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Evaluation of Barriers to E-commerce in Malawi using Grey Relational Analysis

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Abstract: E-commerce (electronic commerce) provides a convenient way of buying or selling products online and is a popular choice in certain segments of societies worldwide. The significance of e-commerce has been observed during the COVID-19 crisis, where customer preferences shifted from physical stores to online stores due to lockdowns and social distancing. E-commerce has been observed to be more effective in developed countries than in developing countries such as Malawi due to the difference in the resources required for the sustainability and growth of e-commerce. The current study evaluated the barriers to e-commerce in Malawi and ranked them using the Dynamic Grey Relational Analysis model. Using the primary data collected from the customers in Malawi, the study found that lack of trust in online systems and limited access to cell phones and computers and online payment methods are the most significant barriers. The study found that both human and technical (infrastructure) factors are hindering the growth of e-commerce in Malawi.

Keywords: Electronic commerce; barriers; grey model; grey relational analysis; Malawi.

1. Introduction

In 1979, British inventor Michael Aldridge introduced and pioneered what eventually came to be known as e-commerce (Greving, 2021). E-commerce is purchasing or selling goods and services over any computer network (Knight & Mann, 2017). By harnessing the power of the internet, e-commerce has changed the way organizations conduct business (Ohene-Djan, 2008). Commercial transactions in e-commerce are conducted through business-to-business (B2B), business-to-consumer (B2C), consumer-to-consumer (C2C), or consumer-to-business (C2B) (Drigas & Leliopoulos, 2018).

Over the past two decades, the widespread use of e-commerce platforms such as Amazon and eBay has fueled a massive increase in online retail. Other e-commerce platforms, such as Shopee have also emerged to fill the gap where these giants have limited access (Mesatania, 2022). The term e-commerce was coined in the 1960s with the rise of e-commerce, the buying and selling of goods through data transmission, which was made possible by the introduction of electronic data interchange (Kiran, 2020). According to the U.S. Census Bureau, e-commerce accounted for 5% of total retail sales in 2011, and by 2020, as the COVID-19 pandemic began; it has risen to more than 16% of retail sales (Lutkevich *et al.*, 2022). E-commerce is becoming a very important option for many businesses as many companies are interested in developing their online stores (Kasemsap,

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2018). The significance of e-commerce first lies in consumer sovereignty; the marketing strategies of all business organizations are to a greater or lesser degree related to consumer satisfaction. Because of freedom, consumers enjoy a wide range of choices and the best services in e-commerce. Orders can be placed via the internet, and goods delivered to consumers' doorsteps, thus avoiding the inconvenience of shopping by hand. Secondly, e-commerce has introduced new markets because it is easier to penetrate and reach customers worldwide within minutes through the internet, enabling suppliers to introduce and promote new products to meet the needs of individual buyers. The third is that the employment opportunities provided by e-commerce are many, e.g., a large number of professionals are employed in the software industry (Arora & Athreye, 2002). The fourth meaning is consumer feedback on the product, seeing other buyers or seeing reviews from other customers before the final purchase (Jain *et al.*, 2021). To succeed in the current era of e-commerce, sellers need to monitor reviews and listen to what shoppers say about their products and customer service (Miva, 2020).

E-commerce is not widespread in Malawi. The country has been relatively slow to embrace the internet. E-commerce in Malawi remains low and faces some challenges. Some of these challenges include lack of trust in online systems, low levels of Internet access among the population, low rates of Internet adoption among businesses, lack of access to finance, and poor ICT skills (Malakata, 2021). These issues are cross-cutting and must be addressed in a coordinated manner (Chiphwanya, 2021). While some e-commerce applications exist in Malawi, such as online banking, business-to-business as well as business-to-consumer, e-commerce has yet to fully take off in Malawi due to the popularity of the internet. However, with the development of ICT infrastructure, more and more companies are realizing the potential of e-commerce and are increasingly included (Kumar *et al.*, 2014). The rest of this paper is structured as follows: Section 2 reviews previous literature, Section 3 gives detailed information about the data and methods, and Section 5 concludes the study.

2. Literature review

E-commerce focuses on buying goods online on a global scale. E-commerce is essentially a part of e-commerce related to financial transactions, so sharing or redesigning business processes is unnecessary (Aranda-Mena & Stewart, 2005). Developing countries are often on the receiving end of technological developments, particularly in industrialization, information technology, and military science (Lawrence & Tar, 2010). Like other developing countries, Malawi faces various challenges in adopting e-commerce. Limited infrastructure, poor access to technology, and low levels of digital literacy among potential consumers have been identified as significant barriers to adopting e-commerce in Malawi. Malawi faces various challenges in terms of infrastructure, such as inadequate road networks, limited electricity supply, and low Internet penetration. According to the World Bank (2023), only 11% of Malawi's population will have access to the internet by 2020, and this limited access is considered a significant barrier to e-commerce adoption. Limited access to reliable electricity also poses a major challenge to e-commerce in Malawi, as it affects the operation of electronic equipment required for e-commerce transactions.

