules govern the arrival of candidates at the examination hall. These rules include verification of the candidate's eligibility with respect to the relevant year of study, course unit, subject name, examination time, and designated examination venue. Upon completion of this verification process, only candidates who are confirmed as eligible are permitted to enter the examination hall.

Accordingly, the above Action Enable Rule is adopted for the recording of candidate attendance in the examination hall.

If **<verify examination** ***credential*****> =** ***fulfilled requirements***
THEN entry to the examination hall
Business Rule Enforcement Level is **<strictly enforced>**

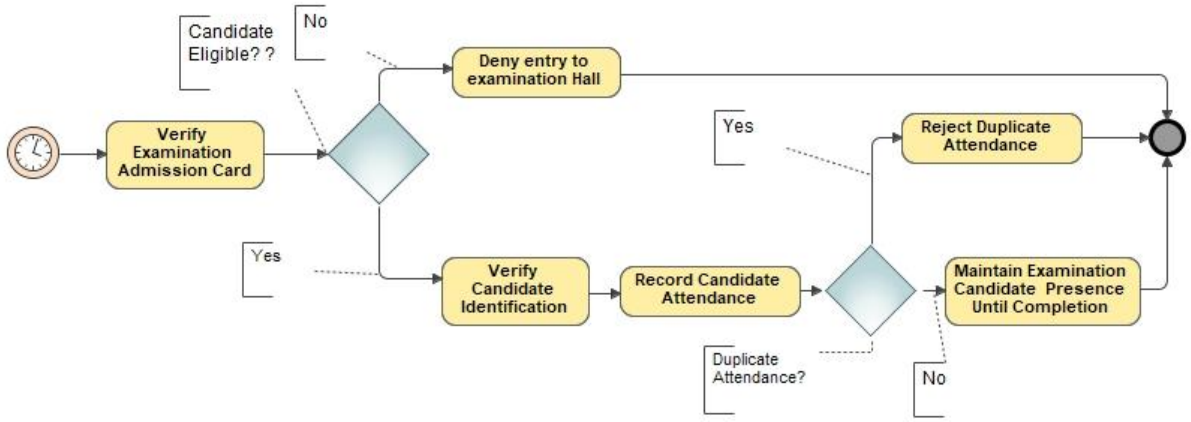
Another rule requires verification of the candidate's examination admission card. If the admission card is available, the candidate's attendance is recorded on the official attendance sheet. If the admission card is not available but the candidate's official identity card is available, the supervisor verifies the candidate against the official attendance sheet; if the eligibility criteria are satisfied, entry to the examination hall is permitted. Furthermore, if the candidate's index number is not listed on the official attendance sheet but both the admission card and official identity card are available, the supervisor may permit entry subject to eligibility verification. In such situations, submission of the admission card and confirmation of the candidate's inclusion in the official attendance records are mandatory either during or after the completion of the examination. These exceptional cases are governed by the post-justified override level of the Business Rule Enforcement Level. Additionally, duplicate verification checks are enforced, and candidates with duplicate attendance records are not permitted to enter the examination hall.

Accordingly, the above **Action Enable Rule** is adopted for the recording of the candidate attendance record.

If **<verify Admission** ***credential*****> =** ***fulfilled requirements***
THEN entry to the examination hall

These exceptional cases are governed by the post-justified override level of the Business Rule Enforcement Level. The graphical representation of the rule enforcement ontology is presented below [Figure 14].

Figure 14: Rule Enforcement Sub-framework for Candidate Admission recode process



Source: Developed by Researchers, 2026

Rule Enforcement Sub-framework for collection of answer scripts

The last section of the execution phases of the SE process. The collection of the answer script process is activated at the end of the examination process in the SE. This represents the rule enforcement workflow for the collection and handling of answer scripts at the conclusion of an examination. The process begins with a decision point that determines whether the examination has officially ended. If the examination has not ended, candidates are instructed to continue writing. Once the examination concludes, authorized invigilators or supervisors initiate the collection of answer scripts from all candidates.

Following collection, the answer scripts are systematically verified against the official attendance records and candidate details (index no) to ensure completeness and validity. In case there are deficiencies, such as missing scripts, "inconsistent script and attendance cards," or "not indicate index no.," the deficiencies are formally documented and reported to the immediate supervisor for appropriate action.

If there are no discrepancies found, these scripts are then counted and matched with the attendance register in order to verify that the total number of scripts is equal to the total number of candidates attending. Then later, these scripts will be packed and secured for preparation for official processing. The final process for obtaining the answer scripts will be when these packed scripts with relevant documents are submitted to the examination department.

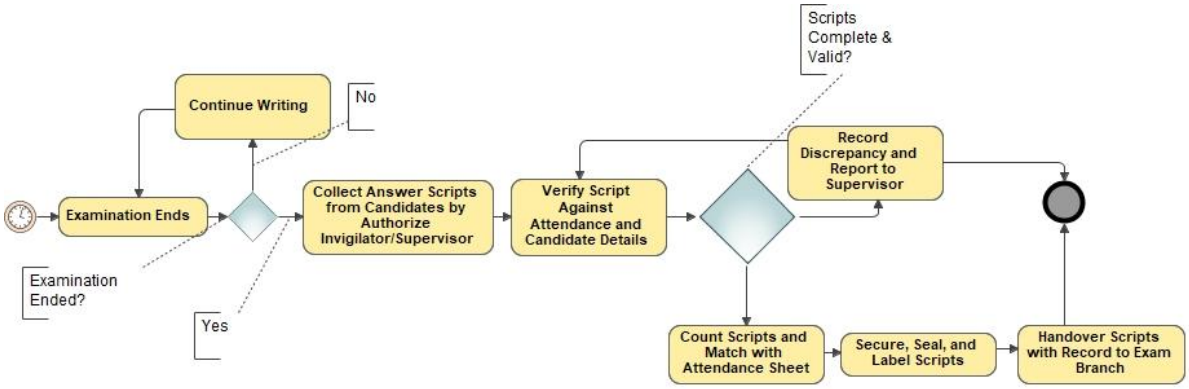
This process thus not only ensures procedural integrity but also traceability of answer scripts in regard to their post-examination handling process, thus ensuring adherence to examination governance policies.

Accordingly, the above Action Enable Rule is adopted for the collection of the answer scripts.

If <verify time credential> = fulfilled requirements
THEN collection of the answer scripts
If <verify answer script credential> = fulfilled requirements
THEN Seal and Label scripts

These exceptional cases are governed by the <strictly enforced> level of the Business Rule Enforcement Level. The graphical representation of the rule enforcement ontology is presented below [Figure 15].

Figure 15: Rule enforcement for the collection of answer script process



Source: Developed by Researchers, 2026

Rule Ontology and Rule Enforcement Sub-framework for post-SE

Upon completion of the SE Execution Phase, the Post-SE Phase is initiated as the final stage of the SE. This phase comprises multiple sub-evaluation processes, which are organized into three primary process groups: Academic Staff Post-SE, Candidate Post–Student Evaluation, and Non-Academic Staff Post–Student Evaluation. Within the Post-SE Phase.

Rule Ontology and Rule Enforcement Sub-framework for Academic Staff Post-SE

In the Academic Post-SE Phase, two primary subcategories are identified: Marking of Answer Scripts and Marksheet Production. The Marking of Answer Scripts subcategory comprises two subprocesses: First Marking of Answer Scripts and Second Marking of Answer Scripts. Similarly, the Marksheet Production subcategory includes the subprocesses Final Marksheet Production and Verification of the Final Marksheet. For this phase, the RORESF are developed and applied specifically to the Marking of Answer Scripts only and First and Second Marking of Answer Scripts, considered together as a unified subprocess. and, not to discuss rules ontology and rule enforcement for the process of "Marksheet Production".

Rule Ontology and Enforcement for First /Second Marking of Answer Scripts

The First Marking and Second Marking of answer scripts both employ the same type of Rule Ontology and Rule Enforcement mechanisms. Therefore, the discussion of these subprocesses is presented together.

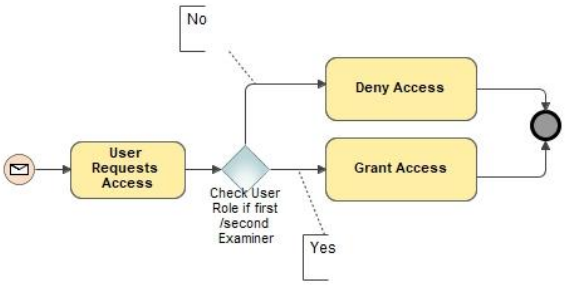
Request Access to answer script:

Accordingly, the above Action Enable Rule is applied to govern this Marking of Answer Scripts process, as outlined in the following:

IF User role= =First examiner /second examiner
THEN Grant to access answer scripts
ELSE deny access

The graphical representation of the rule enforcement ontology is presented below [Figure 16]

Figure 16: Rule enforcement for the First /second request access to marking



Source: Developed by Researchers, 2026

These exceptional cases are governed by the <strictly enforced> level of Business Rule Enforcement.

If the user is assigned the role of First Examiner/second Examiner, the system grants authorization to access the relevant answer scripts, thereby enabling the examiner to perform evaluation and marking responsibilities. Conversely, if the user does not hold the First Examiner/second Examiner role, access to the answer scripts is denied in order to preserve the confidentiality, integrity, and controlled handling of examination materials. This ensures that only authorized individuals can access sensitive assessment data. Therefore. This plays an important role in ensuring that the issue of academic integrity and accountability is addressed.

Authorization rules:

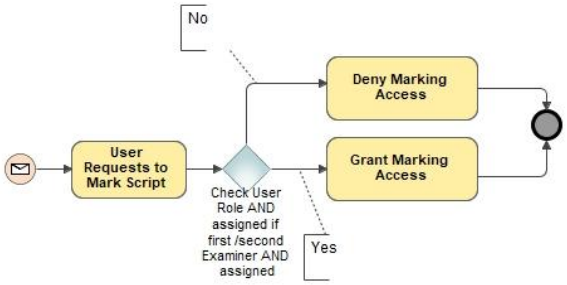
Thus, the above **"Action Enable Rule"** will be applicable for regulating this process according to the following:

IF User Cadential == "First/Second Examiner"
AND Script cadential == TRUE
THEN
Allow marking Access the relevant answer scripts
ELSE
Deny marking Access

This case is governed by the <strictly enforced> level of the Business Rule Enforcement.

The above rule enforcement ontology can be represented using a BPMN activity diagram, as illustrated below [Figure 17].

Figure 17: Rule enforcement for the First /second authentication



Source: Developed by Researchers, 2026

Once the permission to view the answer scripts has been obtained by the First and/or Second Examiner, the process moves to the verification of the authorization status for the answer scripts to be accessed. Based on the rules set for the answer script authorization, the process authenticates the answer script identifier and the answer script ownership information (such as ID, Name, and number of scripts for the answer scripts). If the answer script authorization conditions have been met, the examiner can proceed to mark the answer scripts.

Completion rules:

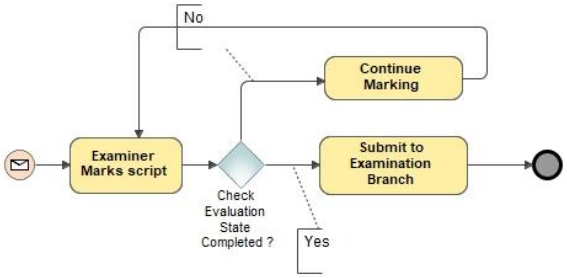
Thus, the above "Action Enable Rule" will be applicable for regulating this process according to the following:

IF Evaluation_Status == "Completed"
THEN Submitted to Examination Branch
ELSE Marking continues

This case is governed by the <strictly enforced> level of the Business Rule Enforcement.

The above rule enforcement ontology can be represented using a BPMN activity diagram, as illustrated below [Figure 18].

Figure 18: Rule enforcement for the First /second completion



Source: Developed by Researchers, 2026

Upon completion of the evaluation by the First and/or Second Examiner, the system verifies the total number of evaluated answer scripts. Subsequently, the examiner records the marks awarded for each individual question in the official marksheet, performs the requisite calculations, and finalizes the results, subject to the condition that the **Evaluation Status** is marked as Completed. Following finalization, the evaluated answer scripts are securely sealed and formally handed over to the Examination Branch in accordance with established institutional procedures. The system shall automatically generate and dispatch notifications to the examiners, as well as to the relevant head of the examination branch, Heads of Departments, and the Dean of the Faculty.

Rule Ontology and Rule Enforcement Sub-framework for non-academic staff post-SE

Among these, three main subprocesses have been identified: Generation of the Displayed Results Sheet, Production of the Degree Certificate, and Issuance of Candidate Notifications. In this phase, the RORESF have been developed for the generation of the displayed results sheet and production of the Degree Certificate; however, they have not been developed for candidate notifications in this phase at this stage.

Rule Ontology and Enforcement for Displayed Results Sheet.

After the Final Marksheet Production and Final Marksheet Verification by the Head of Department, the documents are submitted to the Examination Branch, thus beginning the process of preparing the Displayed Results Sheet. First, access to the system is obtained for the nominated staff member in the Examination Branch. After accessing the final marksheet, the staff member starts the process of preparing the Displayed Results Sheet. During the preparation of the Displayed Results Sheet, the Action Enable Rule Ontology and the Business Rule Enforcement layer are developed and applied to each constituent process involved in the generation of the Displayed Results Sheet.

