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Original Article

Big Data for Business Growth in Somali SMEs

Abdullahi Mohamud Osman[1], Osman Diriye Hussein[2], Adam Muhudin[3]

[1]*SIMAD Innovation Lab, SIMAD University, Mogadishu, Somalia.*
[2]*Faculty of Engineering, SIMAD University, Mogadishu, Somalia.*
[3]*Faculty of Computing, SIMAD University, Mogadishu, Somalia.*

[1]*Corresponding Author : abdullahcadceed@simad.edu.so*

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Abstract - *This study investigates the adoption of big data among Small and Medium-Sized Enterprises (SMEs) in Somalia. The study highlights that while big data offers transformative potential in enhancing decision-making, operational efficiency, and customer satisfaction, adoption levels remain limited due to systemic barriers such as high implementation costs, lack of technical expertise, and infrastructural inadequacies. The study employs a quantitative approach, analysing survey data from 200 SMEs across key sectors, including technology, agriculture, and retail. Findings reveal significant disparities in awareness and adoption, with the technology sector leading in both metrics. Perceived benefits, such as improved decision-making (Mean = 4.2) and customer insights (Mean = 4.0), underscore big data's role in fostering competitive advantage, while challenges like data security concerns (Mean = 3.6) emphasise the need for robust support systems. This study provides actionable recommendations for policymakers and stakeholders to bridge the adoption gap and harness the potential of big data to drive SME growth in Somalia's evolving digital economy.*

Keywords - *Big Data, Technology adoption, Data-driven decision-making, SMEs, Digital transformation, Developing economies, Somalia.*

1. Introduction

In today's global, information-connected world, exponential data growth has typified the modern organisation. Big data, or the ability to capture, store, process, and analyse large volumes of information, is being increasingly utilised by organisations worldwide in nearly every industry for growth and in pursuit of competitive advantage.

Big data has unparalleled opportunities for actionable insights, prediction of market trends, and data-driven decisions at high accuracy and speed. In fact, the revolutionary potential of big data, especially in developing countries like Somalia, has been identified as a driver that may change the game in SMEs. It shall thus enable SMEs to streamline operational efficiency, more effectively reach customers, develop new products, and even invent new business models.

The revolutionary potential of big data finds SMEs in Somalia battling a raft of huge challenges in its adoption, such as resource constraints, technical challenges, and infrastructural inadequacies. Today, the amount of data is increasing exponentially. This growth brings new challenges and opportunities to both individuals and organisations. Big data refers to an enormous volume of both structured and unstructured data. Figure 1 shows that big data can be represented in a three-dimensional format in one way.

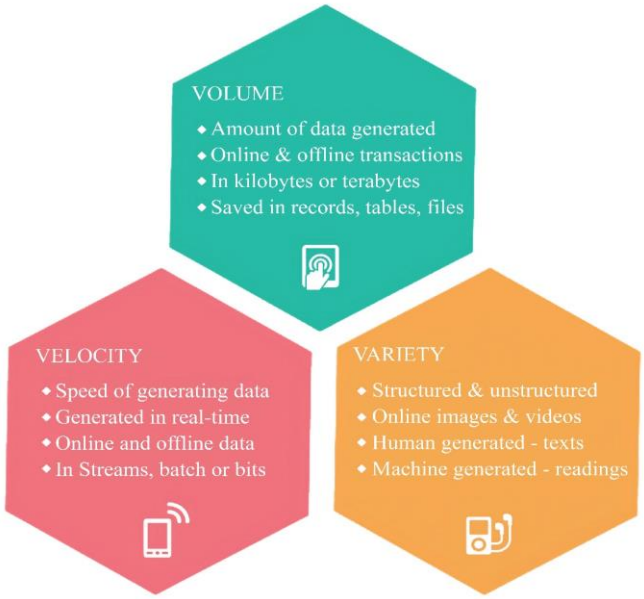

Fig. 1 The 3Vs of Big Data

SMEs represent the vital engine of growth and employment in the global economy. In Somalia, they represent the backbone of the business ecosystem, driving income generation, the creation of employment and

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innovation, and contributing to socio-economic development. Strong SMEs in Somalia outline the need for solutions that can help them achieve sustainability and competitiveness in an increasingly digital world. Big data may turn out to be a promising way to overcome traditional barriers and seize new opportunities for SMEs in Somalia. Leading businesses with advanced data analytics shall enable better predictions of upcoming trends and more accurate forecasts of market demand. They invest available resources more efficiently because data-driven insights may reveal clues regarding how companies achieve better customer experience by refining their marketing strategy and the value creation process via supply chain optimisation and better performance and resilience against market uncertainties (Şen et al., 2016).