In terms of access to technology, a study found that a lack of access to devices such as smartphones, computers, and laptops was a major barrier to e-commerce adoption in Malawi (Chirwa & Ngulube, 2017). This limited access to technology makes it challenging for potential consumers to access e-commerce platforms and make online purchases. The low level of digital literacy among potential consumers was also identified as a significant barrier to adopting e-commerce in Malawi. A study found that limited knowledge of e-commerce among consumers was a significant barrier to its adoption in Malawi (Mlenga & Mkandawire, 2019). Many Malawians lack knowledge of how e-commerce works, how to use online payment systems, and how to identify and mitigate online risks such as fraud.

To address these barriers, various strategies have been proposed. For instance, the Malawi government has launched initiatives aimed at improving internet connectivity and infrastructure, such as the Malawi Rural Electrification Programme (MAREP) and the Malawi National Fiber

Backbone Project (MNFBP) (Taulo *et al.*, 2015; Lishan & Tusubira, 2009). These initiatives aim to improve internet penetration rates and increase access to reliable electricity, which is expected to facilitate e-commerce adoption. In addition, efforts have been made to promote digital literacy among potential consumers. For example, the Malawi Communications Regulatory Authority (MACRA) launched an e-learning platform in 2020 to promote digital literacy and enable individuals to acquire the skills required for e-commerce transactions.

Overall, infrastructure, limited access to technology and low levels of digital literacy are significant barriers to the adoption of e-commerce in Malawi. Addressing these barriers is critical to promoting the adoption of e-commerce in Malawi, and strategies such as improving infrastructure, increasing access to technology, and promoting digital literacy can play an important role in promoting e-commerce adoption in the country. Although several studies have been conducted on barriers to e-commerce globally, in this study, we further investigated the barriers that hinder e-commerce in Malawi. However, this information is very limited. Based on the literature from different regions, a detailed list of the potential barriers has been prepared and shown in Table 1.

Table 1. Barriers and Challenges to e-Commerce

Code	Factor	Description	Source
B1	Low internet penetration	Poor infrastructure and high taxes make internet access expensive for most Malawians. Only 20.2% of the total population had access to the internet at the start of the year 2022.	Chiphwanya (2021); Kemp (2022).
B2	Limited access to electricity	As of 2021, 14.9% of people had access to electricity in Malawi	World Bank (2023)
B3	Education	Educated people are most likely to buy things online. Only 65.75% of adults (15 years and above) in Malawi can read and write.	Lawrence and Tar (2010)
B4	Lack of trust in online systems	Trust is highly significant in making financial transactions, which is critical because people fear getting scammed.	Chiphwanya (2021); Soleimanni (2022)
B5	Privacy and security	Privacy is related to the security of online transactions. Concerns about the risk of their personal information being compromised or stolen.	Udo (2001); Laurent (2021)
B6	Access to cell phones and computers	Limited availability of cell phones and computers, especially in the rural areas. Only 51.4% of the population had mobile connections at the start of the year 2022.	The current study; Kemp (2022)
B7	Payment method	This is based on customers' preferences for certain payment methods when making a purchase. 75% of people use cash payment in Malawi. In contrast, others use online payment methods.	Laurent (2021)
B8	Transportation	E-shopping will lead to the substitution of personal travel with home delivery. The road network of Malawi is poor.	Rotem-Mindali and Weltevreden (2013); Styles (2013)
B9	Urbanization	Urban people are most likely to buy things online. Only 17.70% of the country's population lives in urban areas in Malawi.	The current study
B10	Lack of support from the government	Building roads/infrastructure and promoting schools to learn required skills.	The current study
B11	Lack of knowhow among potential entrepreneurs	Most people would need guidance on how to start and maintain a business due to a lack of knowledge. 60.15% of people in Malawi are self-employed, and most are in agriculture.	Chitura *et al.* (2008)
B12	Lack of access to financing	Any market segment might lack adequate access to capital at reasonable rates to either finance or expand the business.	Malakata (2021)

