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About the Journal

IIMS Journal of Management Science is the scholarly open access journal of the Indian Institute of Management Shillong that publishes research contributions in all areas of management and its allied discipline since 2010. It follows a double blind peer-review process and publishes two issues a year. While submissions from all management domains and their allied disciplines are welcome, the journal encourages articles with cross-functional managerial implications.

The journal looks for original and insightful research articles that create differential research traditions to shed new evidence on contemporary challenges faced by management practitioners, policymakers, academicians, and others. The journal envisages publishing rigorous research output backed by qualitative or quantitative methods. The articles that establish the intuition, argument, and implications using clear and concise English and improve our understanding of the management theory and practice knowledge are preferred. All contributions should be well written in English and supported by either original/empirical data or a well-justified theoretical or mathematical model.

Aims and Scope

IIMS Journal of Management Science is an open-access journal that publishes original research and review articles from all functional areas of business management. It follows a double-blind peer review policy.

The articles from all domains of business management, including (but not limited to): accounting, analytics, banking, communications, economics, finance, industrial relations, information systems, marketing, operations and supply chain management, organisational behaviour, organisational development, human resources management, strategy, sustainability & liberal studies, innovation, entrepreneurship, public policy, international business and corporate social responsibility are welcome.

Contributions with a rigorous analysis of economic, social, political, sustainability, and other factors relevant to management theory, practice, or policy are well received. The journal encourages authors to submit articles with cross-functional implications that provide new insights on contemporary issues faced by management practitioners, firms, societies, policymakers, academicians, and others.

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Contents

Editorial

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As I step into the role of Editor-in-Chief of *IIMS Journal of Management Science*, I am filled with a sense of responsibility and gratitude. Since its inception, the journal has been striving to advance knowledge in the field of Management, and it is an honour to contribute to this legacy.

In taking charge of the editorial team, our focus will be on broadening the journal's scope to include emerging areas of research and interdisciplinary studies as envisioned in the institute's mission. We will actively prioritize the global dissemination of knowledge by enhancing our online presence and accessibility.

The article 'Deciphering the Social Media Content to Identify Common Branding Themes of Bellwether Management Institutions of India' by Abdul Rahim Ahmed Munshi explores the use of social media by leading Indian Institutes of Management (IIMs) to enhance their brand image and engagement. The study identifies that content themes such as achievements, webinars, festival celebrations, public talks by experts and appreciation posts generate the most engagement on platforms like Facebook and Instagram, while professional events and industry-related content drive LinkedIn engagement.

The article 'Cross-Border Product Payments in Sub-Saharan Africa! How MSMEs React to PAPSS as E-payment Innovation: Moderating Role of Experience' by Ambrose Ogbonna Oloveze, Charles C. Ollawa, Kelvin Chukwuoyims and Victoria Ogwu Onya, evaluates the reactions of micro, small and medium enterprises (MSMEs) to the Pan-African Payment and Settlement System (PAPSS), highlighting the roles of ease of use and perceived compatibility as key determinants for adoption. It finds that while the ease of use is the strongest indirect influence on MSMEs' intention to adopt PAPSS, perceived compatibility directly impacts their intention the most. Additionally, the study confirms that prior experience with e-payment systems significantly moderates these relationships, suggesting that less experienced users place greater importance on perceived benefits and ease of use when considering the adoption of PAPSS.

Samson Edo, in his article, 'Payment Digitization and Industrial Activity Nexus: Comparative Evidence from Key Sub-Saharan African Economies' investigates how digital payment affects industrial sector activity in Nigeria and South Africa, revealing that while digital payment significantly boosts industrial activity in both countries, its impact is lower than that of physical capital, human capital and personal income. The study recommends strengthening internet technology and boosting capital investment and personal income to sustain and enhance

industrial growth. Additionally, trade openness showed an insignificant effect, suggesting a need to control imports that compete with domestic goods.

'Efficiency of Macroeconomic Variables to Explain Economic Growth in the BIMSTEC Region' by Subrata Roy and Monika Pal examines the impact of various macroeconomic factors on economic growth within the Bay of Bengal Initiative for Multi-sectoral, Technical and Economic Cooperation (BIMSTEC) region using quarterly data from 2000 to 2021. The study identifies agricultural production, foreign direct investment and employment as significant determinants of economic growth while highlighting the varying impacts of these variables across different member countries. The findings suggest that these macroeconomic factors collectively influence GDP growth in the region, offering insights for policymakers to enhance economic cooperation and development within BIMSTEC.

Joy Lynn R. Legaspi, through his work, 'Environmental Protection: Regulations to Reduce and Eliminate Single-Use Plastic in Response to Climate Change', explores the Philippines' legislative efforts to combat single-use plastic pollution within the framework of sustainable development principles. It highlights the roles of national and local governments in implementing plastic usage regulations, emphasizing the need for reliable data and effective programmes to prevent plastic pollution amid growing global production. The study also underscores the importance of coherent policies and international cooperation in addressing the environmental impacts of plastic waste and contributing to global climate goals.

The review of Mansoor Khan's book *ONE: The Story of the Ultimate Myth* by Sanjeeb Kakoty highlights the book's critique of modern society's obsession with perpetual growth and technological advancement at the expense of harmony with nature. Through the fictional narrative of Dr Abhay Rao and Ms Sonal, the author contrasts the sustainable practices of tribal societies with the unsustainable consumption-driven model of modern civilization, ultimately delivering a profound commentary on the existential crisis facing the contemporary world.

I hope you will enjoy the reading.

Neelam Rani
Editor-in-Chief
IIMS Journal of Management Science

Article

Deciphering the Social Media Content to Identify Common Branding Themes of Bellwether Management Institutions of India

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Abdul Rahim Ahmed Munshi[1]

Abstract

Social media has become an integral part of people's lives. Extant research is full of ample evidence on the impact of social media on the brand image and purchase intentions of consumers. Educational institutions have started using social media for passing information and influencing the attitudes of prospective students. There is a dearth of research on the type of content that can be used on social media to build the desired brand image as well as influence the attitude of prospective students. This study has an objective of identifying the common themes of social media content that are used by the leading IIMs, that is, IIM Ahmedabad, IIM Bangalore and IIM Calcutta. Additionally, another aim is to find the themes that drive maximum engagement. Data was extracted from Facebook and Instagram posts of IIM Ahmedabad, Bangalore and Calcutta for a period of 8 months (i.e., January 2022 to August 2022). The posts were categorized on the basis of commonality and were given a common theme for analysis. Simple descriptive statistics was used to analyse the data. Frequency and mean were used to identify the most popular themes and correlation was used to find the relationship between the number of posts and engagement. Text analysis was also done using word cloud. On the basis of the post content and most frequently used words on all three platforms, word cloud was built for the three institutions. It was

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found that the most engaging themes on Facebook were achievements, webinars, festival celebrations, public talks by experts and appreciation posts. Similarly, the most engaging themes on Instagram were university infrastructure, webinars, achievements, cultural events and festival celebrations, Furthermore, the most engaging themes on LinkedIn were farewell, inauguration, festival celebration, social events and virtual meetings. The results of this study will contribute to the extant literature on what branding themes can be used by educational institutions on social media platforms to maximize engagement.

Keywords

Social media analytics, brand image, content marketing, brand attitude, content analysis

JEL Classification: M31, M37

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Introduction

As technology has evolved, human beings have started preferring virtual environments for interaction rather than face-to-face interactions (del Rocío Bonilla et al., 2020). This phenomenon has affected the way service industries build relationships with their stakeholders. The omnipresent nature of social media has made it possible in portraying multiple roles. These include social media as a marketing and recruitment tool, network facilitator, teaching and learning tool and collaboration (Benson & Morgan, 2018). Social media marketing has received increased attention, especially in the marketing of higher education (Lee et al., 2020). The current generation is very aggressive when it comes to the use of social media as they spend a substantial amount of time in surfing. Universities take this as an opportunity for brand building and student recruitment (Motta & Barbosa, 2018). Most of the universities, especially in the Western world and more recently even in Asian countries have social media pages and are active on many social media platforms (Brech et al., 2017). Recent work in higher education marketing has evidence with regard to the effect of social media marketing on the brand equity of higher education institutions (Perera et al., 2022). Universities invest in paid advertisements for marketing but more so on user-generated content to influence decisions and brand perceptions among prospective students (Chen et al., 2011). Extant literature has shown that about 40% of information prospective students source is from social media (Lee & Lam, 2016). However, there are challenges with respect to getting the desired level of engagement on social media platforms. Notwithstanding the merits of social media, dealing with an elusive user merits substantial scrutiny. Being a public platform, higher education institutions should post the appropriate content to drive user engagement (Goh et al., 2013). Previous research supports the importance of social media marketing but lacks a framework on what can drive engagement on social media platforms (Perera et al., 2022). Oliveira and Figueira (2015) in their

study on social media content analysis for higher education have emphasized on the lack of research studies in this area. Similarly, Qi and Mackie (2014) echoed a similar sentiment in their study on utilizing social media technology in higher education. This research is done with an aim to identify the themes that engage the users (viz, students) the most on popular social networking sites, that is, Facebook, Instagram and LinkedIn. Among the several research questions that this article attempts to address, the most pertinent ones are as follows: What should universities post on their social media platforms to effectively engage with users? Whether there is a relationship between the number of posts on social media platforms and engagement. What are the most frequently used themes utilized by IIM Ahmedabad, Bangalore and Calcutta for posting on their social media platforms? The results of this study will contribute immensely to this rapidly growing area of social media content analysis, especially in the field of higher education. Additionally, it will help practising social media managers and content strategists on themes that can drive traffic on their social media platforms.

Literature Review

Social Media Marketing in Higher Education

When marketers use social media to fulfil their goals, it is often referred to as social media marketing (Brech et al., 2017). Marketers of all sizes try to use social media for their marketing but not all of them are equally successful (Vernuccio, 2014). Similarly, universities and institutions of higher education have also tried social media marketing but again not all of them have been able to drive success on social media (Greenwood, 2012). Over the last two decades competition has flared up in the higher education market worldwide, it is therefore imperative for higher education institutions to market themselves well with a clear-cut marketing and branding strategy (Whisman, 2011). Universities are widely using social media platforms for marketing and branding (Galan et al., 2015). At the same time, universities are also investing largely in marketing to make their position competitive worldwide (Whisman, 2011). Scholars have posited that universities are using social media platforms for building a student community where information can be posted about campus life, student activities and strengthening students' interaction and engagement (Davis et al., 2012). Tuten (2008) posits that as social media is a platform that drives active engagement, it is pivotal in building the desired brand image for universities. Extant literature states that for a university to be successful, it has to maintain strong relations with three key stakeholders, that is, current students, future students and alumni. The quality of these relations determines long-term loyalty towards the university (McAlexander & Koenig, 2001). Social media can aid in maintaining relations with its users due to its interactive nature. Literature with respect to the use of Social Media Marketing (SMM) by Higher Education Institution (HEIs) is limited; however, there is ample evidence on the successful utilization of SMM by universities and institutions in the United States (Barnes & Mattson, 2009). A recent study by Mai To et al. (2022) highlighted the importance of social media presence for marketing and branding purposes. In their study, they highlighted the key social media branding themes

used by Canadian universities. Some researchers have highlighted the use of social media sites by prospective students for searching and choosing universities (Shields & Peruta, 2018; Le et al., 2019). Prospective students mostly look for information related to student life by reading information posted by students. They are also interested in searching for various job and career opportunities they might get from a university. A university can benefit by posting these snippets of information on its social media platforms (Galan et al., 2015). According to Salgado and Vela (2019), it is possible for universities to increase student loyalty by posting positive student experiences on social media platforms and websites. María Bonilla et al. (2019) posited that social media platforms have inherent advantages over traditional media for universities due to their interactive nature.

Indian Education Institutions on Social Networking Sites

There are a large number of social networking sites that are utilized by students for social networking, however, in context of India, the most popular ones are Instagram, Facebook and LinkedIn. These are relatively more popular and are also utilized by universities for their branding initiatives (Paladan, 2018). As per a leading social media portal, Facebook is the leading social media platform with the highest traffic at 58%, followed by Instagram with a traffic of 26.44%. LinkedIn is far from Facebook and Instagram but its traffic is increasing steadily with .33% (Statista, 2022). There are nearly 239.65 million users of Facebook in India, making it the country with the highest number of Facebook users. Instagram, a free application was launched in October 2010, is a hot favourite among the university-going audience of India, it has 230.25 million users in India, which is very close to Facebook. It is a social platform that allows users to post pictures with/without filters and run hashtag campaigns to increase the visibility of their posts among the social media community (Carah & Shaul, 2015; Hu et al., 2014). LinkedIn is a professional networking site, which has close to 87 million users in India (Statista, 2022). Majority of the Indian universities are active on social media platforms and have an account/page on all three popular social media platforms, that is, Facebook, Instagram and LinkedIn (Paladan, 2018). The top management institutions, that is, Indian Institute of Management Ahmedabad, Indian Institute of Management Bangalore and Indian Institute of Management Calcutta, popularly known as IIM (A, B and C) are very active on each of the above social media platforms. IIMA has 5.61 lakh followers on its Facebook page, 89k followers on Instagram and 262,237 followers on LinkedIn. IIMB has 41205 followers on Facebook, 57,500 followers on Instagram and 267,795 followers on LinkedIn, similarly, IIMC has 127,249 followers on Facebook, 29,200 followers on Instagram and 138,741 followers on LinkedIn.

Increasing Student Engagement on Social Media Platforms

Driving user engagement is one of the major goals as well as challenges that social media managers face. There are several studies in extant literature that highlight

the factors/characteristics that can drive engagement on social media platforms. Some of them include vivid postings with pictures and calls for interaction. These kinds of posts drive the highest number of 'likes' (De Vries et al., 2012; Rauschnabel et al., 2011). Similarly, Ashley and Tuten (2015) highlighted the importance of frequent updates and incentives for user participation as crucial factors for engagement. Likewise, experiential, exclusive and image-related messages also drive user engagement. Social media can also be used to build the symbolic image of a university by posting authentic insightful stories of students and university achievements. Researchers have found that users follow university social media pages as an act of self-expression and identification. They validate this feeling of self-expression by liking pages of universities they relate to (Batra et al., 2012; Holmberg & Strannegård, 2015). Besides self-expression, other motivations of following social media pages do exist. Information seeking and entertainment are other reasons for users to follow social media pages (Baldus et al., 2015). Many universities tend to fulfil the informational needs of their users by providing regular updates on their activities. Apart from self-expression and identification, prior research has highlighted that users express love for brands that they feel suit their actual/desired self-identity. Similarly, users on social media tend to follow/display a higher level of engagement with pages that match their self-identity. For example, Hollenbeck and Kaikati (2012) have posited that users follow Facebook brand pages to convey their self/desired identity among their social media community. It is therefore the cult/heritage university brands that have a higher number of followers. Another aspect that has often been talked about with respect to engagement is frequency of posting. It has been posited that social media pages with very few postings often are found to be boring and drive low level of engagement, similarly posting very frequently tends to be annoying and over-stimulating. The challenge is to keep the number of postings optimal. It has been found that intermediate posting drives maximum interaction and engagement (Brech et al., 2017). Evaluating the success and effectiveness of posts on social networks is one of the greatest challenges that marketers face (Maria Bonilla et al., 2019). As per Barger and Labrecque (2013), post engagement in the form of shares, likes and comments are considered to be manifestations of the success of a social media post, likes, shares and comments in the case of Instagram and Facebook; retweets and replies in the case of twitter (Hoffman & Fodor, 2010). There are several types of analytics tools available on social media platforms that measure the level of audience engagement.

What is missing in the literature is the common themes that can drive student engagement on social media platforms.

Methodology

We chose to utilize secondary data, that is, social media posts on Facebook, Instagram and LinkedIn of the top three management institutions of India, that is, Indian Institute of Management Ahmedabad, Indian Institute of Management Bangalore and Indian Institute of Management Calcutta, popularly known as IIM (A, B and C). The design of this study is exploratory in nature. The research

population was social media posts of IIM (A, B and C) on Facebook, Instagram and LinkedIn. The sampling frame was from January 2022 to August 2022 (8 months). The sample size of Facebook posts was 502, Instagram was 438 and LinkedIn was 717. The total sample size taking all three social networking sites was 1,657 posts. The sampling technique was non-probability purposive sampling, as the researcher chose the most recent posts. The posts were categorized on the basis of commonality and were given a common theme for analysis. Simple descriptive statistics was used to analyse the data. Frequency and mean were used to identify the most popular themes and correlation was used to find the relationship between number of posts and engagement. A text analysis was also done using word cloud. Descriptive analysis was done using Microsoft Excel and word cloud was generated using 'freewordcloudgenerator' an open-source platform. Correlation analysis was performed using IBM SPSS. Text was extracted from the social media posts of IIM (A, B and C) on Facebook, Instagram and LinkedIn. On the basis of the post content and most frequently used words on all three platforms, word cloud was built for the three institutions.

Results

Social Media Post Analysis Using Descriptive Statistics and Correlation

Facebook Content Analysis

On analysing the Facebook page content of IIMA, it was found that posts related to webinar (197), achievement (168), appreciation (156), infrastructure (147) and seminar (135) were found to attract the maximum number of likes. The appreciation-related posts were few (5) in number (Table 1), but they drove a considerable number of likes (156). IIM Ahmedabad has 561,000 followers on its Facebook page, which it created on 11 August 2011. Similarly for IIM Bangalore, it was found that posts related to festival celebration (150), public talks (132), infrastructure (125), achievements (116) and book launch (94) were found to attract the maximum number of likes. The appreciation and achievement-related posts were few (9) in number (Table 2), but they drove a considerable number of likes (116 and 94). IIM Bangalore had 41,205 followers on its Facebook page, which it created on 6 August 2013. Similarly, in the case of Facebook content of IIM Calcutta, it was found that posts related to public talks (161), appreciation (158), webinar (144), achievements (137) and festival celebrations (131) were found to attract the maximum number of likes. The appreciation- and achievement-related posts were few (6 and 5) in number (Table 3), but they drove a considerable number of likes (158 and 137). IIM Calcutta had 127,249 followers on its Facebook page, which it created on 27 February 2010. For all the three institutions, achievements and appreciation posts drove the maximum number of likes.

Instagram Content Analysis

On analysing the Instagram content of IIMA, it was found that posts related to webinars (2,998), infrastructure (2,651), application updates (2,356),

Table 1. Facebook Content Analysis of IIMA.

Theme	Likes	No. of Posts	Avg No. of Likes per Post	Rank
Webinar related	4,531	23	197	1
Seminar related	1,620	12	135	5
Convocation related	1,425	15	95	8
Infrastructure related	2,940	20	147	4
Festival celebration related	1,806	14	129	6
Appreciation related	780	5	156	3
Achievement related	3,192	19	168	2
Book launch related	602	7	86	9
Public talks/podcasts/alumni talks/ panel discussion related	2,310	22	105	7
Total	19,206	137	1,218	
Followers		561,000		
Year of establishment of institute		1961		
Year of establishment of page		II AUGUST 2012		
Rank		1		

Table 2. Facebook Content Analysis of IIM Bangalore.

Theme	Likes	No. of Posts	Avg No. of Likes per Post	Rank
Webinar	3,290	47	70	8
Seminar	2,296	28	82	6
Convocation	1,045	19	55	9
Infrastructure	3,375	27	125	3
Festival celebration	3,000	20	150	1
Appreciation	975	13	75	7
Achievement	1,044	9	116	4
Book launch	846	9	94	5
Public talks/podcasts/ alumni talks/panel discussion	1,980	15	132	2
Total	17,851	187	899	
Followers		41,205		
Year of establishment of institute		1973		
Year of establishment of page		6 AUGUST 2013		
Rank		2		

achievements (2,031) and appreciation (1,758) were found to attract the maximum number of likes. The application updates, webinar and achievements-related posts were few (1, 3 and 3) in number (Table 4), but they drove a considerable number of likes (2,356, 2,998 and 2,031). IIM Ahmedabad has 89,000 followers on its Instagram page. Similarly, the Instagram content of IIMB was analysed, it was

Table 3. Facebook Content Analysis of IIMC.

Theme	Likes	No. of Posts	Avg No. of Likes per Post	Rank
Webinar	4,608	32	144	3
Seminar	2,025	27	75	7
Convocation	966	14	69	8
Infrastructure	4,896	48	102	6
Festival celebration	2,489	19	131	5
Appreciation	948	6	158	2
Achievement	685	5	137	4
Book launch	260	4	65	9
Public talks/podcasts/alumni talks/ panel discussion	3,703	23	161	1
Total	20,580	178	1,042	
Followers		127,249		
Year of establishment of institute		1961		
Year of establishment of page		27 February 2010		
Rank		3		

Table 4. Instagram Content Analysis of IIMA.

Content	Likes	Comments	No. of Posts	Avg No. of Likes per Post	Rank
Social events	11,202	14	12	934	12
Infrastructure	127,241	358	48	2,651	2
Convocation ceremony	11,557	42	8	1,445	9
Virtual meetings	1,374	4	4	344	19
Welcome events	10,590	21	7	1,513	8
Inauguration and orientation	6,961	10	5	1,392	10
Festival celebration	19,447	12	12	1,621	7
Farewell/valedictory	6,353	9	9	706	13
Academic appreciation	15,825	18	9	1,758	5
Diversity	842	5	2	421	18
Application updates	2,536	1	1	2,536	3
Cultural events	3,448	5	3	1,149	11
Sports celebration	3,258	17	2	1,629	6
Public talks/podcasts/alumni talk	6,130	6	10	613	16
Seminars	1,302	1	2	651	15
Webinars	8,994	7	3	2,998	1
Workshops	1,074	3	2	537	17
Books and research papers	1,314	3	2	657	14
Achievements	6,093	0	3	2,031	4
Total	245,541	536	144	25,585	
Followers			89,000		
Year of establishment of inst.			1961		
Rank			1		

Table 5. Instagram Content Analysis of IIMB.

Content	Likes	Comments	No. of Posts	Avg No. of Likes per Post	Rank
Social events	12,805	53	13	985	13
Infrastructure	206,103	363	69	2,987	1
Convocation ceremony	9,666	32	9	1,074	9
Virtual meetings	5,121	10	7	732	14
Welcome events	11,367	7	9	1,263	7
Inauguration and orientation	3,084	2	3	1,028	10
Festival celebration	10,560	46	8	1,320	6
Farewell/valedictory	2,656	1	4	664	16
Academic appreciation	15,950	25	11	1,450	4
Application updates	962	9	1	962	12
Cultural events	3,904	69	2	1,952	3
Sports celebration	5,412	45	4	1,353	5
Public talks/podcasts/ alumni talk	9,156	39	14	654	17
Seminars	4,324	8	4	1,081	11
Webinars	3,648	46	3	1,216	8
Workshops	698	3	1	698	15
Books and research papers	354	1	1	354	18
Achievements	6,165	95	3	2,055	2
Total	311,935	854	166	21,828	
Followers			57,500		
Year of establishment of inst.			1973		
Rank			2		

found that posts related to infrastructure (2,987), achievements (2,055), cultural events (1,952), academic appreciation (1,450) and sports celebration (1,353) were found to attract the maximum number of likes. The achievements, cultural events and sports celebration-related posts were few (3, 2 and 4) in number (Table 5), but they drove a considerable number of likes (2,055, 1,952 and 1,353). IIM Bangalore has 57,500 followers on its Instagram page. Furthermore, on analysing the Instagram content of IIMC, it was found that posts related to festival celebrations (1,583), cultural events (1,512), infrastructure (1,423), inauguration and orientation (1,321) and virtual meetings (1,301) were found to attract the maximum number of likes. The festival celebration, cultural events and inauguration and orientation-related posts were few (7, 6 and 2) in number (Table 6) but they drove a considerable number of likes (1,583, 1,512 and 1,321). IIM Calcutta has 29,200 followers on its Instagram page.

LinkedIn Content Analysis

On analysing the LinkedIn page content of IIMA, it was found that posts related to farewell (202), article/report (198), inauguration (192), workshop (190) and festival

Table 6. Instagram Content Analysis of IIMC.

Content	Likes	Comments	No. of Posts	Avg No. of Likes Per Post	Rank
Social events	6,360	14	10	636	14
Infrastructure	52,651	228	37	1,423	3
Convocation ceremony	7,092	21	9	788	11
Virtual meetings	2,602	17	2	1,301	5
Welcome events	5,166	5	6	861	9
Inauguration and orientation	2,642	3	2	1,321	4
Festival celebration	11,081	20	7	1,583	1
Farewell/valedictory	1,746	6	2	873	8
Academic appreciation	8,256	23	8	1,032	6
Application updates	621	1	1	621	15
Cultural events	9,072	24	6	1,512	2
Sports celebration	3,195	20	5	639	13
Public talks/podcasts/alumni talk	5,472	15	15	365	17
Seminars	840	9	1	840	10
Webinars	1,980	24	2	990	7
Workshops	1,130	1	2	565	16
Books and research papers	651	0	3	217	18
Achievements	7,750	32	10	775	12
Total	128,307	463	128	16341.8	
Followers			29,200		
Year of establishment of inst.			1961		
Rank			3		

celebration (168) were found to attract the maximum number of likes. The workshop and farewell-related posts were few (5 and 6) in number (Table 7), but they drove a considerable number of likes (954 and 1,212). IIM Ahmedabad had 262,237 followers on its LinkedIn page. Similarly, on analysing the LinkedIn page content of IIMB, it was found that posts related to welcoming event (279), farewell (240), inauguration (218), charity (187) and public talks (163) were found to attract the maximum number of likes. The welcoming, farewell, inauguration and charity related posts were few (3, 3, 6 and 3) in number (Table 8), but they drove a considerable number of likes (279, 240, 218 and 187). IIM Bangalore had 267,975 followers on its LinkedIn page. Furthermore, on analysing the LinkedIn page content of IIMC, it was found that posts related to virtual meetings/online programmes (256), workshops (237), appreciation (227), social events (216) and celebrations (205) were found to attract the maximum number of likes. The workshop achievement and inauguration-related posts were few (8, 4 and 9) in number (Table 9), but they drove a considerable number of likes (237, 187 and 178). IIM Calcutta had 138,741 followers on its LinkedIn page.

Table 7. LinkedIn Content Analysis of IIMA.

Theme	Likes	Comments	Shares	No. of Posts	Avg No. of Likes per Post	Rank
Webinar	4,091	70	56	66	62	17
Public talks/ panel discussion/ conferences/	2,660	51	24	26	102	12
Achievement	4,764	86	85	31	154	7
Academic event	340	4	5	3	113	10
Application updates	291	16	3	8	36	18
Seminar	1,874	31	14	22	85	14
Inauguration	3,841	24	25	20	192	3
Festival celebration	2,849	8	17	17	168	5
Celebration	4,728	24	31	32	148	8
Workshop	954	22	9	5	190	4
Book launch	785	47	15	11	71	15
Virtual meeting/online programmes	2,614	61	4	24	109	11
Report/article	2,578	53	22	13	198	2
Appreciation	1,348	14	8	15	90	13
Welcoming event	1,084	34	13	17	64	16
Social event	632	54	6	4	158	6
Convocation	389	22	0	3	130	9
Farewell	1,212	28	2	6	202	1
Total	37,034	649	339	323	2,272	
Followers			262,237			
Year of establishment of inst.			1961			
Rank			1			

Table 8. LinkedIn Content Analysis of IIMB.