Authorization rules:

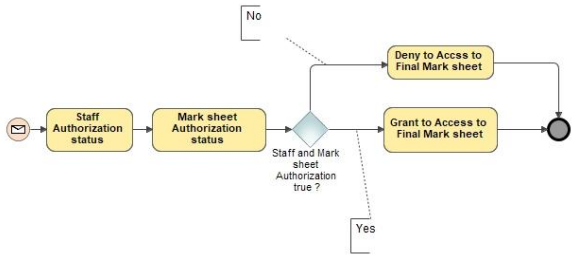
Thus, the above "Action Enable Rule" will be applicable for regulating this process according to the following:

IF Staff Cadential Status AND Marksheet Status == TRUE
THEN
Grant the Access relevant final marksheet for relevant staff member
ELSE
Deny Access to Final marksheet

This case is governed by the <strictly enforced> level of the Business Rule Enforcement.

The above rule enforcement ontology can be represented using a BPMN activity diagram, as illustrated below [Figure 19].

Figure 19: rule enforcement for the authentication for display result sheet



Source: Developed by Researchers, 2026

This rule defines an access control mechanism governing the authorization to access the relevant final marksheet. If the "Staff Cadential Status" is set to TRUE, it indicates that the staff member has been duly authenticated and possesses the necessary institutional privileges to access examination-related records. Simultaneously, if the "Marksheet Status" (final marksheet subject name, Subject ID, Year, Semester, etc) is also TRUE, it confirms that the final marksheet has been officially verified and approved for access within the system. When both conditions are satisfied, the system grants the authorized staff member access to the relevant final marksheet. If either condition is false, access is denied to ensure security, confidentiality, and data integrity.

In this context, a strictly enforced level of Business Rule Enforcement is applied to ensure compliance and governance within the evaluation process. However, the Examination Registrar is permitted to operate under a deferred enforcement rule in exceptional circumstances, such as when the relevant authorized staff member is unavailable to complete the required authorization or in cases of operational emergency. This controlled exception ensures continuity of examination-related processes while maintaining institutional accountability and regulatory oversight.

Rule Ontology and Enforcement for Production of the Degree Certificate

The production of the degree certificate is a process that involves producing official documents that will prove that the student has successfully completed his or her studies. The process can be undertaken only after all the evaluation stages have been completed and approved. Degree certificates are used as legally binding proof of academic success and achievement by students.

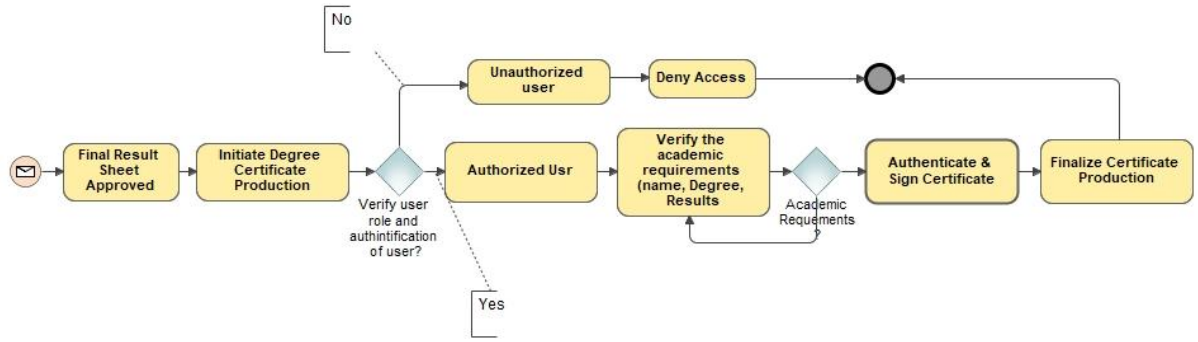
Thus, the above **"Action Enable Rule"** will be applicable for regulating this process according to the following:

IF User Credential == True credential AND academic status Verified == TRUE
THEN
Allow to generate the certificate for the individual candidate
ELSE
Deny Access

This process is governed by the <strictly enforced> level of Business Rule Enforcement.

The above rule enforcement ontology can be represented using a BPMN activity diagram, as illustrated below [Figure 20].

Figure 20: rule enforcement for the production of degree certificate



Source: Developed by Researchers, 2026

Following the completion and formal validation of the final result sheet of the final examination, the production of the degree certificate is Prepare combing with non-academic staff and administrative staff. The Certificate Preparing is governed by a set of explicitly defined business rules that regulate authorization, verification, and procedural execution.

The authorization rule is defined as follows:

"User Credential = = True credential AND academic status Verified = = TRUE"

Within this rule construct, multiple action-enabling sub-rules are evaluated. The condition "User Credential" is used to identify the user credential for given the user permission for preparation and processing of the degree certificate. This includes verification of assigned staff members who is responsibility person in the institutional authorities such as the examination branch, Registrar, and the Vice-Chancellor, whose authenticated approvals and signatures are mandatory for certificate validation.

Simultaneously, the criterion "Academic status verified" guarantees that all academic requirements have been fulfilled. Such a verification requires matching of the candidate's name with the approved degree course and the final result sheet. The certificate production process is accomplished only on fulfillment of all the stated conditions. In case any one of the stated conditions is not fulfilled, then access to the system is denied. The above Business Rule Enforcement mechanisms are represented using the following BPMN diagram [Figure 20].

Rule Ontology and Rule Enforcement Sub-framework for Candidate post-SE

RORESF development is done in the final stage of the framework where the Candidate Post-Student Evaluation Process is conducted. The Candidate Post-Student Evaluation Process is categorized into three broad categories, which include Requesting Intermediate Results, Requesting Final Results, and Requesting Other examination-related documents. As far as the current research study is concerned, RORESF development is done for the former two categories of Requesting Intermediate Results and Requesting Final Results.

Rule Ontology and Enforcement for Requesting Intermediate /Final Results

Requesting Intermediate and Final Results are two sub-processes within the Post-Student Evaluation (Post-SE) process whereby students can obtain access to their intermediate, partial or final academic results prior to the release of the intermediate or degree certificates. The two sub-processes facilitate transparency and timely sharing of academic results in the SEL.

Both sub-processes begin with the candidate and share similar business rules. Like all other processes, the two use similar authorization, validation, and access control mechanisms to make sure that the accuracy and regulatory compliance of the academic information is guaranteed.

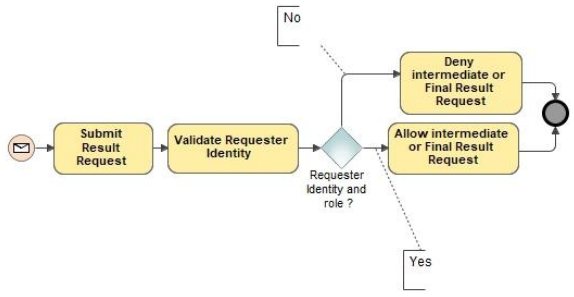
Thus, the above **"Action Enable Rule"** will be applicable for regulating this process according to the following:

Approved Candidate Rule:

IF Candidate Credential = = True AND Requested Status ==True
THEN
Allow to intermediate /final Result Request
ELSE
Deny Request

This process is governed by the <strictly enforced> level of the Business Rule Enforcement. The above rule enforcement ontology can be represented using a BPMN activity diagram, as illustrated below [Figure 21].

Figure 21: rule enforcement for the intermediate and final result



Source: Developed by Researchers, 2026

Initially, the candidate is required to complete and submit the relevant institutional application for requesting academic results. Upon submission, the system evaluates a predefined access-control rule, expressed as:

Candidate_Credential == True AND Requested Status == True

This rule is applicable to the candidate's qualification for seeking either intermediate or final academic results. In this context, this rule authenticates the candidate's qualifications by verifying the candidate's unique identification via an authentication process. Further, this rule also checks the "Requested Status" to determine whether the request is for either intermediate or final results.

If this condition is met, the request is granted access, thereby allowing access to the academic result information. In the event that either of these conditions is not met, the request is denied access. This rule-based system facilitates institutional governance by ensuring secure authorization and maintaining the confidentiality of the access control within the post-student evaluation process.

Research Limitations

This study was undertaken as a pilot study with the objective of developing a Rule Ontology and Rule Enforcement sub-framework. The study was undertaken on one of the processes in the SEL, namely the pre-SE phase, the SE execution phase, and the post-SE phase. These processes were used to design and implement the initial version of the Rule Ontology and Rule Enforcement sub-framework, with the objective of expanding this framework to cover the entire process of the SEL. The study findings show that this theoretical framework offers a solid foundation for the design and implementation of an IT-based solution that facilitates and accelerates the SEL in university settings.

CONCLUSION

This research proposes and validates a comprehensive RORESF for SEL. The proposed framework presents a systematic way of integrating governance policies and enforcing institutional rules on important student evaluation processes, thus improving the level of compliance, transparency, and accountability in the management of educational service activities.

The use of the Action Enable business rule classification and the clear incorporation of the Business Rule Enforcement Levels ensure the separation of rule semantics from rule enforcement strategies, thus allowing the institution to effectively manage the level of regulatory control while at the same time ensuring flexibility, especially in unique or time-sensitive academic situations. The use of BPMN-based representations ensures improved interpretation and implementation of the proposed framework by system designers and developers.

The proposed framework's applicability to selected Pre-SE, SE Execution, and Post-SE processes ensures the framework's flexibility for use in different student evaluation scenarios, including the monitoring of the SE process. Although the proposed framework only addresses some student eval-

uation processes, the proposed rule ontology and rule enforcement mechanisms can easily be generalized to other student evaluation activities and other educational scenarios. In conclusion, the proposed research contributes to the development of a rule-based intelligent SEL and can be of immense use to higher learning institutions seeking to improve the level of governance and academic integrity while at the same time improving the level of automation on student evaluation activities.

This study focuses specifically on SEL. However, future research may extend the proposed ontology-driven rule enforcement framework to other areas of student-related activities and administrative processes within university systems, such as student admission, course registration, attendance management, academic advising, internship management, and graduation processing.

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A Review on Return Migration: Systematic Review and Bibliometric Analysis

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Ravindra Deyshappriya N. P.[1*], Pradeep Uluwaduge[2], Bandara W. M. A. H.[3] and Carlos Mendez[4]

[1*]Department of Management Sciences, Uva Wellassa University of Sri Lanka, Sri Lanka

[2] Department of Social Sciences, Sabaragamuwa University of Sri Lanka, Sri Lanka

[3] Department of Tourism Studies, Uva Wellassa University of Sri Lanka, Sri Lanka

[4] Graduate School of International Development, Nagoya University, Japan

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Abstract

Return Migration has been recognized as a critical part of development and is a much-debated topic in the globalized world. As a result, Scholars were particularly enthusiastic about return migration and thus, this study summarizes and synthesizes empirical research papers on return migration from 2000 – 2024. Systematic Literature Review and PRISMA guidelines were employed to achieve the primary objective of this study. Following seven inclusion criteria, 1697 research papers published during 2000 – 2024 were obtained from Lens.org and Google Scholar, of which 467 papers were considered for review. In addition, Biblioshiny and VOSviewer-based Keyword Co-Occurrence Analysis was used to analyze the content and structure of papers. Accordingly, Keywords Co-occurrence Overlay Visualization results depict a strong relationship between Return Migration and Migration. Further keywords such as Diaspora, Gender, Ethnicity, Transnationalism, Development, and Entrepreneurship denote their strong relationship with the Return Migration. Moreover, Density visualization map denotes that keywords such as entrepreneurship, circular migration, and developing countries appear less frequently and have garnered less attention compared to return migration. Apart from that, the study found 12 themes, they are; Return Migration, Dimensions of Return Migration, Wellbeing and Migration, Entrepreneurial Reintegration, Youth migration, Government Policies on Migration, Migration and Development, Extreme Ends of Migration, Skilled Migration, Age and Migration, Family Dynamics, Economic benefit of Remittances. The findings of this research highlighted that the researcher identified a few studies on certain areas related to return migration. Especially on entrepreneurship, circular migration, developing countries, and transnationalism. This study considered only papers that were downloaded from two databases. This study aids legislators, corporations, and academics in developing enhanced approaches, innovations, and service advancements.

Keywords: Co-Occurrence Analysis, Return Migration, Systematic Literature Review

INTRODUCTION

Return migration means migrants moving back to their home country after living in another country, either permanently or temporarily (Bilecen, 2022; Dustmann & Weiss, 2007). The decision to return can depend on personal, economic, social, and political reasons. Some migrants return because of conflicts, political problems, economic difficulties, or poor conditions in the host country. Others return because they had already planned to go back to their home country (Hamdouch & Wahba, 2015). Return migration is also seen as a "triple-win" process because it can benefit migrants, host countries, and countries of origin (Sinatti, 2015). Return migrants can contribute to the development of their home countries by bringing money, skills, knowledge, and experience gained from abroad. These contributions can help improve employment, strengthen social relationships, and increase productivity (Bilecen, 2022; Sinatti, 2015).