3. Research design and methodology

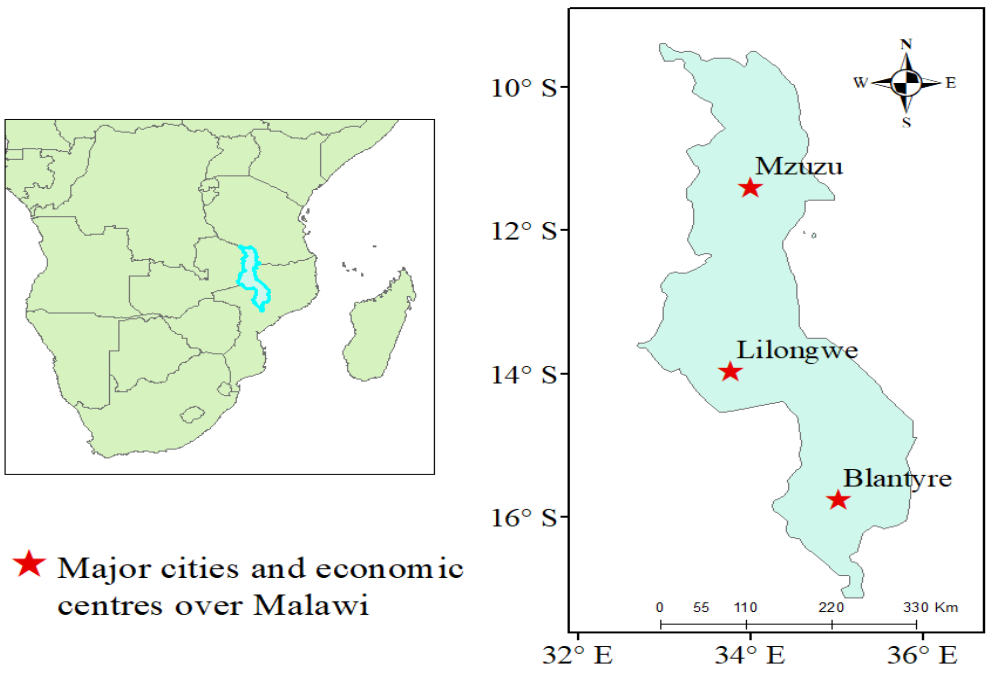
3.1 Study area

Malawi (Figure 1) is a landlocked country in Southeastern Africa with a geographical area of 118,484 square km. It shares borders with Mozambique to the east and southwest, Zambia to the west, and Tanzania to the north. Malawi's biggest economic contributors are the Agriculture industry accounting for more than one-third of the GDP. Furthermore, Malawi's economic outlook remains highly uncertain. In 2023-24, the economy will continue to suffer from high inflation and exchange rate instability (after the currency devaluation of 25% in May 2022). Malawi is one of the smaller e-commerce markets with projected revenue of $287 million by 2023. Revenue is expected to grow at a compound annual growth rate (CAGR 2023-2027) of 17%. Food and personal care is the largest market, accounting for 33.5% of Malawi's e-commerce revenue.

3.2 Data and software

The data utilized in this study was sourced through a questionnaire that was formed and distributed to several Malawians. Over Malawi, data was collected based on 12 common barriers that hinder the development of e-commerce following previous literature (as shown in Table 1). More details about the barriers which were used to construct questions for the questionnaire are summarized in Table 1.

During the study, a total of 51 Malawians responded to the questionnaire. However, the study excluded all respondents whose standard deviation (S.D.) was approaching zero from the questionnaire, signifying that they were unreliable. After excluding them, the sample size was 35 respondents and their responses were part of the analysis. The current study evaluated 12 e-commerce barriers hindering Malawi using the Dynamic Grey Relational Analysis against 35 respondents. For data visualization (drawing graphs), Origin lab software was used.



Source: the author's own construct using ArcMap GIS

Fig 1. Geographical location over Southern Africa and map of Malawi

3.3 Dynamic grey relational analysis

The Grey System Theory (GST) is an emerging methodology proposed by Julong Deng in the 1980s (Ng & Deng, 1995). Grey forecasting (Zhang *et al.*, 2023; Cudjoe *et al.*, 2023) and Grey Relational Analysis (GRA) methods are the core parts of the GST. The GRA is a measure of positive correlation that has seen numerous applications in multiple criteria decision-making (MCDM). Ivanova (2022) used the GRA to evaluate Russia's food supply chain risks during the pandemic. Kharipzhanova and Irfan (2022) used the GRA to assess Pakistan's tourism growth barriers. Esangbedo and Abifarin (2022) used the GRA to optimize parameters in material sciences. Lee *et al.* (2023) used the GRA to evaluate factors influencing consumer purchase decisions for halal products. Tsoy (2022) used the GRA to assess the expectations of Russian citizens from a potential increase in energy trade between Russia and Europe. Deng's GRA is the most influential form of the GRA and has become a significant MCDM method. However, the method has certain shortcomings. For example, the value of its distinguishing coefficient is chosen subjectively, and input data normalization is mandatory. In 2022, Javed *et al.* (2022) overcame these shortcomings by proposing the Dynamic GRA model. Later, Ouali (2022) confirmed the model's validity while studying the supplier selection problem, whereas Mahmoudi and Javed (2023) used it to validate another MCDM model. The key components of the model are discussed below.