Themes	Likes	Comments	Shares	No. of Posts	Avg No. of Likes per Post	Rank
Webinar	3,865	45	21	37	104	12
Public talks/panel discussion/conferences/ Podcasts	5,210	41	8	32	163	5
Achievement	3,645	36	2	29	126	8
Academic event	1,985	23	1	14	142	6
Application updates	766	17	0	12	64	17
Seminar	1,054	36	20	15	70	16
Inauguration	654	9	8	6	218	3
Festive celebration	1,784	22	6	15	119	9
Celebration	1,138	29	3	11	103	13
Workshop	234	35	3	3	78	15

(Table 8 continued)

(Table 8 continued)

Themes	Likes	Comments	Shares	No. of Posts	Avg No. of Likes per Post	Rank
Virtual meeting/online programmes	1,204	32	14	11	109	10
Appreciation	1,098	24	22	13	84	14
Welcoming event	836	16	18	3	279	1
Social event	968	14	11	9	108	11
Convocation	668	25	0	5	134	7
Charity	561	16	0	3	187	4
Information	346	36	0	10	35	18
Farewell	719	28	5	3	240	2
Total	26,735	484	142	231	2,363	
Followers			267,975			
Year of establishment of inst.			1973			
Rank			2			

Table 9. LinkedIn Content Analysis of IIMC.

Themes	Likes	Comments	Shares	No. of Posts	Avg No. of Likes per Post	Rank
Webinar	4,308	36	2	23	187	9
Public talks/panel discussion/conferences/ Podcasts	1,987	25	0	16	124	11
Achievement	1,684	21	6	9	187	10
Academic event	308	5	9	6	51	15
Application updates	226	8	13	3	75	14
Seminar	958	36	5	8	120	12
Inauguration	3,207	22	18	4	178	10
Festive celebration	1,762	18	2	9	196	8
Celebration	3,487	13	0	17	205	5
Workshop	1,895	10	1	8	237	2
Virtual meeting/online programmes	4,861	29	3	19	256	1
Appreciation	3,398	23	5	15	227	3
Welcoming event	327	18	8	3	109	13
Social event	3,247	0	6	15	216	4
Convocation	984	0	0	5	197	7
Farewell	603	28	19	3	201	6
Total	33,242	292	97	163	2,766	
Followers			138,741			
Year of establishment of inst.			1961			
Rank			3			

Maximum Engagement on Facebook, Instagram and LinkedIn

It was found that IIM Bangalore was able to drive maximum engagement on its Facebook page and Instagram page in comparison to IIM Ahmedabad and Calcutta. During the period of January 2022 to August 2022, it shared 187 posts on its Facebook page and 166 posts on its Instagram page, which attracted 17,851 likes and 311,935 likes, respectively. The engagement rate on the Facebook posts was 43.32% and Instagram was 542.49% (Tables 10 and 11). Similarly, it was found that that IIM Calcutta was able to drive maximum engagement on its LinkedIn page. During the period of January 2022 to August 2022, it shared 163 posts on its LinkedIn page, which attracted 138,741 likes with an engagement* of 23.95% (Table 12). The formula used for calculation of engagement was taken from Trunfio and Rossi (2021): (Engagement = likes/followers × 100).

Correlation between Posts and Engagement on Facebook

It was found that there was a significant positive correlation between the number of posts and engagement on Facebook, $r\,(185) = 0.614$, $p < .05$, Instagram, $r\,(176) = 0.324$, $p < .05$ and LinkedIn, $r\,(135) = 0.499$, $p < .01$ (Table 13).

Table 10. Percentage Engagement of all IIMs on Facebook.

Percentage Engagement Indicating Strength of Content (March 2021–March 2022)					
Institute	Followers	Posts	Likes	Engagement	Rank
IIMB	41,205	187	17851	43.32241233	1
IIMC	127,249	178	20580	16.17301511	2
IIMA	561,000	137	19206	3.423529412	3

Table 11. Percentage Engagement of all IIMs on Instagram.

Percentage Engagement (March 2021–March 2022)					
Institute	Followers	Posts	Likes	Engagement	Rank
IIMB	57500	166	311935	542.4956522	1
IIMC	29200	128	128307	439.4075342	2
IIMA	89000	144	245541	275.888764	3

Table 12. Percentage Engagement of all IIMs on LinkedIn.

Percentage Engagement (March 2021–March 2022)					
Institute	Followers	Posts	Likes*	Engagement	Rank
IIMC	138,741	163	33,242	23.95975234	1
IIMA	262,237	323	37,034	14.12233972	2
IIMB	267,975	231	26,735	9.976676929	3

Note: *Only likes have been considered, other options like love, insightful, celebrate and funny have not been considered.

Most Engaging Themes on Facebook, Instagram and LinkedIn

It was found that the top five engaging themes for promotion on Facebook were achievements (421 likes per post), webinars (421 likes per post), festival celebrations (410 likes per post), public talks by experts (398 likes per post) and appreciation (389 likes per post). Similarly, the top five engaging themes for promotion on Instagram were infrastructure (7,061 likes per post), webinars (5,204 likes per post), achievements (4,861 likes per post), cultural events (4,613 likes per post) and festival celebrations (4,524 likes per post). Furthermore, the top five engaging themes for promotion on LinkedIn were farewell (643 likes per post), inauguration (588 likes per post), festival celebration (483 likes per post), social events (482 likes per post) and virtual/online meetings (474 likes per post) (Tables 14–17).

Text Analysis of Facebook Posts Using Word Cloud

Text analysis of IIMA posts revealed that the most commonly used words by IIM Ahmedabad on its Facebook posts were leadership, research, Ashank Desai centre

Table 13. Correlation between Number of Posts and Engagement on Facebook, Instagram and LinkedIn.

Relationship	*R*	*P*-Value
Correlation between number of posts and engagement on Facebook	0.614**	.001
Correlation between number of posts and engagement on Facebook	0.324**	.016
Correlation between number of posts and engagement on Facebook	0.499**	.000

Note: ** Correlation is significant at the 0.05 level (2-tailed).

Table 14. Most Engaging Themes for Promotion on Facebook.

	Average No. of Likes per Post				
Theme	IIMA	IIMB	IIMC	Average Likes	Rank
Webinar	197	70	144	411	2
Achievements	168	116	137	421	1
Appreciation	156	75	158	389	5
Infrastructure	147	125	102	374	
Seminars	135	82	75	292	
Public talk by experts	105	132	161	398	4
Festival celebrations	129	150	131	410	3
Book launch	86	94	65	245	
Convocation	95	55	69	219	
Followers	561,000	41,205	127,249		

Table 15. Most Engaging Themes for Promotion on Instagram.

	Average Number of Likes per Post				
Theme	IIMA	IIMB	IIMC	Total Average Likes	Rank
Workshops	537	698	565	1,800	
Webinars	2,998	1,216	990	5,204	2
Infrastructure	2,651	2,987	1,423	7,061	1
Application updates	2,536	962	621	4,119	
Achievements	2,031	2,055	775	4,861	3
Academic appreciation	1,758	1,450	1,032	4,240	
Sports celebration	1,629	1,353	639	3,621	
Festival celebration	1,621	1,320	1,583	4,524	5
Welcome events	1,513	1,263	861	3,637	
Convocation ceremony	1,445	1,074	788	3,307	
Inauguration and orientation	1,392	1,028	1,321	3,741	
Cultural events	1,149	1,952	1,512	4,613	4
Virtual meetings	344	732	1,301	2,377	
Farewell/valedictory	706	664	873	2,243	
Seminars	651	1,081	840	2,572	
Followers	89,000	57,500	29,200		

Table 16. Most Engaging Themes for Promotion on LinkedIn.

	Average Number of Likes per Post				
Theme	IIMA	IIMB	IIMC	Average Likes	Rank
Achievement	154	126	187	467	
Academic event	113	142	51	306	
Inauguration	192	218	178	588	2
Festival celebration	168	119	196	483	3
Workshop	190	78	237	505	
Virtual/online meeting	109	109	256	474	5
Social event	158	108	216	482	4
Convocation	130	134	197	461	
Farewell	202	240	201	643	1
Public talks	102	163	124	389	
Followers	262,237	267,975	138,741		

for leadership, strategy, AI, alumni, data, economy, on-campus courses, digital, webinar, international, marketing, executive education and the like. Majority of the posts highlighted research, leadership and executive education as salient differentiators and USPs of IIMA. IIM Bangalore Facebook posts revealed the multidimensional positioning that it intended to create using non-academic themes like har ghar tiranga, climate change concerns, amrit mahotsav and vista (the annual business summit that includes academic and cultural competitions)

(Figures 1–3). Apart from non-academic themes, the institute had an equal focus on academic themes like research, data analytics, entrepreneurship, faculty achievements (book launches), leadership, entrepreneurship summit and NRCEL (incubation centre for startups). Additionally, there was emphasis on women-oriented themes and eradicating inequality. Text analysis of IIM Calcutta revealed its focus on industry interface through its focus on management development programs, leadership, awards, CEO series and executive education. Other frequently used words were vision, national, global, research, data, pride, growth,

Figure 1. Word Cloud of Facebook Content of IIM Ahmedabad, Bangalore and Calcutta.

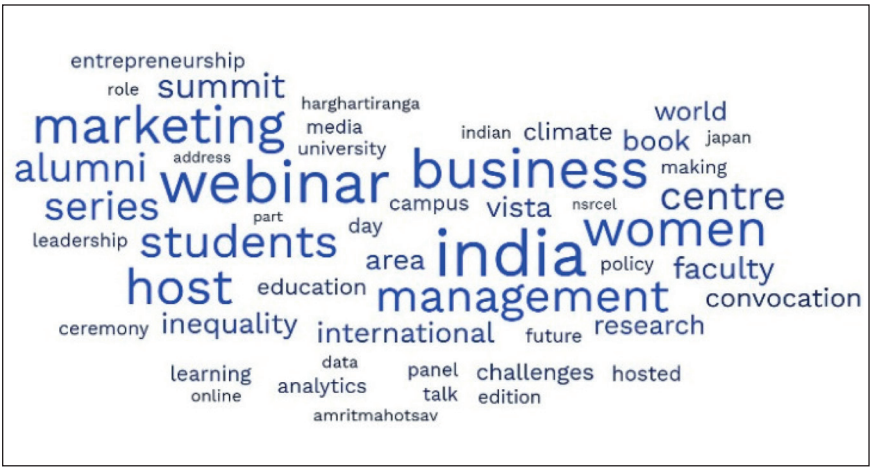

Figure 2. Word Cloud of Facebook Content of IIM Bangalore.

Figure 3. Word Cloud of Facebook Content of IIM Calcutta.

CEO and so on. There was emphasis on convocation, alumnus, marketing, global, national and growth. The positioning of IIM Calcutta was very similar to IIMA in terms of post content and themes.

Text Analysis of Instagram Posts Using Word Cloud

It was found that the most repeatedly used words by IIMA on its Instagram posts were leadership, research, webinar, science, development, analytics, artificial intelligence, Vikram Sarabhai, Louis Kahn Plaza, Ashank Desai centre for leadership development and community. It was evident that IIMA used the above words more often in its post highlighting a more rational and educational focused positioning but Instagram being a more image-oriented platform, words/themes like memories, LGBTQ, alumni, red, welcome, club, on-campus experiences, convocation and such light-hearted and nostalgia invoking themes have also found way in the body copy of the posts (Figures 4–6).

Most repeatedly used words by IIMB on its Instagram posts were campus, startup, alumni, fest celebrations, experience, startup, competitions, executive program, faculty, the place to be, eximius (entrepreneurship summit) and winners. It was clear that IIMB used the above words more often in its post highlighting a more youth-oriented positioning. Other words that found their way into the body copy of their Instagram posts were happy, journey, fest, celebrations and vista (cultural fest), journey, congratulations and performance. IIM Bangalore was very clear in its lively, vivid and colourful positioning it wanted to create on Instagram.

The most commonly used words by IIMC on its Instagram posts were MDP, leaders, research, industry executive program, convocation, global, data, international collaboration, analytics, alumni, success and so on. These words

Figure 4. Word Cloud of Instagram Content of IIM Ahmedabad.

Figure 5. Word Cloud of Instagram Content of IIM Bangalore.

were well in sync with the posts on Facebook, whereby it wants to position itself as a more rational, academic oriented and traditional institute. Some other words that found way into the body copy of its Instagram posts were pride, love, congratulate, Joka, etc. These words/themes were utilized to appeal to give the institute a youthful appeal along with a more corporate-oriented theme.

Text Analysis of LinkedIn Posts Using Word Cloud

It was found that the most commonly used words by IIMA on its LinkedIn posts were leadership, business, development, marketing, research, science, analytics, alumni, webinar, executive development, Ashank Desai centre for leadership

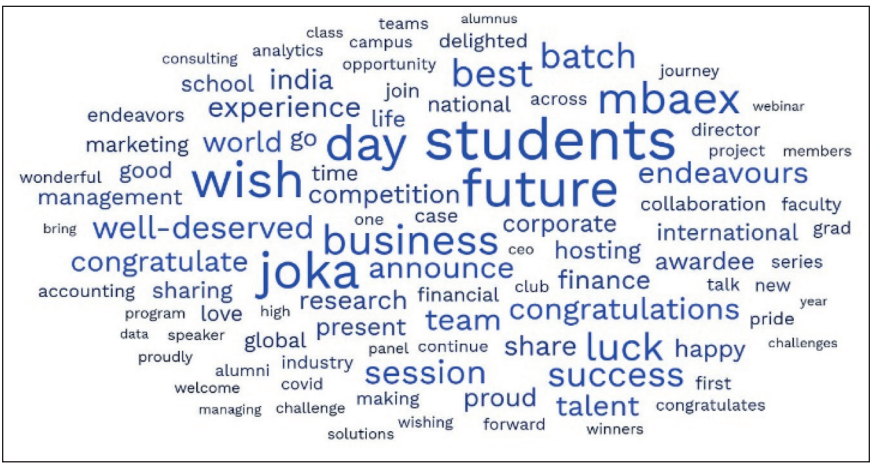

Figure 6. Word Cloud of Instagram Content of IIM Calcutta.

Figure 7. Word Cloud of LinkedIn Content of IIM Ahmedabad.

development, workshop and centre for logistics and transportation. Other words highlighted in the body copy of its LinkedIn page were data, transportation, alumni, strategy, economy and digital. Unlike the Instagram posts of IIM Ahmedabad, light-hearted themes did not find way in the LinkedIn posts of IIM Ahmedabad. LinkedIn being a platform for professionals, the posts reflected its academic and professional-oriented positioning. Similarly, the most commonly used words by IIMB on its LinkedIn posts were innovation, leadership, business, conference, learning, research, data and doctoral. Other words highlighted in the body copy of its LinkedIn page were alumni, innovation, competition, women, technology, international, alumni and marketing. IIMB had a sharp contrast in the

Figure 8. Word Cloud of LinkedIn Content of IIM Bangalore.

Figure 9. Word Cloud of LinkedIn Content of IIM Calcutta.

positioning of its LinkedIn page in comparison to its Facebook and Instagram page, The body copy, design and colours of the posts on LinkedIn reflected its academic and innovation-based positioning. Furthermore, frequently used words by IIM Calcutta on its LinkedIn posts were management, business, alumnus, management development program, global, leaders, award, executive programs, digital, winners, CEO, development, success, strategic and so on. Other words highlighted in the body copy were congratulate, convocation, well-deserved, team and government. IIM Calcutta continued its focus on corporate interface and connect by highlighting its global approach, MBA executive and management development programs. The positioning of IIM Calcutta was similar to IIMA both being the oldest management institutes of India (Figures 7–9).

Table 17. Comparison of Facebook, Instagram and LinkedIn Pages of IIM (A, B and C).

Social Media Platform	Maximum Engagement	No. of Posts	Likes	Engagement	Correlation between Posts and Engagement	Top Themes
Facebook	IIMB	187	17,851	43.32%	0.84 (positive)	Achievements, webinars, festival celebrations, public talks by experts and appreciation.
Instagram	IIMB	166	311,935	542.49%	0.47 (positive)	Infrastructure, webinars, achievements, cultural events and festival celebrations.
LinkedIn	IIMC	163	138,741	23.95%	–0.62 (negative)	Farewell, inauguration, festival celebration, social events and virtual/ online meetings.

Discussion

Social media is here to stay, youngsters are glued to this medium for information, entertainment and networking. Penetration of internet and data is on an all-time high in developing countries. Considering this in the background education institutions have been active on social media platforms. What is lacking is a common framework, themes of what should be shared to maximize engagement on social media platforms. This study was been done with an intention to fill this gap. The purpose of this study was to identify the most engaging themes on social media platforms taking cues from the posts of IIM Ahmedabad, Bangalore and Calcutta, and second, to identify which IIM out of the three selected in this study has the maximum engagement on Facebook, LinkedIn and Instagram. Third, to investigate the correlation between posts and engagement. The study illustrates that the most engaging themes for promotion on social media were achievements of students, faculty and institutions, webinars on trending topics like AI, data analytics and digital transformation, festival celebrations, public talks by experts about entrepreneurship journey, network modelling, design thinking, financial inclusion, case-based pedagogy, data science, alumni journeys at IIMs, appreciation posts for placed students, infrastructure, cultural events, festival celebrations, farewell, inauguration, social events and virtual/online meetings. These results concur with the findings of Figueira (2018), whose study on data mining of the social media posts of top 5 higher education

institutions in the world, concluded that celebration, happy, award, congratulations, prize, pride, etc., were the words that were frequently used on their social media platforms. Furthermore, the study illustrates that IIM Bangalore was able to drive maximum engagement on Facebook and Instagram through its vivid, vibrant and diverse content. in the other IIMs, that is, IIM Ahmedabad and IIM Calcutta posted content that was more academic in orientation. This was reflected in the engagement on LinkedIn, where IIM Calcutta was able to drive maximum engagement due to its content that was more industry focussed. It was also found that there was a positive correlation between number of posts and engagement in the case of Facebook, Instagram and LinkedIn. These results concur with the findings of Ashley and Tuten (2015) who posit that frequent updates on social media platforms are essential for user engagement. Furthermore, this result is in contrast to a study by Figueira (2018), where it was found that notwithstanding a smaller number of posts, Stanford University had a higher level of engagement in comparison to Harvard and MIT. This contrast in results can be attributed to the difference in culture between the countries where the research is conducted.

Implications of the Study

This article makes several contributions both to academia and industry. There are less descriptive studies about use of social media in higher education. This article extends theoretical knowledge on which social media themes can be used on Facebook, Instagram and LinkedIn to maximize engagement with stakeholders in higher education. Several branding themes frequently used by IIM Ahmedabad, Bangalore and Calcutta were identified. These themes will be useful for practicing social media managers to increase engagement and traffic on their social media platforms. Findings of this study add to the body of knowledge; themes that could maximize engagement for HEIs social media platforms. Findings of the study also highlighted frequent posting on social media platforms to maintain visibility. Additionally, this study highlights the need for social media managers to focus on the content for platforms like LinkedIn where the audience is different in comparison to Facebook and Instagram. LinkedIn demands content that is rational and appeals to the rational needs of the users.

Limitations and Future Research

The current study has considered the social media posts of only three management institutions, that is, IIM Ahmedabad, IIM Bangalore and IIM Calcutta. The results of content analysis cannot be generalized for a diverse set of institutions. The sampling duration considered in this study was 8 months, further studies can extend the duration for a longer period. Furthermore, the current study takes into consideration only three social media platforms, that is, Facebook, Instagram and LinkedIn, further studies can include other platforms like Twitter, Pinterest and YouTube. Future studies can take into consideration education institutions from diverse disciplines to dig deeper insights in content and analytics. More advanced statistical tests can be used for further analysis in future studies.

Conclusion

The present study attempted to identify social media branding themes used by IIM Ahmedabad, Bangalore and Calcutta. The findings from the study show that higher education institutions can post on themes related to achievements, webinars, festival celebrations, public talks by experts, appreciation posts, infrastructure, cultural events, festival celebrations, farewells, inaugurations, social events and virtual/online meetings on their social media platforms to maximize engagement with users. Additionally, it was found that there was a positive correlation between number of posts and engagement. Accordingly, universities must actively post on their social media platforms. Replication of this study with higher education institutions of varied disciplines is recommended for validating the responses across different institutions.

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Article

Cross-border Product Payments in Sub-Saharan Africa! How MSMEs React to PAPSS as E-payment Innovation: Moderating Role of Experience

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Abstract

The purpose of the study is to evaluate micro, small and medium enterprises' (MSMEs) reaction to the pan-African payment and settlement system (PAPSS). The new cross-border e-payment technology is designed to facilitate cross-border instant payments, motivate cross-border businesses and promote sub-Saharan African trades which have been a real problem following the involvement of third currency, untimely payment and regulations that impact payments across borders. The study is important because of the non-existence of empirical results on what motivates MSMEs' intention to use it and how the experience might impact the intention to use PAPSS. Thus, the study considered the impact of MSMEs' previous experience on e-payment as a moderating influence on intention to use PAPSS. An adapted questionnaire that was structured on 7-point Likert scale was used in the survey to collect data from MSMEs in Nigeria. Structural equation modelling and the Hayes process for moderation were used in the analysis. The authors learned that ease of use is the strongest indirect determinant of intention

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to use PAPSS while perceived compatibility is the strongest direct determinant of intention to use PAPSS. Further, the authors discovered the important role of the simplicity of the innovation and its compatibility with users' characteristics in promoting intention to use. The level of experience is confirmed to be significant in moderating intention to use PAPSS. Therefore, deeper involvement of the apex banks and commercial banks in communicating simplicity is paramount to achieve significant progress, while the services of tech experts and professionals can be utilised to provide periodic information to business owners through organised TV and radio programmes. Notably, this is a novel study that focuses on new cross-border payments in sub-Saharan Africa.

Keywords

E-payment, PAPSS, intention to use, MSME, cross-border payment, sub-Saharan Africa

JEL Classifications: M15, M31, L81, Q55, P45, O55, O33

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Introduction

The era of digital technology is tremendously transforming the global economy. This is inclusive of the sub-Saharan African economy where technology has continued to thrive in changing the dynamics of business operations for micro, small and medium enterprises (MSMEs) in product offering, services and payment processes. Typically, economies like the Nigerian economy have shown rapid progress in the adoption of digital innovations like e-payment (Igudia, 2018). These are driven by factors such as interoperability, the mobile-first generation that loves instant payments, the informal sector demand for transparency, the rising use of m-payments and the demand for frictionless payments (Nairametrics, 2023a). Despite the progress, African MSMEs are cumbered with several challenges such as poor level of information technology (IT) skills (Igudia, 2018), deficient financial infrastructure, high exclusion rate (Oyelami et al., 2020) and poor IT infrastructure that mostly appear in form of network instability (Abdulmumin, 2020). In the midst of these challenges, Nigerian MSMEs have continued to demand for an innovative payment system that will improve the efficiency and performance of their businesses (Thisday, 2023).

In Nigeria, the activities of MSMEs constitute 96% of total operating ventures in different economic sectors, with 73% of sole proprietorship businesses representing the highest in ownership structure (PwC, 2020). MSMEs are about 41.5 million in Nigeria (Small & Medium Enterprises Development Agency of Nigeria and National Bureau of Statistics, 2017). They contribute significantly to economic growth and development, employment growth and industrialisation (National Bureau of Statistics, 2019). Statistically, they contribute about 77% of workforce employment, 50% of gross domestic product and 8% of exports

(PwC, 2020). Despite the contributions to the national economy, the export contribution is poor compared with MSMEs' 49.4% and 68% contribution in India and China, respectively (Taiwo-Oguntu, 2022). The factors accounting for this include MSMEs' poor competitiveness, inadequacy of finance, policy and regulatory issues that hinder MSMEs' development, poor linkage to the potentials of regional markets and lack of policies that promote MSMEs' participation in regional markets (Okojie, 2022). However, the role of technology in the global economy, its application in MSMEs' operations, IT skill and knowledge needs of owners, need for instant payments and the competitiveness of the sector are recognised to be critical in improving the contribution of MSMEs in cross-border trades (Taiwo-Oguntu, 2022).

Remarkably, Nigeria's MSME industry has the highest number of businesses in the sub-Saharan region at 99.8% and is the greatest contributor to employment generation at 84% (PwC, 2020). These MSMEs' survival rate after five years of operation is about 20% because of the challenges associated with compliance regulations and multiple taxes, insufficiency of cashflows and issues with obtaining finance (Enabling Business Environment Secretariat, 2021). The industry is cumbered with delayed payments, cashflows and revenue challenges because of associated terms of trade policies (PwC, 2020). Though upskilling, business digitalisation and integration of technological advancements are gaps to be covered in the industry (PwC, 2020), the industry records an abysmal adoption rate of innovations (Igboeli & Bisallah, 2020). Generally, their performance is impacted by rising inflation, high interest and exchange rates, the pressure to reduce the price of their products (PwC, 2020), while the existing payment infrastructure badly impacts access to forex (Abraham, 2023). Banks are the major institutions involved in cross-border payments in the sector with studies indicating that 61% of MSMEs prefer banks' solutions to 19.5% of MSMEs opting for fintech solutions (Abraham, 2023). However, MSMEs feel comfortable with the banks across sub-Saharan Africa because of years of business and trust in the system (Abraham, 2023). Recently, fintech such as NALA, eTranzact and Flutterwave have evolved to offer services to MSMEs in Nigeria to accelerate commerce in the region (Michael, 2023).

Payments in Africa are majorly through real-time gross settlement systems (RTGS) transfers (Interledger Foundation, 2021). Recently, the African Export–Import Bank (Afreximbank) and African Continental Free Trade Agreement (AfCFTA) introduced the pan-African payment and settlement system (PAPSS), which is driven towards promoting cross-border payments in the African market (KPMG, 2021). African payment systems are highly fragmented (Interledger Foundation, 2021). PAPSS serves as a centralised payment settlement system for promoting the instant payment of product purchases across national frontiers in Africa. It 'is a central financial market infrastructure that supports payment arrangements for the purpose of expanding the international trade of African states, and to facilitate central bank's economic and financial integration' (Stanbic IBTC, n.d., p. 1). The goal is to drastically minimise reliance on third currency in payment for goods, positively impact e-commerce in Africa and facilitate instant payments and safety of business transactions (Aro, 2022). It has been successfully

piloted in Nigeria, Ghana, Guinea, Gambia and Liberia with further planned rollouts in 2023 at Zimbabwe, Zambia and Djibouti (Rwandapost, 2023). The goal is to boost African trade by executing payments in local currencies since payments are the lifeblood of trade (Aelex, 2022). The cutting-edge technology requires a participating bank or payment service provider to sign up to the system and prefund the settlement account (KMPG, 2021). With this, instant payments occur in local currencies once the importer issues payment instructions to the participant bank (KMPG, 2021), thereby enabling payments and receipts in local currency (Aelex, 2022). The issue with exchange rates is resolved through PAPSS as it is available to the participating bank and communicates to the importer. The process occurs instantaneously or near instantaneously (KPMG, 2021). The key advantage to the entrepreneur and MSMEs is facilitation of intra-African trade and cross-border payments (Aelex, 2022), minimisation of heavy reliance on third currency, provision of low-cost measure and risk-controlled instant payment (Stanbic IBTC, n.d.). The major attraction to entrepreneurs and MSMEs is the chance of instantaneous payment (Aelex, 2022).