Migration has become an important part of global development, and it is widely discussed in both academic and policy studies. According to De Haas (2010), migration theories have developed through three main approaches: Neo-classical, Structuralist, and Neo-Marxist. These approaches help us understand how ideas about migration and development have changed over time. The Neo-classical approach mainly sees migration as a way to support economic development, especially because of differences in labour markets between countries (Massey et al., 1993, 1999). The Neo-Marxist approach, on the other hand, argues that migration can also create or increase inequalities between regions (De Haas, 2010; Nzima et al., 2017). More recent pluralist approaches look at both structural conditions and individual factors when explaining why people migrate (De Haas, 2010; Massey et al., 1993; Nzima et al., 2017). In the same way, the New Economics of Labour Migration (NELM) explains migration as a decision made by households, rather than only by

* **Corresponding author:** Tel.: +94 (77) 288 6337; Email: ravindra@uwu.ac.lk
https://orcid.org/0000-0002-5283-1207

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individuals (Nzima et al., 2017). The Sustainable Livelihood Approach (SLA) also looks at migration as a way for people and households to improve their livelihoods, diversify their sources of income, and achieve better long-term development (Massey et al., 1993).

Previous studies show that return migrants can make important contributions to economic and social development. Many return migrants become entrepreneurs and support investment, the use of remittances, and the development of businesses (Naudé et al., 2017). Some return migrants, especially highly educated women, start businesses in areas such as agriculture, trade, and hospitality (Zulfiu Alili & Adnett, 2021). At the community level, return migration can also support rural development (Alibabaiee & Jom'epour, 2017). The decision to return can be influenced by social, personal, economic, and policy-related factors, with social and personal factors having a stronger influence (Weldemariam et al., 2023). Family responsibilities can also affect the decision to return, and women may be more likely to return when their parents are still alive (Haddad & Caron, 2023).

Although several studies have reviewed different areas of return migration, such as migration and development (Debnath, 2016; Wahba, 2014), migration drivers (Mohamed & Abdul-Talib, 2020), retirement migration (Ciobanu & Ramos, 2015), and human capital and SME internationalisation (Gittins & Fink, 2015), the existing literature is still divided across different disciplines, theories, countries, and research areas. Therefore, we still need a more comprehensive review to understand how research on return migration has developed over time. This type of review can help us identify research trends, important research areas, emerging themes, and knowledge gaps. It can also help us understand where future research should focus and provide useful directions for policymakers (Andrlić et al., 2023; Priyashantha, 2023; Priyashantha et al., 2023; Priyashantha & Dilhani, 2022).

To address this gap, we reviewed and mapped research on return migration published between 2000 and 2024. We followed the PRISMA guidelines and collected journal articles from Lens.org and Google Scholar. We then analysed the selected studies using a Systematic Literature Review (SLR) approach. We also used Keyword Co-occurrence Analysis in VOSviewer to identify the main research themes, influential studies, geographical patterns, research connections, and emerging research areas. In the rest of the paper, we present the materials and methods, results and findings, discussion, and conclusions. The findings are organised into article selection, article characteristics, synthesis of results, and bias assessment.

MATERIALS AND METHODS

Article selection process and methods

We used the SLR methodology in this study. According to Liberati et al. (2009), the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework is a useful standard for planning, conducting, and reporting an SLR. Therefore, we followed the PRISMA guidelines and prepared a research protocol at the planning stage. The protocol is presented in Table 1. It includes the article selection method, search terms, inclusion criteria, analysis methods, and reporting structure. We decided the search terms and article inclusion criteria at the planning stage, as shown in Table 1.

Table 1. Review Protocol

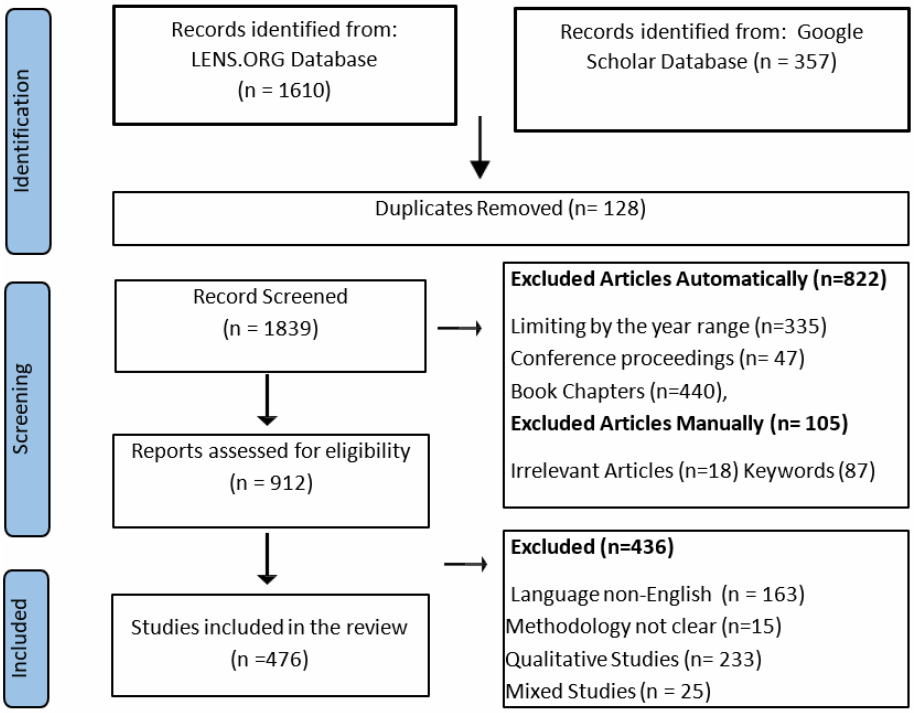
Article selection method	**PRISMA guidelines**
Search strings	Return Migration
Inclusion criteria	1. Year range: 2000 -2024
	2. Subject area: Management
	3. Language of article: English
	4. Keywords: Return Migration
	5. Source type: Journals
	6. Type of Study: Empirical
	7. Methodological quality: Articles that followed the Quantitative Methods
Databases	Lens. Org, Google Scholar
Analysis Method	Keyword Co-occurrence Analysis, PRISMA guidelines
Reporting structure	PRISMA guidelines

Source: Authors' Conception, 2025

As shown in Table 1, we selected the articles based on the PRISMA requirements and developed the PRISMA flow diagram to present the selection process. It includes three main

steps: "identification," "screening," and "included." Figure 1 also shows how we followed these stages throughout the study. In the identification stage, we used "Return Migration" as the main search term. We entered this term into Lens.org and Google Scholar based on the databases available to us. In the screening stage, we used both automatic and manual screening methods. For the automatic screening, we applied criteria one to seven listed in Table 1 using the available filtering options in the databases. Therefore, articles that did not meet these criteria were excluded. We then used manual screening to check the remaining articles and decide which studies could be included in the review.

Figure 1. Flow Diagram on PRISMA Article Selection



Source: Authors' Creation Based on the PRISMA Flow Diagram, 2025

The analysis methods

Biblioshiny and VOSviewer are widely used bibliometric tools for analysing the content and structure of scientific literature (Aparicio et al., 2019; Paule-Vianez et al., 2020; Van Eck & Waltman, 2014). In this study, Biblioshiny was mainly used to examine publication productivity, citation performance, and research trends (Cobo et al., 2012; Priyashantha et al., 2023). Likewise, VOSviewer was used to create scientific maps showing the structure, development, and main contributors in the research field (Aparicio et al., 2019; Cobo et al., 2012). Since keywords can represent the main themes of published studies, keyword co-occurrence was used as the main unit of analysis (Callon et al., 1983; Jain et al., 2022; Andrlić et al., 2023; Priyashantha, 2023).

The relationships among keywords were presented using the Keyword Co-occurrence Network Visualization (KCNV) generated through VOSviewer (Aparicio et al., 2019; Van Eck & Waltman, 2014). Figure 4 presents the KCNV. The Density Visualization Map (DVM) was also used to show research intensity in different areas. In this map, blue represents low-density areas, green represents moderate-density areas, and red represents high-density areas. Therefore, the map can help identify areas that may need further research (Andrlić et al., 2023; Van Eck & Waltman, 2014). In addition, Biblioshiny was used to generate the Overall Information of the Article Set (OIAS), Annual Article Publications (AAP), Average Citation Received (ACR), and Source Journals of Articles (SJA). Finally, VOSviewer was used to produce network visualisations.

RESULTS AND DISCUSSION

Selection of papers

Following the PRISMA 2020 guidelines, 1,697 records were initially identified from LENS.org and Google Scholar (Page et al., 2021). Based on the predefined inclusion criteria, articles published outside the 2000–2024 period (n = 335), non-English publications (n = 163), book chapters (n = 440), and conference proceedings (n = 47) were excluded. In addition, using the keyword "Return Migration," we identified 87 more studies from the reference lists. The remaining 912 articles were then screened manually. As a result, 233 qualitative studies, 25 mixed-method studies, and 15 articles with unclear methodologies were excluded. Figure 1 presents the complete PRISMA study selection process (Page et al., 2021).

Characteristics of papers

This section presents the main characteristics of the selected articles. Table 2 summarises the bibliometric profile of our dataset, which includes 476 articles published between 2000 and 2024 in 302 journals by 839 authors. We also found 8,608 references and 1,027 author keywords, which show the wide range of research on return migration. Figure 2 presents the annual publication and citation trends. We found that articles published up to 2019 received around 38

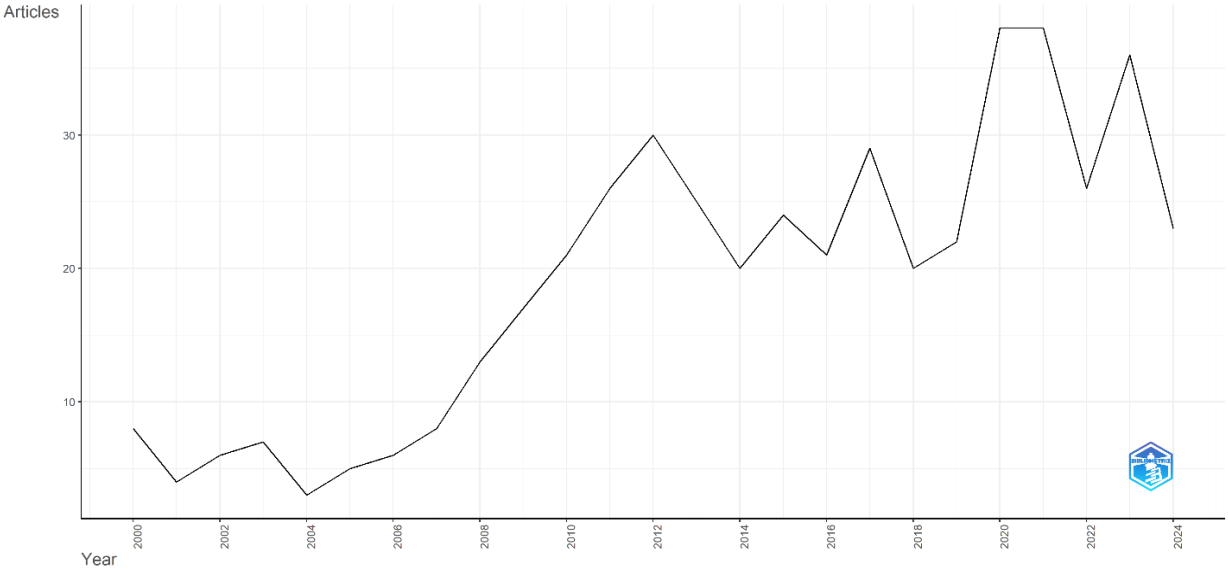
citations on average, and this trend continued up to 2022. However, the COVID-19 pandemic may have affected research patterns after this period because it had a major impact on global migration flows. By 2024, the average number of citations had decreased to 24, which may be linked to changes in research trends over time. Figure 4 also presents the most influential journals. The SSRN Electronic Journal, Journal of International Migration, and Journal of Ethnic and Migration Studies had the highest number of publications, with 27, 20, and 20 articles, respectively.