The Grey Relational Grade (GRG) (Γ_{0k}) is:

$$\Gamma_{0k} = \sum_{j=1}^{n} w(j) \times \gamma_{0k}(j) \tag{1}$$

where, the Grey Relational Coefficient (GRC) ($\gamma_{0k}(j)$) is:

$$\gamma_{0k}(j) = \frac{\Delta_{min} + \xi(j)\Delta_{max}}{|\Delta_{0k}(j)| + \xi(j)\Delta_{max}}, k = 1,2,\ldots.m \tag{2}$$

where,

$$|\Delta_{0k}(j)| = |x_0(j) - x_k(j)| \tag{3}$$

$$\Delta_{min} = min_k min_j |x_0(j) - x_k(j)| \tag{4}$$

$$\Delta_{max} = max_k max_j |x_0(j) - x_k(j)| \tag{5}$$

$$\xi(j) = \{\xi(1), \xi(2), \ldots, \xi(n)\}, \xi(j) \in (0, 1] \tag{6}$$

The Dynamic GRA model was built and executed on Microsoft Excel. The method proposed by Javed *et al.* (2022) was used to estimate the values of the dynamic distinguishing coefficients.

4. Results and discussion

The original data is shown in Table 2. The key parameters and the dynamic distinguishing coefficients are shown in Table 3. For the sake of convenience, the fifteen potential barriers were labelled B1 to B15 (see Table 1) and the thirty-five respondents were labelled R1 to R35. Later, the current study used the Dynamic GRA for the evaluation of the barriers. The original data is shown in Table 2. The key parameters and the dynamic distinguishing coefficients are shown in Table 3. The dynamic grey relational grades and ranks of the barriers are shown in Tables 4 and 5.

Figure 2 demonstrates the dynamic grey relational grade and the ranking of the barriers. The top barriers were as follows: (lack of trust in online systems) B4, (access to cell phones and computers) B6, (payment method) B7, (lack of knowledge among potential entrepreneurs) B11 and (lack of access to financing) B12.

The first significant barrier was B4, which is the lack of trust in online systems. People are less likely to conduct e-commerce transactions when they worry about exposing their personal and

Table 2. Original data collected through the questionnaire

	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
R1	7	4	5	6	7	7	5	7	7	3	3	7	6	4	4	4
R2	5	4	3	4	5	5	4	4	5	4	2	4	4	2	1	3
R3	7	7	6	2	7	4	6	4	2	6	4	6	7	4	4	4
R4	7	6	5	3	2	6	7	7	1	3	7	7	7	3	5	5
R5	5	1	2	1	3	1	1	2	1	3	2	1	2	5	5	4
R6	5	5	2	5	2	2	3	3	2	4	4	3	4	1	2	4
R7	7	2	2	5	7	6	3	4	6	6	4	4	5	4	5	4
R8	7	6	6	7	7	4	7	7	4	3	7	7	7	3	4	3
R9	6	4	5	5	6	3	5	3	5	5	5	5	6	2	3	3
R10	7	7	6	2	6	3	6	6	2	3	3	5	3	5	5	5
R11	6	2	6	6	6	6	6	6	6	6	3	5	5	4	4	4
R12	4	1	2	3	3	1	4	4	4	2	4	4	2	2	1	2
R13	7	7	7	7	7	7	7	7	7	5	7	5	6	3	3	3
R14	7	7	7	7	7	7	7	7	7	5	7	7	7	4	4	4
R15	7	3	6	4	6	6	6	5	7	4	4	6	6	4	6	4
R16	7	6	4	3	7	5	6	6	6	4	5	5	5	2	3	5
R17	4	4	3	4	4	3	4	4	4	4	4	4	4	1	1	1
R18	7	6	3	6	7	6	6	7	6	6	3	4	6	1	1	1
R19	7	6	7	7	7	6	7	6	5	5	6	7	6	2	5	7
R20	7	7	7	7	7	7	7	7	5	7	7	7	7	4	4	4
R21	6	6	6	4	6	1	6	6	6	4	1	6	6	1	4	6
R22	7	6	3	6	7	7	7	7	2	6	2	6	2	2	2	4
R23	7	6	5	7	6	5	7	6	2	5	5	7	5	2	5	6
R24	7	5	3	6	7	6	6	6	3	5	1	6	3	1	5	2
R25	6	6	5	5	6	3	4	5	6	4	5	5	6	2	6	5
R26	7	7	7	2	7	7	7	7	7	2	1	7	6	1	2	3
R27	7	3	3	6	7	7	7	7	7	6	5	5	5	4	4	6
R28	7	3	4	7	6	7	7	7	7	7	4	6	6	4	5	6
R29	7	7	6	5	6	7	5	6	5	7	7	6	5	5	3	4
R30	7	7	1	1	7	1	3	3	2	3	3	3	3	3	3	3
R31	7	1	2	4	5	5	5	5	5	3	7	7	7	7	7	7
R32	7	5	2	6	7	7	4	7	6	6	4	4	6	1	5	5
R33	6	5	6	6	6	6	6	6	6	6	6	6	6	3	3	3
R34	7	7	7	5	7	5	5	7	7	5	7	4	7	2	3	5
R35	7	5	2	6	7	5	7	7	7	7	7	6	7	2	3	5