However, the e-payment system in Nigeria is characterised by online transfers, automated teller machine (ATM) transactions, mobile money operators (MMOs), point of sale (PoS) transactions, unstructured supplementary service data (USSD) transfers, mobile app transfers (not mobile money), national electronic fund transfer (NEFT), RTGS transfers and direct debts with online transfers accounting for the largest percentage of e-payments (Statista Research Department, 2022). The adoption of e-payment was accelerated by the COVID-19 pandemic leading to 40.9% and 46.5% increases in value and volume of transactions, respectively (Nairametrics, 2023b). This is further deepened by the naira scarcity that increased the adoption of e-payment channels while becoming a menace to users because of the e-payment glitches at the time. However, experience is an important variable in adopting innovation. Extant studies indicate that it arises from an impression (Carbone & Haeckel, 1994) and influences behaviour (Fishbein & Ajzen, 1975) while the level of effort committed to the usage of the system depends on the level of experience (Liebana-Cabanillas et al., 2014). Thus, what are the determinants of MSME owners' intention to adopt PAPSS? To what extent does the level of experience moderate MSMEs' intention to adopt PAPSS? The purpose of the study is to estimate MSMEs' reaction to new payment technology for cross-border payment and evaluate the impact of their level of experience on adoption.

Literature Review

The significance of accepting new technology has made it an attraction to researchers, so studies have continued to evolve with the emergence of technological innovations in the business environment. With the emergence of PAPSS, its successful rollouts and involvement of the banks as partners in the operation, the success can be predicted given the existing business relationships between MSME owners and banks in cross-border transactions. However, banks are not the only parties involved in recent times. The advancements in technology have facilitated the

involvement of fintech in offering opportunities to MSMEs in cross-border payments. For instance, fintech such as AZA Finance that operates in Ghana, Nigeria, Kenya and several other nations (AZA Finance, n.d.), NALA operates in Tanzania, Flutterwave and Lemfi operate in sub-Saharan Africa (Michael, 2023), and while there is the existence of collaborated efforts between banks and fintech such as Access Bank and eTranzact's involvement in Nigeria, Ghana and Kenya (Abraham, 2023); and Access Bank and Thunes partnership that offers cross-border payments across 13 markets in Africa (Moses-Ashike, 2023). The goal of these involvements is to promote cross-border business transactions, facilitate payments and increase the scale of businesses in the region.

However, attracting new users and maintaining old ones are of interest in marketing. With respect to innovation, several models and theories have been used in the literature to study consumer behaviour. Some of them include the technology acceptance model (TAM) (Davis, 1989), diffusion of innovation (DOI) (Rogers, 2003) and theory of reasoned action (Fishbein & Ajzen, 1975). The present study is focused on a model of behaviour that deals with the acceptance of innovation. This includes TAM and DOI. First, the usefulness of TAM in e-payment studies is supported by the robustness of the model, its applicability in different types of technological innovation, reaffirmation of the validity of the theory through studies and its specific ability to deal with factors that influence the adoption of information system (Jeong & Yoon, 2013). The limitation of TAM such as the omission of vital variables (Jeong & Yoon, 2013) has resulted in the combination of the factors with other model's factors (Hidayat-ur-Rehman et al., 2022; Liebana-Cabanillas et al., 2014; Oloveze, et al., 2022a). For instance, Coskun et al. (2022) explored factors influencing the adoption of online payment systems by using TAM and DOI theories to confirm relative advantage as the most important predictor of intention to adopt an online system. In another study involving mobile payments, Ali et al. (2022) integrated the frameworks of TAM, DOI and unified theory of acceptance and use of technology to predict usage behaviour; relative advantage was confirmed as the most significant direct factor influencing intention to use. Schierz et al. (2010) identified compatibility, mobility and subjective norm as the determinants of adopting m-payment services. Liebana-Cabanillas et al. (2014) developed a model that included external influences, trust and risk to original TAM with age as a moderating variable. The result supports the extension of TAM to study innovations. Oloveze et al. (2022a) extended the TAM construct with trust, customisation, risk and subjective norm to study cardless cash and consumer psychology in Nigeria and discovered that customisation is the most vital significant determinant of intention to use. Sheng et al. (2011) demonstrated that perceived usefulness, ease of use, compatibility and perceived risk are significant determinants that influence the acceptance of mobile banking. Finally, Yang et al. (2012) considered the effects of behavioural beliefs, social influence and personal traits to confirm perceived risk, compatibility, personal innovativeness in IT, subjective norm, relative advantage and perceived fee as significant determinants of m-payment service adoption across time. In this regard, the present study

considered the adoption of PAPSS by MSMEs through factors of TAM and DOI models by including experience as a moderating variable on intention to use PAPSS.

Hypotheses Development

Ease of Use

Ease of use (EoU) is the perception that users have about an innovation specifically in being less complicated to use or simple in application. It is a key variable of Davis' (1989) TAM. It is argued to influence perceived usefulness (Hossain et al., 2017) but not supported as a direct influence on behavioural intention (Davis, 1989). Thus, TAM suggests a simultaneous influence on intention particularly from self-efficacy and instrumentality. It has been variedly applied in the study of innovations such as online shopping (Oloveze et al., 2022b) and location-based studies (Hossain et al., 2017). With respect to PAPSS, it is believed that as a novel payment system, it should be simple in application and implementation, thereby making it a better option than the existing payment system. Thereto, the authors consider a nexus between EoU and relative advantage when the implementation by users is perceived to be simpler than the existing option. Thus, we hypothesise:

H_1: EoU is positively related to perceived usefulness towards adopting PAPSS.
H_2: EoU is positively related to the relative advantage towards adopting PAPSS.

Perceived Trust

Perceived trust is a perception of being trustworthy, maintenance of promised security and a psychological state of entrusting reliance and confidence in expected payment outcomes. It is often associated with the confidentiality of data and level of integrity in service usage (Kalinic et al., 2019). It is vital in the acceptance of innovations (She et al., 2017) given its significant role in the pre-adoption and post-adoption of innovations (Talwar et al., 2020). Studies suggest that it can positively improve perceived usefulness (Liebana-Cabanillas & Alonso-Dos-Santos, 2017) and intention (Ali et al., 2022). It can improve users' recognition of the superior benefit of an innovation over an existing one especially where users perceive it to be more reliable, safe, trustworthy and promising than existing options. Thus, we hypothesise:

H_3: Perceived trust is positively related to perceived usefulness towards adopting PAPSS.
H_4: Perceived trust is positively related to relative advantage towards adopting PAPSS.

Ease of Access

The concept of accessibility is gradually integrated into the e-payment system to gain a deeper insight on issues of accessibility by potential innovation users. It is a multidimensional construct that consists of computer, and information accessibility, reliability, ease of learning (Rice & Shook, 1988) and system usability (Karahanna & Straub, 1999). In this study, the focus is on system usability, accessibility to information and reliability of the novel payment system. Extant studies suggest a relationship between ease of access and system usability, thereby enhancing adoption (Poon, 2008). Accessibility is claimed to influence users' perceived usefulness of a system (Fonchamnyo, 2013) such that it improves the potential of future usage (Liebana-Cabanillas et al., 2013). Where accessibility to use PAPSS is perceived to be simple to make and receive payments instantly than existing option, users will most likely have positive reactions to its use. Therefore, we hypothesise:

H_5: EoA is positively related to perceived usefulness towards adopting PAPSS.
H_6: EoA is positively related to the relative advantage towards adopting PAPSS.

Perceived Compatibility

The concept of compatibility is one of the technological characteristics that influence adoption. It deals with the extent of consistency in values, beliefs and previous experiences associated with the potential user (Rogers, 2003). Intention to adopt innovation is enhanced where there is compatibility between the potential users' needs and the technology offerings (Hidayat-ur-Rehman et al., 2022). Studies suggest its influence on perceived usefulness (Ramos-de-Luna et al., 2017) and intention to use (Schierz et al., 2010) especially when there is coherence between the potential adopters' values, lifestyle and innovation characteristics. Further, the offer of a superior experience is associated with compatibility where users' values and lifestyles are consistent with the choice of better ways of doing things. Thus, where users perceive that the innovation will offer a better experience, it will improve the chance of adoption. Therefore, we hypothesise:

H_7: Perceived compatibility is positively related to perceived usefulness towards adopting PAPSS.
H_8: Perceived compatibility is positively related to the relative advantage towards adopting PAPSS.
H_9: Perceived compatibility is positively related to the intention to adopt PAPSS.

Perceived Usefulness

Perceived usefulness is one of the vital variables of TAM. It is the degree to which an innovation is able to improve users' performance (Davis, 1989). The innovation must offer utility to potential users to have any chance of adoption (Oloveze et al., 2021). Studies suggest that it impacts intention to use (Ali et al., 2022). In this study, the key usefulness is the intended promotion of cross-border trade and instant payment in local currency, and minimisation of excessive dependence on third currency. Therefore, we hypothesise:

H_{10}: Perceived usefulness is positively related to intention to adopt PAPSS

Relative Advantage

In e-payment, every new technology is considered to have an edge over older ones given that it is a requirement for the sustenance and survival of new technology (Utomo et al., 2022). Relative advantage is a concept that considers an innovation to be better in benefit offering, performance and utility than existing ones (Khanra et al., 2021). In the e-payment system, it consists of better benefits of time utility, transparency of transaction, security and superior satisfaction (Moncada et al., 2022). Studies confirm its effect on intention to use (Ali et al., 2022; Hidayat-ur-Rehman et al., 2022). Therefore, we hypothesise:

H_{11}: Relative advantage is positively related to intention to adopt PAPSS.

Experience

Experience is a concept that has gained the attention of professionals given its applicability in various fields. However, Bilgihan et al. (2016) argue that information on experience is fragmented. Experience is the impression carried by the user after being in contact with a product or service, and this forms or consolidates perception (Carbone & Haeckel, 1994). It influences current behaviour where the previous experience is positive about an item (Fishbein & Ajzen, 1975) so that higher use experience with previous innovations positively influences the adoption of similar innovations. This is often influenced by higher benefits and less invested efforts such that potential users with a low level of experience are motivated by intrinsic and extrinsic benefits to the extent that they invest more time (Liebana-Cabanillas et al., 2014). Extant literature indicates the existence of contrasting results. Hernández et al. (2009) and Liebana-Cabanillas et al. (2014) argue that users with a low level of experience consider usefulness more in their intention to adopt a system. Experience has the tendency to produce deep impacts on consumer/user memory especially when it is associated with the benefits and features of an item (Chase & Dasu, 2014). In this context, it includes a blend of knowledge and occurrences that can collectively shape user attitude and behaviour. Users with experience of similar

innovation or common IT skills will appreciate the usefulness, thereby improving the user's perception of usefulness and usage. Extant literature suggests that users with IT experience and previous experience of related innovation are more likely motivated by the usefulness in improving efficiency and performance (Dholakia & Uusitalo, 2022), which in turn has improved positive influence on users' intention (Liebana-Cabanillas et al., 2014; Niemelä-Nyrhinen, 2009). Similarly, users with an increased experience of related innovation are more likely to understand and appreciate the better utility, performance and benefit of an innovation compared with existing options. The relative advantage is anchored on a previous experience of users in being able to discover the difference between existing options against PAPSS innovation. Increased user experience of the operation of IT or similar innovation tends to create a pathway for users' mental assessment of the available options to the users. Thus, with regard to the moderating effect of experience, the users with a low level of experience in IT or similar innovation will require a higher perception of usefulness compared with the users that are more experienced. Though some studies revealed no moderating effect of experience on the relationship between perceived usefulness and intention (Castaneda et al., 2007; Gefen et al., 2003), others suggest a significant moderating effect (Liebana-Cabanillas et al., 2014). Similarly, with relative advantage, the ability of the users to understand and perceive the difference between the utility of two different innovations is anchored on the level of the users' experience. This will suggest that usefulness and relative advantage are more important to users who are inexperienced. This is because studies suggest that the impact of experience in moderating the effect of usefulness and relative advantage on intention tends to reduce with time because of the knowledge that the user was able to acquire through experience (Taylor & Todd, 1995; Venkatesh et al., 2003). Therefore, any innovation such as PAPSS can be evaluated using previous experience. This will lead to different levels of user perception of usefulness and relative advantage towards intention to use. In this study, perceived usefulness is posited to be moderated by experience so that the effect of perceived usefulness on intention to use PAPSS is higher among MSMEs with a low level of e-payment experience. The impact of relative advantage on intention to use is posited to be higher among low-level experienced users of e-payment, considering that the insufficient experience will make them pay more attention to the better and improved benefits as motivation for adoption. Therefore, we hypothesise:

H_{12}: The effect of perceived usefulness on intention to use PAPSS is significantly higher among MSMEs with low e-payment experience.

H_{13}: The effect of relative advantage on intention to use PAPSS is significantly higher among MSMEs with low e-payment experience.

Research Methodology

Measurement Development

The questionnaire items were adapted from the literature. Figure 1 shows the conceptual model of the study and the different paths in the model.

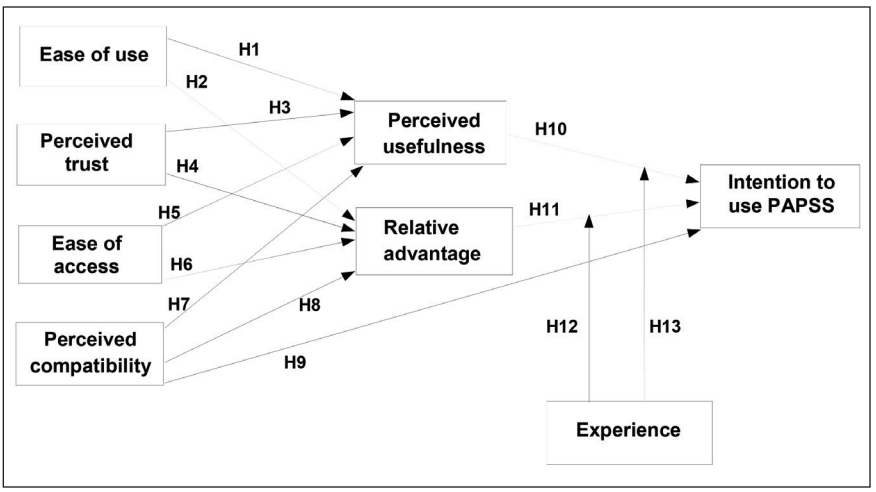

Figure 1. Conceptual Model.

Perceived usefulness, EoU and compatibility were adapted from Schierz et al. (2010). Each variable was measured with four items. Intention to use was adapted from Davis (1989) and measured with three items. Ease of access was adapted from Liebana-Cabanillas et al. (2013) and measured with four items. Perceived trust was adapted from Liebana-Cabanillas et al. (2014) and measured with three items. Relative advantage was adapted from Moore and Benbasat (1991) and measured with three items. The questionnaire was designed on 7-point Likert scale. Preliminary checks were done for reliability and suitability of the scale using experts in the field.

Data Collection

Data were collected through self-administration and online methods using a questionnaire designed on Google Form. The link was shared to first contacts while snowball sampling was also adopted to share the link to other appropriate respondents. The MSME owners were selected from a cluster of MSMEs who accept the e-payment channel in their business. A total of 314 samples were drawn. Twenty-nine (9.2%) copies were screened out for not having used the e-payment channel in their business, thus making the valid forms used to be 285 (90.8%).

Results

The results from the respondents revealed that out of the 285 valid forms, 76% of male owners of MSME were represented in the study while 24% of female respondents participated in the survey. This confirms the male dominance of MSMEs in Nigeria, which is consistent with earlier studies (CSEA, 2023). The

age of the respondents revealed that 54% of respondents were below 35 years, while 46% of respondents were above 35 years. With experience, 62.5% had high experience of the usage of e-payment channels while 37.5% had low experience. Studies confirmed that experience can significantly influence the success of entrepreneurial ventures (Genty et al., 2015). This is consistent with the adoption of practices and payment methods that MSME owners perceive can improve performance.

Confirmatory Factor Analysis: Reliability and Validity

STATA and SPSS 21 were used in the analysis. Common method bias (CMB) was conducted through Herman's single-factor test by adjusting all items to a single factor using an unrotated option. The result of 50% indicates that CMB is not a problem. Confirmatory factor analysis was executed for reliability and validity using varimax rotation with Kaiser normalisation. The Kaiser–Meyer–Olkin is 0.928, thereby confirming sampling adequacy. Bartlett's test of sphericity value of 6560.781 at $p = 0.000$ confirms the rejection of the null hypothesis of no difference in the variance of the responses. It validates data suitability for factor analysis. Reliability was executed through Cronbach's alpha, composite reliability and average variance extracted using thresholds of 0.6, 0.7 and 0.5, respectively

Table 1. Measurement Model Evaluation.

Variable	Item	Factor Loads	Cronbach Alpha	Composite reliability	Average variance extracted	R^2
Ease of use	PEoU2	0.817	0.87	0.81	0.59	–
	PEoU3	0.747				
	PEoU4	0.729				
Perceived usefulness	PU1	0.742	0.95	0.85	0.58	0.80
	PU2	0.774				
	PU3	0.770				
	PU4	0.759				
Perceived trust	PT1	0.721	0.94	0.76	0.52	–
	PT2	0.727				
	PT3	0.712				
Relative advantage	RA1	0.669	0.85	0.65	0.50	0.82
	RA2	0.711				
Perceived compatibility	PC1	0.827	0.91	0.82	0.61	–
	PC2	0.781				
	PC3	0.729				
Ease of access	EoA1	0.808	0.84	0.90	0.74	–
	EoA2	0.881				
	EoA3	0.896				
Intention to use PAPSS	INT1	0.756	0.93	0.83	0.62	0.74
	INT2	0.808				
	INT3	0.794				

(Hair et al., 2006). The result in Table 1 shows that the thresholds were met, thereby confirming the reliability of the instrument. Validity was executed using convergent validity through the factor loadings of the indicators. All the loadings were above 0.6 (Bagozzi & Yi, 1988), thereby confirming the validity of the instrument. However, ease of use, perceived compatibility, ease of access and relative advantage were not added to the analysis because the loadings were less than 0.6. Therefore, relative advantage was measured with 2 items. This is accepted in situations where the two retained items have high correlation (that is $r > 0.70$) and fair uncorrelation with other variables (Worthington & Whittaker, 2006; Yong & Pearce, 2013). In this case, the r value of RA1 and RA2 is 0.768.

Testing of Hypotheses

Structural equation modelling (SEM) through maximum likelihood and the Hayes process model for moderation were used in the analysis. First, the fit of the structural model was confirmed through the goodness-of-fit indicators following the recommendations in the literature. The values for all the indicators exceed the recommended thresholds in literature except the chi-square value as shown in Table 2. Chi-square is influenced by large samples as obtained in the present study. The R^2 value (0.926) of the model further confirms the fit of the structural model. R^2 is a reliable indicator of variance explained in the model which should be closer to 1 (Falk & Miller, 1992).

Second, the paths were examined through standardised estimates, statistical significance and critical ratio of the paths as shown in Table 3 and Figure 2. Ten of the 11 assessed paths were significant. The findings revealed that EoU is positive and significantly related to perceived usefulness and relative advantage. Therefore, the result supports H_1 ($\beta = 0.62$, $p \leq 0.001$) and H_2 ($\beta = 0.26$, $p \leq 0.001$). Further, H_3 ($\beta = 0.21$, $p \leq 0.001$) and H_4 ($\beta = 0.19$, $p \leq 0.001$) were confirmed, thus proving the significant effect of perceived trust on perceived usefulness and relative

Table 2. Model Fit Indices.

Fit Indices	Recommended Value	Value in the Model	Reference
$\chi^{2/df}$	<5	22.599	Bentler and Paul (1996)
RMSEA	<0.08	0.080	Hu and Bentler (1999)
CFI	>0.90	0.986	Bentler and Paul (1996)
TLI	>0.90	0.947	Schumaker and Lomax (2016)
SRMR	<0.08	0.013	Pituch and Stevens (2016)
R^2(PU)		0.797	
R^2(RA)		0.820	
R^2(INT)		0.714	
Overall R^2		0.926	

Note: RMSEA = root mean squared error of approximation; CFI = comparative fit index; TLI = Tucker–Lewis index; SRMR = standardised root mean squared residual; RA = relative advantage; INT = intention to use.

Table 3. Hypothesised Relationships.

Hypotheses	Std. β	SE	Z	P	Decision
H_1: Ease of use → Perceived usefulness	0.62	0.04	16.21	0.000	Yes
H_2: Ease of use → Relative advantage	0.26	0.04	6.73	0.000	Yes
H_3: Perceived trust → Perceived usefulness	0.21	0.04	4.83	0.000	Yes
H_4: Perceived trust → Relative advantage	0.19	0.04	4.80	0.000	Yes
H_5: Ease of access → Perceived usefulness	0.05	0.03	1.64	0.101	No
H_6: Ease of access → Relative advantage	0.09	0.03	3.28	0.001	Yes
H_7: Perceived compatibility → Perceived usefulness	0.12	0.04	2.86	0.004	Yes
H_8: Perceived compatibility → Relative advantage	0.51	0.04	13.24	0.000	Yes
H_9: Perceived compatibility → Intention to use PAPSS	0.50	0.06	8.28	0.000	Yes
H_{10}: Perceived usefulness → Intention to use PAPSS	0.36	0.05	7.01	0.000	Yes
H_{11}: Relative advantage → Intention to use PAPSS	0.25	0.07	2.70	0.087	Yes

Moderating Effect	High Experience				Low Experience				
Hypotheses	Coeff	SE	t	p	Coeff	SE	t	p	F
H_{12}: RA→ Intention to use PAPSS	0.60	0.04	13.47	0.000	0.82	0.05	15.26	0.000	9.93**
H_{13}: PU→ Intention to use PAPSS	0.70	0.04	16.60	0.000	0.85	0.05	17.36	0.000	5.69*

Notes: **p-value < 0.001; *p-value <0.05.

advantage, respectively. H_5 was rejected, thereby revealing that ease of access does not influence perceived usefulness. However, H_6 ($\beta = 0.09$, $p \leq 0.001$) is supported, thereby confirming the significant effect of ease of access on relative advantage. H_7, H_8 and H_9 were from perceived compatibility. The findings reveal that perceived compatibility significantly influences perceived usefulness, relative advantage and intention to use PAPSS. Therefore, the results confirm and support H_7 ($\beta = 0.12$, $p \leq 0.05$), H_8 ($\beta = 0.51$, $p \leq 0.001$) and H_9 ($\beta = 0.50$, $p \leq 0.001$), respectively. Also, the results show that perceived usefulness and relative advantage have positive and significant influence on the intention to use PAPSS. The results support and confirm H_{10} ($\beta = 0.36$, $p \leq 0.001$) and H_{11} ($\beta = 0.25$, $p \leq 0.1$).

The moderating effect of experience is illustrated in Table 3 and Figure 2. The Hayes process was adopted in assessing the moderating effect of experience on intention to use PAPSS. The continuous items were mean centred. The 5000 bootstrapping method was used with the 95% confidence level for confidence intervals and the bias-corrected bootstrap CI method. The result confirms that

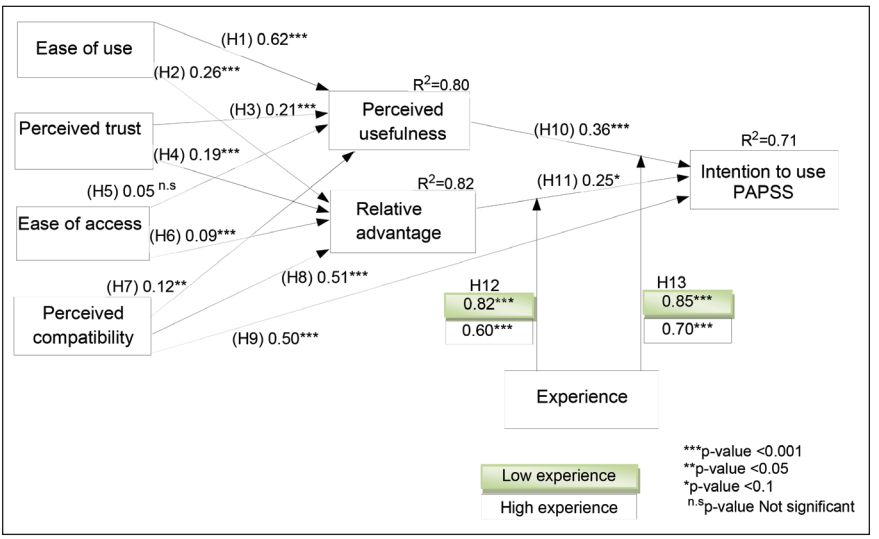

Figure 2. Result of Conceptual Model.

experience significantly moderates the effect of perceived usefulness and relative advantage on intention to use PAPSS between the two groups. This is supported by the *p* values of the estimates H_{12} (β = 0.82, $p \leq 0.001$) for low experience and (β = 0.60, $p \leq 0.001$) for high experience with a significance difference (*f*-value = 9.93, $p \leq 0.001$). With perceived usefulness, the hypothesis is confirmed H_{13} (β = 0.85, $p \leq 0.001$) for low experience and (β = 0.70, $p \leq 0.001$) for high experience with a significance difference (*f*-value = 5.69, $p \leq 0.05$).

Discussion, Implications, Conclusion and Limitation

Discussion of Results

The purpose of the study is the reaction of MSMEs to the cross-border novel payment system and the impact of their level of experience on intention to adopt the innovation. The structural model was validated, thus proving the three-layer model to be a good fit in the estimation. Notably, the model was anchored on the innovation characteristics of PAPSS through relative advantage and the personal characteristics of MSMEs' potential users through perceived usefulness. The model proved that the indirect effect in the first layer (EoU, perceived trust, ease of access and perceived compatibility) influences the variables in the second layer (perceived usefulness and relative advantage), whereas the second layer estimates confirm the direct effect on intention to use PAPSS. Perceived compatibility is estimated indirectly and directly because of the significance of the alignment of values and believes with characteristics of innovation. This is confirmed in the study. Further, the relationship between the second layer and intention to use PAPSS was tested and confirmed. Thus, with the support of the paths, the results are discussed.

First, EoU is the most significant determinant of perceived usefulness among the variables. Previous studies indicate the importance of simplicity of innovation and effortlessness in usage as a condition for the success of adoption. It aligns with previous studies on technological payment innovation (Liebana-Cabanillas et al., 2014; Oloveze et al., 2022b; Ramos-de-Luna et al., 2017) and confirms its important role in the adoption of payment innovation in developing nations. Thus, EoU is the strongest indirect factor for PAPSS greater penetration in Nigeria and sub-Saharan nations where PAPSS has been piloted. Further, the relationship between EoU and relative advantage proves that the adoption of PAPSS is facilitated when its application and usage are easier and better than the previous existing payment option. Therefore, projecting the EoU is fundamental. This demands the use of strategic marketing communications by the right sources such as the participating bank, apex bank and service providers to disseminate the relative advantage of PAPSS on effortlessness is usage.

Second, perceived trust is positive and significantly related to perceived usefulness as the second most important factor. This is similar to earlier studies on payment innovation (Liebana-Cabanillas & Alonso-Dos-Santos, 2017). The result reveals the significant role of trust in pre-adoption, thereby deepening the emphasis on users' trust in a reliable payment system that delivers on promises. Regardless of the promises of the technology, consistency in reliability, trustworthiness and offer of better performance than previous innovation is critical in motivating MSME users to adopt PAPSS. Further, trust is associated with a relative advantage, though the relationship is weak. However, it indicates the importance of deepening trust issues around the new payment system and projecting the superior security it has over existing options. Customers and users of the payment system tend to patronise a payment system that offers better security and superior benefits. Designing strategies to promote the benefit is necessary for improved adoption.