Table 02: Overall Information of the Article Set

Description	Results
Timespan	2000:2024
Sources	302
Documents	476
Annual Growth Rate %	4.5
Document Average Age	9.54
Average citations per doc	24.31
References	8608
Keywords Plus (ID)	1027
Author's Keywords (DE)	1027
Authors	839
Authors of single-authored docs	184
Single-authored docs	202
Co-Authors per Doc	1.99

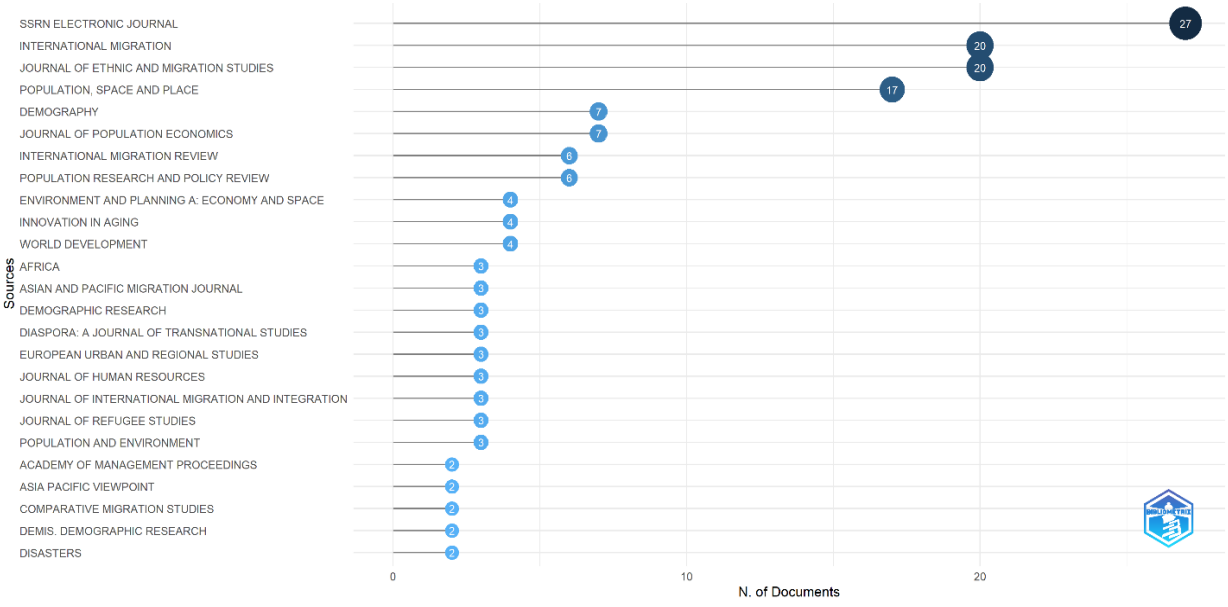
Source: Biblioshiny Output, 2025

Figure 2: Average Number of Citations Obtained for the Papers



Source: Biblioshiny Output, 2025

Figure 3: Most Relevant Sources



Source: Biblioshiny Output, 2025

THEMATIC DISCUSSION

Results of the papers

The purpose of this section is to describe the results of the study that are related to the research objective. The results were obtained via KCNV and DVM analyses.

Current Empirical Knowledge on Return Migration

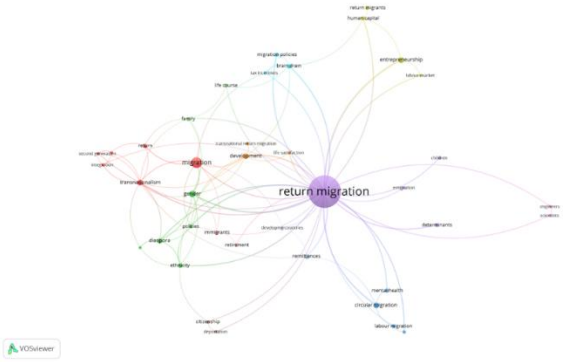
VOSviewer identified many keywords with occurrence levels ranging from 01 to 07 based on its minimum keyword occurrence function. However, we selected a minimum of three occurrences to identify the most common themes related to return migration. This helped us focus on the keywords that appeared more often and were more relevant to the main areas of this study. Table 4 presents the frequency of the 40 selected keywords, while the KCNV in Figure 4 shows the relationships among these keywords.

Table 4: Keywords with a Minimum of Two Occurrences in Articles

Keyword	Occurrences	Total link strength
brain drain	6	10
Children	3	3
circular migration	9	8
citizenship	4	4
covid 19	4	5
deportation	3	3
determinants	5	5
developing countries	3	5
development	9	14
Diaspora	8	14
emigration	3	2
engineers	3	6
entrepreneurship	11	12
ethnic return migration	3	4
Ethnicity	6	13
Family	6	12
Gender	12	21
human capital	5	7
immigrants	5	6
integration	3	5
internal return migration	3	0
labour market	3	4
labour migration	5	3
life course	5	7
life satisfaction	3	4
mental health	5	4
Migration	33	17
migration policies	5	6
Policies	5	11
remittances	8	10
retirement	5	4
Return	6	6
return migrants	5	1
return migration	288	127
return migration intentions	3	4
scientists	3	6
second generation	3	5
tax incentives	3	5
transnational return migration	3	1
transnationalism	9	18

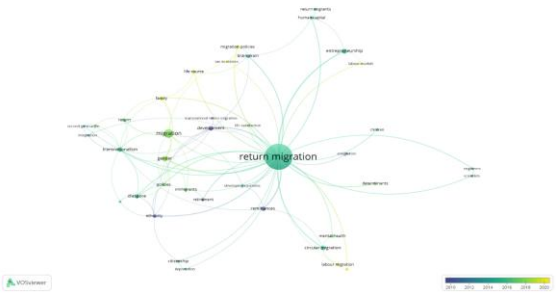
Source: VOSviewer Output, 2025

Figure 4: The Keywords Co-occurrence Network Visualization



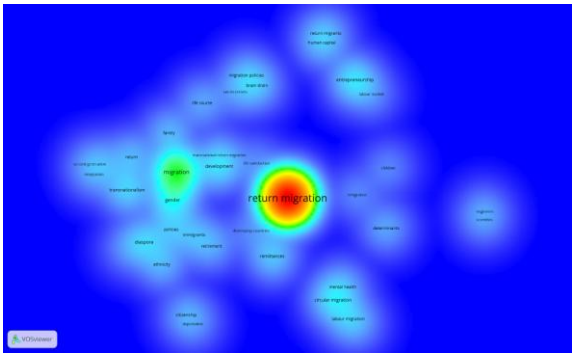
Source: VOSviewer Output, 2025

Figure 5: The Keywords Co-occurrence Overlay Visualization



Source: VOSviewer Output, 2025

Figure 6: Density Visualization Map of Keywords



Source: VOSviewer Output (2025)

The Keyword Co-occurrence Network Visualization (KCNV) shows the relationships among keywords. The width of the links shows the strength of these relationships, while the size of the nodes shows how often each keyword appears. Larger nodes therefore represent keywords with higher numbers of occurrences (Priyashantha & Dilhani, 2022; Van Eck & Waltman, 2014). As shown in Figure 4, return migration and migration are closely connected through stronger links, indicating a strong conceptual relationship and extensive research attention. Similarly, keywords such as diaspora, gender, ethnicity, transnationalism, development, and entrepreneurship demonstrate strong associations with return migration. However, the greater distance between entrepreneurship and return migration indicates a lower co-occurrence frequency, suggesting limited research examining these concepts together.

In the KCNV, the size of the circles shows how often the keywords are cited, while the different colours show the average publication period of the studies related to each keyword. (Priyashantha & Dilhani, 2022; Van Eck & Waltman, 2014; Wang et al., 2020). Figure 5 reveals that most return migration studies were published between 2014 and 2022. Earlier research around 2010 mainly focused on keywords such as remittances, ethnicity, retirement, development, and transnational return migration. Studies published during 2014–2018 emphasised return migration, migration, gender, diaspora, transnationalism, circular migration, and entrepreneurship. More recent studies (2019–2020) highlighted themes including labour migration, life course, labour markets, migration policies, tax incentives, and families.

The Density Visualization Map (DVM) shows which research areas have more or less attention and can also help us identify possible research gaps. Red areas show themes that have been studied more, while green and blue areas show themes that have received less attention. Therefore, these less explored areas may provide opportunities for future research. (Priyashantha & Dilhani, 2022; Van Eck & Waltman, 2014). Figure 6 demonstrates that return migration is the most dominant and frequently studied keyword, while migration represents a significant but less intensive theme. Other keywords, including entrepreneurship, circular migration, and developing countries, appear in lower-density areas, indicating opportunities for further investigation.

Furthermore, VOSviewer groups keywords into clusters based on how often they appear and how closely they are related. Keywords in the same cluster are usually connected and can show similar research areas or themes (Priyashantha, 2023; Priyashantha et al., 2023; Priyashantha & Dilhani, 2022). Accordingly, this study identified 12 distinct keyword clusters.

Table 5. Twelve Clusters with the Categorization of Keywords

Color Code	Cluster theme	Keywords	Authors	Journals
Red	Navigating Integration	Integration	Arowolo (2000); De Haas (2010); Fokkema (2011); Klinthäll (2006)	Journal of Mediterranean Studies; Journal of international migration and integration; International migration
		Return Migration Intention	Carling and Pettersen (2014); De Haas and Fokkema (2011); Fokkema (2011); Tezcan (2019)	Journal of Mediterranean Studies; Demographic research; International migration; Population, Space and Place
		Second Generation	Fokkema (2011); Groenewold and De Valk (2017); King et al. (2014)	Journal of Mediterranean Studies; Demographic Research; Journal of Transnational Studies
		Transnationalism	Carling and Pettersen (2014); Groenewold and De Valk (2017); King et al. (2014); Schiele (2021)	Journal of ethnic and migration studies; International Migration; Demographic research; Journal of Transnational Studies
Green	Dimensions of Return Migration	Diaspora	Fittante and Barry (2022); Mateos (2020); Meel (2017); Song (2020); Tsuda (2010)	Ethnic and Racial Studies; Nations and Nationalism; New West Indian Guide; Migration Letters; Asian Studies Review
		Ethnic Return Migration	Bonnenfant (2012); Kuşçu (2014); Tsuda (2010)	Nations and Nationalism; International Migration
		Ethnicity	Anniste and Tammaru (2014)	Demographic Research
		Gender	Haddad and Caron (2023); Nwankwo and Govia (2022); Olwig (2012); Samari (2021);	Journal of the Royal Anthropological Institute; Journal of Ethnic and Migration Studies; Journal of Comparative Economics; Population, Space and Place;

			Tuccio and Wahba (2018)	Journal of Immigrant and Minority Health
		Policies	Fernández-Sánchez et al. (2023); Martínez-Buján (2019); Seol and Lee (2011)	Asian and Pacific Migration Journal; International Migration; Journal of ethnic and migration studies
Blue	Wellbeing and Migration	Circular migration	Elsayeh (2025); Hercog and Siegel (2011); Nwadiuko et al. (2021)	Health policy and planning, International Migration
		COVID 19	Farooq and Arif (2023); Pitoyo et al. (2021); Predojević-Despić (2021)	GeoEco; Demografija; Journal of Ethnic and Migration Studies
		Labour Migration	Adamopoulou (2024); Predojević-Despić (2021); Tyagi (2011)	International Journal of Research in Computer Application & Management; Demografija; Southeast European and Black Sea Studies
		Mental Health	Donato et al. (2020); Li et al. (2019); Siriwardhana and Stewart (2013)	International health; Aapplied economics letters; Frontiers in psychiatry
Yellow	Entrepreneurial Reintegration	Entrepreneurship	Alarcón and Ordóñez (2015); Black and Castaldo (2009); Hamdouch and Wahba (2015); Lara Lara et al. (2021); Liu (2020)	Tijdschrift voor economische en sociale geografie ; Cepal review; Middle East Development Journal; Desarrollo y Sociedad;Asia Pacific Viewpoint
		Human Capital	Amanzadeh et al. (2024); Lacomba and Cloquell (2017); Maria and Wassink (2016); Williams and Baláž (2005)	Social Problems; International migration review ; International Migration ; National Bureau of Economic Research
		Labour Market	Murakami (2014); Sahu and Das (2010); Shima (2010)	Review of Development and Change; The journal of Technology Transfer
		Return Migrants	Barrett and Mosca (2013); Hui et al. (2019); Liu et al. (2020); Williams and Baláž (2005)	Journal of Finance and Economics; Ageing International; Journal of Ethnic and Migration Studies; International Migration Review
Purple	Youth Migration	Children	Démurger and Xu (2015); Dustmann (2003); Li and Liang (2024); Li et al. (2019)	Journal of Population Economics; Applied Economics Letters; Social Science Research; Journal of Migration
		Determinants	Gibson and McKenzie (2011); Israel et al. (2019); Toomistu et al. (2024); Yendaw (2013)	Journal of Development Economics; Israeli STEM research; Migration Studies
		Emigration	Gibson and McKenzie (2011); Masferrer and Roberts (2012); Nekby (2006)	Journal of Population Economics; Journal of Development Economics; Population Research and Policy Review
Cyan	Government Policies on Migration	Brain Drain	Biondo et al. (2012); Dustmann (2003); Efendi et al. (2018)	Journal of Development Economics; Indian Journal of Public Health Research & Development,

		Migration Policies	Cassarino (2009); Flahaux (2017); Giordano and Terranova (2012)	International Migration Review; Forced Migration Review; Journal of Global Policy and Governance
		Tax Incentives	Andersen (2005); Bassetto and Ippedico (2024); Kleven et al. (2020)	IZA Discussion Papers; Economics Letters; Journal of Economic Perspectives
Orange	Migration and Development	Development	Bucheli and Fontenla (2024); Kopliku (2019); Seol and Lee (2011)	Research in Social Change; Review of Economics and Statistics; Asian and Pacific Migration Journal
		Life Satisfaction	Hui et al. (2019); Lapshyna and Düvell (2015); Schiele (2021)	Journal of Finance and Economics; Migration and Development; Journal of ethnic and migration studies
		Transnational Return Migration	Coe (2011); Plaza (2008); lack & King, (2004)	American Ethnologist; Revue Européenne des Migrations Internationals; Population, Space and Place
Brown	Extreme Ends of Migration	Citizenship	Despagne and Manzano-Munguía (2020); Leblang (2017); Lynn-Ee Ho (2011)	Comparative Political Studies; Citizenship Studies; Children and Youth Services Review
		Deportation	Diaz et al. (2016); Drotbohm (2011); Majidi and Schuster (2018)	Citizenship Studies; Demography
Pink	Skilled Migration	Engineers	Sabharwal and Varma (2016); Zeithammer and Kellogg (2013)	International Migration; Journal of Marketing Research; Bulletin of Science
		Scientists	Gaulé (2014); Sabharwal and Varma (2016); Zeithammer and Kellogg (2013)	Economics Letters; Technology & Society; Journal of Marketing Research
Light Red	Age and Migration	Immigrants	King and Newbold (2008); Mensah and Owusu Ansah (2022); Ravuri (2014)	The Social Science Journal; Population, Space and Place; International Migration
		Retirement	Cobb-Clark and Stillman (2013); Hunter (2011); Sheftel (2021)	Journal of Migration; Innovation in Aging; Population, Space and Place
Light Green	Family Dynamics	Family	Gillespie et al. (2022); Olwig (2012); Samari (2021)	Population Research and Policy Review; Journal of Ethnic and Migration Studies; Journal of the Royal Anthropological Institute
		Life Course	Gillespie et al. (2022); Sheftel (2021); Spring et al. (2024)	Population, Space and Place; Population Research and Policy Review; Psychological Sciences and Social Sciences
Light Blue	Economic benefit of Remittances	Developing Countries	Cattaneo and Robinson (2020); Haddad and Caron (2023); Wahba (2014)	World of Labor; Population, Space and Place; Demography
		Remittances	Collier et al. (2018); Jones and De la Torre (2011); Rose and Shaw (2008)	Global Networks; Mexican Studies; Review of Development Economics

Source: Authors' Conception, 2025

Return Migration -Red

The main keywords in this cluster were Integration, Return Migration Intention, Second Generation, and Transnationalism. In this section, we discuss the main findings related to these keywords.