financial information online. Concerns about security, privacy, and the dependability of online services might contribute to this lack of trust. Furthermore, some customers might like conventional brick-and-mortar businesses where they can see things in-person and speak with salespeople. E-commerce companies must endeavor to create a reputation for being dependable and trustworthy in order to get beyond this obstacle. They can achieve this by taking steps like using safe encryption technology, having transparent privacy rules, and offering helpful customer service.

The second most significant barrier was B6, which was cell phone and computer access. This study has observed that many Malawians do not have access to cell phones and computers. This is a major barrier to electronic commerce because electronic commerce relies heavily on the use of technology. Cell phones and computers are the primary devices used to access the internet, the backbone of electronic commerce. Without internet access, it is impossible to participate in many aspects of e-commerce, including online shopping, online banking, and online auctions. Furthermore, the use of technology such as mobile apps or digital wallets is increasingly becoming integral to electronic commerce, and not having access to these tools would severely limit an individual's ability to participate in e-commerce. Therefore, not having access to cell phones and computers can be a major obstacle for people to take advantage of the full benefits of electronic commerce.

Table 3. The delta, and the dynamic distinguishing coefficients

	B1	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**	**B11**	**B12**	**B13**	**B14**	**B15**	**ξ (k)**
R1	3	2	1	0	0	2	0	0	4	4	0	1	3	3	3	0.43
R2	1	2	1	0	0	1	1	0	1	3	1	1	3	4	2	0.35
R3	0	1	5	0	3	1	3	5	1	3	1	0	3	3	3	0.53
R4	1	2	4	5	1	0	0	6	4	0	0	0	4	2	2	0.52
R5	4	3	4	2	4	4	3	4	2	3	4	3	0	0	1	0.68
R6	0	3	0	3	3	2	2	3	1	1	2	1	4	3	1	0.48
R7	5	5	2	0	1	4	3	1	1	3	3	2	3	2	3	0.63
R8	1	1	0	0	3	0	0	3	4	0	0	0	4	3	4	0.38
R9	2	1	1	0	3	1	3	1	1	1	1	0	4	3	3	0.42
R10	0	1	5	1	4	1	1	5	4	4	2	4	2	2	2	0.63
R11	4	0	0	0	0	0	0	0	0	3	1	1	2	2	2	0.25
R12	3	2	1	1	3	0	0	0	2	0	0	2	2	3	2	0.35
R13	0	0	0	0	0	0	0	0	2	0	2	1	4	4	4	0.28
R14	0	0	0	0	0	0	0	0	2	0	0	0	3	3	3	0.18
R15	4	1	3	1	1	1	2	0	3	3	1	1	3	1	3	0.47
R16	1	3	4	0	2	1	1	1	3	2	2	2	5	4	2	0.55
R17	0	1	0	0	1	0	0	0	0	0	0	0	3	3	3	0.18
R18	1	4	1	0	1	1	0	1	1	4	3	1	6	6	6	0.60
R19	1	0	0	0	1	0	1	2	2	1	0	1	5	2	0	0.27
R20	0	0	0	0	0	0	0	2	0	0	0	0	3	3	3	0.18
R21	0	0	2	0	5	0	0	0	2	5	0	0	5	2	0	0.35
R22	1	4	1	0	0	0	0	5	1	5	1	5	5	5	3	0.60
R23	1	2	0	1	2	0	1	5	2	2	0	2	5	2	1	0.43
R24	2	4	1	0	1	1	1	4	2	6	1	4	6	2	5	0.67
R25	0	1	1	0	3	2	1	0	2	1	1	0	4	0	1	0.28
R26	0	0	5	0	0	0	0	0	5	6	0	1	6	5	4	0.53
R27	4	4	1	0	0	0	0	0	1	2	2	2	3	3	1	0.38
R28	4	3	0	1	0	0	0	0	0	3	1	1	3	2	1	0.32
R29	0	1	2	1	0	2	1	2	0	0	1	2	2	4	3	0.35
R30	0	6	6	0	6	4	4	5	4	4	4	4	4	4	4	0.98
R31	6	5	3	2	2	2	2	2	4	0	0	0	0	0	0	0.47
R32	2	5	1	0	0	3	0	1	1	3	3	1	6	2	2	0.50
R33	1	0	0	0	0	0	0	0	0	0	0	0	3	3	3	0.17
R34	0	0	2	0	2	2	0	0	2	0	3	0	5	4	2	0.37
R35	2	5	1	0	2	0	0	0	0	0	1	0	5	4	2	0.37