Third, perceived compatibility is theorised as a direct and indirect determinant of intention to use PAPSS. The positive results are confirmed in the literature (Ramos-de-Luna et al., 2017; Schierz et al., 2010). The implication is that the coherence of the characteristics of PAPSS with the MSME users' values and lifestyles is vital in adopting PAPSS. Thus, the innovation characteristics should be tailored to the lifestyle of users and their values while aligning it with their past experiences on e-payment. Though the relationship is weak on perceived usefulness, the effect on relative advantage and intention to use PAPSS is the highest, thereby revealing compatibility as the most significant direct predictor of relative advantage and intention to use.

Fourth, ease of access is proven to be associated with relative advantage, though the effect level is weak. The positive result aligns with earlier results (Fonchamnyo, 2013). Thus, the adoption of PAPSS is dependent on better usability, better access to information and more reliability of the system. With this potential, future usage is improved where MSMEs perceive better benefit of accessibility in making and receiving instant payment for e-commerce transactions than existing payment options. This implies that there is a need to design friendly policies that encourage MSME users' adoption of PAPSS. Communicating the

benefit to MSMEs is essential to enable them to gain better information on the new payment technology.

Fifth, perceived usefulness significantly predicts intention to use PAPSS. The positive result is consistent with TAM and earlier studies (Ali et al., 2022; Davis 1989; Oloveze et al., 2022b). MSME users place value on PAPSS from its ease of handling payments and promotion of instant payments in local currency. Further, the result contributes to the existing body of knowledge by validating the path between usefulness and intention to use new payment technology.

Sixth, the moderating effect of experience between relative advantage and intention to use PAPSS is higher among users with low experience than those with high experience. The result indicates the important role of knowledge, and IT skill and innovativeness in adoption. Where MSME users have a low level of experience, the tendency to pay more attention to better benefits of the innovation over the existing payment system is justified.

Seventh, experience moderates the influence of perceived usefulness on intention to use PAPSS. The influence is higher among users with low experience with the e-payment system, thereby proving consistency with earlier studies (Hernández et al., 2009; Liebana-Cabanillas et al., 2014). Those with a low e-payment system experience are motivated by intrinsic and extrinsic benefits as well as the usefulness of the innovation than ones with high experience in the e-payment system. Notably, users with low experience will commit more effort and seek more information to understand the usefulness than ones with high experience.

Implications and Contributions

The implications of the findings border on the theoretical contribution and managerial implication. This is a novel study following the novelty of the innovation, its localisation and drive to contribute to improved commerce within sub-Saharan Africa. It involved a three-layer model to identify the direct and indirect effects of the variables that influence MSMEs' intention to use PAPSS. Theoretically, the result confirms that perceived compatibility has the strongest direct impact on the intention to use PAPSS. Perceived usefulness and relative advantage also had a direct effect on intention to use PAPSS. The model also confirmed the indirect influences on the intention to use PAPSS. This includes EoU influence on perceived usefulness and relative advantage; perceived trust influence on perceived usefulness and relative advantage; ease of access path to relative advantage; and perceived compatibility path to perceived usefulness and relative advantage.

From the managerial perspective, the focus should be on aligning the operation and use to the users' previous experience, values, needs and beliefs of technology being able to impact business. In this regard, the involvement of the apex banks and commercial banks is paramount in creating and deepening communication on its values and contribution to business operations. The promotional communications should emphasise the difference and how it is better than earlier options. Second, the low values of perceived usefulness and relative advantage suggest the need to provide more information on its usefulness to the businesses and on how

the innovation is superior in performance compared with the earlier options in existence. Further, since experience is established to have a moderating influence in the study, the services of tech experts and professionals can be utilised to provide information to business owners through either organised TV programmes, commercials or sponsored awareness programmes. Notably, the adoption of this innovation reveals that where it is connected to the users' beliefs, values and previous experience, the volume of trade will increase, and more MSMEs will use it while its potential will gain further attraction in other regions.

Conclusion

The study considered the moderating effect of experience on intention to use PAPSS. A three-layer model was used to identify the significant factors and the moderating effect of experience on the relationships. The model was tested using SEM analysis and the Hayes process. The model evaluation proved that the model was appropriate and a good fit. The results of the analysis provided an understanding that the variables have linear relationships towards MSMEs' intention to use PAPSS. The major variable with the strongest direct significant effect is perceived compatibility while EoU has the strongest significant indirect effect. The result from experience further proved that experience has a significant role in intention to use PAPSS. MSMEs with low experience have a higher perception of usefulness and relative advantage to the intention to use PAPSS than ones with high experience. However, the study had a number of limitations.

Limitation and Suggestion for Further Studies

One of the few limitations is the localisation of the study to Nigeria. Nigeria is one of the five African states where the innovation has been rolled out. Therefore, in line with future studies, the direction can be on the integration of the operation of PAPSS among MSMEs in different geographical locations. Another limitation is that the study adopted a cross-sectional survey, thereby limiting the evolvement of users' behaviour to the innovation that occurs with time. This calls for a longitudinal survey to provide deeper insight into the predictors of MSME users' intention to adopt PAPSS. This will deepen the robustness associated with the path relationships. The use of a non-probabilistic sampling technique is another key limitation given that samples were not randomly selected. Thus, future studies can adopt a probabilistic sampling approach given that it can impact external validity. Further, future studies should consider the inclusion of more variables and estimate how firm readiness and innovativeness of owners can mediate the predictors of PAPSS usage.

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Article

Payment Digitization and Industrial Activity Nexus: Comparative Evidence from Key Sub-Saharan African Economies

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Abstract

This study investigates how digital payment affects industrial sector activity in selected Sub-Saharan African countries. The selected countries are Nigeria and South Africa, which are the largest economies in the sub-region with rapid adoption of digital payment. The investigation is motivated by the strategic importance of the payment system in facilitating industrial production and turnover. The methodologies of unrestricted error correction model (UECM) and dynamic ordinary least squares model (DOLS) are employed in the study. The UECM results show that the adoption of digital payment impacted significantly on industrial sector activity in both countries. The impact is, however, lower than the impact of physical capital, human capital, and personal income. The positive role of digital payment is, therefore, strongly complemented by the three variables. On the other hand, trade openness has an insignificant effect, which indicates a relatively weak role in facilitating industrial activity. The DOLS results are not significantly different from the UECM results, which indicates that the estimated impacts on industrial activity are consistent. The findings suggest the need to deepen the digital payment system, in order to sustain its role in industrial production and expansion. This could be done by strengthening the internet technology that is used in digital payment. Furthermore, the role of physical and human capital needs to be sustained by encouraging capital investment, while that of personal

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income may be sustained by reducing income tax. The low effect of trade openness could be improved by controlling the import of industrial goods.

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Introduction

Financial transactions in developing countries are predominantly based on cash payments. However, the evolution of digital payment has significantly reduced dependence on cash payment, which seems to have influenced the level of industrial activity in most developing economies, particularly in Sub-Saharan Africa. The increasing adoption of digital payment in these countries reflects the perception that it has some economic advantages over cash payment. Indeed, it is argued that digital mode of payment tends to encourage activity in various sectors of the economy (Chen & Xie, 2019). It also facilitates international transactions and inflows of foreign investment to different sectors of the economy, leading to faster growth. Over the last decade, some countries in Sub-Saharan Africa, have witnessed a considerable shift from cash payment to digital payment, following the implementation of digital payment policy. However, the effect of this shift on industrial activity has remained a contentious issue.

Some economists argue that digital payment promote industrial activity by increasing product turnover. Furthermore, industrial activity is encouraged as foreigner can easily transfer funds to buy products of domestic industries. This view is supported by Li and Liu (2005) and Vertakova et al. (2015), who posited that such foreign transactions promote the growth of industries, directly and indirectly, through an increase in production and export of industrial goods. Some economists, on the other hand, hold the view that digital payment encourages foreign buyers of domestic manufactures, which may only have short-term positive effect on industrial activity. In support of this argument, Aga (2014) and Pandya and Sisombat (2017) posited that digital payment system that is not secured may discourage foreign buyers and slow industrial sector activity in the long run.

In spite of the contentions revolving around the role of digital payment, it is largely considered to be a potential driving force of industrial sector activity in developing countries. However, it is not yet clear whether this assertion holds true in the two leading economies of Sub-Saharan Africa, namely, Nigeria and South Africa. This study, therefore, attempts to investigate the role of digital payment in facilitating industrial sector activity and its policy implications in the selected countries. More precisely, the study aims to determine the short-run and long-run effects of digital payment on industrial sector activity. This issue has yet to be given adequate attention in empirical studies of Sub-Saharan African countries.

The two countries under investigation have witnessed rapid adoption of digital payment over the period 2012–2022. In Nigeria, which is the largest economy in Sub-Saharan Africa, the volume of digital payment rose astronomically from 428.2 million in 2012, to about 25.13 billion in 2022 (Nigeria Bureau of Statistics, 2022). Similarly, South Africa, which is the second largest economy in Africa, witnessed tremendous increase in volume from 117.22 million in 2018, to about 8.39 billion in 2022 (International Trade Administration, 2023). Other countries have also witnessed the same phenomenon, but data are not yet available to investigate them.

The investigation is carried out by employing the unrestricted error correction model (UECM) and the dynamic ordinary least squares model (DOLS). In terms of scope, the study covers the period 2012Q1–2022Q4. It is structured into six sections comprising an introduction, literature review, empirical methodology, empirical results, policy implications and imperatives, and conclusion.

Literature Review

The theoretical literature on industrial sector activity draws heavily from the neoclassical and endogenous theories of growth (Grossman & Helpman, 1990; Romer, 1990; Solow, 1956; Swan, 1956), which relate production activity to physical and human capital. Therefore, physical and human capital form the basic factors in the theory of industrial sector activity (Kiely, 1994). However, there were concerns that these factors alone do not adequately explain industrial activity, which led to further extensions of the theory (Rahman, 2010; Sugihara, 2019). One such extension was propounded by Banerjee (2000), which links industrial sector activity to the state of the capital market. According to the theory, if the capital market is underdeveloped and unable to mobilize long-term funds, industrial sector activity remains low. In this situation, opportunities with high returns may abound for industries, but inadequate resources become a major constraint to expansion (Legros & Newman, 1995). Industries would, therefore, be characterized by slow growth. On the other hand, when the capital market is fairly well developed and able to mobilize long-term funds for industries, there would be rapid growth in activity, as well as sustainable development in the industrial sector (Morduch, 1990).

Another extension of the theory emphasized the important role of government in facilitating industrial growth (Tongxina et al., 2011). This model is derived from the Japanese experience that positively relates industrial performance to a policy environment that promotes market forces and competition. This model has remained the main attraction for developing countries aspiring to achieve rapid industrial growth similar to that of Japan and China. Furthermore, Worku (2010) posited that electronic payment drives industrial activity by lowering the cost of business.

The empirical aspect of industrial sector activity presents a considerable array of studies on its determinants, but not much has been done on the role of digital payment. However, Saroy et al. (2023) only investigated the role in the banking sector of India within the period 2011–2019, using data envelopment analysis and

dynamic panel data methods. The empirical results showed that greater adoption of digital payment improved cost efficiency but not technical efficiency. This differentiated impact is attributed to a reduction in operational expenses without reducing the level of inputs. Similarly, Kasri et al. (2022) investigated the impact of digital payment on the banking system in Indonesia over the period 2013–2021, using the vector error correction model (VECM) and vector autoregressive model (VAR). The study found that digital payment transactions had a positive long-run relationship with banking stability. Furthermore, it was discovered that digital payment had unidirectional causality on banking stability. Past empirical studies on industrial activity seem to have focused more on other factors affecting the activity. Yang et al. (2021) analysed the transformation of the manufacturing industry of Hong Kong during the period 2008–2018, to determine the factors responsible for the phenomenon. After a careful investigation, it was discovered that technological innovation, scale agglomeration, and market demand were the major drivers, which suggests that appropriate policies are needed to sustain these factors. In a previous study, Vertakova et al. (2015) observed that membership of the World Trade Organization changed the composition of factors influencing industrial activity in Russia. It led to market competitiveness, reduction in state control, increase in cross-border investments, and improvement in credit to the private sector. All these changes caused appreciable growth of the industrial sector, characterized by new technologies and improved product quality. The drivers of industrial production in developing countries were again investigated in a study by Martorano et al. (2017), for two different periods of 1970–1990 and 1991–2014. The countries investigated were selected based on their pattern of industrialization that was considered quite remarkable and sustained over a long period of time. The empirical results revealed that production was driven by a combination of factors including country initial conditions, resource endowments, and geographical location. Other variables that influenced production include investment promotion, openness of the economy, financial development, as well as macroeconomic and institutional stability.

Singh and Kumar (2021) used state-wise panel data to examine the factors affecting industries in India, within the period 2003–2018. The linear, log-linear, and non-linear models were employed in estimating the effects, which revealed that capital formation, credit to economy, and literacy rate, were the strong drivers of growth in industrial sector activity. A previous study of Saudi Arabia by Ali (2020) revealed that the country witnessed rapid expansion in industrial sector within four decades, due to an enabling business environment. The study, however, concluded that there are small manufacturing industries in the country that should be given more attention to achieve substantial growth. It went further to recommend easy credit and technical assistance for the small manufacturing industries. Engidaw (2021) used a different approach to study the effect of country-level factors on micro and small enterprises in Ethiopia, by employing a framework of stratified and random sampling. It revealed a positive relationship between the factors and growth of the enterprises. More precisely, market demand, financial development, and infrastructure had significant positive effect on the level of activity. Among these variables, infrastructure had the most significant effect,

hence the study recommended that more policy attention should be given to provision of infrastructure.

Global value chain (GVC) is also considered to be important in explaining growth in industrial sector activity across countries. Kummritz (2016) provided evidence on the role by using inter-country input-output tables, which revealed that participation in GVC led to higher productivity of industries in all the countries, independent of income levels. More specifically, the study revealed that 1% increase in participation led to 0.11% rise in value-added and 0.33% rise in labor productivity. In a more recent study of industries in Ethiopia, Whitfield et al. (2020) examined the benefits of GVC participation to manufacturing industries in Ethiopia. Generally, it was discovered that participation in GVC did not significantly improve the level of activity in manufacturing industries, due to the fact that industrial policy in the country favored domestic linkages more than global linkages.

Some studies in developing countries have also investigated the role of foreign direct investment (FDI) in industries. In a study conducted by Mishra et al. (2001), 1% increase in foreign investment to Africa was found to boost manufacturing activity by more than 5%, which is considered remarkable in a continent that is characterized by political instability and unfavorable investment climate. Further evidence from cross-country regression by Iamsiroroj and Ulubasoglu (2015), covering selected developing countries, revealed that FDI accelerated growth in industrial sector, especially in countries with a large pool of skilled labor. In these countries, the foreign investments in industries, which were largely channeled through the domestic capital market, led to significant increase in industrial turnover. The capital market was able to sustain the flow of foreign investments to industries, due to its resilience and capacity to hold industries accountable for invested funds. The capital market has been a major player in safeguarding industrial investment, in order to avoid financial crises that may occur due to mismanagement. Such crises have indeed occurred in some countries that opened up their economies to foreign capital (Hausman & Fernandez-Arias, 2000).

Samantha and Liu (2018) again investigated how inflow of foreign investments affected industries in Sri Lanka during the period of economic liberalization (1980–2016), using the autoregressive distributed lag model. The study found insignificant relationship in the short-run and long-run. It concluded that government policy should be focused on attracting more foreign investments with advanced technology capable of increasing industrial productivity. In another study, Inada (2013) examined the effect of foreign investment on industries in China, following the lifting of restriction on entry of foreign affiliates in 2002. The study used industry-level panel data, and found that the industries experienced a significantly larger turnover and export volume. It was also discovered that foreign investment significantly increased productivity of the industries, far beyond the level achieved before 2002.

In a recent study, Adejumo (2020) used Granger causality test to determine the effect of FDI on the manufacturing industries in Nigeria, under regulated and deregulated economic regimes of the period 1970–2015. It was discovered that the causality is unidirectional from FDI to manufacturing output and export, which

supports the view that FDI is a strong determinant of industrial activity. The results, therefore, suggest that FDI is a strategic factor that needs adequate policy attention, in order to achieve rapid industrial sector growth in Nigeria, and indeed, other similar countries. This prescription was also made in an earlier study by Samouel and Aram (2016), underscoring the need for developing countries to formulate viable policies that can attract more FDI that would enhance industrial sector growth. Akpan and Eweke (2017) used VAR method to study the effect of FDI on industrial performance in Nigeria, during the period 1981–2015. It was revealed that FDI and industrial sector growth have a bidirectional causality, suggesting that they positively affect each other. The results, therefore, support the case that FDI significantly affects industrial growth.

So far, empirical studies have attributed growth in industrial sector activity to several factors. However, no study has given adequate attention to the role of digital payment in facilitating growth of industrial sector activity in Sub-Saharan African countries, thus creating a void in existing literature. It is, therefore, important to undertake study that would determine this role and its policy implications in typical Sub-Saharan African countries.

Empirical Methodology

Theoretical Modeling

The neoclassical and endogenous theories of growth emphasize the importance of physical and human capital in facilitating economic activity. It is hypothesized that increase in capital investment leads to expansion of activity in various sectors of the economy. However, it has been discovered that capital investment alone does not determine the level of industrial sector activity, hence Banerjee (2000) and Tongxina et al. (2011) proposed alternative explanations that focused on the role of capital market and policy environment. Furthermore, Worku (2010) proposed an explanation that focused on the important role of payment system in facilitating industrial sector activity. More precisely, electronic payment is posited to have lower cost that encourages industries to grow. This present study takes into consideration the key factors affecting industrial sector activity, with particular focus on the payment system. The payment system has short-run and long-run effects on industrial sector activity.

The model relating industrial sector activity to the various factors may, therefore, be presented in the form of UECM and DOLS. The UECM model is employed because it possesses the capacity to eliminate the problem of endogeneity, and also suitable for estimating both short-run and long-run effects. The model may be derived from the basic framework presented below:

$$IDP_t = f\left[DP_t, PK_t, HK_t, PY_t, TT_t\right] \tag{1}$$

$$IDP_t = \alpha_0 + \sum\nolimits_{j=1}^{5} \alpha_j X_t + \mu_t \tag{2}$$

The framework shows the functional relationships between industrial sector activity and the exogenous variables in (1), with the empirical version stated in (2). The endogenous variable is IDP_t (industrial sector activity), while the exogenous variables are DP_t (digital payment), PK_t (physical capital), HK_t (human capital), PY_t (personal income), and TT (trade openness). The parameters α_j and μ_{it} represent impact and error term, respectively. The framework is transformed to the unrestricted VECM, as shown below:

$$IDP_t = \alpha_0 + \sum_{j=1}^{5} \alpha_j Z_t + \alpha_6 IDP_{t-1} + \varepsilon_t \tag{3}$$

$$IDP_t = \alpha_0 + \sum_{j=1}^{6} \alpha_j Z_{t-1} + \sum_{k=1}^{6} \lambda_k \Delta Z_{i-1} + \upsilon_t \tag{4}$$

Where,

IDP_t = industrial sector activity (endogenous variable)
Z_{t-1} = vector of lagged exogenous variables (j = 1, 2, …., 6)
Δ = first difference operator
α_j = long-run coefficients of exogenous variables
λ_i = short-run coefficients of exogenous variables.

The model shows that industrial activity depends on five underlying variables, and the lagged endogenous variable as indicated in equation (3), in conformity with the theoretical requirements of UECM. On the other hand, equation (4) indicates the short-run and long-run relationships between industrial activity and the variables. The parameters α_j (j = 1, 2, ……., 6) represent long-run coefficients of the exogenous variables, while λ_j (j = 1, 2, . …., 6) are short-run coefficients.

The DOLS model is also constructed to support the UECM model, in order to ensure consistent and dependable estimation results. It is a dynamic equation model commonly estimated to determine the long-run relationship between endogenous and exogenous variables, with the advantage of eliminating the problem of endogeneity (Stock & Watson, 1993). The model in its reduced form is presented in (5). It is made dynamic in (6) by introducing leads and lags. The leads and lags are introduced to minimize serial correlation and correct for endogeneity.

$$IDP_t = \partial_0 + \sum_{j=1}^{5} \partial_j X_t + \epsilon_t \tag{5}$$

$$IDP_t = \partial_0 + \sum_{j=1}^{5} \partial_j X_t + \sum_{j=1}^{5} \sum_{k=-q,\,p}^{n} \pi_j X_{t-k} + \omega_t \tag{6}$$

Where,

IDP_t = industrial sector activity (endogenous variable)
X_t = vector of exogenous variables (j = 1, 2, …., 5)
∂_j = coefficients of exogenous variables

The model simply relates industrial activity (IDP_t) to digital payment (DP_t), physical capital (PK_t), human capital (HK_t), personal income (PY_t), and trade openness (TT_t).

Basic Concepts in the Model

Industrial Activity

This concept refers to a specific branch of economic activity involving production or manufacturing of goods, and provision of services. It encompasses activities by firms engaged in offering similar or different products. These activities are characterized by their unique features, which include product type, technology, and the market they serve. Industrial activity is governed by a set of regulations, and takes place in a competitive environment. Manufacturing represents the major hub of industrial activity. According to International Labor Organization (2023), the other components of industrial activity include construction, mining, electricity, gas, water supply, services, etc. Before the advent of Covid-19, China led the world in manufacturing with over $2.01 trillion output (West & Lansang, 2018), followed by the United States ($1.87 trillion), Japan ($1.06 trillion), Germany ($700 billion), and South Korea ($372 billion). Overall, China, United States, and Japan contributed about 48% of world manufacturing output. The Covid-19 pandemic disrupted manufacturing activity regionally and globally, as manufacturing export of China and Japan dropped by over 17.8% in 2020, but the export of US increase slightly by 0.7% (Chinaorgcn, 2023). However, China was able recover quickly in 2021 and increased manufacturing export by 6.7% to retain its leadership position among the five top manufacturing countries in the world (Kansas City Fed, 2023). According to Safeguard Global (2023), China contributed 28.4% of world manufacturing output in 2023, followed by the United States (16.6%), Japan (7.5%), Germany (5.8%), and India (3.3%). India has made spectacular progress in manufacturing by climbing to the fifth position among world industrial countries.

Digital Payment

This system of payment involves electronic transfer of money from one account to another using digital devices. The system encompasses payment methods that use digital channels, such as the internet, mobile phones, and automated devices to transmit and receive money. The instruments of transfer include mobile bank applications, credit and debit cards, prepaid cards, etc. Digital payment can be described as primary, partial, or full. Primary digital payment enables the payer to transfer money directly to account of the payee who then withdraws the cash from the account. Partial digital payment allows the payer to transfer money to the account of a third-party agent who receives the payment and disburse cash to the payee. Full digital payment is one in which the payer transfers cash to the payee

who receives it digitally and also spends it digitally. Digital payment offers significant benefits to individuals, firms, governments, and international organizations. The system of digital payment has evolved rapidly over the last two decades, with the introduction of different modes of transactions, such as point of sale transfer, online sales transfer, automated teller machine transfer, automated clearing house transfer, digital wallet transfer, etc. It has also expanded rapidly to cover transactions within countries and across borders. The expansion is facilitated by increasing proliferation of smartphones and consumer adaptation to digital technology. It is anticipated that the digital payment system will continue to witness rapid growth in developing countries, particularly India and Indonesia, where smartphones are increasingly encroaching on rural areas due to government push for digital driven economy. The unified payment interface, digital India, and the introduction of helpline 14444 are a few initiatives the Indian government has launched to support digital payment system. These initiatives helped in positioning India as the country with the highest digital transactions in the world, accounting for about 46%, as at 2022. India is followed by Brazil, China, Thailand, and South Korea (Unified Payments Interface, 2023). In general, the Asia-Pacific region leads other regions of the world in the digital payment transactions.

Estimation Techniques

The UECM methodology is employed in determining the effect of exogenous variables on industrial activity in each country, following Aliyu and Ismail (2017) and Hussain (2007). The methodology allows each variable to adjust and minimize the endogeneity problem. The DOLS methodology is also employed to determine the effects. It is a dynamic equation technique that corrects for endogeneity and serial correlation by including leads and lags of exogenous variables. The leads and lags ensure that the model accounts fully for changes in industrial activity. These techniques of UECM and DOLS are employed in this study because of their ability to minimize serial correlation and endogeneity problem. They are preferred to the basic and less complex methodologies of error correction mechanism and ordinary least squares, due to their capacity that allows estimation to be done without imposing restrictions of linearity or nonlinearity. The lack of restriction, therefore, makes them more suitable in empirical studies.

The data employed in estimation are index of industrial production (industrial sector activity), volume of electronic money transfers (digital payment), gross fixed capital formation (physical capital), adult literacy rate (human capital), disposable income (personal income), and ratio of import and export to GDP (trade openness).

Empirical Results

Model Estimation Results

The estimation results of the UECM are reported in Table 1. In Nigeria, the short-run and long-run effects of digital payment are 0.53 and 0.58, respectively, which

Table 1. Unrestricted Error Correction Model Estimation Results.

Endogenous Variable: IDP Estimation Period: 2012Q1–2022Q4				
	Nigeria		South Africa	
Regressor	Coefficient	*t*-Value	Coefficient	*t*-Value
Intercept	2.36	8.46	1.87	6.66
ΔDP	0.53*	2.25	0.56*	2.39
ΔPK	0.65*	3.31	0.68*	3.39
ΔHK	0.63*	3.12	0.66*	3.49
ΔPY	0.61*	3.08	0.64*	3.41
ΔTT	0.31	1.39	0.28	1.25
ΔIDP_{-1}	0.28	1.24	0.23	1.16
DP_{-1}	0.58*	2.36	0.61*	3.01
PK_{-1}	0.73**	6.99	0.75**	7.22
HK_{-1}	0.72**	6.92	0.67*	3.24
PY_{-1}	0.62*	3.13	0.65*	3.48
TT_{-1}	0.33	1.41	0.26	1.19
IDP_{-1}	0.34	1.49	0.29	1.28
Diagnostics				
Adjusted R^2: = 0.88, SEE= 0.029, *F*-stat = 40.12, Durbin's h = –1.89, Log likelihood = 110.13, Akaike criterion = 70.42			Adjusted R^2 = 90.22, SEE = 0.031, *F*-stat = 38.91, Durbin's h = –1.90, Log likelihood = 107.28, Akaike criterion = 69.20	

Notes: * Significant at 5% level, **Significant at 1% level; IDP—industrial activity, DP—to digital payment, PK—physical capital, HK—human capital, PY—personal income, TT—trade openness; the first difference operator Δ attached to the variables indicates short-run, while the variables without the operator indicate long-run.

are significant at the 5% level. The results, therefore, suggest that digital payment had appreciable effect on industrial activity in Nigeria. However, these effects are lower than the effects of physical capital and human capital, which are above 0.64 and significant at 5%. Personal income also produced significant effect of over 0.60, which exceeds the effect of digital payment. It is only trade openness that had insignificant effects lower than 0.34. The response of industrial activity to its own lag is indicated by the coefficient of IDP_{-1}, which is below 0.35, suggesting that current activity does not significantly depend on past level of activity. In South Africa, the results are not significantly different from Nigeria. The short-run and long-run impacts of digital payment (0.56 and 0.61) are significant at 5%. It follows that digital payment-enhanced industrial activity, as much as it deed in Nigeria. Physical capital and human capital had more significant impact of over 0.65, while personal income also exerted more significant impact of over 0.63. The impact of trade openness falls below 0.30 and insignificant at 5%, making it the only variable with unimpressive impact. The response of current industrial activity to the past level of activity is below 0.30, which is also insignificant.