Integration: Integration can influence return migration decisions through social, economic, and transnational factors (Fokkema, 2011). However, factors such as education, participation in the labour market, and social and economic connections in the host country do not have a strong influence on return migration decisions (De Haas et al., 2015). At the same time, effective institutional support and suitable reintegration programmes can help migrants return successfully (Arowolo, 2000). Temporary residency systems may also limit migrants' economic integration in the host country (Klinthäll, 2006).

Return Migration Intention: Return intentions can be stronger among migrants who maintain close social and cultural ties with their home countries (Fokkema, 2011). On the other hand, integration in the host country may reduce the intention to return when migrants have weaker connections with their home countries (De Haas & Fokkema, 2011). In addition, economic conditions, social relationships, discrimination, and the opportunities available in both the host and home countries can influence return decisions (Carling & Pettersen, 2014; Tezcan, 2019).

Second Generation: Second-generation migrants who maintain strong transnational ties and close connections with their home countries may be more likely to consider returning (Fokkema, 2011). Their migration decisions can also be influenced by acculturation, personal characteristics, and the cultural differences between the host and home countries (Groenewold & De Valk, 2017).

Transnationalism: Transnational social networks can influence return decisions because migrants' relationships across countries can affect their willingness to return (Carling & Pettersen, 2014). In addition, differences in expectations about life satisfaction among return migrants may lead to different levels of planned return across countries (Schiele, 2021).

Dimensions of Return Migration- Green

The main keywords in this cluster were Diaspora, Ethnic Return Migration, Ethnicity, Gender, and Policies. The main findings related to these areas are discussed below.

Diaspora: Diasporic identity and emotional attachment to the home country can influence decisions to return, while political and economic conditions also play an important role (Fittante & Barry, 2022). Ethnic nation-states can also encourage people from the diaspora to return through special immigration policies (Tsuda, 2010). In addition, family, social, cultural, spiritual, and religious connections may be more important than economic benefits for some diaspora return migrants (Meel, 2017). Therefore, suitable diaspora policies are needed to manage the increasing movement of people across countries (Mateos, 2020).

Ethnic Return Migration: Ethnic return migration can give ethnic nations an opportunity to attract people from the same ethnic background and maintain their ethnic connections (Tsuda, 2010). However, it can also create concerns because of the social and economic pressure it may place on local institutions and the possibility of giving preference to certain ethnic groups over others (Kuşçu, 2014).

Ethnicity: Ethnicity is a significant determinant of return migration, as differences among ethnic groups influence integration levels and return intentions (Anniste & Tammaru, 2014).

Gender: Gender can influence return migration through changes in family roles and household decisions. Women may change or redefine their roles after returning to their home countries, while their migration experiences can also affect their independence and decisions to return (Olwig, 2012; Samari, 2021). In addition, marriage, divorce, and parenthood can affect the return patterns of men and women in different ways (Haddad & Caron, 2023).

Policies: Effective return migration policies should consider human rights, economic development, and social stability together (Seol & Lee, 2011). However, existing policies may not fully consider the different needs of migrant groups. They can also leave out host families and local communities from the reintegration process (Fernández-Sánchez et al., 2023). In some cases, this may make the reintegration process more difficult for both return migrants and the communities they return to.

Wellbeing and Migration - Blue

The main keywords in this cluster were Circular Migration, COVID-19, Labour Migration, and Mental Health. In this section, we discuss the main findings related to these themes and how they connect with return migration research.

Circular Migration: Circular migrants are often male, have lower levels of education, and come from remote or less developed areas compared with other return migrants (Nwankwo & Govia, 2022). Their decisions to return may be influenced by family situations, unsuccessful experiences of migration, or achieving their financial goals. At the same time, circular migration can benefit both origin and destination countries. It may support remittances, help share skills and knowledge, and also help fill labour shortages (Hercog & Siegel, 2011).

COVID-19: The pandemic showed that return migration can also be linked with public health, as returning migrants may contribute to the spread of infections through their contact with local communities (Pitoyo et al., 2021). Therefore, migration policies need to consider the risks and challenges faced by migrants and their families. Proper support for reintegration and better awareness among people planning to migrate are also important, especially after the pandemic (Predojević-Despić, 2021; Farooq & Arif, 2023).

Labour Migration: Skilled workers' migration and their decisions to return can be influenced by better communication, easier travel, and flexible citizenship arrangements (Tyagi, 2011). Return migration may become more likely when the wage gap between the home and host countries becomes smaller. The COVID-19 crisis also led many temporary skilled migrants to return because they faced problems with em-

ployment and mobility. At the same time, changes in working conditions and travel restrictions also affected their decisions to return.

Mental Health: Return migration can affect mental health in different ways. For some displaced people, returning may have negative effects, while for others, it can bring psychological benefits after conflicts have ended (Siriwardhana & Stewart, 2013). Return migration has also been linked with a higher risk of depression and lower resilience among children living in disadvantaged rural areas (Li et al., 2019). In addition, some return migrants may experience depression, anxiety, tiredness, and pain, and these experiences can also vary according to age, gender, and other demographic factors (Donato et al., 2020).

Entrepreneurial Reintegration - Yellow

The main keywords in this cluster were Entrepreneurship, Human Capital, Labour Market, and Return Migrants. In this section, we discuss the main findings related to these themes.

Entrepreneurship: Return migrants' business activities can be influenced by their personal characteristics, the length of time they spent abroad, their reasons for returning, and the financial, human, and social resources they gained while living abroad (Black & Castaldo, 2009). Work experience gained overseas can also play an important role in starting a business after returning. Similarly, business experience during migration, voluntary return, and work in areas such as hospitality and agriculture can increase the chance of starting a business. On the other hand, higher education and previous public sector work may reduce the tendency to start a business (Alarcón & Ordóñez, 2015). Age and the income earned abroad can also affect the business activities of return migrants.

Human Capital: Human capital gained abroad can play an important role in improving the economic opportunities of return migrants (Maria & Wassink, 2016). Both formal skills, such as professional qualifications and language skills, and informal skills gained through work experience can help migrants with reintegration and starting businesses. However, Williams and Baláž (2005) argue that formal education alone cannot fully explain the value of international work experience. They also highlight the importance of interpersonal skills, confidence, and social skills.

Labour Market: Migrant workers often face low wages, unstable jobs, and limited social protection, and these conditions can affect their economic situation before and after returning home (Sahu & Das, 2010). Remittances also often help support household livelihoods, especially for families facing poverty and debt. In addition, return migration and labour market participation are closely linked because migrants' expectations about the value of their skills and work experience gained abroad can influence their employment decisions after returning home (Shima, 2010).

Return Migrants: The growth of return migration is also linked with rural labour movements and changes in social and economic conditions (Hui et al., 2019). Factors such as family responsibilities, health, better housing, and access to community services can influence people's decisions to return (Liu et al., 2020). However, returning home is not always easy, as return migrants may face more social isolation and loneliness compared with people who have never migrated (Barrett & Mosca, 2013).

Youth migration - Purple

The main keywords in this cluster were Children, Determinants, Emigration, and Return Migration. However, Return Migration was not included in this cluster because it represents the main focus of our study. Therefore, the other three keywords are discussed below.

Children: Children's situations can strongly influence migrants' decisions to return. Parents may think about their children's future, education, and gender when making these decisions (Dustmann, 2003). However, return migration can have negative effects on children's mental health, such as lower resilience and self-esteem and a higher risk of depression (Li et al., 2019; Li & Liang, 2024). At the same time, returning may also bring some cognitive benefits for children living in urban areas. Parents with school-aged children may also delay their return to save more money and resources for their children's education, while grandparents can help by taking care of children when parents are away (Démurger & Xu, 2015).

Determinants: Return migration decisions can be influenced by individual characteristics, economic conditions, social networks, and family factors. Things such as risk preferences, patience, education choices, financial limitations, and lifestyle can also affect a person's decision to return (Gibson & McKenzie, 2011). Economic and social capital may have a positive influence on return decisions, while cultural capital may have less influence (Israel et al., 2019). Family ties are also an important factor in these decisions (Yendaw, 2013). However, in some situations, social and political conditions may have a stronger influence than personal networks (Toomistu et al., 2024). Overall, these factors can work together and shape how and why migrants decide to return.

Emigration: Emigration patterns can be related to education and skill levels. Highly educated people may be more likely to move to third countries instead of returning to their home countries (Nekby, 2006). In addition, personal preferences and individual characteristics can strongly influence the emigration decisions of highly skilled migrants (Gibson & McKenzie, 2011).

Government Policies on Migration - Cyan

The main keywords in this cluster were Brain Drain, Migration Policies, and Tax Incentives. In this section, we discuss the main findings related to these areas and how they are connected with return migration.

Brain Drain: Brain drain can affect human capital development in both origin and destination countries. From a microeconomic view, it reflects migrants' decisions about whether to move and return. However, social connections and networks can also influence these decisions (Biondo et al., 2012). At the same time, return migration can turn brain drain into "brain gain" when migrants bring back the skills, knowledge, and experience they gained abroad (Dustmann et al., 2011).

Migration Policies: Migration policies play an important role in managing migration flows and protecting migrants' rights (Cassarino, 2009). However, restrictive policies may discourage migrants from returning. So, policymakers need to consider how policies and institutions in a country can influence migrants' decisions to return (Flahaux, 2017).

Tax Incentives: Tax incentives are also used to encourage highly skilled migrants, especially younger professionals, to return to their home countries. Such policies can affect migration decisions among different income groups by making return migration more attractive (Bassetto & Ippedico, 2024).

Migration and Development - Orange

The main keywords in this cluster were Development, Life Satisfaction, and Transnational Return Migration. In this section, we discuss the main findings related to these themes.

Development: Return migrants can support development through the social, financial, and human capital they gain while living abroad. When they return and reintegrate into their home communities, they can also contribute to social and economic changes. Their return may help improve income, participation in work, health, and education (Kopliku, 2019; Bucheli & Fontenla, 2024).

Life Satisfaction: Migration experiences can affect the wellbeing of return migrants because they may feel a sense of loss when they compare their living conditions with the better conditions they experienced abroad (Hui et al., 2019). Also, dissatisfaction with living conditions can influence migration decisions, as it may affect people's aspirations and plans to move (Lapshyna & Düvell, 2015).

Transnational Return Migration: Transnational migration can affect family structures and gender relations. Female transnational migrants may face challenges similar to those experienced by internal migrants, but their experiences can also be shaped by the specific conditions of moving and living across countries (Coe, 2011).

Extreme Ends of Migration – Brown

stronger factor. Highly educated immigrants were also more likely to return because they may have better opportunities to use their skills in their home country (Ravuri, 2014).

Retirement: Cobb-Clark and Stillman (2013) found that migrants are more likely to return to their home countries when they reach retirement, especially when the conditions are favourable. They also found that return patterns can be different among immigrant groups, depending on their age and retirement situation.

Family Dynamics – Light Green

The main keywords in the light green cluster were Family and Life Course. In this section, we discuss the main findings related to these keywords.

Family: Samari (2021) found that women whose husbands returned from Arab countries tend to follow more traditional gender roles and have less involvement in household decisions compared with women from non-migrant households. Family also plays an important role in return migration decisions, but its influence may become weaker as return migrants get older (Gillespie et al., 2022).

Life Course: Spring et al. (2024) found that life-course changes and migration are closely connected. Events such as divorce, losing a job, the death of a family member, and physical or mental health problems can affect migration decisions. At the same time, poor physical health may reduce the chance of further migration and make return migration more likely.

Economic Benefit of Remittances – Light Blue

The main keywords in the light blue cluster were Developing Countries and Remittances. In this section, we discuss the main findings related to these keywords.