The third most significant barrier was the lack of good payment method. Many Malawians find this to be a barrier as most methods are not favorable for e-commerce because they deter customers from making transactions. Customers want to be able to pay using their preferred method, whether it's a credit card or debit card, various digital wallets, such as PayPal, and they want to feel safe about the security of their payment information. Customers may decide to shop elsewhere if a website or online store does not provide a choice of payment methods or if the checkout process is difficult. A challenging payment method can potentially harm a brand's reputation and reduce consumer loyalty.

The fourth barrier from the ranking was a lack of knowledge among potential entrepreneurs. This is an important barrier to e-commerce in several ways. Firstly, Technology and Marketing: One of the prime reasons businesses fail to adopt e-commerce is a lack of knowledge about technology and marketing. E-commerce requires certain technical knowledge to set up and operate e-commerce platforms, manage payments, inventory, supply chain management, and so on.

Table 4. The dynamic grey relational coefficients

	B1	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**	**B11**	**B12**	**B13**	**B14**	**B15**
R1	0.46	0.57	0.72	1.00	1.00	0.57	1.00	1.00	0.39	0.39	1.00	0.72	0.46	0.46	0.46
R2	0.68	0.51	0.68	1.00	1.00	0.68	0.68	1.00	0.68	0.41	0.68	0.68	0.41	0.34	0.51
R3	1.00	0.76	0.39	1.00	0.52	0.76	0.52	0.39	0.76	0.52	0.76	1.00	0.52	0.52	0.52
R4	0.76	0.61	0.44	0.38	0.76	1.00	1.00	0.34	0.44	1.00	1.00	1.00	0.44	0.61	0.61
R5	0.51	0.58	0.51	0.67	0.51	0.51	0.58	0.51	0.67	0.58	0.51	0.58	1.00	1.00	0.80
R6	1.00	0.49	1.00	0.49	0.49	0.59	0.59	0.49	0.74	0.74	0.59	0.74	0.42	0.49	0.74
R7	0.43	0.43	0.66	1.00	0.79	0.49	0.56	0.79	0.79	0.56	0.56	0.66	0.56	0.66	0.56
R8	0.70	0.70	1.00	1.00	0.43	1.00	1.00	0.43	0.37	1.00	1.00	1.00	0.37	0.43	0.37
R9	0.56	0.71	0.71	1.00	0.45	0.71	0.45	0.71	0.71	0.71	0.71	1.00	0.38	0.45	0.45
R10	1.00	0.79	0.43	0.79	0.49	0.79	0.79	0.43	0.49	0.49	0.66	0.49	0.66	0.66	0.66
R11	0.27	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.60	0.60	0.43	0.43	0.43
R12	0.41	0.51	0.68	0.68	0.41	1.00	1.00	1.00	0.51	1.00	1.00	0.51	0.51	0.41	0.51
R13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.46	1.00	0.46	0.63	0.30	0.30	0.30
R14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.35	1.00	1.00	1.00	0.27	0.27	0.27
R15	0.41	0.74	0.48	0.74	0.74	0.74	0.58	1.00	0.48	0.48	0.74	0.74	0.48	0.74	0.48
R16	0.77	0.52	0.45	1.00	0.62	0.77	0.77	0.77	0.52	0.62	0.62	0.62	0.40	0.45	0.62
R17	1.00	0.52	1.00	1.00	0.52	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.27	0.27	0.27
R18	0.78	0.47	0.78	1.00	0.78	0.78	1.00	0.78	0.78	0.47	0.55	0.78	0.38	0.38	0.38