In summary, the results show that industrial activity in both countries benefited appreciably from digital payment, which was largely complemented by some of

the control variables. The diagnostics show that estimation errors are highly minimized, which makes the estimation results robust and reliable. The extent to which the benefits can be sustained depends on the policy direction of the countries.

The DOLS model was also estimated to back up the UECM estimation and ensure dependability of results. The DOLS results are reported in Table 2 for the two countries. In Nigeria, digital payment had significant long-run impact of 0.62 on industrial activity, at the 5% level, which is, however, surpassed by physical capital (0.72), human capital (0.68), and personal income (0.66). Trade openness is the only exogenous variable that had insignificant impact of 0.39. In South Africa, the impact of digital payment is observed to be 0.59, is also lower than the impact physical capital (0.64), human capital (0.61), and personal income (0.60). The only variable with insignificant effect is trade openness (0.28). The results are similar to the estimates produced by the UECM model, and clearly suggests that digital payment played appreciable role in facilitating industrial activity in both countries, which was strongly complemented by physical capital, human capital, and personal income.

The lags and leads are all positive in both countries, thus minimizing the endogeneity problem in estimation. Also, the adjusted coefficients of R^2 (0.94, 0.89)

Table 2. Dynamic Ordinary Least Squares Estimation Results.

Endogenous Variable: IDP_t				
Exogenous Variable	Nigeria		South Africa	
	Estimate	*t*-Statistic	Estimate	*t*-Statistic
Intercept	1.02	3.97	1.31	4.23
DP	0.62	3.54	0.59*	2.56
PK	0.72**	6.62	0.64*	3.67
HK	0.68*	3.99	0.61*	3.16
PY	0.66*	3.76	0.60*	3.09
TT	0.39	1.42	0.28	1.17
DP_{-1}	0.33	1.25	0.38	1.39
PK_{-1}	0.61	1.22	0.56	2.66
HK_{-1}	0.55	2.62	0.52	2.29
PY_{-1}	0.57	2.89	0.54	2.61
TT_{-1}	0.43	1.42	0.39	1.39
DP_{+1}	0.29	1.22	0.31	1.25
PK_{+1}	0.30	1.25	0.28	1.19
HK_{+1}	0.25	1.11	0.23	1.08
PY_{+1}	0.19	1.07	0.36	1.41
TT_{+1}	0.28	1.21	0.33	1.37
Diagnostics	Adjusted R^2 = 0.94, *F*-statistic =15.09** Durbin's h = 1.96 Log likelihood = 72.16		Adjusted R^2 = 0.89, *F*-statistic =13.27** Durbin's h = 2.02 Log likelihood = 69.23	

Notes: * Significant at the 5% level; ** Significant at the 1% level; Leads and lags = 1.
IDP—industrial activity, DP—to digital payment, PK—physical capital, HK—human capital, PY—personal income, TT—trade openness; the variables with leads and lags are only included to minimize the problem of endogeneity in estimation.

Table 3. Unit Root Test Results on Residuals of DOLS Regression.

	Nigeria		South Africa	
Residual Series	Drift	Drift and Trend	Drift	Drift and Trend
Level	–4.09	–5.11	–3.61	–4.28
First difference	–13.12*	–15.55*	–12.88*	–14.32*

Note: *Significant at the 5% level; Phillips-Perron test.

indicate that all the variables were able to account for 94% of systemic change in Nigeria, and 89% of systemic change in South Africa. The overall impact of variables is significant at 1% in both countries, as indicated by the *F*-statistics (15.09, 13.27). The Durbin's h values (1.96, 2.02) and log-likelihood values (72.16, 69.23) show that serial correlation is highly minimized, thus making the estimated results unbiased and reliable.

To ensure that the variables in each country are stationary, unit root test is conducted on the residuals of DOLS regression, by using the PP technique proposed by Phillips and Perron (1988). The results, reported in Table 3, show that the residuals are non-stationary in levels for both countries, as indicated by the insignificant test statistics. However, the statistics are significant in first differences, hence the null hypothesis that variables are non-stationary is rejected, which makes the estimation results non-spurious.

Forecasting Capacity of Estimated Model

The forecasting capacity is tested by using UECM estimation results. This is done by splitting the study period into two approximately equal subperiods. The data for each subperiod is fitted into the estimated UECM model to produce forecast errors in the two subperiods, which are then evaluated to determine the forecasting capacity. For a model to have good forecasts, the errors in the two subperiods should be similar. This procedure has been adopted in several studies, such as Otavio et al. (2011), Jiang and Liu (2011), Kuo (2016), etc. In Table 4, all the measures of forecast error have values less than unity, indicating that the errors are negligible in both countries. The forecasting capacity of the estimated model can, therefore, be considered quite good, which makes the model reliable for short-run forecasts of industrial activity.

Structural Stability

The empirical results have shown how industrial activity is affected by digital payment and other variables. It is, therefore, possible to use the estimates as a basis for policymaking. However, the results can only be considered useful for policymaking if structural stability exists within the model. The maximum likelihood estimator is employed to test for stability, which involves splitting the entire period of study into two subperiods, by choosing a suitable breakpoint

Table 4. Results of Forecasting Test.

Prediction Model: UECM
Subperiod 1: 2012Q1–2016Q4
Subperiod 2: 2017Q1–2022Q4

Measure of Forecasting Error	Nigeria		South Africa	
	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2
MAE	0.1104	0.1386	0.1402	0.1687
MAPE	0.8803	0.9742	0.9179	0.9892
RMSE	0.1416	0.1577	0.2532	0.1955
Theil-T	0.0083	0.0096	0.0946	0.0766

Note: MAE—Mean absolute error, MAPE—Mean absolute prediction error, RMSE—root mean square error, Theil-T—Theil's coefficient of inequality.

Table 5. Maximum Likelihood Structural Stability Estimates.

Endogenous Variable: IDP

		All Period (2012Q1–2022Q4)		Subperiod 1 (2012Q1–2016Q4)		Subperiod 2 (2017Q1–2022Q4)	
Country	Exogenous Variable	Coefficient	Asymptotic *t*-Statistic	Coefficient	Asymptotic *t*-Statistic	Coefficient	Asymptotic *t*-Statistic
Nigeria	Intercept	0.31	1.13	0.28	1.09	0.29	1.09
	DP_{-1}	0.29	1.09	0.30	1.10	0.31	1.14
	PK_{-1}	0.30	1.11	0.31	1.12	0.28	1.08
	HK_{-1}	0.28	1.07	0.29	1.08	0.30	1.11
	PY_{-1}	0.31	1.13	0.25	1.03	0.27	1.05
	TT_{-1}	0.26	1.03	0.23	1.01	0.24	1.02
	IDP_{-1}	0.27	1.05	0.26	1.04	0.25	1.05
South Africa	Intercept	0.26	1.07	0.23	1.03	0.26	1.06
	DP_{-1}	0.33	1.18	0.28	1.11	0.25	1.03
	PK_{-1}	0.27	1.09	0.24	1.06	0.31	1.16
	HK_{-1}	0.30	1.14	0.27	1.10	0.29	1.13
	PY_{-1}	0.25	1.02	0.26	1.08	0.30	1.15
	TT_{-1}	0.31	1.15	0.29	1.13	0.24	1.06
	IDP_{-1}	0.24	1.05	0.25	1.01	0.28	1.12

Note: IDP—industrial production, DP—digital payment, PK—physical capital, HK—human capital, PY—purchasing power, TT—trade openness.

(Yu et al., 2008). The breakpoint, as shown in Table 5, is the period 2016Q4, which was characterized by economic disturbance in Nigeria and South Africa due to the downturn in global oil market. The table reports maximum likelihood estimates of the whole period and subperiods, which are not significant at 5%. Again, the subperiod estimates of each variable are not significantly different. The test, therefore, indicates acceptance of the null hypothesis of no structural instability, hence the estimated results may be considered suitable for policy making. In Table 6, the insignificant variation in values Rho, normalized bias statistic,

Table 6. Maximum Likelihood Reliability Estimates.

Country	Alternative Break Point	Structural Break Parameter Estimate		Normalized Bias Statistic	Standard Deviation (SD)	Root Mean Square Error (RMSE)
		Rho 1	Rho 2			
Nigeria	2016Q1	0.08	0.09	0.37	0.13	0.24
	2016Q2	0.06	0.07	0.33	0.11	0.20
	2016Q3	0.09	0.08	0.35	0.15	0.26
	2016Q4	0.07	0.09	0.37	0.13	0.24
	2017Q1	0.10	0.11	0.39	0.15	0.26
	2017Q2	0.07	0.08	0.37	0.12	0.23
	2017Q3	0.09	0.10	0.38	0.14	0.25
South Africa	2016Q1	0.05	0.04	0.29	0.10	0.22
	2016Q2	0.07	0.09	0.31	0.16	0.21
	2016Q3	0.08	0.10	0.30	0.17	0.25
	2016Q4	0.06	0.07	0.34	0.11	0.20
	2017Q1	0.09	0.05	0.36	0.14	0.27
	2017Q2	0.04	0.03	0.39	0.13	0.24
	2017Q3	0.10	0.08	0.32	0.15	0.26

Note: Alternative breakpoints are distributed evenly around the period 2016Q4.

standard deviation, and root mean square error, indicate that the stability test results are unbiased and reliable.

Policy Implications and Imperatives

In both countries, the UECM estimation produced results that reveal significant short-run and long-run effects of digital payment on industrial activity. The DOLS estimation results are largely similar to the long-run effects of UECM. The significant role of digital payment was strongly complemented by physical capital, human capital, and personal income, while trade openness played an insignificant role. These findings, therefore, have some useful policy implications:

1. Digital payment made a meaningful contribution to growth in industrial activity in the short-run and long-run. This finding is different from the one produced in a past study by Saroy et al. (2023), where the role of digital payment was investigated in banking sector activity rather than industrial sector activity, and found to have a positive impact on cost efficiency but not technical efficiency. Again, the finding in this present study is different from the one produced from a past study by Kasri et al. (2022), where digital payment was also investigated in relation to banking activity rather than industrial activity, and found to have a positive relationship with a unidirectional causality on banking stability. The implication of the current finding is that industrial activity will continue to expand as the economy shifts away from cash payment to digital payment. It is, therefore, necessary to sustain this trend by strengthening internet technology, which is considered to be the bedrock of digital payment.

2. It is also revealed that physical capital, human capital, and personal income strongly complemented the positive role of digital payment in driving industrial activity. This finding aligns with the results in past studies by Engidaw (2021) and Singh and Kumar (2021) that found positive impacts of capital formation, physical infrastructure, human capital (literacy rate), and market demand (personal income). The implication of the current finding is that these control variables are also important in shaping the trend of industrial activity. Therefore, their impacts need to be enhanced through appropriate policy measures, such as increase in investment to boost capital stock, and tax-cut to boost personal income.
3. The study further revealed that the effect of trade openness on industrial activity is considerably low. This finding is however different from the results in the past study by Martorano (2019) that revealed a significant positive effect. The insignificant effect in the present study may be attributed to the low capacity of industries in the key Sub-Saharan African countries to compete favorably with foreign industrial goods. It is therefore necessary to limit trade openness by controlling imports that compete and crowd out domestic industrial goods.

Conclusion

In this study, an investigation was undertaken to determine the role of digital payment in fostering industrial sector activity in key Sub-Saharan African economies, during the period 2012Q1–2022Q4. The study adds to the growing research works on industrial activity in emerging countries. The methodologies of UECM and DOLS were employed to investigate the issue. The estimation results of UECM and DOLS, which are not significantly different revealed that:

- Digital payment impacted significantly on industrial activity in both countries.
- Physical capital, human capital, and personal income also contributed significantly to industrial activity.
- Trade openness is the only control variable with an insignificant impact on industrial activity.

The forecasting capacity of estimated model was tested by using UECM estimation results, which produced negligible forecast errors. It shows that the model possesses a good forecasting capacity, and is reliable for predicting short-run trends in industrial activity. The test of stability also revealed no significant structural break, hence the estimated model may be considered suitable for policy making. These findings, therefore, suggest that:

- The industrial activity will continue to grow as the digital payment system expands, hence it is imperative to strengthen the internet technology, which is considered to be the bedrock of digital payment.

- Physical capital, human capital, and personal income are complementary variables that spur industrial activity, hence they need to be sustained by providing a viable policy framework that would boost capital investment and personal income.
- Trade openness dragged industrial activity, hence the need to limit the openness by controlling import of foreign goods that compete and crowd out domestic industrial good from the market.

Declaration of Conflicting Interest

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Article

Efficiency of Macroeconomic Variables to Explain Economic Growth in the BIMSTEC Region

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Abstract

This article has examined the impact of selected macroeconomic variables on economic growth in the Bay of Bengal Initiative for Multi-sectoral, Technical and Economic Cooperation (BIMSTEC). Thus, quarterly data have been considered over a period from 2000 to 2021. The study has taken into consideration the Cobb–Douglas production function as a model specification to examine the above issue. It has been found that agricultural production is an important macroeconomic determinant to justify economic growth in BIMSTEC and its members. However, foreign direct investment is a significant macroeconomic factor for economic growth in BIMSTEC and also in India. Moreover, GDP in Bhutan, Sri Lanka and Thailand is positively and significantly affected by the balance of trade.

Keywords

AGP, BIMSTEC, EMP, FDI, BoT

JEL Classification: Q1, J2, F1, F21

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Introduction

The evolution of a sub-regional cooperation among South and South East Asian nations was first initiated in June 1997 by establishing BIST-EC (Bangladesh,

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India, Sri Lanka and Thailand Economic Cooperation). Myanmar joined this organization in December 1997, and it became BIMST-EC. In 2004, Nepal and Bhutan became members and subsequently BIMST-EC became BIMSTEC (Bay of Bengal Initiative for Multi-sectoral, Technical and Economic Cooperation). This sub-regional group came into existence with an aspiration towards India's look East and Thailand's look West policies for deeper cooperation in the region. The BIMSTEC region provides a unique similarity like rich historical and cultural linkages that helps to promote deeper cooperation in the region. BIMSTEC brings together 1.68 billion people (22%) of the world population with a combined GDP of US$3.697 trillion (2021). BIMSTEC focuses on 14 priority sectors for cooperation and integration: (i) transport and communication, (ii) tourism, (iii) environment and disaster management, (iv) counter-terrorism and transnational crimes, (v) trade and investment, (vi) cultural cooperation, (vii) energy, (viii) agriculture, (ix) poverty alleviation, (x) technology, (xi) fisheries, (xii) public health, (xiii) people-to-people contract and (xiv) climate change. According to Batra (2010), these priority sectors for cooperation have been clearly identified keeping in view harmonizing and establishing adequate infrastructure facilities such as road, rail, air and shipping in the member countries. In February 2004, BIMSTEC signed an agreement for a Free Trade Area (FTA) in order to strengthen economic, trade and investment cooperation among the member countries. During the global financial turmoil in 2008, BIMSTEC was less affected as compared to other regional treaties (SAARC, ASEAN, SAFTA, NAFTA, EU, APEC and OPEC). In 2018, BIMSTEC reaffirmed in its fourth summit declaration in Kathmandu, Nepal, with a strong commitment to make it a dynamic, effective and result-oriented regional organization that will promote peace, prosperous and sustainable economic growth in the Bay of Bengal Region through meaningful cooperation, deeper integration and collective efforts. The fourth summit recognized the need for poverty alleviation in the region and expressed its firm commitment to work together for the implementation of a sustainable development agenda by 2030. BIMSTEC is a more powerful and active regional cooperation that enhances inter-linkages and interdependence within the region and provides greater opportunities to advance regional cooperation. It has been well established that a significant volume of trade is covered by the regional trading arrangements and its importance is increasing in the present era. However, South Asian countries are not successful in the world to form unbeaten regional trading arrangements next to sub-Saharan African countries (Bhattacharya, 2007). In 2007, Banik opined that BIMSTEC is purely guided by economic interest rather than political and, thus, more successful as compared to SAFTA.

A limited number of studies have focused on the probable impact of BIMSTEC-FTA. However, few studies have applied (Bhattacharya, 2007; Kabir & Selim 2010) quantitative techniques to examine the possible impact of BIMSTEC-FTA. On the other hand, a significant number of studies have examined the impact of macroeconomic variables on economic growth. However, very few studies have explored the above relationship in BIMSTEC. Therefore, a more extensive study is required to explore BIMSTEC properly. Against this backdrop, this study tries to examine the probable impact of macroeconomic indicators on economic growth in BIMSTEC.

The rest of the article has been organized as follows: After a brief introduction in Section 1, Section 2 extensively discusses the literature review and identifies the research gap. Section 3 depicts the data and the study period. Similarly, Section 4 has shown the theoretical linkage of economic growth with the macroeconomic variables followed by hypothesis formulation. Section 5 deals with methodological aspects. Section 6 explains the outcomes. Finally, the conclusion and recommendation have been given in Section 7.

Literature Survey

Various studies have established the relationship between economic growth and macroeconomic variables in developed countries (Grossman & Helpman, 1992; Lucas, 1988; Solow, 1956). Similarly, in developing countries, many studies have dealt with the same issue (Das et al., 2009; Sarma et al., 2005). On the other hand, a significant number of studies have developed many economic theories and statistical approaches and many of them have empirically examined the above issue by applying various econometric tools and techniques. A quite number of studies have shown a clear connection between economic growth and the macroeconomic variables and some of them have shown opposite outcomes. Therefore, this economic debate has given immense importance to the academic and professional communities for hunting new knowledge and linkages and, as a result, new evidence is added to the existing literature. Therefore, social scientists are interested in examining the impact of macroeconomic variables (foreign direct investment (FDI), export, import, foreign exchange, inflation, oil price, equity market, etc.) on economic growth from the very beginning.

Theoretical Perspective

Both theoretical and empirical growth researchers have recognized that macroeconomic factors can affect economic growth but with little agreement. The economic growth theory is extensively focused on neoclassical and endogenous growth theories. Solow (1956) has opined that importance is given to factors such as physical capital accumulation and human capital growth (Lucas, 1988). On the other hand, many economic growth contributors (Easterly & Wetzel, 1989; World Bank, 1990) have preferred growth theories. Solow-Swan (1956) has developed the neoclassical growth theory (endogenous growth model), where it has been stated that physical capital accumulation is an input of short-run economic growth while technology is the principal determinant of long-term economic development. Further, neoclassical theory has considered human capital stock as the central driving factor of economic growth (Islam, 1995; Mankiw et al., 1992). Oppositely, the proponents of endogenous growth theory have given attention to efficiency (Aghion & Howitt, 1992b; Grossman & Helpman, 1991; Lucas, 1988). It is well recognized that every country tries to accumulate human capital stock, physical capital and productivity factors for economic development (Aghion et al., 1991a; Frankel, 1962; Grossman & Helpman, 1992; Lucas, 1988; Mankiw et al., 1992; Solow, 1956). According to Easterly and

Wetzel. (1989), savings and investment have been considered indispensable economic growth factors (Fischer, 1992). Further, these factors became popular in the 1990s by focusing on macroeconomic stability, the efficacy of an economic institutional system and the regulatory environment for the market. Fischer (1992) opines that economic growth depends on macroeconomic stability that has been affected by economic uncertainty. Similarly, economic uncertainties are caused by policies that reduce the market mechanism's capacity. Similarly, another type of economic uncertainty is caused by the investors' holding on assets which is very temporal. However, this kind of economic uncertainty affects the capital market badly because there is a chance of capital flight if it is not controlled (Pindyck & Somalino, 1993; World Bank, 1990). Many studies have considered a variety of macroeconomic variables with little agreement on their effects on economic growth (e.g., Barro & Sala-i-Martin, 2004; Boserup, 1996; Bruno et al., 1998; Burnside & Dollar, 2000; Fischer, 1983; Knight et al., 1993; McKinnon, 1973; Mundell, 1963; Shaw, 1973; Solow, 1956). Many growth economists have considered time-series data to examine the effect of macroeconomic factors on economic growth (Ciccone & Jarocinski, 2010; Sala-i-Martin et al., 2004). Few studies have claimed that consideration of many macroeconomic determinants enhances the model efficiency (Bayraktar & Wang, 2006; Doppelhofer et al., 2004) but it behaves differently when pooled together and, thus, the policymakers become confused sometimes when they develop country-specific economic policies. Antwi et al. (2013) have considered a large number of macroeconomic factors to study economic growth. Thus, from the above theoretical discussion, we can get an idea about the origin and development of many theories and different kinds of macroeconomic variables.

Empirical Evidence

Lots of studies have empirically examined the association between economic growth and macroeconomic variables. In 1992, Fischer examined the relationship between macroeconomic stability and economic development in SSA and LAC countries over a period from 1970 to 1985 and depicted that economic development is positively affected by human capital, investment and budget surplus while initial real GDP, inflation and dummy variables have a negative impact. Here, the study has opined that economic growth largely depends on the stability of the macroeconomic determinants. Similarly, Knight et al. (1993) examined the same issue with a slight difference in respect of the selection of macroeconomic variables and the evidence is almost the same as observed by Fischer (1992). Similarly, Chen and Feng (2000) examined a similar issue in China and reported positive and negative associations between economic growth and macroeconomic indicators. Here, the study has identified (Knight, 1993; Roy, 2020; Seyfried, 2011) a few macroeconomic indicators (private business, foreign trade and education) that can promote long-term economic growth (Fischer, 1992; Knight et al., 1993) in China. Sharma and Panagiotidis (2005) examined the causal relationship between export and economic growth in India under the VAR environment. The study showed the presence of a co-integrating association between the variables where a causal relationship was absent.

However, the impulse response function has shown a positive response that runs from export to economic growth (Bakari, 2017; Kumar, 2016; Mathiyazhagan, 2005). Similarly, Dash (2009) applied the same technique to examine the causal relationship between Indian export and economic growth in post-liberalization period (1992–2007) where a short-run causal relationship was absent (Dritsaki & Stiakakis, 2014; Mukerji et al., 2014;). However, Elbeydi et al. (2010) have shown both short-run and long-run equilibrium relationships between export and economic development in Libiya and claimed that Libiya is an export-led country (Ali et al., 2018; Kaur et al., 2017). Das et al. (2009) have examined the impact of agriculture credit on agricultural production (AGP) in India (Golait, 2007) by applying the dynamic panel data approach proposed by Arellano and Bond (1991). Here, the study has reported that agricultural credit has a significant positive impact on agricultural output. However, there are many gaps in agricultural delivery and, thus, agriculture is not properly developed. Moreover, the study has recommended framing appropriate policy for the development of agriculture in the country (Pattanayak & Mallick, 2017). In 2010, Mawugnon et al. examined the association between FDI and economic growth in Togo over a period from 1999 to 2009 by applying the Granger causality test. The study has reported about presence of a unidirectional causal relationship runs from FDI to GDP, and it has also been observed that FDI has a significant positive impact on economic growth (Alagidede et al., 2011; Mehrara & Firouzjaee, 2011; Raghuram et al., 2020). Along with this, the study has focused on developing appropriate infrastructural facilities in the country with a view to attracting FDI into the country. In contrast, Chang and Mendy (2012) examine the relationship between trade openness and economic growth in African countries over a period from 1980 to 2009. Here, the study applied a panel data approach and reported a significantly positive association between trade openness and economic growth. However, the study has also depicted that (Acaravci & Ozturk, 2012; Hemzawi and Umutoni 2021; Sahni & Atri, 2012) domestic investment and gross national savings have negatively associated with economic growth. Moreover, Acaravci et al. have opined that FDI may be improved if the country promotes free trade zones, trade regime, tax incentives, human capital base, financial market regulations, financial system and infrastructure quality. Following the same notion, Manh et al. (2014) examined the dynamics between employment and economic growth in Vietnam. Here, the study has applied Cobb–Douglas production function to observe the above issue and reported that employment has a significantly positive impact on economic growth (Ajakaiye et al., 2015). Finally, the study has recommended for introducing vocational courses in the country for the improvement of labour productivity. Likewise, Ahmed et al. (2015) considered stock market and economic growth to check the econometrical association between them over a period from 1984 to 2013 in Nigeria under the VAR environment. The study has reported the presence of both long-run and short-run associations between the variables (Chaudhary et al., 2016; Farahmand & Ethem, 2020; Gokmenoglu et al., 2015; Ibrahiem, 2015; Khan & Khan, 2018; Nwaolisa & Chijindu, 2016; Yenipazarlı, A., & Yılmaz, 2016). On the other hand, Ali et al. (2016) have tried to forecast the bilateral trade between India and Bangladesh over a period from 1991 to 2014 by considering quarterly time-series data. Thus, the study developed ARIMA and

ARMA approaches and reported that the ARIMA model is superior to forecast bilateral trade as compared to ARMA and the study further opined that both the countries may benefit from bilateral trade that enables economic prosperity and cooperation. Bhattacharya and Gupta (2015) examined the association between the macroeconomic variables (food inflation, international prices, fuel inflation) and agricultural wages. Here, the study applied the SVAR and FEVD approaches and reported that fuel inflation affects both industrial growth and global food inflation. It has also been reported that a 14% variation in wage inflation occurred due to food inflation followed by the industrial sector. The study has argued that food and aggregate inflation are affected by increase in food inflation. Here, the study has identified agricultural wage growth, which is an important factor of food inflation, should be adjusted with productivity growth. In contrast, Kang and Dagli (2018) examined the dynamics between international trade and exchange rates in the context of the global financial crisis over a period from 2001 to 2015 in 72 countries. Thus, the study has applied the Fisher-type unit-root test and the Gravity model and reported that export is positively affected by real exchange rates (Jana et al., 2019). In 2019, Gokmenuglu et al. tried to establish the impact of carbon emissions on financial development and industrialization in Turkey by considering a long time period (1960–2010) under the VAR framework. The study reported the presence of a long-run equilibrium association between the variables and also confirmed the presence of a unidirectional relationship which runs from financial development to carbon emission (Jijian et al., 2021). The study has recommended to the policymakers regarding the framing of financial policy that can protect the environment from carbon emissions and promote environmental sustainability. In 2019, Sener et al. examined the causal association between competitiveness, innovation and foreign trade over a period range between 2007 and 2017. The study applied the Dumitrescu and Hurlin (2012) panel causality test and observed the presence of unidirectional causality that passes from GII to IDI and GCI. Moreover, the study has recommended developing R&D in collaboration with university, industry and government for the improvement of foreign trade in the country.

Now, it is observed from the extensive literature survey that a large number of studies have developed various theoretical and mathematical frameworks to examine the various economic issues and many of them have empirically examined the association between the macroeconomic variables and economic growth by applying various statistical and econometrical equations and shown diverse evidences which are quite natural due to countries' ideology, sentiment, internal and external geopolitical tension, economic and political environment. No doubt, those studies have contributed new insights to the existing literature. However, a very limited number of studies have focused on BIMSTEC.