Developing Countries: Return migration can bring economic benefits when migrants gain financial resources and skills abroad and use them after returning home. However, these benefits can depend on the skills and savings they bring back, as well as the ability of the home country to support return migrants and make use of their investments (Wahba, 2014). Repeated migration is also common in developing countries, especially among young male migrants (Cattaneo & Robinson, 2020).

Remittances: Although there are different views about the effects of remittances, they play an important role in supporting household income and development (Rose & Shaw, 2008). For example, in Bolivia, money received through remittances made up almost half of the income of households with active migrants (Jones & De la Torre, 2011). Remittances are not only about money, but they can also bring new ideas, values, and social practices. These can influence people's lifestyles, investment in education and skills, and long-term social and cultural development in both origin and destination countries (Collier et al., 2018).

CONCLUSIONS

In this study, we systematically reviewed the return migration literature published between 2000 and 2024 using the PRISMA framework and bibliometric tools such as Biblioshiny and VOSviewer. Our analysis identified twelve main themes: return migration, dimensions of return migration, wellbeing and migration, entrepreneurial reintegration, youth migration, government policies, migration and development, extreme ends of migration, skilled migration, age and migration, family dynamics, and the economic benefits of remittances. These findings show that return migration is studied across different areas, and the research field has changed and developed over time.

Our review also identified some areas that have received less attention, such as entrepreneurship, circular migration, transnationalism, and return migration in developing countries. Therefore, these areas can provide useful directions for future researchers. However, our study also has some limitations. We included only empirical journal articles from two databases, so some relevant studies may not have been included in our analysis. However, even with these limitations, our study brings together research that is spread across different areas and provides useful evidence for researchers and policymakers. The findings can also help us

and future researchers develop new ideas, conduct further studies, and support policies that may improve return migration and the reintegration of migrants.

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FOREIGN DIRECT INVESTMENT, EXTERNAL DEBTS, AND POVERTY REDUCTION IN SUB-SAHARAN AFRICAN COUNTRIES

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ABDULRAHMAN Idris Abdulganiyu[1*] and ABDULSALAM Abdulquddus Adewale[2]

[1*2]Department of Economics, University of Ilorin, Nigeria

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Abstract

Poverty has been one of the major setbacks to the overall social and economic development. The study examines the link between foreign direct investment (FDI), external debt, and the reduction in poverty in 30 Sub-Saharan African countries from 2006 to 2020. This research study used Principal Component Analysis (PCA) vis-à-vis panel unit root/stationarity test, correlation analysis/multi-collinearity test, Hauman test, Two-Step GMM estimation, Arellano-Bond, Wald test, and post estimation test for the analysis. The descriptive statistics indicate a statistically significant variability in economic indicators with non-normal distributions showing the multifaceted economic settings of the SSA, utilizing secondary data available from WDI (2023). The result of the Generalized Method of Moments (GMM) estimator indicates FDI, showing that poverty has a statistically negatively insignificant impact on poverty reduction in SSA. These benefits could depend on institutional quality, absorptive capacity, and sectoral allocation. The result on the external debt also indicates significant positive effects on poverty, whereas the interaction between FDI and external debt (EXT) shows a negative and weak correlation. This suggests heavy reliance on both FDI and external debts and could hinder the speed of poverty reduction. The lagged dependent variable confirms the tough persistence reduction in poverty. Outcomes of the result on trade openness and inflation revealed a significant positive effect on poverty reduction, while government size, though, but showing negatively significant effect in eradicating poverty in the regions. Thus, suggest the need for policymakers in SSA countries to adequately manage their external financing, while promoting inclusive trade and optimized public spending to ensure growth transforms into reasonable poverty reduction.

Keywords: External debt, FDI, Poverty reduction, Sub-Saharan Africa.

INTRODUCTION

Looking at it from a wider perspective, poverty reduction is seen as one of the most critical issues undermining the growth and economic development of every nation. This becomes necessary where approximately 719 million people living worldwide live below the purchasing power parity line of $2.15 per day as of 2020, representing a persistent extreme poverty level in the global economic development (World Bank, 2022). The largest portion of the population goes to the sub-Saharan African countries, with approximately 648 million people. This represents the highest concentration of most vulnerable poor individuals, accounting for averagely 60% of the nations (Schoch, Kofi, Lakner & Friedman, 2022). Thus, poverty in Sub-Saharan Africa now stood at 53% in 1990, while a notable reduction was found in 2009 and 2019, respectively. The total number of poor people increased on average to 391 million in 2019 from 278 million in 1990. This implies that, whilst the individual standard of living has improved tremendously. Even though the rate of reduction is not commensurate with the rapid population growth rate in the region (Schoch, Kofi, Lakner & Friedman, 2022).

Winkler (2013) observed that a reduction in poverty can be attained through different economic and social channels, which include sustainable economic growth, human capital development, creation of job opportunities, infrastructural development, and accessibility to capital formation. Investment performs a key function in the nation's economic development, as it enhances productive capacity, stimulates employment opportunities, and raises household incomes, thereby leading to poverty reduction. However, other factors like trade openness, quality of governance, inflation, and population growth could also have a tendency to influence the poverty results, while external debt and foreign direct investment (FDI) show major direct external financing mechanisms through which capital constraints can be relaxed (Zaghdoudi, 2018).

According to Shamim et al. (2014), FDI provides a channel for development owing to its capability to create employment, facilitate technology transfer, improve managerial practices, and incorporate host economies into worldwide value chains. Foreign investment has contributed immensely to poverty reduction through the expansion of income-generating opportunities, increasing productive capacity, and improving household welfare. The net FDI inflows accounted for over 2.7% of world GDP in the 2000s

* **Corresponding author:** Tel.: +23 480 3612 7131; Email: agrahman@unilorin.edu.ng
https://orcid.org/0009-0005-5010-6078

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(World Bank, 2023). This underscores its role as a source of financial development in both developed and underdeveloped nations (World Bank, 2023). In Sub-Saharan Africa, FDI inflows change over time, thereby making the execution of various policy reforms attractive and sustainable to foreign investment (Arogundade et al., 2022). Various research studies have shown that FDI can assist in poverty reduction in certain situations, its effect depends on institutional quality, structural uniqueness, and the nature of poverty policies adopted (Dada & Akinlo, 2021).

According to Shabbir and Yasin (2015), when countries source their capital for financial development through an external means, this can lead to an increase in foreign capital required for investment and developmental projects that could improve the welfare of the citizenry. In order to improve the welfare of its people, the sub-Saharan African governments have sought to develop the living standard of their people through promoting growth across all the key sectors, such as employment generation, infrastructural expansion, and the like. However, this could not be realized due to inadequate domestic financial resources that have constrained many governments as a result of reliance on external debt. External borrowing plays a major role in supplementing domestic savings deficit and financing development programmes (Sulaiman & Azeez, 2012). Hence, there is a significant positive impact on human development when external debt is maintained below an optimal threshold of 41.76% (Zaghdoudi, 2018).

According to the World Development Indicators reports, Sub-Saharan Africa's total external debt stock increased from about US$272.85 1973 to US$3,672.79 million in 1990, while debt servicing rose from US$28.87 million to US$225.87 million in the same period. By 2021, total external debt stock had reached US$16,454.07 million, with debt servicing amounting to US$1,743.30 million. South Africa and Nigeria recorded the highest debts of US$170 and US$76.2 billion, respectively, while Comoros and São Tomé and Príncipe had the lowest debt stocks at US$337 million and US$306 million (World Development Indicators [WDI], 2023).

One of the pressing methodological issues as regards empirical studies on poverty is how poverty reduction is measured. Standard approaches usually rely on single-dimensional measures such as income levels or household consumption, which reflect only the financial aspect of welfare. However, the multidimensional measure, like the Human Development Index, reflects the non-monetary measures, including education and health. Owing to the natural multifaceted nature of poverty reduction, the study adopts Principal Component Analysis (PCA) to create multiple poverty reduction measures that combine HDI and per capita consumption. PCA combines several indicators into a single index by capturing the highest proportion of variation, offering a good depiction of improvements in overall well-being across both monetary and social dimensions.

This approach enhances the observed assessment of the bond between external financial flows and poverty reduction beyond what individual indicators can provide. Thus, this study investigates how foreign direct investment and external debt influence the reduction in poverty in Sub-Saharan Africa. In particular, the multidimensional poverty reduction index created by Principal Component Analysis (PCA) to assess how foreign direct investment influences poverty reduction, investigates the role of external debt on poverty reduction, and further assesses their combined impact on poverty outcomes.

Research Problem

The Sub-Sahara Africa has experienced different and relatively slow growth as regards poverty reduction despite the consistent inflows of foreign direct investment and growing dependency on external debt. The overall total of people living below the international poverty line increased from around 278 million in 1990 to over 391 million in 2019, despite the fall in poverty incidence over time. Schoch and Lakner (2020) observed that several efforts made to eradicate poverty in the region have not been successful due to an increase in population. Not only that, but the inflows of foreign direct investment also portray a major fluctuation in external debt, which rose from US$272.85m in 1973 to US$16,454.07m in 2021 (WDI, 2023). This development raises a very important question as regards the effectiveness of foreign direct investment and external debt loans on inclusive and sustainable poverty reduction outcomes. In addition, a critical analysis of the impact of FDI and external debts remains inconclusive as a result of variation in sensitivity due to model specification and poverty indicators. Therefore, it becomes a notable gap which this study aims to fill concerning the impact of (FDI and external debt in eradicating poverty using a multidimensional broad framework in sub-Saharan Africa.

LITERATURE REVIEW

Theoretical Framework

The theory is built on Ragnar Nurkse's vicious cycle of poverty theory and Harrod–Domar's investment-led growth theory. This theory found poverty to be self-acclaimed and very difficult to escape due to some interconnected factors, thereby restraining efforts toward poverty reduction. Nurkse's (1953) theory explained the factors hindering the developing nations from achieving sustainable poverty reduction. The study identified individuals and a community trapped in poverty faced by a set of obstacles hindering their improvement in socio-economic positions that dawdling poverty reduction processes. Most developing nations are faced with low income that could lead to low productivity, which invariably can result in underutilization of resources. Resource mismanagement can be seen as part of a vicious cycle of poverty, in that it can lead to low productivity and, consequently, underutilization of resources in the sub-Saharan region. Foreign direct investment can assist the SSA countries in weakening and breaking the vicious cycle of poverty through encouragement of technological transfer, job creation, and enhancement of productive capacity, and hence, reducing poverty.

The Harrod–Domar investment-led growth theory posits that investment can be used to stimulate economic growth, thereby leading to an increase in total investment demand, which could eventually boost employment generation and economic productivity (Moloi & Marwala, 2020). The investment-led growth theory, based on the Harrod–Domar model, emphasizes the need for increased investment and higher economic productivity and job creation. FDI comprises foreign firms established in SSA countries, which

brings in more capital for investments, establishing more jobs, transferring more skills and knowledge, increasing productivity that could stimulate economic growth, and reducing poverty in the SSA countries. Furthermore, when external debts are channeled towards productive activities, this could lead to a reduction in poverty through fostering economic growth and capital accumulation.

External debt and poverty reductions

Several efforts have been established on the link between how external debt has been used to reduce poverty, with the submission that a high level of external debt is a major limitation for development performance and frustrates attempts to eliminate poverty. Shabbir and Yasin (2015), observed that government spending, in allocating social service having adverse effects on the rising external debt and increased debt service payments in developing nations. Thus, studies suggest excessive dependence on external borrowing that could move capital away from the critical initiatives intended to reduce poverty.

In another development, Zaghdoudi and Hakimi (2017) opined that a rise in foreign debt can aggravate the poverty level. The results of the Granger causality test revealed the existence of a bidirectional effect on both external debt and poverty in the short and long runs. In furtherance of their study, Zaghdoudi (2018) used the Panel Smooth Threshold Regression (PSTR) model to analyze data collected from 95 underdeveloped nations. The results of their findings found a non-linear relationship with external debt and human development, with an optimal debt threshold of 41.76%. Although the external debts contribute positively to poverty reduction, it however, become detrimental when the outcome is negative. The result is in line with the conclusion that holds that external debt promotes poverty reduction only when maintained within the bearable limits (Saungweme & Mufandaedza, 2013). The results of the findings of Ekpo and Udo (2015) show per capita income and infant mortality rates to be negative on foreign debt servicing, whereas Sulaiman and Azeez (2012) found external debt to be a source of great significance to Nigerian economic growth. Although the study emphasized that borrowing should be effectively allocated to profitable ventures to avoid unfavourable welfare outcomes. On the whole, the literature suggests that, while external debt can support poverty reduction when effectively managed, excessive debt accumulation and servicing often weaken social spending and welfare outcomes.

FDI- Poverty reduction relationship

Although studies are abounding on the effect of FDI on poverty reduction, it differs from one country or region to another. Researchers have shown that inflows of foreign direct investment on its contribution in reducing poverty in the areas of employment generation, increased incomes, and improvement in the general well-being of its people. Take, for example, the study by Tsaurai (2018), who was of the view that the mutual effects of FDI and natural resource endowments encouraged investment, thereby leading to a reduction in poverty. In the same vein, Chindengwike (2022) also observed that FDI has a significant impact on poverty reduction on the East African economies. This was further corroborated in the studies by Fauzel, Seetanah, & Sannassee (2016) and Gökmenoğlu, Apinran, & Taşpınar (2018) that attributed a positive effect on human capital development and hence stressed the need for improving the welfare of the people.