R19	0.62	1.00	1.00	1.00	0.62	1.00	0.62	0.44	0.44	0.62	1.00	0.62	0.24	0.44	1.00
R20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.35	1.00	1.00	1.00	1.00	0.27	0.27	0.27
R21	1.00	1.00	0.51	1.00	0.30	1.00	1.00	1.00	0.51	0.30	1.00	1.00	0.30	0.51	1.00
R22	0.78	0.47	0.78	1.00	1.00	1.00	1.00	0.42	0.78	0.42	0.78	0.42	0.42	0.42	0.55
R23	0.72	0.57	1.00	0.72	0.57	1.00	0.72	0.34	0.57	0.57	1.00	0.57	0.34	0.57	0.72
R24	0.67	0.50	0.80	1.00	0.80	0.80	0.80	0.50	0.67	0.40	0.80	0.50	0.40	0.67	0.44
R25	1.00	0.63	0.63	1.00	0.36	0.46	0.63	1.00	0.46	0.63	0.63	1.00	0.30	1.00	0.63
R26	1.00	1.00	0.39	1.00	1.00	1.00	1.00	1.00	0.39	0.35	1.00	0.76	0.35	0.39	0.44
R27	0.37	0.37	0.70	1.00	1.00	1.00	1.00	1.00	0.70	0.53	0.53	0.53	0.43	0.43	0.70
R28	0.32	0.39	1.00	0.66	1.00	1.00	1.00	1.00	1.00	0.39	0.66	0.66	0.39	0.49	0.66
R29	1.00	0.68	0.51	0.68	1.00	0.51	0.68	0.51	1.00	1.00	0.68	0.51	0.51	0.34	0.41
R30	1.00	0.50	0.50	1.00	0.50	0.60	0.60	0.54	0.60	0.60	0.60	0.60	0.60	0.60	0.60
R31	0.32	0.36	0.48	0.58	0.58	0.58	0.58	0.58	0.41	1.00	1.00	1.00	1.00	1.00	1.00
R32	0.60	0.38	0.75	1.00	1.00	0.50	1.00	0.75	0.75	0.50	0.50	0.75	0.33	0.60	0.60
R33	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.25	0.25	0.25
R34	1.00	1.00	0.52	1.00	0.52	0.52	1.00	1.00	0.52	1.00	0.42	1.00	0.31	0.35	0.52
R35	0.52	0.31	0.69	1.00	0.52	1.00	1.00	1.00	1.00	1.00	0.69	1.00	0.31	0.35	0.52

Without a basic understanding of these concepts, entrepreneurs can find it challenging to launch their e-commerce platform. Entrepreneurs can be hesitant to use electronic commerce due to the perceived risk of fraudulent activities or cyber-attacks. The lack of knowledge of digital security measures can result in a reluctance to embrace e-commerce, the choice to stick to traditional business models. Thirdly, Policy and Regulations: Entrepreneurs might struggle to comply with the necessary policies, regulations, and best practices of electronic commerce. Regulations can vary by country or state. As for Malawi, keeping up with these requirements can be challenging without expert guidance. In summary, a lack of awareness or knowledge about technology, marketing, security, regulations, and compliance required for successful electronic commerce operations can be a significant stumbling block for entrepreneurs in the changing market scenario.

Lack of financial access was the fifth major obstacle. This is yet another significant hurdle to electronic commerce because it can be difficult to invest in e-commerce infrastructure like website construction, digital marketing, and online payment systems without sufficient cash. A lack of

Table 5. The dynamic grey relational grades and ranks

	GRG	Rank
B1	0.719	9
B2	0.659	11
B3	0.720	8
B4	0.897	1
B5	0.722	7
B6	0.810	3
B7	0.833	2
B8	0.746	6
B9	0.656	12
B10	0.674	10
B11	0.763	4
B12	0.762	5
B13	0.428	15
B14	0.501	14
B15	0.550	13