Thus, with this economic intuition, this study examines the impact of macroeconomic determinants on economic growth in BIMSTEC. Many studies in the past have explored macroeconomic relationships but those are not adequate to explain the exact nature of the macroeconomic variables because the nature of the variables is changing over time. Thus, it is important to explore the economic association between them by considering a representative data set. Therefore, the study has considered a few selected macroeconomic variables to study the impact on

economic growth in BIMSTEC, and it is expected that this study will surely provide new insights.

Data and Study Period

The study has considered quarterly real GDP at factor price that represents economic growth, balance of trade (BoT), AGP, employment (EMP) and inflows of FDI of the BIMSTEC and its members (India, Bangladesh, Nepal, Bhutan and Sri Lanka, Myanmar and Thailand). Here, the selection of control variables has been guided by economic intuition and previous studies. The data have been obtained from the official website of the World Bank (www.worldbank.org) and cross-checked with various reports published by the central banks of the respective countries with a study period ranging between 2000 and 2021.

Theoretical Interpretation and Hypothesis Formulation: Foreign Trade (BoT) and GDP

Foreign trade refers to the exchange of goods and services from the domestic country to others and vice-versa. It helps to boost economic growth in diverse ways. A country is said to be export-led when it exports a large amount of goods and services to other nations and earns foreign currencies that promote economic growth. Similarly, imports of goods represent an outflow of funds from the domestic country that sometimes adversely affects economic growth but high imports of productive assets signify huge domestic demand for industrialization which is a good sign for economic growth in the long run. Hence, every country tries to maintain a healthy balance between export and import for economic development. The association between foreign trade and economic growth is recognized in the 18th century when David Ricardo and Adam Smith opined about the significance of foreign trade for economic growth (Awokuse, 2007; Baines, 2003; Chia, 2015;Frieden & Rogowski, 1996) and this opinion has been well accepted by the economists (Carbaugh, 2011; Lee 1995; Hachicha, 2003). With this notion, the following hypothesis has been formulated:

H_1: BoT has no effect on GDP.

GDP and FDI

It has already been established that the inflow of FDI into the core sectors plays an important role as a source of capital, trade technology and management in transition economies that promotes economic development in the domestic economy (Caves, 1974, 1996; Kokko, 1994; Sahoo et al., 2002) and, thus, FDI is an important determinant for economic growth that affects the economy positively. Many studies have opined that FDI has a long-run association with economic growth (Sahoo & Mathiyazhagan, 2003). With this economic insight, the following hypothesis has been developed:

H_2: FDI has no effect on GDP.

GDP and Agricultural Production

It is well recognized that agriculture plays an important role in economic growth, particularly in labour-intensive countries where adequate agricultural land is available. The BIMSTEC region is well known for its agricultural richness and provides raw materials to the agricultural industry that promotes economic activities and development (Madi et al., 2020). Many authors have argued that economic growth generates agriculture when countries invest with large-scale farmers (Collier & Dercon, 2009; Maxwell, 2004; Reardon et al., 2006). In addition, productivity can transform agriculture into a growth-driven economy that leads to the formulation of the following hypothesis:

H_3: AGP has no impact on GDP.

GDP and Employment (EMP)

Economic growth and development are closely associated that generate employment (Mandloi & Bansal, 2014). On the other hand, the labour market can either promote or restrict economic growth (Boltho & Glyn, 1995; Herman, 2011; Phan, 2006). Similarly, employment is an important macroeconomic factor that reduces poverty and promotes economic growth simultaneously (Dopke, 2001; Kapos, 2005). Schmid (2008) talks about both extensive and intensive growth theories that help to create employment in the country. Thus, with this economic insight, the following hypothesis is formulated:

H_4: EMP has no effect on GDP.

From the above discussion, the relationship between GDP and the above-mentioned macroeconomic variables can be presented in a diagram (Figure 1).

Methodology

The study has been started by transforming the data of the macroeconomic variables into natural logarithm forms as follows:

$$\text{Log}\, Y = \log\left(\frac{Y_{t+1}}{Y_t}\right) \tag{1}$$

The pattern of time-series distribution has been examined by applying the Jarque–Bera (1980) test statistic as follows:

$$JB = \frac{n}{6}\left[S^2 + \frac{1}{4}(K-3)^2\right] \tag{2}$$

where n denotes the number of observations. S and K are the skewness and kurtosis, respectively.

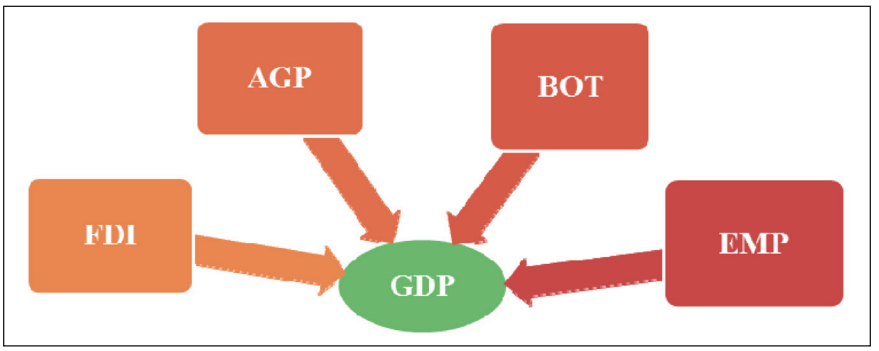

Figure 1. Relationship Between GDP and Macroeconomic Variables.

The distribution follows normality if the expected values of skewness and kurtosis are 0 and 3, respectively.

The outcome of descriptive statistics of the selected macroeconomic variables has been presented in Table 1. The mean FDI of Bangladesh, Nepal, Bhutan, Sri Lanka and Myanmar is negative, which means the above-mentioned countries were not in a position to attract FDI during the study period, which adversely affected the economy. It has also been found that Bhutan has a negative average BoT, which means the country was not in a position to export goods and services to its members and it may be for its heavy internal demand. The table also shows that the computed J-B statistic of EMP in Bangladesh, Nepal, Sri Lanka and Myanmar is statistically insignificant, which means the time-series observation follows a normal distribution. Moreover, the normality assumption is true for FDI in Thailand.

Thereafter, the study applied augmented Dickey–Fuller (ADF) and Philips–Pherron (P-P) tests to examine the stationarity of the time-series observation and, thus, the following equation has been considered:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \sum_{i=1}^{m} \gamma_i \Delta Y_{t-i} + e_t \tag{3}$$

Similarly, the P-P test (1988) is the modification of the ADF test that considers AR(1) process as follows:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + e_t \tag{4}$$

Table 2 shows the outcome of the unit-root test based on two test statistics. It has been found that the time-series observations are non-stationary at their levels but become stationary when the first difference operator has been used.

The classical, neoclassical and modern growth theories have identified those determinants which are expected to be effective for economic growth (Antwi et al., 2013). Here, the study has considered Cobb–Douglas production function as the model

Table 1. Descriptive Statistics.

Variable	OB	Mean	Median	Max	Min	Std. Dev.	Skew.	Kurt.	JB	Prob.
INDIA										
logGDP	88	15.7224	15.7635	16.5057	14.8014	0.6045	−0.1097	1.4366	9.1383**	0.0103
logBOT	88	12.8488	13.3493	14.1702	10.2147	1.2174	−0.9979	2.6267	15.1176**	0.0005
logFDI	88	11.4617	11.7951	13.3551	9.2167	1.2839	−0.5313	1.9601	8.1058**	0.0173
logAGP	88	19.0991	19.4072	19.8262	16.6060	0.7720	−1.5200	5.4331	55.5964**	0.0000
logEMP	88	19.9164	19.9386	19.9949	19.7713	0.0596	−1.1206	3.2112	18.5908**	0.0000
BANGLADESH										
logGDP	88	4.7715	4.6885	5.9239	3.9371	0.6640	0.3829	1.7929	7.4933**	0.0235
logBOT	88	1.8962	1.8968	3.1367	0.8197	0.7334	0.0436	1.7069	6.1584**	0.0459
logFDI	88	−0.2107	0.2190	1.0402	−2.9957	1.1312	−0.9842	3.0412	14.2136**	0.0008
logAGP	88	16.4455	16.4945	17.3416	15.6837	0.5073	−0.0497	1.6589	6.6306**	0.0363
logEMP	88	17.8587	17.8596	18.0529	17.6418	0.1207	−0.0413	2.0236	3.5204	0.1720
NEPAL										
logGDP	88	2.6317	2.6629	3.5319	1.6154	0.6534	−0.1365	1.5206	8.2981**	0.0157
logBOT	88	0.9616	1.2547	2.4440	−1.0498	1.0654	−0.3475	1.8138	6.9298**	0.0312
logFDI	88	−2.8921	−2.4079	−1.6094	−4.6051	0.9632	−0.7828	2.2804	10.8866**	0.0043
logAGP	88	15.4513	15.6518	16.1096	14.5607	0.5497	−0.3488	1.5007	10.0264**	0.0066
logEMP	88	16.4588	16.4698	16.6366	16.2896	0.0980	−0.0007	2.0326	3.4055	0.1821
BHUTAN										
logGDP	88	0.1786	0.3226	0.9321	−0.9162	0.6200	−0.4668	1.7857	8.6026**	0.0135
logBOT	88	−1.5053	−1.2678	−0.5447	−3.5065	0.8735	−0.7760	2.5152	9.6955**	0.0078
logFDI	88	−4.1832	−4.6051	−2.5257	−4.6051	0.6171	1.4845	4.3591	39.0982**	0.0000
logAGP	88	12.4866	12.6225	13.1158	11.4754	0.5417	−0.7849	2.2416	11.1465**	0.0037
logEMP	88	12.6370	12.6755	12.7822	12.3881	0.1123	−0.7951	2.5465	10.0263**	0.0066

(Table 1 continued)

(Table 1 continued)

Variable	OB	Mean	Median	Max	Min	Std. Dev.	Skew.	Kurt.	JB	Prob.
SRI LANKA										
logGDP	88	3.7377	3.8888	4.4768	2.7511	0.6603	−0.3207	1.4582	10.2245**	0.0060
logBOT	88	1.2433	1.5264	2.1540	−0.0202	0.7028	−0.5304	1.8473	8.9978**	0.0111
logFDI	88	−0.7016	−0.6223	0.4762	−1.7719	0.6976	−0.1788	1.7682	6.0324**	0.0489
logAGP	88	14.9058	15.1007	15.5428	14.1932	0.4689	−0.2701	1.4222	10.1974**	0.0061
logEMP	88	15.9059	15.8992	15.9847	15.8493	0.0367	0.5166	2.2954	5.7354	0.0568
MYANMAR										
logGDP	88	3.2179	3.5076	4.3685	1.7298	0.9724	−0.3130	1.4070	10.7419**	0.0046
logBOT	88	1.9951	2.7221	2.7738	0.00000	0.6688	−1.7664	5.2987	65.1390**	0.0000
logFDI	88	−0.1704	−0.0142	1.5686	−1.8971	1.1054	−0.1126	1.5609	7.7787**	0.0204
logAGP	88	16.4455	16.4945	17.3416	15.6837	0.5073	−0.0497	1.6589	6.6306**	0.0363
logEMP	88	16.9583	16.9534	17.0185	16.8868	0.0370	−0.1262	1.9962	3.9278	0.1403
THAILAND										
logGDP	88	5.6249	5.7534	6.2990	4.7899	0.5039	−0.4112	1.7044	8.6346**	0.0133
logBOT	88	2.6036	2.5477	4.0402	−0.2484	1.0635	−0.7605	3.5392	9.5491**	0.0084
logFDI	88	1.8880	1.8330	2.7688	0.9042	0.5021	−0.0030	2.2214	2.2229	0.3290
logAGP	88	17.0934	17.3100	17.7071	16.2491	0.4883	−0.5986	1.8201	10.3607**	0.0056
logEMP	88	17.3496	17.4731	17.5102	15.1772	0.4788	−4.3048	1.7137	12.077**	0.0000
BIMSTEC										
logGDP	88	15.7224	15.7636	16.5058	14.8014	0.6045	−0.1097	1.4366	9.1383**	0.0103
logBOT	88	12.8488	13.3493	14.1702	10.2148	1.2174	−0.9979	2.6266	15.1169**	0.0005
logFDI	88	11.4617	11.7951	13.3551	9.2167	1.2839	−0.5313	1.9601	8.1058**	0.0173
logAGP	88	19.2231	19.4956	19.9317	17.2763	0.6883	−1.0555	3.5458	17.4348**	0.0001
logEMP	88	20.0806	20.0995	20.1743	19.9287	0.0659	−0.8891	2.8543	11.6734**	0.0029

Note: **Significant at the 5% level.

Table 2. Test of Stationarity.

	ADF Test				P-P Test			
	Level		1st Diff.		Level		1st Diff.	
Var.	t-stat.	Prob.	t-stat.	Prob.	t-stat.	Prob.	t-stat.	Prob.
INDIA								
logGDP	0.0660	0.9613	−10.217**	0.0000	0.2712	0.9755	−10.398**	0.0001
logBOT	−2.1085	0.2419	−9.9617**	0.0000	−2.5991	0.0970	−9.9619**	0.0000
logFDI	−0.5541	0.8740	−3.6672**	0.0063	−0.9157	0.7789	−9.8461**	0.0000
logAGP	−1.4543	0.5517	−7.6416**	0.0000	−2.3789	0.1506	−9.1831**	0.0000
logEMP	−2.6584	0.0859	−8.6284**	0.0000	−3.5526	0.0688	−9.6660**	0.0000
BANGLADESH								
logGDP	0.5280	0.9868	−24.0291**	0.0001	1.3602	0.9988	−12.3896**	0.0001
logBOT	−0.5883	0.8668	−9.5503**	0.0000	−0.5372	0.8777	−9.5687**	0.0000
logFDI	−1.4997	0.5292	−9.2333**	0.0000	−1.4997	0.5292	−9.2333**	0.0000
logAGP	0.1655	0.9689	−9.9053**	0.0000	0.4638	0.9845	−10.0494**	0.0000
logEMP	−1.3296	0.6124	−23.9656**	0.0001	−1.3764	0.5903	−16.7639**	0.0001
NEPAL								
logGDP	−0.9984	0.7507	−3.1537**	0.0265	−0.9678	0.7616	−11.1189**	0.0001
logBOT	−1.6724	0.4414	−2.9951**	0.0394	−3.4697	0.0111	−10.9743**	0.0001
logFDI	−2.6242	0.0920	−9.1654**	0.0000	−2.8349	0.0576	−9.1654**	0.0000
logAGP	−1.2338	0.6564	−3.2792**	0.0190	−1.2115	0.6665	−10.2591**	0.0000
logEMP	−1.5958	0.4802	−17.1732**	0.0001	−1.3362	0.6095	−10.7019**	0.0001
BHUTAN								
logGDP	−2.1239	0.2360	−3.0643**	0.0332	−2.5471	0.1081	−10.6520**	0.0001
logBOT	−1.6280	0.4640	−9.2067**	0.0000	−1.6394	0.4582	−9.2067**	0.0000
logFDI	−1.4885	0.5343	−6.4443**	0.0000	−1.5261	0.5145	−6.4352**	0.0000
logAGP	−1.4441	0.5570	−3.0598**	0.0336	−1.4456	0.5563	−9.4524**	0.0000
logEMP	−2.2776	0.1817	−11.4851**	0.0001	−2.2481	0.1971	−11.5123**	0.0001

(Table 2 continued)

(Table 2 continued)

	ADF Test				P-P Test			
	Level		1st Diff.		Level		1st Diff.	
Var.	t-stat.	Prob.	t-stat.	Prob.	t-stat.	Prob.	t-stat.	Prob.
SRI LANKA								
logGDP	−2.3213	0.1679	−7.8666**	0.0000	−1.1557	0.6903	−10.3251**	0.0000
logBOT	−1.5504	0.5035	−9.2591**	0.0000	−1.5504	0.5035	−9.2591**	0.0000
logFDI	−1.5223	0.4669	−9.1955**	0.0000	−1.6223	0.4669	−9.1955**	0.0000
logAGP	−0.4335	0.8977	−9.4704**	0.0000	−0.4051	0.9027	−9.4807**	0.0000
logEMP	−1.2743	0.6384	−9.1975**	0.0000	−1.2743	0.6384	−9.1975**	0.0000
MYANMAR								
logGDP	−0.8010	0.8134	−11.0109	0.0001	−0.9805	0.7572	−10.4068	0.0000
logBOT	−1.6545	0.4506	−9.1673	0.0000	−1.7156	0.4199	−9.167317	0.0000
logFDI	−1.1694	0.6846	−9.2544	0.0000	−1.1694	0.6846	−9.2544	0.0000
logAGP	0.1655	0.9689	−9.9053	0.0000	0.4638	0.9845	−10.0494	0.0000
logEMP	−1.9857	0.2926	−9.3445	0.0000	−1.9975	0.2875	−9.2914	0.0000
THAILAND								
logGDP	−1.6279	0.4639	−16.5645	0.0001	−1.0858	0.7184	−10.3005	0.0000
logBOT	−2.1935	0.2102	−9.1665	0.0000	−2.2963	0.1755	−9.1665	0.0000
logFDI	−2.1099	0.2414	−6.4105	0.0000	−2.0597	0.1547	−9.1656	0.0000
logAGP	−1.3887	0.5843	−3.1241	0.0286	−1.3885	0.5844	−9.5450	0.0000
logEMP	−0.4251	0.8988	−7.5859	0.0000	−3.9245	0.0028	−9.1653	0.0000
BIMSTEC								
logGDP	−0.8086	0.8115	−10.4276	0.0000	−0.8232	0.8073	−10.7162	0.0001
logBOT	−2.1085	0.2419	−9.9617	0.0000	−2.5990	0.0970	−9.9619	0.0000
logFDI	−0.5541	0.8740	−3.6672	0.0063	−0.9157	0.7789	−9.8461	0.0000
logAGP	−1.2414	0.6530	−7.5410	0.0000	−2.0062	0.2837	−9.1963	0.0000
logEMP	−2.2770	0.1819	−8.9842	0.0000	−3.8200	0.0039	−9.8749	0.0000

Note: **Significant at the 5% level.

specification with a view to establishing economic association between economic growth and the selected macroeconomic variables as follows:

$$Q = f(L_1, C_2) \tag{5}$$

where output (Q) is a function of labour (L) and capital (C), respectively. The above production function can be written as:

$$Q = \alpha_0 L^{\beta_1} C^{\beta_2} \Rightarrow \log Q = \alpha_0 + \beta_1 \log L + \beta_2 C \tag{6}$$

Equation (6) is a double log functional form that cannot be estimated through OLS due to economic uncertainty and, thus, the above equation can be rewritten as follows:

$$\log Q = \alpha_0 + \log \beta_1 L + \log \beta_2 C + \varepsilon_t \tag{7}$$

Thus, the movement of Q depends on L and C that means if L and C change 1%, then Q will react β_1 and β_2 percent assuming other things remain constant. It means that the impact of labour variation (L) on production (Q) decreases when L gets larger or vice-versa, and it holds true for C. Therefore, change in production depends on labour and capital. The present study has developed the functional form based on the assumption of Cobb–Douglas production function as follows:

$$GDP = f(BoT, FDI, AGP, EMP) \tag{8}$$

The above functional form can be written as follows:

$$\begin{aligned} &GDP = \alpha_0 BoT^{\beta_1} FDI^{\beta_2} AGP^{\beta_3} EMP^{\beta_4} \\ &\Rightarrow \log GDP = \alpha_0 + \beta_1 \log BoT + \beta_2 \log FDI + \beta_3 \log AGP + \beta_4 EMP \end{aligned} \tag{9}$$

In the same way, equation (9) has encountered the same problem as explained in equation (6). Therefore, to remove this problem, equation (9) can be rewritten as follows:

$$\begin{aligned} \Delta \log GDP = \alpha_0 + \beta_1 \Delta \log BoT + \beta_2 \Delta \log FDI + \\ \beta_3 \Delta \log AGP + \beta_4 \Delta \log EMP + \varepsilon_t \end{aligned} \tag{10}$$

where α is the intercept term. β values s are the slope coefficients to be estimated. Δ is the difference operator and ε is the error term with 0 mean and constant standard deviation. Equation (10) has been estimated through the OLS technique.

The study applied the Brock–Dechert–Scheinkman (BDS) independence test to examine the non-linear pattern of the residual distribution that has been derived from equation (10). According to Brock et al. (1996), a sample of independently and identically distribution (i.i.d.) $\{x_t: t = 1, 2, 3, \ldots, n\}$ can be written as follows:

$$BDS = \sqrt{n-m+1}\,\frac{b_{m,n}(d)}{\sigma_{m,n}(d)} \rightarrow \mathrm{N}(0,1) \tag{11}$$

where $b_{m,n}(d) = C_{m,n}(d) - \mathrm{C}_{1,n-m+1}(d)^m$, $C_{m,n}(d)$ and $C_{1,n-m+1}(d)^m$ are the correlation integrals. $\sigma_{m,n}(d)$ is the standard error of $b_{m,n}(d)$. d is the distance and m is the dimension. Here, it is assumed that $d = 0.7$ and $m = 2$ to 6, which means for a given d and $m > 1$ then $C_{m,n}(d) - \mathrm{C}_{1,n-m+1}(d)^{\mathrm{m}} = 0$.

Finally, the CUSUM test has been applied to check the parameters' stability of the regression equation (10).

Result and Analysis

The outcome of equation (10) has been presented in Table 3 and the estimated coefficients of AGP are found to be positively significant in BIMSTEC and its member countries, which means a 1% change in AGP, GDP changes accordingly. Thus, AGP is recognized as a significant determinant that has the power to influence GDP in this case. Additionally, the BIMSTEC countries are efficient in agricultural activities due to their geographical location, good weather conditions, fertile agricultural land, advanced technology, credit facilities and government support towards farmers. Similarly, the coefficient of FDI in India has been found to be positively significant, which means economic growth in India is positively affected by FDI, but Bangladesh has been found to be negatively significant, which means if FDI is increased by 1%, economic growth will decrease by 10.96%. Thus, policymakers should take necessary measures to correct this situation. But, it is surprising that the coefficient of FDI in BIMSTEC is positively significant, which signifies that economic growth in the BIMSTEC region is favourably affected by FDI. Likewise, the coefficient of EMP in Bangladesh, Nepal, Bhutan, Sri Lanka and Myanmar is positive and significant, which implies that GDP is significantly and favourably influenced by EMP, and this evidence is also true in BIMSTEC. However, GDP in Thailand has been found to be statistically significant and negative. But in the case of India, the effect of EMP on GDP has been found to be insignificant. Similarly, the BoT has a significant positive impact on GDP in Bhutan, Sri Lanka and Thailand, which is a good sign. However, BoT has no significant impact on GDP in BIMSTEC, India, Bangladesh and Nepal. Moreover, the estimated F-statistic has been found to be significant and positive in BIMSTEC and its members, which means the macroeconomic variables can jointly and significantly influence GDP. In addition, it has been found that economic growth in BIMSTEC has been significantly and positively affected by FDI, AGP and EMP. Therefore, it may be opined that these macroeconomic factors have the power to justify economic growth in BIMSTEC except BoT. Thus, there is ample opportunity to enhance trade and cooperation in BIMSTEC and its member countries that can promote sustainable economic growth.

Table 4 has reported the outcome of the Pearson correlation matrix for checking multicollinearity. According to Gujrati (2004) and Hair et al. (2011), the problem of multicollinearity takes place when the Pearson correlation coefficient exceeds 0.90. The table shows that the correlation coefficient between the

Table 3. Outcome of Equation (10).

Ind. Var.	β Coef.	t-stat.	Prob.	F-Statistic	Probability
INDIA					
ΔlogBOT	0.0239	0.3318	0.7408	202.4135**	0.0000
ΔlogFDI	0.2871	6.3001**	0.0000		
ΔlogAGP	0.2067	5.6929**	0.0000		
ΔlogEMP	1.1027	0.8710	0.3863		
BANGLADESH					
ΔlogBOT	0.0731	0.9005	0.3705	658.2275**	0.0000
ΔlogFDI	−0.1096	−4.5860**	0.0000		
ΔlogAGP	0.5549	4.7868**	0.0000		
ΔlogEMP	3.6033	7.8752**	0.0000		
NEPAL					
ΔlogBOT	0.0957	1.0905	0.2787	1860.112**	0.0000
ΔlogFDI	0.0167	1.6570	0.1013		
ΔlogAGP	0.6066	6.1494**	0.0000		
ΔlogEMP	2.1890	3.9452**	0.0002		
BHUTAN					
ΔlogBOT	0.0870	4.8046**	0.0000	709.1069**	0.0000
ΔlogFDI	0.0354	1.7245	0.0884		
ΔlogAGP	0.2612	3.6930**	0.0004		
ΔlogEMP	3.7231	11.2442**	0.0000		

(Table 3 continued)

(Table 3 continued)

Ind. Var.	β Coef.	t-stat.	Prob.	F-Statistic	Probability
		SRI LANKA			
ΔlogBOT	0.2169	3.3708**	0.0011	960.1650**	0.0000
ΔlogFDI	0.0429	0.7542	0.4529		
ΔlogAGP	0.8014	10.7622**	0.0000		
ΔlogEMP	3.2748	4.4285**	0.0000		
		MYANMAR			
ΔlogBOT	0.0572	1.5647	0.1215	759.3152**	0.0000
ΔlogFDI	0.0909	1.7028	0.0924		
ΔlogAGP	1.2129	11.6586**	0.0000		
ΔlogEMP	8.0063	6.6740**	0.0000		
		THAILAND			
ΔlogBOT	0.0864	7.1380**	0.0000	448.4118**	0.0000
ΔlogFDI	0.0114	0.4282	0.6696		
ΔlogAGP	0.9306	34.5282**	0.0000		
ΔlogEMP	−0.0678	−2.5835**	0.0116		
		BIMSTEC			
ΔlogBOT	−0.0155	−1.0230	0.3093	234.6500**	0.0000
ΔlogFDI	0.2048	4.8541**	0.0000		
ΔlogAGP	0.3707	6.3764**	0.0000		
ΔlogEMP	3.3884	2.9271**	0.0044		

Note: **Significant at the 5% level.

Table 4. Outcome of Pearson Correlation Matrix.