In contrast to this study, Anetor et al. (2020) observed increment on FDI does not automatically translate into the eradication of poverty as a result of institutional weaknesses in sectoral allocation across the regions. Arogundade et al. (2022) further reiterate institutional quality, absorptive capacity, which is in tandem with Magombeyi and Odhiambo (2017), who found deviation in methodology, poverty proxies, and sample selection based on large, diverse evidence on the FDI–poverty relationships.

Beyond Africa, mixed results are observed; for instance, Saleem et al. (2021) and Tsaurai (2023) found that FDI significantly promotes poverty reduction in Pakistan and BRICS countries, particularly when complemented with economic growth. While foreign investment can trim down poverty in the short run, its long-run effects can be unpleasant, if not supported by sustained economic growth (Han et al. 2023). Thus, the outcomes of the various studies suggested that the effectiveness of FDI in reducing poverty is centered on structural institutional and macroeconomic factors.

Methodological Approaches

On methodology issues, previous studies employ a wide variety of econometric models to ascertain the interactions between poverty, foreign direct investment, and external debt based on the Generalized Method of Moments (GMM). The result is frequently employed on panel-based analyses to correct endogeneity issues and control for unobserved country-specific effects (Shabbir & Yasin, 2015; Ayenew, 2022; Azolibe, 2022). Most of the time-series studies relied more on the Ordinary Least Squares (OLS), Autoregressive Distributed Lag (ARDL) model, Vector Error Correction Model (VECM), and cointegration techniques to explore long-run and short-run dynamics (Sulaiman & Azeez, 2012; Jilenga, Xu, & Gondje-Dacka, 2016; Fauzel et al., 2016). More so, some of the recent studies applied advance non-linear threshold models such as panel smooth threshold regression, panel threshold regression, and dynamic panel threshold analysis to capture regime-dependent effects (Zaghdoudi, 2018; Dada & Akinlo, 2021; Arogundade et al., 2022) which lacks agreement in the literature due to wide varieties in empirical approaches and inconsistency in their findings, thereby emphasizing the necessity of using reliable and adaptable estimation techniques.

Research Gap and its Limitations

A key shortcoming in the existing body of research relates to how poverty reduction is measured. The majority of studies rely on single-dimension proxies by per capita income, household expenditure, or poverty incidence, which primarily reflect the monetary aspect of welfare (Anigbogu et al., 2016; Ogunniyi & Amusa, 2018). Some researchers have used comprehensive measurements such as the Human Development Index to integrate both health and educational dimensions, which in itself failed to adequately represent the short-run changes in household well-being. Therefore, in order to forestall the deficiency this method could have generated, this study adopts a more complex approach using the human development index (HDI) and per capita consumption expenditure as a composite of poverty reduction indicators using Principal Component Analysis (PCA). This, we believe, will reduce the prejudice that could come from

using one specific method of poverty measurement by incorporating the financial and non-financial aspects of well-being. The PCA indicator will give a more inclusive and reliable representation of poverty without any element of bias, which could reduce the maximum possibility of variations across the underlying welfare measures.

Despite the widespread research studies on this issue, there are quite a lot of gaps needed to be addressed. Most of these studies centered on FDI or external debt in isolation, paying little or no interest on its mutual effect on poverty reduction. Besides, overdependence on a particular poverty measurement underestimates the multidimensional nature of poverty, which makes the results from SSA inconclusive as a result of methodological variations and contextual heterogeneity. Therefore, the study has added to existing knowledge on the correlation between FDI, external debt, and the double effects of foreign direct investment and external debt on poverty eradication using Principal Component Analysis.

MATERIALS AND METHODS

Drawing from the theoretical framework of Nurkse's vicious cycle of poverty and Harrod-Domar's investment-led growth theory, the key variables of external financing in capital-constrained economies are FDI and external debt. Even though the external debt servicing allows the government to boost domestic savings and financial projects through foreign direct investment, FDI offers a steady and debt-free capital that can boost productivity through employment generation, technology transfer, and output expansion. However, studies have shown that its effects in reducing poverty are conditional; while excessive or poorly managed external debt allowed high debt-servicing obligations that can hamper poverty reduction (Shabbir & Yasin, 2015; Zaghdoudi & Hakimi, 2017).

From the available studies in the literature, it could be observed that inflation, government size, and trade openness are used as control variables in poverty reduction due to the direct and indirect influence it has on the welfare results. Inflation affects poverty reduction through purchasing power and real incomes, particularly for low-income earners. Trade openness impacts poverty reduction through income distribution, employment generation, and market accessibility, while government size reflects the scale of public expenditure and intervention, which influences poverty reduction through social spending, public service delivery, and the effectiveness with which external financial inflows translate into inclusive growth. The vicious cycle of poverty and its persistent effect on welfare over time shows current improvements in poverty reduction, which are closely related to previous living conditions. These are supported by both theory and data-driven research, justifying the use of lagged poverty reduction measures.

In order to determine the poverty reduction index, which combines per capita consumption along with the Human Development Index (HDI) to cover all aspects of poverty measurement, the study utilized the Principal Component Analysis (PCA) model to achieve that. In addition, most of the previous studies focus more on a single poverty indicator, which is either based on monetary or non-monetary aspects of well-being. The PCA-based method provides a more comprehensive poverty measurement by combining both financial and non-financial aspects of poverty into a single composite measure. Due to constraints in data availability, emphasis on income or consumption, traditional global poverty measurements such as international poverty lines and poverty headcount ratios are not used in this study. These measures are extremely sensitive to price changes and institutional differences between countries; hence, they failed to account for non-monetary aspects of well-being. Even though the PCA-based index offers a more flexible and robust measure suitable for cross-country analysis, it is sensitive to variable selection and weighting structure that could affect comparability across countries.

In spite of its relevance to selected variables, this method still has its limitations. Foreign direct investment may be concentrated in capital-intensive sectors with weak local links, thus reducing its poverty-reducing impact. When a significant portion of public funds is devoted towards debt repayment, external debt may restrict the resources available for social and development programs. Likewise, inflation may not fully reflect the uneven effects of rising prices on different income groups, particularly the poor, even if it is a good indicator of general macroeconomic stability. Trade openness may expose weak sectors to external shocks, which may reduce their poverty-reducing ability. Government size reflects the level of public spending; it may not accurately capture how well the resources are used because a larger government does not necessarily imply improved welfare conditions

Model Specification

Ragnar Nurkse's vicious cycle of poverty and Harrod-Domar's investment-led growth theories form the theoretical basis for this study.

$$POV = f(FDI, EXT) \quad \ldots\ldots 1$$

Where: POV, FDI, and EXT represent poverty reduction, foreign direct investment, and external debt, respectively. The model's regression equations, along with its explanatory variables, are presented as follows:

$$POVit = f(FDIit, EXTit, CPIit, TOPit, GOVit, POVt\text{-}1it) \quad \ldots\ldots 2$$

Where: POVit = Poverty reduction (Per capita consumption and HDI were compressed using PCA to form a composite poverty reduction variable); FDIit = Foreign direct investment; EXTit = External debt; CPIit = Consumer price index; TOPit = Trade Openness; GOVit = Government Size; POVt-1it = lag of the dependent variable; i = Country; t = Time (in years). When a lag variable is built into the model, it will automatically change the model into a dynamic one as presented in the econometric form as follows:

$$POVit = 0 + 1FDIit + 2EXTit + 3CPIit + 4TOPit + 5GOVit + 6POVt\text{-}1it + \mu \quad \ldots\ldots 3$$

Table 1: Expected Signs (Theory-based)

Notation	Expected Sign	Justification
FDI	+	Job creation, an increase in income enhance poverty reduction
EXT	±	Reduces poverty when effectively managed, debt burden hinders poverty reduction
CPI	-	Reduces the real income and purchasing power of the poor, weakening poverty reduction
TOP	+	Growth derived from trade supports poverty reduction
GOV	+	Government spending on social services facilitates poverty reduction
POVt-1	+	Vicious cycle of poverty

Source: Authors' Computation, 2023

Data source and variable description

The study covers 30 countries in Sub-Saharan Africa, with annual observations from 2006 to 2020, utilizing a balanced panel approach. These countries were chosen based on their data accessibility on both dependent and explanatory variables for the period under consideration. The variables used include poverty reduction, external debt, foreign direct investment, consumer price index, trade openness, and government size. Poverty reduction is measured using a composite index derived from per capita consumption, and the Human Development Index was compressed using Principal Component Analysis to capture the multidimensional poverty indexes. The study covers the following countries: Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Côte d'Ivoire, Eswatini, Gabon, Gambia, Ghana, Guinea-Bissau, Kenya, Madagascar, Mali, Mauritania, Mauritius, Niger, Nigeria, Rwanda, Senegal, Seychelles, South Africa, Sudan, Tanzania, Togo, and Zambia. Most of the data used for this study were obtained from the World Development Indicators bulletin on different issues.

Table 2: Overview of variable, measurement, and data source

Variable Notation	Definition	Measurement	Unit of measurement	Source
POV	Poverty reduction	Principal Component Analysis (PCC and HDI)	Index	World Development Indicators.
FDI	Foreign direct investment	Foreign direct investment, net inflows (% of GDP)	Percentage	World Development Indicators.
EXT	External debt	External debt stocks (%)	Percentage	World Development Indicators.
CPI	Consumer price index	Consumer price index (2010 = 100)	Index	World Development Indicators
TOP	Trade openness	Trade (%)	Percentage	World Development Indicators
GOV	Government size	General government final consumption expenditure (% of GDP)	Percentage	World Development Indicators

Source: Developed from WDI Reports, 2023

Techniques of Analysis

A composite index evaluating poverty reduction was created via Principal Component Analysis in order to verify the reliability of the empirical findings. PCA is particularly useful for reducing dimensionality, addressing multicollinearity, and enhancing model efficiency when multiple indicators measure a similar concept (Vyas & Kumaranayake, 2006). A correlation analysis between the Human Development Index and per capita consumption was carried out prior to the PCA. Therefore, when the level of the human development component increases, the rate of poverty reduction will decrease and vice versa (indicating shortfalls in consumption-based poverty reduction). According to the analysis, there was a significant negative correlation of -0.5495. The justification for combining both indicators into a single composite measure of poverty reduction is strengthened by this strong connection.

Table 3: Principal Components/Correlation

PCC			**Number of obs**	**= 450**
			Number of comp.	=2
			Trace	=2
Rotation: (unrotated = principal)			Rho	= 1.0000
Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.38869	777379	0.6943	0.6943
Comp2	.611311		0.3057	1.0000

Source: Computed by the Authors, 2023

PCA was therefore applied to PCC and HDI to generate a unified poverty reduction variable (POV). Table 3 results show the first principal component (Comp1) having an eigenvalue of 1.3887, exceeding the Kaiser criterion of unity (eigenvalue

> 1), and explains 69.43% of the total variation in the combined indicators. In contrast, the second component (Comp2) accounts for only 30.57% of the variation with an eigenvalue below one. Therefore, Comp1 is retained as the composite poverty reduction index because it captures the largest proportion of information contained in PCC and HDI. This component is subsequently used as the poverty reduction variable (POV) in the regression analysis to ensure robustness and reduce potential multicollinearity bias.

Correlation Analysis/Multicollinearity Test

The study conducts a pairwise correlation analysis to establish the existence of linear correlation among variables and detect the potential multicollinearity among the explanatory variables. A correlation coefficient of 0.80 or above is considered indicative of serious multicollinearity and suggests that such variables should not be included simultaneously in the same model.

System GMM estimation

Drawing from the methodologies outlined in Arellano and Bover (1995), modified by Blundell and Bond (1998) and Gossel (2022), on a two-step system GMM approach. This study exploits cross-country variations, addresses issues regarding unobserved heterogeneity in view of time-invariant omitted variables, various internal instruments to discuss issues relating to reverse causality and endogeneity of expounding variables.

Post Estimation Test

The study employs the Sargan test, particularly for overidentifying restrictions, and the Arellano-Bond test to check for second-order serial correlation in the error term, with the sole aim of authenticating the reliability of the model tools used. The Sargan test is widely used as a validity check, especially the two-step system GMM technique, to guarantee the credibility of GMM results (Ullah et al., 2018). The study applies two conditions of the Sargan test: that is, the p-value must be greater than 5%, and also exercising caution when p-values are excessively high because this could indicate having too many instruments, which weakens estimation reliability (Ujunwa, 2020).