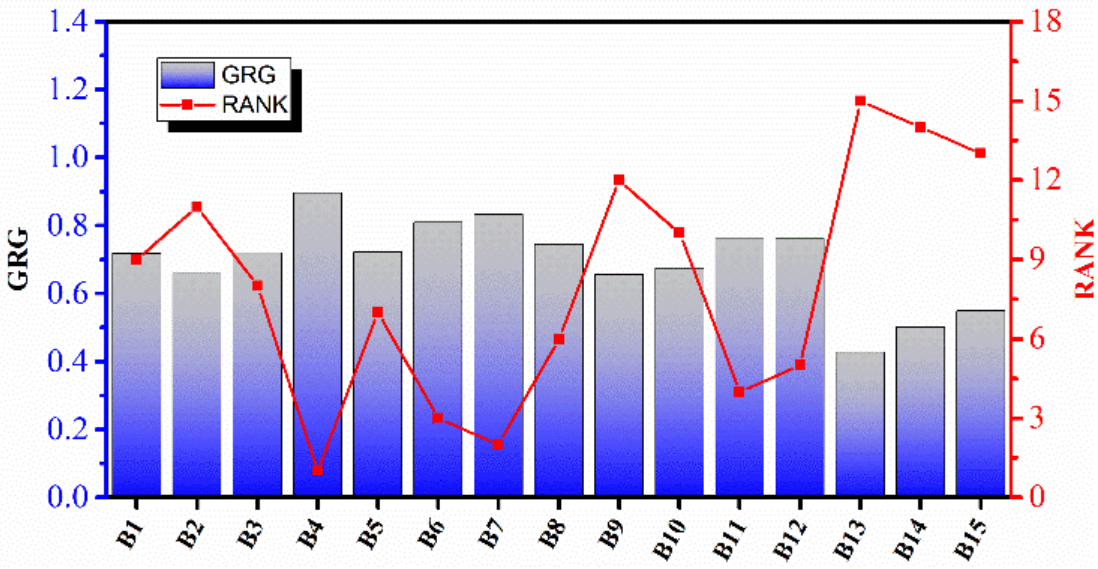


Fig 2. The dynamic grey relational grades-based ranking

funds might also make it challenging to pay for other operational expenses related to online product sales, such as product shipping and inventory purchases. Furthermore, unlike traditional brick-and-mortar businesses, e-commerce start-ups may not have a physical storefront to use as collateral for a loan or line of credit. As a result, they may be perceived as higher-risk clients to lenders, making it difficult to secure financing. Lack of funding can also restrict a company's capacity to increase its product options, enhance customer satisfaction, and take advantage of new digital marketing opportunities, stunting growth and bringing in little money. Finally, the study confirmed the suitability of the Grey Relational Analysis as demonstrated by earlier studies (e.g., Fidan, 2020; Agustin, 2022) for studying the factors influencing e-commerce.

5. Conclusion and recommendations

The current study has evaluated the barriers of electronic commerce hindering Malawi. The study used Dynamic GRA to evaluate the fifteen barriers based on the data collected from thirty-five respondents. The findings showed that Dynamic GRA is a reliable approach to assess barriers to e-commerce as it successfully ranked the barriers and helped us distinguish more important

barriers from the less important ones. The most important barriers are found to be: a lack of trust in online systems, limited access to cell phones and computers, and unavailability of effective payment methods to support online transactions. Thus, human and technical factors are hindering the growth of e-commerce in Malawi.

Based on the findings, the study makes five recommendations: (1) there is a need to create transparent privacy policies that will be carefully adhered to, employ secure payment gateways and encryption techniques, and include customer evaluations and ratings to foster trust and offer customers guarantees and warranties. (2) There is a need to improve the access to cell phones and computers. By offering offline services like phone ordering, cash on delivery, and SMS notification; partnering with regional businesses or organizations that can act as access point providers; and delivering online services that can be accessed using low-tech devices like feature phones, efforts should be made to improve e-commerce. (3) A good payment system should be introduced. Providing a variety of payment options that satisfy the needs of diverse clients, collaborating with trustworthy and well-known payment gateways, creating a safe and intuitive payment platform, and offering a cash-on-delivery service is important to overcome barriers to e-commerce. (4) Training should be provided to potential entrepreneurs. Creating workshops and training programs to educate aspiring business owners, collaborating with regional institutions or groups that may assist with training and providing mentorship and coaching programs can greatly facilitate the development of an online infrastructure needed to improve e-commerce. (5) Improving access to financing is crucial. By offering crowdfunding services, collaborating with banks, financial institutions, or venture capitalists who can provide funding, creating partnerships with government agencies or organizations that offer financing for small businesses, and creating microfinance programs specifically for e-commerce businesses the currently dire situation of e-commerce in Malawi can be improved. Finally, lessons should be learned from other developing countries like China, the largest e-commerce market globally, where the widespread use of online payment methods (e.g., Alipay and WeChat Pay) and the presence of a competitive e-commerce infrastructure (e.g., Taobao, JD.com, and Pinduoduo) have made the life of online customers much easier and thus played an indispensable role in the growth of e-commerce in the country.

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