		INDIA		
Variable	ΔlogBOT	ΔlogFDI	ΔlogAGP	ΔlogEMP
ΔlogBOT	1.0000	0.7412	0.6817	0.8812
ΔlogFDI	0.8745	1.0000	0.6810	0.7354
ΔlogAGP	0.6817	0.6810	1.0000	0.6311
ΔlogEMP	0.7915	0.8945	0.6311	1.0000
		BANGLADESH		
ΔlogBOT	1.0000	0.8687	0.8680	0.8658
ΔlogFDI	0.8687	1.0000	0.8803	0.8460
ΔlogAGP	0.8680	0.8803	1.0000	0.8610
ΔlogEMP	0.8658	0.8460	0.8610	1.0000
		NEPAL		
ΔlogBOT	1.0000	0.4268	0.8836	0.7850
ΔlogFDI	0.4268	1.0000	0.4758	0.4536
ΔlogAGP	0.8836	0.4758	1.0000	0.8549
ΔlogEMP	0.7850	0.4536	0.8549	1.0000
		BHUTAN		
ΔlogBOT	1.0000	0.0621	0.6692	0.6634
ΔlogFDI	0.0621	1.0000	0.3742	0.3191
ΔlogAGP	0.6692	0.3742	1.0000	0.8488
ΔlogEMP	0.6634	0.3191	0.8488	1.0000
		SRI LANKA		
ΔlogBOT	1.0000	0.8422	0.8368	0.7072
ΔlogFDI	0.8422	1.0000	0.7343	0.8208
ΔlogAGP	0.8368	0.7343	1.0000	0.8473
ΔlogEMP	0.7072	0.8208	0.8473	1.0000
		MYANMAR		
ΔlogBOT	1.0000	−0.5391	−0.4192	−0.6480
ΔlogFDI	−0.5391	1.0000	0.8366	0.8900
ΔlogAGP	−0.4192	0.8366	1.0000	0.8465
ΔlogEMP	−0.6480	0.8900	0.8465	1.0000
		THAILAND		
ΔlogBOT	1.0000	−0.1422	0.2401	−0.2419
ΔlogFDI	−0.1422	1.0000	0.3424	−0.2729
ΔlogAGP	0.2401	0.3424	1.0000	−0.0817
ΔlogEMP	−0.2419	−0.2729	−0.0817	1.0000
		BIMSTEC		
ΔlogBOT	1.0000	0.8356	0.7544	0.8637
ΔlogFDI	0.8356	1.0000	0.7588	0.8372
ΔlogAGP	0.7544	0.7588	1.0000	0.7392
ΔlogEMP	0.8637	0.8372	0.7392	1.0000

independent variables lies between 0.3191 and 0.8945, which means the absence of multicollinearity.

The outcome of the BDS test has been presented in Table 5. The BDS test statistics of BIMSTEC and its member countries are statistically significant at the distance chosen distance (d = 0.7) and dimensions (m = 2–6), which means the standardized residuals series are not independently and identically distributed (i.i.d.).

Finally, the study has applied the CUSUM test to examine the parameters' stability and the outcome has been presented in Figure 2. The figure shows that the position of cumulative sums of scaled recursive residuals (blue line) lies in between two red lines, which means the parameters of equation (10) are stable and, thus, the estimated regression model is adequate.

Table 5. Outcome of BDS Independence Test.

Dimension	BDS Statistic	z-statistic	Normal Prob.	Bootstrap Prob.
INDIA				
2	0.1639	12.9549**	0.0000	0.0000
3	0.2680	13.1454**	0.0000	0.0000
4	0.3292	13.3652**	0.0000	0.0000
5	0.3610	13.8519**	0.0000	0.0000
6	0.3867	15.1558**	0.0000	0.0000
BANGLADESH				
2	0.1614	18.4004**	0.0000	0.0000
3	0.2617	18.7151**	0.0000	0.0000
4	0.3179	19.0298**	0.0000	0.0000
5	0.3428	19.6242**	0.0000	0.0000
6	0.3604	21.3269**	0.0000	0.0000
NEPAL				
2	0.1435	20.6244**	0.0000	0.0000
3	0.2239	20.3381**	0.0000	0.0000
4	0.2613	20.0238**	0.0000	0.0000
5	0.2690	19.8760**	0.0000	0.0000
6	0.2776	21.3723**	0.0000	0.0000
BHUTAN				
2	0.1560	24.1001	0.0000	0.0000
3	0.2524	24.3582	0.0000	0.0000
4	0.3073	24.7423	0.0000	0.0000
5	0.3327	25.5326	0.0000	0.0000
6	0.3435	27.1635	0.0000	0.0000
SRI LANKA				
2	0.1456	15.1745	0.0000	0.0000
3	0.2303	15.0583	0.0000	0.0000
4	0.2722	14.9105	0.0000	0.0000
5	0.2845	14.9147	0.0000	0.0000
6	0.2847	15.4336	0.0000	0.0000

(Table 5 continued)

(Table 5 continued)

MYANMAR				
2	0.1665	19.0033	0.0000	0.0000
3	0.2701	19.4189	0.0000	0.0000
4	0.3288	19.8799	0.0000	0.0000
5	0.3581	20.7994	0.0000	0.0000
6	0.3666	22.1082	0.0000	0.0000
THAILAND				
2	0.1412	14.9237	0.0000	0.0000
3	0.2187	14.4629	0.0000	0.0000
4	0.2558	14.1353	0.0000	0.0000
5	0.2704	14.2567	0.0000	0.0000
6	0.2737	14.8799	0.0000	0.0000
BIMSTEC				
2	0.1568	14.7945	0.0000	0.0000
3	0.2529	14.8350	0.0000	0.0000
4	0.3051	14.8475	0.0000	0.0000
5	0.3257	15.0163	0.0000	0.0000
6	0.3446	16.2678	0.0000	0.0000

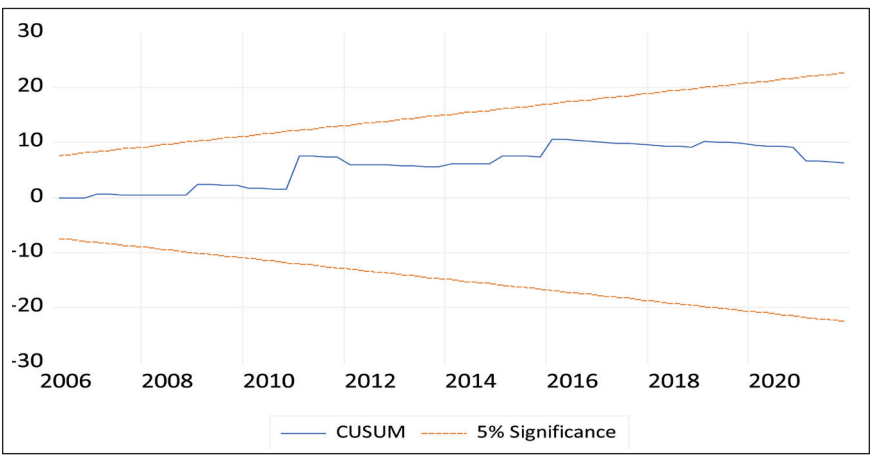

Figure 2. CUSUM Test.

Conclusion and Recommendation

AGP has played a significant role in the economic growth of BIMSTEC and its members. It has been observed that BIMSTEC is rich in its agricultural activities and added significant contributions to the region. Similarly, FDI has been considered as an important macroeconomic determinant for economic development in BIMSTEC and also in India, whereas other members are not. Likewise, employment is an essential macroeconomic factor for economic growth in BIMSTEC and

its members such as Bangladesh, Nepal, Bhutan, Sri Lanka and Myanmar. Similarly, BoT has also been recognized an important macroeconomic determinant for economic growth in BIMSTEC and its members such as Bhutan, Sri Lanka and Thailand.

Therefore, the outcome of this study is significant and helpful for policymaking. Policymakers may urge the BIMSTEC leaders for the improvement of trade cooperation among the members that will help to establish strong cooperation and peace among the members, and as a result, all member countries can gain competitive economic benefit. The study has also been suggested to develop a common platform for FDI in the region where the developed members can extend their FDI support to the less developed members and can grow in the future.

Thus, there is ample opportunity for future research in BIMSTEC in various dimensions the researchers can explore.

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Article

Environmental Protection: Regulations to Reduce and Eliminate Single-use Plastic in Response to Climate Change

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Abstract

This article examines how the Philippines' numerous legislations address the problem of single-use plastic pollution in accordance with the concepts of sustainable development. By examining scholarly and related literature on plastic manufacturing and use, plastic ban and restrictions, and other policies connected to plastic pollution, the study found that the national government agencies worked together to address a wide range of climate change solutions to significantly reduce plastic production as well as usage. Plastic usage regulations have been enacted in each of the 17 local government units that fall under Metro Manila's authority. Individual cities and municipalities, however, may impose varying restrictions due to the fact that their legislation may permit the inclusion of a large variety of different types of plastic compounds. Given this complexity, the rationale behind gradually reducing the consumption of single-use plastic products becomes paramount. Local government agencies require reliable data and effective programs to prevent plastic pollution as global plastic production grows. Regardless of their economic situation, more Philippine cities and municipalities are participating in projects that show their ability to have a global impact on environmental preservation.

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Keywords

Environment, plastic pollution, plastic ban and restriction, single-use plastic

JEL Classification: Q53, Q56, Q58

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Introduction

Global efforts to combat climate change have intensified in recent years, with the Paris Agreement of 2016 highlighting the imperative to limit temperature increases to less than 2°C (3.6°F) compared to the point before industrialization by the year 2030, necessitating a 45% reduction in emissions (IPCC, 2018). Sustainable development principles have become significant frameworks for consideration of climate change, emphasizing long-term decision-making, interdisciplinary approaches, and local community engagement (Widhalm et al., 2021).

The United Nations–established 2030 Agenda for Sustainable Development delineates a collection of 17 Sustainable Development Goals (SDGs) aimed at fostering global peace and prosperity (UN, 2015).

Human activities, particularly the release of greenhouse gases, are identified as the principal catalysts behind climate change, aggravating global warming beyond natural levels (Widhalm et al., 2021). Of significant concern is the role of plastic pollution, which contributes to greenhouse gas emissions and poses severe environmental threats throughout its lifecycle, from production to disposal (Liang et al., 2021).

While numerous countries have implemented measures to mitigate plastic pollution, the effectiveness and coherence of these efforts vary. The Philippines, in particular, faces significant challenges, with studies highlighting its disproportionate contribution to global plastic waste (CCC, 2021; Braganza et al., 2017; McKinsey, 2015; Schachter & Karasik, 2022). As such, this study aims to analyze the Philippines' legislative initiatives in addressing single-use plastic pollution within the framework of sustainable development principles.

The escalating threat of climate change necessitates urgent and comprehensive action to mitigate greenhouse gas emissions and address environmental degradation. Despite global commitments and initiatives, challenges persist, particularly regarding the proliferation of single-use plastics and inadequate legislative responses. This study focuses on the Philippines, where significant gaps exist in addressing the environmental impact of plastic pollution, threatening both local ecosystems and global climate goals.

The urgency to address plastic pollution stems from its multifaceted environmental consequences, including greenhouse gas emissions, marine pollution, and ecosystem disruption. By examining the Philippines' legislative efforts, this study seeks to identify opportunities for enhancing policy coherence and effectiveness in combating single-use plastic pollution in the wider framework of sustainable development. Such insights are crucial for informing targeted interventions

and fostering international cooperation to reduce the detrimental effects of plastic pollution at both local and global scales.

This study contributes to the ongoing discourse on mitigating climate change and promoting sustainable development by providing a comprehensive analysis of the Philippines' legislative response to single-use plastic pollution. By clarifying the strengths and weaknesses of existing policies, it offers valuable insights for stakeholders, specifically policymakers and environmental advocates seeking to enhance the efficacy of plastic waste management strategies. Moreover, the results of this study have consequences for global efforts to attain the objectives specified in the Paris Agreement and the SDGs, emphasizing the interconnectedness of environmental conservation and sustainable development objectives.

Review of Literature

International Agreements and Policies

International agreements and policies encompass critical frameworks aimed at addressing climate change, notably those exemplified by the Kyoto Protocol and the Paris Agreement. The Kyoto Protocol, established on December 11, 1997, and effective from February 16, 2005, binds industrialized nations to regulate and lower the release of greenhouse gases, operationalizing the United Nations Framework Convention on Climate Change (UNFCCC). Implementation requires meticulous monitoring, review, and verification to ensure transparency and accountability (UNFCCC, 2015a).

Similarly, in the Paris Agreement, ratified on December 12, 2015, and enacted on November 4, 2016, the objective was to restrict the increase in global temperatures, emphasizing progressively ambitious climate action through nationally determined contributions (NDCs). This multilateral agreement highlights the importance of financial assistance and transparency, especially for vulnerable nations (UNFCCC, 2015b). Moreover, both agreements stress mitigation strategies and adaptation efforts, highlighting the need for comprehensive policies across various sectors such as energy, transportation, and agriculture. In this endeavor, nations commit to mitigating adverse impacts on lower-middle income countries and fostering international collaboration through forums such as the Conference of the Parties (COP). These agreements mark significant milestones in combating climate change, emphasizing collective responsibility and concerted action on a global scale (UN, 2015).

United Nations Environmental Sustainability

The 17 SDGs were developed by the United Nations in 2015 with commitments from 193 governments, to guide global sustainability efforts by 2030. These goals, outlined in the 2015 UN Sustainable Development Report, target various challenges, including climate change, waste management, and sustainable economies (UNDP, 2023). They emphasize key areas such as sanitation and water quality

(SDG 6), community development that is sustainable (SDG 11), ethical purchasing and manufacturing (SDG 12), combating climate change (SDG 13), and life beneath the water (SDG 14). Each goal advocates for specific actions, such as promoting citizen engagement, reducing plastic usage, and mitigating emissions, while noting the importance of collaboration among governments, civil society, and the business community for achieving universal sustainability and addressing interrelated global challenges (UNDP, 2023).

Definition and Environmental Impact of Single-use Plastics

Single-use plastics, commonly referred to as SUPs, encompass packaging or consumer products designed for one-time use before disposal, recycling, or destruction. The European Commission defines them as items rarely recycled, leading to significant waste accumulation (EU, 2021). The United Nations Environment Programme (UNEP) elaborates on SUPs as disposable plastics extensively utilized in packaging, including items such as plastic bags, food containers, bottles, straws, cups, and cutlery, contributing to environmental degradation (UNEP, 2018). The pervasive use of SUPs reflects a throwaway culture, posing grave threats to ecosystems and human health. Their persistence in the environment leads to water pollution, marine life fatalities, drainage obstruction, and the emission of harmful gases during production and disposal. These plastics persist for centuries, breaking down into microplastics that infiltrate the food chain, ultimately impacting human health (CCC, 2021).

Worldwide Regulations and Initiatives

- Bans: Across 27 countries, legislation prohibits the manufacturing, distribution, import, or consumption of single-use plastics to varying extents (UNEP, 2018). Particularly prevalent in small island states, these bans target specific items, such as tableware, cutlery, and polystyrene products (UNEP, 2018). Countries like Canada integrate such bans into broader environmental initiatives, lacking detailed enforcement mechanisms (UNEP, 2018).
- Taxes: 29 nations implement taxes on single-use plastics, aiming to reduce waste, manage plastic disposal, and promote recycling (UNEP, 2018). Europe leads in the number of countries with such taxation systems, followed by the Asia-Pacific, Africa, and Latin America (UNEP, 2018).
- Extended producer responsibility (EPR): A total of 63 nations have implemented EPR rules specifically targeting single-use plastics, with Europe having the highest adoption rate (UNEP, 2018). EPR focuses on reusing plastic packaging and single-use items, varying in implementation across countries and sometimes placing responsibility on retailers or distributors (UNEP, 2018).
- Deposit-refund mechanisms: 23 countries have deposit-refund systems mandating the return of single-use plastic products, primarily targeting beverage bottles (UNEP, 2018). Most prevalent in Europe, these

mechanisms incentivize recycling but lack representation in other regions (UNEP, 2018).

- Recycling mandates: 51 countries enforce recycling regulations, with the majority setting explicit recycling goals (UNEP, 2018). European nations lead in implementing recycling mandates, often aligned with EU directives on packaging waste (UNEP, 2018). Policymakers worldwide turn to market-based instruments such as taxes and bans to address single-use plastics, reflecting growing global efforts toward environmental conservation (UNEP, 2018).

Management of Plastic Waste in the Philippines

- Overview of plastic pollution issue: Plastic contamination is a substantial concern to the Philippines, with the country being a major contributor to marine plastic contamination. Annually, the Philippines generates 2.7 million metric tons of garbage, with 0.5 million metric tons of plastic waste leaking into the environment. Between 70% and 90% of illegally disposed waste ends up in water bodies, exacerbating the problem (Braganza et al., 2017; McKinsey, 2015; Schachter & Karasik, 2022). A study by the World Wide Fund for Nature (WWF) Philippines in 2020 revealed that out of 2.15 million tons of plastic consumed annually, 35% (760 thousand tons) is lost to the open environment and 33% (706 thousand tons) ends up in landfills and dumpsites (Business World, 2022; WWF, 2020). The sachet economy, characterized by the extensive use of single-use plastic packaging, worsens the plastic pollution crisis. The Philippines consumes 164 million sachets daily, leading to substantial environmental degradation. Additionally, disposable diapers further compound the issue, as they are challenging to manage and dispose of (GAIA, 2019).
- Challenges faced: Several challenges hinder the effective management of plastic waste in the Philippines. The prevalence of single-use plastic packaging, particularly in the sachet economy, contributes significantly to pollution. Moreover, the lack of proper disposal mechanisms for items such as sachets and diapers exacerbates the problem. Despite efforts by local governments to implement zero-waste initiatives, inadequate infrastructure and limited resources hamper effective solid waste management (GAIA, 2019).
- Policy recommendations: Addressing the plastic waste crisis includes implementing a nationwide ban on single-use plastic bags, enforcing regulations on products packaged in single-use plastics, compelling diaper companies to expand recycling programs and develop alternatives to single-use diapers, strengthening regulations against waste burning, and holding companies accountable for their plastic packaging waste, particularly multinational corporations, by encouraging innovative product design and distribution strategies (GAIA, 2019). These recommendations aim to address the fundamental factors contributing to plastic pollution in the Philippines and promote sustainable waste management practices.

Plastic pollution and climate change are two interconnected global challenges that require urgent attention and coordinated action at international, national, and local levels. While plastic waste poses significant threats to marine ecosystems and human health, climate change aggravates environmental degradation and threatens the livelihoods of millions worldwide. In response to these challenges, international agreements, policies, and sustainable development goals have been established to mitigate greenhouse gas emissions, promote sustainable practices, and address plastic pollution (UNDP, 2023; UNEP, 2018).

Methodology

The research methodology employed a comprehensive approach to understand and evaluate the policies related to plastic pollution and single-use plastics in the Philippines only.

Figure 1 illustrates the sequential steps in the research methodology. The following steps were undertaken:

1. Literature review: The researcher conducted an extensive review of academic and relevant literature, focusing on plastic pollution in the Philippines and legislative measures addressing this issue. The selection criteria included articles relevant to plastic pollution and existing legislation.
2. Policy evaluation: The methodology involved assessing policy effectiveness by analyzing recent news articles related to policies discussed in the literature. Despite not every policy having news coverage, the available

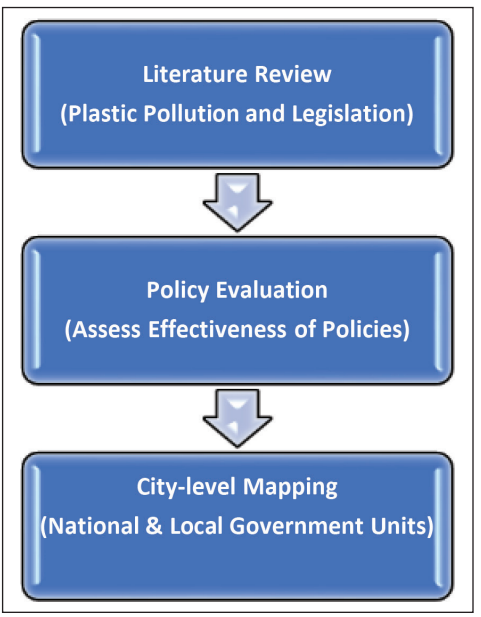

Figure 1. Sequential Steps in the Research Methodology.

information provided valuable context. Secondary and tertiary sources were utilized for deeper understanding.

3. City-level mapping: A detailed mapping of policies introduced by both national and local government units within Metro Manila was presented. Specific ordinances and projects for various cities were identified, including: Caloocan: Ordinance No. 0503, S-2013; Las Piñas: Ordinance No. 1036–11; Makati: Ordinance No. 2003–095; Mandaluyong: Ordinance No. 523, S-2013; Manila: Ordinance No. 8282, S-2012; Marikina: Ordinance No. 18, S-2012; Muntinlupa: Ordinance No. 10–109; Pasig: Ordinance No. 9, S-2010; Parañaque: Ordinance No. 18–40, S-2018; Pasay: Ordinance No. 4647, S-2011; Quezon: Ordinance No. 2876, S-2019; Malabon: Ordinance No. 01–2013; Navotas: Ordinance No. 2015–14; Pateros: Ordinance No. 2011–10; San Juan: "Kuha sa Tingi" Project—A Zero Waste Campaign; Taguig: "Zero Waste Plan"; and Valenzuela: "May Balik sa Plastik Program."

Results and Discussion

National Government Unit's Plastic Bans and Regulations

On March 12, 2021, in the city of Manila, during the inaugural session of the Cabinet Cluster on Climate Change Adaptation, Mitigation, and Disaster Risk Reduction (CCAM-DRR), the Technical Working Group (TWG) on Circular Economy, Sustainable Consumption and Production, and Single-use Plastics, the Climate Change Commission (CCC) put forth a proposal advocating for the adoption of waste avoidance and reduction as the primary strategy, which entails the gradual elimination of single-use plastics (CCC, 2021).

The movement has garnered extensive support, as seen by the significant number of cities, municipalities, and provinces, totaling at least 489, that have enforced prohibitions and restrictions on disposable plastics. According to Commissioner Rachel Herrera of the CCC, there is an urgent need for a nationwide prohibition in order to bolster their initiatives focused on climate-resilient recovery and environmental preservation, as well as to mitigate the escalating carbon emissions originating from the country (CCC, 2021).

The government agencies showcased ongoing efforts and analyses conducted in collaboration with the commercial sectors. These efforts were established subsequent to an address made to the cabinet group regarding the resolution titled "Adopting the Principles of Sustainable Consumption and Production, Towards Regulation and Phaseout of Single-use Plastics, and a Responsible Transition to the Use of Environment-Friendly Products" on January 27, 2021 (CCC, 2021).

The purpose of the gathering was to synchronize and integrate resilient and sustainable initiatives within the governmental framework. Pollution from plastic is undeniably a matter of significant concern with regard to public health, waste management, and climate change. Assistant Director Vizminda Osorio of the Department of Environment and Natural Resources-Environment and

Management Bureau (DENR-EMB), who presided over the TWG meeting, emphasized the pressing necessity to advance the concepts of circular economy and environmentally conscious consumption and manufacturing concepts within their management and community frameworks (CCC, 2021).

Following the enactment of RA No. 9003, the National Solid Waste Management Commission (NSWMC) was formally established as an inter-agency body responsible for overseeing the implementation of solid waste management plans and crafting policies aligned with the law's objectives (Republic of the Philippines—Republic Act No. 9003, 2021). The commission comprises 14 government sector members and 3 commercial sector members. Notably, the government sector representation includes heads of key agencies such as the Department of Environment and Natural Resources (DENR), Food and Drug Administration (FDA), and Department of Trade and Industry (DTI), along with other crucial entities. Additionally, the private sector representation encompasses individuals from non-governmental organizations (NGOs) focusing on recycling and environmental protection, the recycling industry, and the manufacturing or packaging industry (RA No. 9003).

Section 2 of Republic Act No. 9003 establishes the policy of the state to implement a methodical, all-encompassing, and environmentally conscious system for managing solid waste. This system aims to establish standards and objectives for controlling the amount of waste material produced by techniques such as source reduction and waste minimization (NSWMC Resolution 1363, 2020).

In accordance with Section 8(f) of Republic Act No. 9003, it is stipulated that DENR is tasked with the responsibility of proposing policies aimed at removing obstacles hindering trash reduction initiatives. In consideration of the prevailing circumstances, it is essential to recognize that certain materials are widely acknowledged as unnecessary single-use plastics, including: (a) plastic cups with a thickness below 0.2 mm; (b) disposable plastic straws; (c) plastic coffee stirrers; (d) plastic spoons; (e) plastic forks; (f) plastic knives; and (g) plastic bags for laboratory use and thin-film bags (less than 15 microns thick) (NSWMC Resolution 1363, 2020).

Given the need to provide precise directives for national government agencies (NGAs), local government unit (LGU) offices, and other government-controlled entities, it is essential to implement a ban on the use of superfluous plastic that is used only once as a means to mitigate and prevent solid waste (NSWMC Resolution 1363, 2020).

Resolution No. 1363, Series 2020, enacted by the NSWMC, proposes that the DENR be instructed to develop and execute a plan to prohibit the use of non-essential disposable plastics by NGAs, LGU offices, and all other government-controlled offices (NSWMC Resolution 1363, 2020).

The DENR has implemented several strategies and programming efforts with the objective of preventing, reducing, and managing marine litter. Director Osorio placed significant emphasis on the overarching goal of attaining the complete eradication of waste in the waters of the Philippines by the year 2040, with a notable focus on the principles of responsibility and accountability.

The aforementioned statement was made at the formal unveiling of the National Plan of Action for the Prevention, Reduction, and Management of Marine Litter (CCC, 2021).

Also, a diverse group of legislators from both the Senate and the House of Representatives have individually introduced their own iterations of a legislative proposal with the aim of addressing the escalating issue of plastic waste and pollution in the nation under House Bill 9147, "Single-use Plastic Product Regulation Act." The House of Representatives has approved a resolution aimed at gradually eliminating single-use plastic items while also imposing a prohibition on their manufacturing, importation, sale, distribution, availability, and use for a span of four years (CNN Philippines, 2021; Devio, 2021; House Bill 9147, 2021).

Section 3 of the proposed legislation pertains to the gradual elimination of single-use plastic products. The Act stipulates that the elimination of non-compostable single-use plastic items should be implemented over a span of four years, commencing from the date of its enactment. The items that fall under the scope of this study include: (a) ceramic dishes such as plates and saucers; (b) cups, bowls, and lids; (c) utensils such as spoons, forks, knives, and chopsticks; (d) containers for food and beverages made from expanded polystyrene; (e) plastics that are designed to degrade through oxidation, known as oxo-degradable plastics; (f) thin films, packaging materials, or bags with a thickness of less than 50 microns; and (g) multilayered sachets and pouches that incorporate other materials (House Bill 9147, 2021).

The following items will be gradually discontinued within a timeframe of one year from the commencement of this legislation: (a) drinking straws; (b) stirrers; (c) sticks for candy, balloons, and cotton buds; (d) buntings; (e) confetti; and (f) packaging or bags having a thickness of less than 10 microns. Subsequently, a prohibition shall be imposed on the manufacture, importation, sale, distribution, supply, or use of the aforementioned plastic items. The use of appropriately labeled, flexible, and disposable plastic drinking straws for individuals with certain medical issues should be permitted in cases where viable alternatives, such as reusable or compostable options, are not readily accessible (House Bill 9147, 2021).

Section 5: Implementation Strategy for the Gradual Elimination of Single-use Plastic Products by the DENR), in collaboration with the NSWMC, will develop a phase-out plan, hereafter referred to as the plan. This will be done in cooperation with pertinent government departments and agencies, as well as stakeholders. The plan must be completed within six months from the day this Act takes effect (House Bill 9147, 2021).

The DTI, in collaboration with the DENR, the Department of Science and Technology (DOST), and the FDA under the Department of Health (DOH), will develop a *consumption, reduction, and recovery program.* This program aims to achieve a substantial decrease in the consumption of single-use plastic products and promote increased recovery through recycling, treatment, or appropriate disposal methods. The formulation of this program will involve consultations with relevant stakeholders and align with the phase-out period specified in the legislation. These measures encompass national initiatives aimed at reducing consumption,

setting targets for waste recovery, and implementing other strategies to ensure the availability of reusable and compostable alternatives to single-use plastic products. Additionally, these measures stipulate that such products should not be provided free of charge to the final consumer at the point of sale (House Bill 9147, 2021).