Table 1. SMEs key factors

Enterprise Category	Number of Employees	Turnover	Balance Sheet Total
Medium	**<250**	≤ € 50 million	≤ € 43 million
Small	**<50**	≤ € 10 million	≤ € 10 million
Micro	**<10**	≤ € 2 million	≤ € 2 million

However, some challenges come along with SMEs' adoption of big data. The most striking relates to data security and privacy concerns. With SMEs more likely to handle customer-sensitive information, they have to undertake data encryption to maintain the customers' trust and, at the same time, adhere to the regulatory frameworks. For example, in Somalia, where mechanisms of digital governance and cybersecurity are not well established, the risks from poor data protection mechanisms are evident. A data breach or misuse of customer information may translate to huge consequences, such as reputational damage, financial losses, and possible legal liabilities for the listed SMEs, who were in great need of focusing on setting up robust data management practices and investments in secure technological infrastructure that would mitigate these risks, according to Mishra & Sharma (2015).

Major systemic barriers impeding the ability of, as well as benefits to, SMEs in Somalia include issues related to data security. Most SMEs fall under an ecosystem that suffers from a general low level of digital literacy, poor information technology infrastructure, and high implementation costs. Besides, access to skilled professionals who can develop and maintain big data systems is an issue that has not been solved yet. For example, the unavailability of appropriate, affordable, user-friendly management tools raises the digital divide and makes it impossible to include advanced analytics in the decision-making of the largest proportion of SMEs. One cannot always have assurance of access to the internet and a stable electricity supply; thus, making efforts to build digital capacities in Somali businesses is complicated. Development of such solutions has to be done through the collective effort of all the involved stakeholders: policymakers, providers of technology, and the business environment of Somalia's SME leaders, in an approach to such systemic barriers with cost-effective solutions in meeting unique needs (Abdul et al., 2023). With these challenges notwithstanding, the benefits of big data to Somali SMEs cannot be doubted. Thus, SMEs derive much-needed insights through data analytics to support business decisions and foster growth. Examples are that real-time processing of data supports forecasting of customer behavior, which is relevant for creating customised marketing campaigns and enhancing supply chain tactics. These capabilities are more than vital in the volatile marketplace conditions of Somalia, where the needs and tastes of customers may change dramatically. Big data will significantly help provide SMEs with the timely and accurate information needed to proactively respond to market dynamics, ensure customer loyalty, and improve operational efficiency. Similarly, big data analytics might give SMEs the opportunity to identify inefficient operations and wastages and smooth out workflows to reduce costs and improve productivity (Coleman et al., 2016). With big data, it would be possible to expand its potential from the level of individual businesses to the entire economy of Somalia. Big data will increase diversification and strengthen the economy's resilience by supporting innovation, enabling SMEs to compete more effectively in local and international markets. Further, as SMEs turn data-driven, they would help drive the digital transformation of Somalia into a vibrant technology-enabled business ecosystem. For this dream to come true, however, structured collaboration would be needed to address the identified structural and cultural obstacles to big data adoption.

This study discusses the opportunities and challenges big data presents to enable business growth among SMEs in Somalia. The paper went further to point out how big data could enable innovation, improve decision-making, and promote sustainable growth by indicating systemic obstacles to adopting big data. Consequently, this work seeks to provide a roadmap of actionable insights and pragmatic recommendations that could help address the status of big data utilisation in Somali SMEs. In light of this, the findings and recommendations are expected to contribute to enabling SMEs in Somalia to effectively exploit the transformational potential of big data and unlock new avenues of growth and competitiveness in the increasingly digitised environment.

2. Literature Review

The integration of big data technologies in SMEs is considered one of the main areas of scholarly research today, since it may help contribute towards enterprise growth and enhance competitive advantage generally through innovative practices. This synthesises extant literature related to big data in SMEs, their opportunities and challenges, and its implications.

2.1. Big Data Definition

Big data simply refers to the huge amounts of high-speed, complex and dynamic data demanding advanced technologies and methods of data management and analytics.