RESULTS AND DISCUSSION

Table 4: Descriptive Statistics of the Variables used

Variable	Obs	Mean	Std. Dev.	Min	Max
POV	450	-1.20e-08	1.178427	-2.037798	2.939446
FDI	450	3.977186	5.450849	-18.91777	57.87725
EXT	450	6.688263	6.392568	0	37.36543
CPI	450	129.8242	173.6526	0	3364.82
TOP	450	68.53202	35.70722	0	225.0231
GOV	450	14.08722	6.573746	0	39.45063

Source: Computed by the Authors, 2023

The descriptive statistics show the total number of variables used for computation as 450 in Table 4. The average value of poverty (POV) is −1.20e-08 with a standard deviation of 1.18, indicating the extent of dispersion from the mean. The minimum value in the data set is −2.04, while the maximum is 2.94, respectively. The average value for foreign direct investment (FDI) is 3.98 with a standard deviation of 5.45, ranging from −18.92 at the minimum and maximum of 57.88. External debt (EXT) accounts for 6.69 and a standard deviation signifying a divergence from the mean value of 6.39, with the minimum value of 0 and the maximum of 37.37. The results of the consumer price index indicate 129.82 with a standard deviation of 173.65, signifying substantial deviation across various countries and times. The value of trade openness (TOP) shows a mean of 68.53 and 35.71 as standard deviation. An average value of government size (GOV) is 14.09, while the standard deviation is 6.57, whose value ranges from 0 to 39.45, the minimum and maximum, respectively. In general, the use of the panel data method and the two-step System GMM estimation techniques is necessary for descriptive statistics results, which show significant variation in poverty reduction and the explanatory variables across countries and over time.

Correlation analysis

Table 5: Pairwise Correlations Analysis

Variable	POV	FDI	EXT	CPI	TOP	GOV
POV	1.0000					
FDI	0.2698	1.0000				
EXT	-0.5561	-0.1118*	1.0000			
CPI	-0.0381	-0.0427	-0.0214	1.0000		
TOP	0.5992	0.4969*	-0.3021*	-0.1874*	1.0000	
GOV	0.2522	0.1373*	-0.0544	0.1438*	0.3782*	1.0000

Source: Computed by the Researchers, 2023

Table 5 exhibits poverty reduction (POV) to be fairly strong and has a positive correlation along with foreign investment (FDI) and government size (GOV), with a very strong relationship with trade openness (TOP). This suggests that, as FDI, GOV, and TOP increase, poverty reduction (POV) also tends to decrease due to a strong relationship existing between them, that is, 0.27, 0.25, and 0.60, respectively. Poverty reduction exhibits a very strong, but negative bond with external debt. The coefficient value is -0.57, signifying that, when external debt accrued, the SSA falls as poverty reduction declines. With the correlation coefficient of -003, the inflation rate appears weak and exhibits negative links with poverty reduction. This suggests that as inflation rises, the

tendency for poverty reduction to decline is low due to the strength of their relationship.

Table 6: Fixed Effect and Random Effect

VARIABLES	Model 1			Model 2			Model 3		
	OLS	FE	RE	OLS	FE	RE	OLS	FE	RE
LnFDI	0.000805	-0.0297	-0.0157						
	(0.0286)	(0.0331)	(0.0317)						
EXT				0.00605	0.0100	0.00774			
				(0.00537)	(0.00894)	(0.00741)			
FDI*EXT							-0.00121	-0.000184	-0.000633
							(0.00170)	(0.00198)	(0.00189)
LnCPI	0.0144	0.0498	0.0420	0.0215	0.0444	0.0405	0.0170	0.0492	0.0425
	(0.0593)	(0.0537)	(0.0547)	(0.0594)	(0.0537)	(0.0547)	(0.0592)	(0.0539)	(0.0549)
LnTOP	0.187***	-0.0407	0.0594	0.200***	-0.0570	0.0542	0.194***	-0.0481	0.0552
	(0.0568)	(0.0743)	(0.0679)	(0.0544)	(0.0741)	(0.0666)	(0.0542)	(0.0739)	(0.0669)
LnGOV	-0.00479	-0.573***	-0.372***	-0.00587	-0.557***	-0.363***	-0.0120	-0.570***	-0.371***
	(0.0556)	(0.0726)	(0.0671)	(0.0553)	(0.0733)	(0.0672)	(0.0562)	(0.0728)	(0.0673)
Constant	-0.885**	1.328***	0.440	-1.007**	1.288***	0.382	-0.903**	1.329***	0.443
	(0.410)	(0.457)	(0.439)	(0.419)	(0.459)	(0.443)	(0.406)	(0.458)	(0.439)
Observations	450	450	450	450	450	450	450	450	450
R-squared	0.030	0.134		0.033	0.135		0.031	0.132	
Number of SSAid		30	30		30	30		30	30

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Researchers Computation, 2023

Table 6 displays models 1–3 for the Ordinary Least Squares (OLS), Fixed Effects (FE), and Random Effects (RE) estimation, respectively. In Model 1, the pooled OLS results show no positive connection existing between foreign direct investment (lnFDI) and poverty reduction. Inflation (lnCPI) shows a positive and non-statistically significant relationship with poverty, while trade openness (lnTOP) exhibits a positive and statistically significant relationship at 1% level of significance, signifying increased in trade openness enhances poverty reduction. Government size (lnGOV) is not significant under OLS estimation. Under the fixed effects (FE) estimation, government size shows a negative impact on poverty level, implying increase in government expenditure has contributed to a reduction in the rate of poverty. The variables for controlled inflation and trade openness are often characterized by one-time country-specific factors, which in most cases always remained insignificant. The results of the random effects (RE) show that government size is negatively significant to poverty reduction, while other variables remain insignificant.

The results on Model 2 show external debt (EXT) to be positive and statistically insignificant to poverty reduction across OLS, FE, and RE estimations. Under OLS estimation techniques, trade openness remains statistically significant, signifying intensification of the role of trade openness in promoting poverty reduction, while the government size exhibits a negative and statistically significant result with FE and RE results.

The interaction term (FDI*EXT) captures the simultaneous effect of FDI on external debt in Model 3. The result shows a negative and statistically insignificant result in all estimation methods used. Meaning, the outcome of the results of FDI on external debt has not positively reduced the rate of poverty in the SSA countries. However, the level of trade openness is positively significant using the OLS estimation. Government size upholds negative and statistically significant with poverty in FE and RE estimations.

Generally, the results show trade openness consistently contributing positively to poverty reduction under pooled OLS estimation, thereby highlighting the impact of external trade in SSA countries. Similarly, government size consistently exhibits a negative and significant effect once country differences have been accounted for, suggesting inefficiencies in public sector spending or misallocation of resources. The finding indicates that both foreign direct investment and inflation are not statistically significant across models. This result motivates the use of a dynamic estimation approach since poverty reduction exhibits persistence, and static panel approaches may be biased because of endogeneity and unobserved country effects.

Table 7: Hausman test results

Ho: difference in coefficients not systematic		
Model	chi2(5)	Prob>chi2
1	60.14	0.0000
2	59.59	0.0000
3	59.13	0.0000

Source: Computed by the Authors, 2023

Using a probability value of the Hausman test result in models 1 – 3, it could be observed that the results of the null hypothesis (H0) do not show a logical difference in the coefficients. Thus, we have to reject the p-values that are statistically significant at 1%. Hence, the panel fixed effects model is a more appropriate specification.

Two-Step GMM estimation

The study utilized two-step GMM estimation techniques to capture the model specification in equation 3.

Table 8: Two-step GMM estimation result.

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3
L.lnPOV	0.405***	0.382***	0.410***
	(0.00523)	(0.00493)	(0.00592)
lnFDI	-0.00628		
	(0.00960)		
EXT		0.0252***	
		(0.00180)	
FXT			-0.000361*
			(0.000192)
lnCPI	0.0334***	0.0326***	0.0346***
	(0.00366)	(0.00341)	(0.00341)
lnTOP	0.157***	0.138***	0.189***
	(0.0399)	(0.0375)	(0.0318)
lnGOV	-0.314***	-0.281***	-0.280***
	(0.0242)	(0.0233)	(0.0253)
Constant	-0.0349	-0.203	-0.255
	(0.202)	(0.179)	(0.173)
Observations	420	420	420
Number of SSAid	30	30	30

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Researchers Computation, 2023

The findings obtained from the Two-step GMM estimator regarding the role of FDI, external debt (EXT), simultaneous adoption of FDI and external debt on poverty reduction are displayed in Table 8. The foreign direct investment (lnFDI) coefficient appears negative and statistically insignificant, indicating that FDI has not exerted a significant inverse influence in the period under study. Hence, the findings are contrary to Tsaurai (2018), Ozoh et al. (2022), and Han et al. (2023). The outcomes of the results indicate the benefits FDI could derive in reducing poverty through corresponding features like quality of the institution, absorptive capacity, and sectoral allocation of resources.

The dependent lagged variable (L.lnPOV) is positive and significant throughout, affirming that persistence poverty reduction dynamics justified the use of the dynamic estimation method. While the lag in consumer price index (lnCPI) also exhibits a positive and significant correlation with poverty reduction, this testifies to rising price levels that are allied with increased poverty reduction. The views are in line with our expectations of Das (2011); Anetor, Esho, & Verhoef (2020); Fauzel et al (2016), that sees moderate inflation as a reflection of strong and growing enterprises, increasing job employment creation, and increased demand for goods and services, which invariably leads to poverty reduction.

Most of the models regressed indicate trade openness that has a positive and significant weight in reducing poverty in the SSA. This implies that increased participation in open and free trade contributes to the reduction of poverty. The results on government size (lnGOV) negatively affect the outcome of poverty reduction in three models, which indicate that larger government expenditure could be poorly targeted, thus limiting its value in reducing poverty.

Model 2 explains external debt (EXT), having a positive and statistically significant correlation with poverty reduction. This indicates a direct connection with reduction in poverty. This corroborates the a priori expectation that indicates either negative or positive significance levels depending on its usage. This outcome is consistent with Zahra Nasir, Rahman, & Idress (2023), who observed that efficient utilization of funds sourced outside the country could lead to poverty reduction and enlargement initiatives.

Model 3 captures the combined effect of FDI and external debt through an interaction term that has a negative and weakly significant impact on poverty. The joint effect of these variables tends to eradicate poverty in SSA countries. This suggests that while external financing may be beneficial individually, excessive reliance on both FDI and external debt simultaneously may impose adjustment costs, debt servicing pressures, or profit repatriation effects that weaken poverty reduction efforts.

In all, the GMM results highlight the dynamic nature of poverty reduction in SSA countries, with strong persistence effects, positive roles for trade openness and inflation, mixed outcomes for external financing, and a consistently negative influence of government size on poverty reduction.

Post Estimation Results

Table 9: Sargan Test

H_0: overidentifying restrictions are valid			
	Model 1	Model 2	Model 3
chi2(25)	21.34656	20.33165	22.56697
Prob> chi2	0.6731	0.7292	0.6028

Source: Computed by the Authors, 2023

From Table 9, the post estimation results (Sargan test), H0 shows the overidentifying restrictions are valid (that is, the instruments variable used in the regression model are exogenous and do not have any omitted variable bias). With a probability value greater than 10%, we fail to reject H0, the instruments are valid, and there is no evidence of endogeneity or omitted variable bias. Hence, the model specification of all the models and estimation is valid.

Table 10: Arelleno-Bond test

	Model 1		Model 2		Model 3	
Order	Z	Prob> z	Z	Prob> z	Z	Prob> z
1	-2.2443	0.0248	-2.2355	0.0254	-2.2613	0.0237
2	-0.69175	0.4891	-.71382	0.4753	-.68358	0.4942

H0: Computed by the Authors, 2023

Table 10 presents the autocorrelation of the first and second-order autocorrelation tests. First-order autocorrelation (AR1) is statistically significant across all models because the probability values are below 0.05. This result is expected in first-differenced GMM estimations and does not invalidate the model. While the second-order test (AR2) checks for the presence of second-order autocorrelation, where there is absence of autocorrelation. Based on (AR2) result, Based on the results provided, we fail to reject the null hypothesis, as indicated by the estimated AR2, since all probability values are above 0.05 i.e. (5% significance level) are above 0.05 (5% significance level). Thus, there is no second-order autocorrelation present in any of the models specified above.

Table 11: Results of Wald Test

	Model 1	Model 2	Model 3
Wald chi2(5)	39304.86	18550.53	14540.02
Prob> chi2	0.0000	0.0000	0.0000

Source: Researchers Computation (2023)

The Wald test checks for the overall significance of the model. From the above table result (table 9), it can be inferred that the probability value of the Wald test for all models (1-3) is significant at all significance level, implying that the overall model is statistically significant. Thus, the model in general is validated by the rejection of the null hypothesis that suggests the explanatory variables collectively exert a significant influence.

CONCLUSION

From the foregoing analysis, it could be seen that there is no statistical link between FDI and poverty reduction as observed within the reviewed period. Thus, the power to reduce poverty depends on its corresponding factors, like the quality of institutions, absorptive power, and sectoral allocation. Furthermore, external debt also revealed a significant and positive link with a reduction in poverty, which shows that when external debt is properly managed, it can lead to improvement in poverty eradication. When considering the FDI and external debt (EXT) simultaneously, a weak and significantly negative effect implies excessive reliance on external financing can entail modification of the costs of debt servicing pressures, and invariably hinder poverty reductions.

In the same vein, poverty has a significant positive correlation with trade openness (TOP) as well as inflation (CPI). This indicates that an improvement in trade liberalization, along with moderate inflation, can lead to an increase in income and overall improvement in productivity in Sub-Saharan Africa. In other words, government size (GOV) results appear negatively significant with the level of poverty, thereby limiting its effectiveness in poverty reduction.

In general, two-step system estimates show a dynamic behavior in eliminating poverty in their various regions, which revealed a persistent effect on inflation and trade openness, and invariably have diverse effects on external financing, and a persistent negative effect on government size. Therefore, for reduction in poverty to be attained, emphasis should be laid more on well-targeted government policies that promote productive investment and proper monitoring of external funds.

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