The formulation of *producer responsibility schemes* is necessary to effectively achieve the goals outlined in Section 7 of this Act. During the phase-out periods, these programs also act as temporary solutions to reduce the environmental harm that single-use plastic products cause (House Bill 9147, 2021).

In order to comply with the provisions outlined in Sections 6 and 14 of this legislation, it is necessary to develop suitable approaches that will aid local manufacturers in the adoption of the necessary technology and sustainable materials for the creation of *reusable or compostable options* to replace single-use plastic products. These alternatives should also possess high recoverability and recyclability attributes (House Bill 9147, 2021).

Methods of Raising Public Awareness

The DENR, in collaboration with the Department of Education and the Department of Interior and Local Government (DILG), is tasked with creating an information dissemination plan for the Information and Education Campaign (IEC) mandated by Section I of this Act, with the goals of informing consumers about (a) the environmental effects of using and disposing of single-use plastic products; (b) waste reduction, reuse, recycling, and recovery systems; and (c) other best practices (House Bill 9147, 2021).

In accordance with current law, the Department of Finance (DOF), the DILG, and the DTI will work together to establish mechanisms that provide financial or non-fiscal rewards and incentives. These incentives aim to encourage manufacturers, importers, sellers, and end users to actively engage in programs designed to accomplish the objectives outlined in the plan (House Bill 9147, 2021).

The Act imposes penalties for intentional infringements of Sections 3, 4, 6, 7, 8, 14, and 15, as well as for the fabrication of papers mandated by the Act. Additionally, misrepresentation by individuals engaged in the production, importation, or distribution of single-use plastic items, as well as by commercial premises, will also be subject to penalties (House Bill 9147, 2021).

The imposition of a plastic prohibition in the office activities of the CCC has already been implemented by Office Order No. 2020-010, titled "Office Waste Management System," which was issued on January 24, 2020. According to the office order, the use of disposable plastics, including plastic straws, stirrers, utensils, food wrappers, shopping bags, instant food packing, lids, drinking bottles, and caps, is not allowed on the office premises during official meetings, conferences, and other events (CCC—OWMS Order 2020-010).

In line with President Ferdinand Marcos Jr.'s pledge to reduce ocean pollution, the Philippine Senate has passed a bill that will impose tariffs on single-use plastics. To discourage use and safeguard the environment, the law proposes a tax of 100 pesos ($1.75) per kilogram on the production and import of single-use plastics, which would increase by 4% per year beginning in 2026. There is a projection

to generate a yearly income of 9.3 billion pesos to finance solid waste management initiatives (Reuters, 2022).

Local Government Units' Plastic Bans and Regulations

Different LGUs have been enforcing plastic limits since 2011, with varying degrees of success. According to 2019 data from NSWMC, 489 cities and municipalities (30% of all cities and municipalities in the nation) have implemented some policy to limit the distribution and usage of plastics, most notably plastic bags, except for the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM). Local governments nationwide regulate the use of plastics (CCC, 2021; Teves, 2021).

Metro Manila has plastic regulations in its 17 local government units. But various cities and towns may have different restrictions since their rules may cover different types of plastic, as briefly discussed below.

Caloocan: Ordinance No. 0503, S-2013

The scope of this ordinance encompasses all retail and commercial enterprises that are subject to its regulations under the territorial authority of Caloocan City. These enterprises are prohibited by law from engaging in the sale, supply, and utilization of materials that are not biodegradable, such as polystyrene and bags made of secondary packaging involving dry and wet commodities (Republic of the Philippines, 2013a).

The scope of this law excludes the principal packaging of items and any additional packaging that is integral to the product itself, since viable alternative packaging options are not now accessible in the market. These products include a range of commodities, including but not limited to snack foods, food that is frozen, hardware items, water in bottles or soda, fruit juices, oil for cooking, plastic sachet products containing soap, shampoo and conditioner, cosmetics, and similar items.

The plastic materials used for the packaging of fresh, wet items that are directly acquired from wet marketplaces are classified as secondary packaging. Consequently, it is essential that these materials possess biodegradable or oxo-biodegradable properties.

Any businesses found to be in breach of this code will be given an ordinance violation receipt (OVR) and will face penalties such as the following: The first violation carries a penalty of 1,000 pesos (PHP1,000). The second infraction carries a penalty of PHP3,000. In the event of a third offense, the offender will be subjected to a monetary penalty of up to PHP5,000 and the termination of the company's permit for at least one year (https://drive.google.com/file/d/1JJ3dnDQPxtnkoJNyVLAAymG11s1cI9Ww/view).

Las Piñas: Ordinance No. 1036-11

City Ordinance No. 1036-11, enacted in 2011, is a legislative measure that prohibits the use and dissemination of thin film, one-time-use plastic bags, as well as polystyrene foam (commonly known as Styrofoam or Styropor), by commercial

enterprises within the jurisdiction of the City of Las Piñas. The ordinance also outlines the penalties to be imposed for non-compliance with its provisions (Republic of the Philippines, 2011a).

In the event that any establishment fails to comply with the ordinance, they will be liable to face the following penalties: An initial violation results in a penalty of PHP1,000. The second violation would result in a penalty of PHP3,000. The third violation entails a penalty of a PHP5,000 and/or a maximum prison sentence of six months, as determined by the court. In the event of a commercial establishment, their operating license may be revoked for a period of one year (https://laspinascity.gov.ph/publications?page=2).

Makati: Ordinance No. 2003-095

The purpose of this legislation is to officially adopt the Makati City Management of Solid Waste Code and establish penalties for any violations. It is important to note that these penalties are subject to all applicable laws as well as existing legal rules and regulations (Republic of the Philippines, 2003).

All food establishments, including food service chains, restaurants, supermarkets, eateries, and similar businesses located in the City of Makati, are required to eliminate their existing inventory of plastics, Styrofoam, and similar materials used for food and product packaging within a period of nine years. These items should be replaced with biodegradable alternatives such as paper plates, bags, mugs, and food packs.

The proposed strategy involves implementing a gradual decrease in stocks over a period of five years, with a yearly reduction rate of 5% throughout this time frame. Over the course of three consecutive years, there was a consistent decline of 20% each year. Over the course of the last year, there has been a decline of 15%.

Individuals who fail to adhere to any of the provisions outlined in these ordinances will be subject to penalties as follows: An individual may be subject to a penalty of PHP1,000 or a period of imprisonment ranging from 5 to 30 days, or both, as determined by the court's discretion. A corporation or establishment may be subject to a penalty of PHP5,000 or a period of imprisonment ranging from 30 days to 1 year, or both, as determined by the court's discretion (https://www.makati.gov.ph/content/resolutions-and-ordinances/search).

Mandaluyong: Ordinance No. 523, S-2013

The purpose of this ordinance is to further reduce the use of bags made of plastic and Styrofoam in business enterprises within the City of Mandaluyong. It aims to promote environmental sustainability and encourage the adoption of more eco-friendly alternatives. By revising Sections 1, 2, and 4 of Ordinance No. 479, S-2011, this regulation strengthens the previous efforts made toward phasing out plastic bags and Styrofoam in the city (Republic of the Philippines, 2013b).

Individuals found using or violating Section 2 materials or this ordinance will face penalties such as a fine of PHP500–5,000, cancelation or termination of a permit or license, or being imprisoned for 1–3 months. The penalty will be levied on the owner or operator of the establishment, the manager, or the

person in charge. If the violator is a corporation, a partnership, or an association, the punishment is going to be enforced on the president, general manager, or managing partner (https://mandaluyong.gov.ph/download/ordinance-no-523-s-2013/).

Manila: Ordinance No. 8282, S-2012

This regulation is designed to tackle environmental issues linked to the use of plastic bags and polystyrene containers. By prohibiting plastic bags for dry goods and regulating their usage for wet goods, it encourages the adoption of more environmentally friendly alternatives. Furthermore, banning the use of polystyrene and similar materials as containers for various products helps reduce non-biodegradable waste and promotes the use of eco-friendly substitutes. The penalties for violations act as a deterrent, promoting compliance with these regulations and fostering a more environmentally aware community.

Penalties for breaching any of the prohibited actions are as follows: for the initial violation, a fine of PHP1,000 and the requirement to display signage outside the establishment detailing the offense; for subsequent violations, a fine of PHP2,500 and similar signage; and for a third offense, a fine of PHP5,000 and/or imprisonment for up to six months, as determined by the court. Additionally, for business establishments, their operating license may be revoked for a period of one year (https://citycouncilofmanila.ph/wp-content/uploads/2023/02/ORDINANCE-NO.-8282.pdf).

Marikina: Ordinance No. 18, S-2012

This ordinance restricts the utilization of plastic bags for packaging wet goods while outright banning their usage for dry items. It promotes the transition to alternative packaging materials for wet goods to minimize plastic waste and promote environmental sustainability. Additionally, it acknowledges the detrimental effects of plastic packaging on dry goods and limits its usage to protect the environment further.

Establishments can be penalized as follows: PHP1,000 for a first offense; PHP3,000 for a second offense and temporary closure until complete compliance; and PHP5,000 for a third offense together with permanent closure. Individuals who violate the terms of this agreement will be fined PHP500 or, if they are unable to pay the fine, will be required to perform eight hours of community service or donate 200 cc of blood (https://bplo.marikina.gov.ph/ordinance/Ordinance%20No.%20018%20Series%20of%202012.pdf).

Muntinlupa: Ordinance No. 10-109

The ordinance aims to promote environmental sustainability by reducing plastic waste and encouraging the use of more eco-friendly alternatives. It also recognizes the harmful effects of Styrofoam/Styropor on the environment and seeks to eliminate its usage within the city. The penalties outlined in the ordinance serve as a deterrent to ensure compliance and encourage businesses and residents to adopt more sustainable practices (Republic of the Philippines, 2010a).

Violations of prohibited acts by business establishments can result in penalties such as a fine of PHP500 for the first offense, PHP1,000 for the second offense, and PHP2,500 for the third offense. The court may also impose imprisonment for up to six months, or the establishment may lose their license for one year (http://www.quezoncitycouncil.ph/ordinance/SP/SP-2876,%20S-2019.pdf).

Pasig: Ordinance No. 9, S-2010

The ordinance bans the use of plastic bags for dry goods, regulates their usage for wet goods, and prohibits the use of Styrofoam and similar materials as containers for food, produce, and other products (Republic of the Philippines, 2010b). Violators, whether businesses or individuals, will face penalties. For the first offense, a fine of PHP500 will be imposed, PHP1,000 for the second offense, and PHP2,500 for the third offense. Penalties may also include imprisonment for up to six months, with the general manager or president being subject to imprisonment. Furthermore, a one-year cancelation of the business license will be enforced (https://www.foi.gov.ph/requests/aglzfmVmb2ktcGhyHgsSB0NvbnRlbnQiEVVTQVAtNDU0OTA3ODMzNjA2DA).

Parañaque: Ordinance No. 18-40, S-2018

The City of Parañaque has taken a significant step toward environmental sustainability by passing Ordinance No. 18-40 in 2018. This ordinance effectively bans the use, provision, and sale of single-use plastic items such as sando bags, stirrers, straws, cups, cutlery and utensils, Styrofoam plates, cups, bowls, and take-away packaging. The implementation of this ban began in January 2021. This ordinance aims to regulate the use of Styrofoam and plastic bags for prepared food and beverage containers and imposes penalties for non-compliance.

The legislation specifies that establishments found to be violating prohibited acts will be subject to penalties, including a fine of PHP5,000 for the first, second, and third violations. Furthermore, the establishment may be temporarily closed and its business license revoked for a period of one year (https://web.facebook.com/cenroparanaque.ph/photos/a.419808598191302/1621099784728838/?type=3&_rdc=1&_rdr).

Pasay: Ordinance No. 4647, S-2011

On September 12, 2011, Pasay City implemented regulations governing the use of non-compostable plastic carry-out bags while also encouraging the adoption of recyclable paper and reusable bags (Republic of the Philippines, 2011b).

The regulations entail penalties, including a warning, a fine of PHP1,000, a fine of PHP3,000, and the possible closure or cancelation of the mayor's business permit for violators. Additionally, tampering with certification, submitting falsified documents, or passing off counterfeit compostable bags as genuine will result in an administrative fine of PHP3,000 for the first infraction and PHP5,000 for subsequent violations (https://www.pasaycitysecretariat.com/_Attachments/Resolutions/2019111201920_RESO-4873-S2019.pdf).

Quezon: Ordinance No. 2876, S-2019

The regulation bans the utilization of single-use plastic or disposable items, such as cutlery, for dine-in services across all hotels and restaurants in Quezon City. Its goal is to mitigate the environmental repercussions associated with single-use plastics and disposable materials within the food service sector. By implementing this ban, Quezon City is taking a proactive step toward promoting sustainable practices and encouraging businesses to adopt more eco-friendly alternatives for dine-in purposes (Republic of the Philippines, 2019).

The ordinance sets forth penalties for violations committed by restaurants and hotels. A first offense carries a fine of PHP1,000, while a second offense incurs a fine of PHP3,000, along with the withdrawal of environmental clearance and an order to halt operations from the Business Permits and Licensing Department. For a third offense, a fine of PHP5,000 is imposed, the business permit is withdrawn, and a closure order is issued (http://www.quezoncitycouncil.ph/ordinance/SP/SP-2876,%20S-2019.pdf).

Malabon: Ordinance No. 01-2013

According to recent information from the Philippine Daily Inquirer, Ordinance No. 01-2013, which governs the utilization of plastic bags for wet goods, bans the use of Styrofoam/Styropor bags, and imposes penalties for their usage, has been sent back to the Malabon City Council for revisions. Businesses are required to adhere to "Plastic-Free Days" every Friday, and violations may result in fines. The consequences for breaching the ordinance range from a PHP1,000 monetary penalty, a cautionary notice, and mandatory participation in a seminar for the initial offense to a PHP5,000 monetary penalty and a one-year revocation of their operating license. Individuals who violate the ordinance are subject to fines ranging from PHP500 to PHP1,500, as well as community work and a lecture, the severity of which is determined by the number of violations committed (Melican, 2013).

Navotas: Ordinance No. 2015-14

Navotas City Ordinance No. 2015-14 restricts the use of polystyrene packaging and plastic bags exclusively on Fridays. According to Connie Labay from Navotas CENRO, the legislation is being rigorously enforced in pharmacies and fast food restaurants. However, she stated that the stringent enforcement of this policy is still ongoing in Navotas fish markets, where fish goods are either wrapped or purchased in plastic bags (Cayabyab, 2019).

Pateros: Ordinance No. 2011-10

This regulation imposes a prohibition on the usage of plastic items and imposes restrictions on their utilization for wet goods, while also forbidding the use of Styrofoam products (https://events.development.asia/system/files/materials/2012/04/201204-rehabilitation-four-river-systems-pateros.pdf).

San Juan: "Kuha sa Tingi" Project: A Zero Waste Campaign

San Juan City is dedicated to addressing the challenge of plastic waste in the country. We have already initiated multiple endeavors with the objective of repurposing or recycling plastics. "Communities have the potential to demonstrate that we can decrease, if not completely eradicate, the use of disposable plastics," stated Mayor Francis Zamora of San Juan City. "Kuha Sa Tingi achieves this by eliminating sachets and other disposable plastics and advocating for the adoption of reusable and refillable systems." This project not only safeguards the environment and diminishes plastic trash but also generates employment opportunities and promotes a zero-waste circular economy (Greenpeace Philippines, 2022).

Taguig: "Zero Waste Plan"

The Taguig municipal administration has reaffirmed its dedication to environmental preservation. With the introduction of its Zero Waste Plan, an integrated initiative aimed at reducing solid waste and enhancing waste management, the organization plans to achieve an 80% diversion of solid waste from landfills and dumpsites by 2023. The objective of the initiative is to enhance the general health and wellness of Taguig by tackling issues related to water and soil contamination as well as mitigating air pollution. Taguig will also participate in global initiatives to eliminate the use of disposable plastics. Individuals are advised to utilize canvas bags or eco-bags as a substitute for plastic bags while purchasing miscellaneous items such as meat, fruits, and vegetables (Caliwan, 2020).

Valenzuela: "May Balik sa Plastik Program"

The first nationwide initiative in to collect residual waste was the "May Balik sa Plastik" program, which Nestlé Philippines started. The campaign is a combined effort by Nestlé, the Valenzuela City government, the Department of Education, and Green Antz Builders, Inc. Mayor Rex Gatchalian stated that the program holds significance for the city's citizens as it aims to educate young individuals about the importance of plastic garbage. His approach does not involve banning plastics; instead, it focuses on repurposing and recycling them for other purposes. Although various schools in the city have previously devised their own techniques for managing plastic waste, such as transforming it into furniture, Gatchalian emphasized that the new program will offer further support in efficiently handling these materials. Nestlé's new program consists of three main components: collection of plastic garbage and cartons from public schools; collection of plastic waste and cartons from barangays; and instructional activities aimed at raising awareness and promoting behavioral change. Through this initiative, individuals who meet the criteria will get rewards from Nestlé and the local government for gathering and surrendering plastic waste and beverage cartons (Garcia & Pedrajas, 2019).

Building upon these findings, a comparative analysis of recent research offers valuable insights into commonalities and disparities in plastic reduction strategies, enforcement practices, and stakeholder engagement approaches. By synthesizing evidence from multiple sources, such as the following:

- National Government Initiatives: Recent research might reveal updates on national government initiatives toward plastic waste reduction, including the implementation status of proposed legislative measures and the effectiveness of policies introduced by government agencies such as the CCC and the NSWMC.

Implications: Validation of the effectiveness of national-level policies and legislative proposals can provide insights into their impact on reducing plastic pollution and fostering sustainable waste management practices. Further analysis can identify potential areas for improvement and the need for additional measures to achieve the desired outcomes.

- Local Government Actions: Comparative analysis of LGU initiatives from recent studies can highlight variations in approaches, enforcement mechanisms, and outcomes across different regions or municipalities. This analysis can include the evaluation of penalties imposed for non-compliance, the level of public awareness and engagement, and the success of innovative projects aimed at reducing plastic waste.

Implications: Understanding the strengths and weaknesses of local government efforts can inform policymakers and stakeholders about effective strategies for addressing plastic pollution at the community level. Insights from comparative studies can guide the replication of successful initiatives in other areas and the development of tailored interventions to suit specific local contexts.

- Enforcement and Penalties: Recent research may provide updated information on the enforcement of plastic ban and regulations, including compliance rates, challenges faced by enforcement agencies, and the impact of penalties on behavior change among businesses and individuals.

Implications: Analysis of enforcement practices and penalty systems can offer valuable insights into the effectiveness of regulatory measures in deterring plastic pollution. Identifying barriers to compliance and exploring strategies to enhance enforcement mechanisms can support the implementation of more robust and equitable enforcement strategies.

- Collaboration and Awareness: Comparative studies may examine the level of collaboration between stakeholders involved in plastic waste reduction efforts, the effectiveness of public awareness campaigns, and the role of education in promoting sustainable behavior.

Implications: Assessing the degree of collaboration and awareness-raising activities can help identify synergies and gaps in stakeholder engagement strategies. Insights from such studies can inform the development of holistic approaches to plastic waste management that leverage collective action and foster a culture of environmental stewardship.

Conclusion

Over the years, there have been endeavors to decrease the utilization of plastic with the aim of mitigating environmental damage. Plastic exerts detrimental effects on the natural environment and its inhabitants, encompassing several creatures, particularly humans. The study offers a comprehensive overview in terms of the following:

- National government initiatives: The study highlights various initiatives undertaken by the national government, including proposals, resolutions, and legislative actions aimed at reducing single-use plastics. These efforts indicate a concerted approach toward addressing plastic pollution at the national level, aligning with the objective of mitigating environmental degradation.
- Legislative framework: The inclusion of relevant laws and resolutions, such as Republic Act No. 9003 and House Bill 9147, demonstrates the legal foundation for plastic waste management. These legislative measures provide a framework for the gradual elimination of single-use plastics and the promotion of sustainable alternatives, reflecting the study's objective of enacting regulations to curb plastic usage.
- Inter-agency collaboration: The involvement of multiple government agencies, as outlined in the composition of the NSWMC, and collaborative efforts between departments such as DENR, DTI, and FDA, indicate a coordinated approach toward implementing plastic regulations. This collaboration underscores the study's objective of synchronizing sustainability initiatives within the governmental framework.
- Local government regulations: The detailed descriptions of ordinances enacted by various local government units demonstrate the diversity of approaches taken to address plastic usage at the grassroots level. These ordinances impose penalties for non-compliance and encourage the adoption of eco-friendly practices, aligning with the study's objective of promoting sustainable consumption and waste management practices at the local level.
- Public awareness and engagement: The inclusion of information dissemination plans, public awareness campaigns, and incentives for compliance highlights the importance of engaging stakeholders and raising awareness about the environmental impacts of single-use plastics. These efforts aim to foster behavioral change and promote community involvement in plastic waste reduction, supporting the study's objective of achieving sustainable consumption patterns.

These initiatives align with the objective of the study, which is to achieve sustainable plastic waste management and environmental preservation. However, to contribute to more effective and sustainable plastic waste management practices, ultimately mitigating environmental damage and protecting the well-being of current and future generations, stakeholders may consider the following recommendations:

- National government: Strengthen and enforce existing initiatives aimed at reducing single-use plastics, ensuring that they are implemented effectively across all regions of the country. Allocate sufficient resources and funding toward the research and development of sustainable alternatives to single-use plastics. Implement nationwide awareness campaigns to educate the public about the environmental impacts of plastic pollution and promote sustainable consumption practices. Consider revising and updating existing legislation to address emerging challenges and incorporate best practices in plastic waste management.
- Legislative framework: Review and amend existing laws and regulations related to plastic waste management to ensure they are comprehensive and enforceable. Collaborate with relevant stakeholders, including environmental experts, industry representatives, and NGOs, to draft effective legislation that balances environmental conservation with economic considerations. Continuously monitor the implementation and enforcement of plastic waste management laws to address any loopholes or shortcomings.
- Inter-agency collaboration: Strengthen coordination and communication among government agencies responsible for environmental protection, waste management, trade, and health to ensure a holistic approach to plastic pollution mitigation. Establish clear roles and responsibilities for each agency within the inter-agency collaboration framework to avoid duplication of efforts and streamline decision-making processes. Foster partnerships with international organizations and other countries to exchange best practices and leverage resources for addressing transboundary plastic pollution issues.
- Local government regulations: Encourage local governments to adopt and enforce ordinances banning or restricting the use of single-use plastics in their respective jurisdictions. Provide technical assistance and capacity-building support to local government units to develop and implement effective waste management systems, including recycling and composting facilities. Facilitate knowledge-sharing and peer learning among local governments to showcase successful initiatives and encourage replication of best practices.
- Public engagement: Launch public awareness campaigns to educate individuals and communities about the environmental impacts of single-use plastics and empower them to take action to reduce their plastic footprint. Implement incentive programs to encourage consumers and businesses to adopt eco-friendly alternatives to single-use plastics, such as reusable bags, containers, and utensils. Foster partnerships with civil society organizations, schools, and businesses to mobilize grassroots support for plastic waste reduction initiatives.
- Future research: Conduct further research to assess the effectiveness of existing plastic waste management policies and initiatives in achieving their intended objectives. Explore innovative technologies and strategies for plastic recycling, upcycling, and waste-to-energy conversion to reduce

the environmental burden of plastic pollution. Investigate the socioeconomic impacts of plastic pollution on vulnerable communities, including informal waste pickers and coastal populations, to inform targeted interventions and policy responses. Monitor and evaluate trends in plastic production, consumption, and waste generation to inform evidence-based decision-making and policy formulation.

Overall, regardless of their economic condition, it is promising to see a growing number of cities and municipalities in the Philippines actively participating in programs that demonstrate their capacity to play a significant role on a global scale in the field of environmental preservation.

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Book Review

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Mansoor Khan, *ONE: The Story of the Ultimate Myth* (Harper Collins India, 2023), 147pp., ₹499, ISBN: 9789356990579 (Hardbound).

Reviewed by: Sanjeeb Kakoty Indian Institute of Management Shillong, Meghalaya, India

As I picked up the latest book by Mansoor Khan, *ONE: The Story of the Ultimate Myth,* I was not quite sure what to expect. Some time back he had politely expressed his inability to come to IIM Shillong as he was busy writing this book and he had graciously spent some time giving me an insight to the weave of the book. But like all good storytellers, he ended the conversation just when my curiosity was at its peak. So, in a sense, I was waiting to lay my hands on it. I immediately ordered it, the moment he called me to say the book was out.

What a book it turned out to be! A mere 147 pages and a font was easy on the eyes, the style typically Mansoor Khan. He decided to take headlong the existential crisis of the modern world and its flawed growth model. But this was not done, as is normally done through a collation of bland data and facts but through a storyline that is supposed to be fiction. But for a world that is living through a timeline that has seen fact emerge stranger than fiction, the book skilfully succeeds in delivering its message in a profound manner. The contrast between the innate logic of how Tribal societies organized themselves and lived in harmony with nature against the modern man's intoxication with the opiate of perpetual growth and his frantic race for more. This is the cause of disharmony in the world and lays the foundation for its inevitable doom. As it were, the only way to achieve growth of the exponential kind is to ensure higher and greater levels of consumption. To do that would require more production which in turn would require greater resources and more raw materials. But in a finite world that is impossibility. This is sought to be overcome with the use of technological innovations.

The book uses two primary characters in the narrative: Dr Abhay Rao, a genetic engineer, and Ms Sonal, a sociology professor. The classroom lectures of Sonal regarding the true meaning of development and the wanton destruction and

resource imbalance unleashed by the present model juxtaposed with the contrary views expressed by a student make fascinating reading. Her stint as a sympathizer of a large anti-dam movement ultimately led her to aberrant social behaviour, leading to her losing her job and being administered painful electric shocks, psychiatric medication, and counselling, which are certainly heart-wrenching. So also is the story of Dr Abhay, who refused to go ahead with his advanced experiments in seed genetics as he felt that playing with nature without adequate knowledge could lead to disastrous consequences. His reticence came at a crucial moment for the GM seed company he co-founded, which led to serious personal consequences. Abhay paid the price by losing his job, his savings and his reputation, his psychiatric sessions and becoming a nobody.

The meeting of these two souls led to an unusual friendship. A friendship that saw Abhay sharing a script of a book he had written with Sonal. Through her eyes, the book is revealed to us, and in the end, you end up thinking of the story of the Emperor's New Clothes. In that story, it needed the purity of a child to speak the truth. In the case of this book, as happens with the modern world, the speaker of the truth is painted as a dissenter and often proclaimed either insane or a threat to society for nobody can bear to hear the truth.

It is hardly surprising that the accomplished storyteller Mansoor Khan, who took film-making to another level through his Bollywood superhits like *Qayamat Se Qayamat Tak*, *Jo Jeeta Wohi Sikander*, *Akele Hum Akele Tum*, *Josh* and *Jaane Tu Ya Jaane Na*, should have adopted this unusual format to drive home a few home truths. The fact that he is an alumnus of such respectable institutions as IIT Bombay, Cornell University and MIT makes it apparent that he knows what he is talking about. Probably what is missing is a suggested reading list that would take the reader further on a journey he invited them to join in the first place.

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