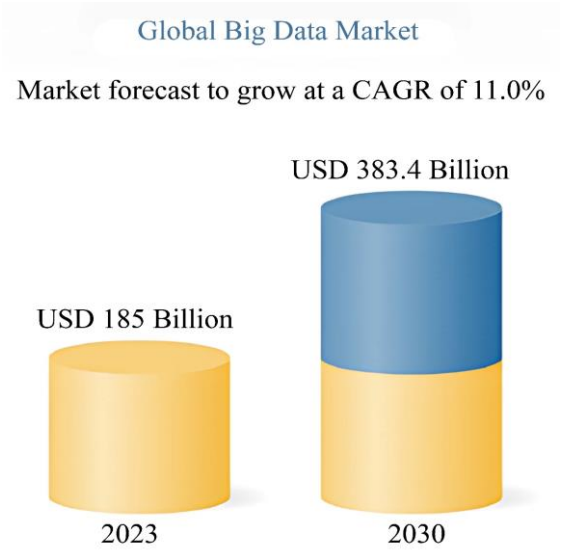

Fig. 2 Global Big Data market

Big data now forms an integral part of modern-day business, fundamentally altering the organisations' modus operandi of functioning and arriving at decisions. Statistics prove this with a number of compelling facts that substantiate its transformative role in business intelligence and strategic planning. Firms using big data analytics note huge improvement points within areas such as efficiency, customer satisfaction, and competitiveness. Large volumes of processing and analysis of data allow businesses to unlock the valuable insight lying inside, predict market trends, and make data-driven decisions with precision and speed. As industries are rapidly becoming dependent on big data solutions, the impact keeps reshaping the global business landscapes, raising the relevant need for innovation and sustainable growth.

Table 2. Big Data facts

Feature	Fact
Data Management	24 PB of data managed by Google over a day
Query Searches	1 billion searches are conducted by Google every day
Email	250 billion email communications happen every day
Videos Watched	6 billion hrs. of video watched per month on YouTube
Data Volume	90% of the data has been created in the past 2 years

2.2. Opportunities of Big Data in SMEs

Big data opens excellent opportunities for small and medium enterprises that contribute to decision-making, efficient work, and innovation. According to Sen et al. (2016), big data could also help SMEs stand shoulder-to-shoulder with large enterprises. As was brought out in their research, data analysis enhances marketing plans, cuts operating costs, and enlightens consumer behavior. Most of the time, small and medium-sized businesses in Somalia cannot compete with large-scale companies due to the scarcity of resources; big data is an opportunity to level the playing field to some extent.

Other works by Del Vecchio et al. (2018) explain how big data can help open innovation, most relevant to SMEs' competitiveness, showing that big data will allow firms to view market trends, customer preferences, and new markets for growth. Such an ability to change fast is very important for SMEs in turbulent economies such as Somalia, where market conditions change overnight due to external factors such as political instability and changes in consumer behavior.

Iqbal et al. (2018) explain that big data allows SMEs to scale up their business operations efficiently because it facilitates the optimisation of resource use and smoothening of processes. The authors have also pointed out a few important areas in which big data is applied in the supply chain management context, and the benefits of which the Somali SMEs can immensely derive due to the associated logistical issues with doing business in the region. It allows the firms to manage inventories, predict demand, and identify bottlenecks in the process; hence, it improves operational efficiency and customer satisfaction.

Big data knowledge management by Wang and Wang 2020 adds credence to its transformative power for SMEs. This allows raw data to be transformed into meaningful knowledge; in this respect, SMEs will gain deep insights relating to operations and the general market. In this regard, for Somali SMEs making headway through a mostly challenging business environment, benefiting from emerging opportunities in such areas as retail, agriculture, and technology is even more relevant.

2.3. Challenges in Adopting Big Data

Despite all of the potential of big data, its challenges are immense in their adoption among SMEs. Financial, technical, and organisational barriers hamper smaller firms from fully exploiting big data technologies. Shah et al. (2017) refer to the cost as one of the major barriers: immense upfront investment in data infrastructure and analytics tools makes big data solutions unaffordable for many SMEs. That challenge is very sharp in Somalia, with real limitations of financial resources and access to affordable technology hampering innovation. Technical challenges are also continuing to be a big inhibitor of the adoption of big data. Shah et al. (2017) argue that due to a lack of technical skills among SMEs, big data cannot be collected, processed, and analysed in decision-making. In the context of Somali SMEs, this skill gap will need some intervention, which may go all the way from providing

capacity-building programs to partnering with technology providers. Nasrollahi et al. (2021) go further to emphasise the role of organisational readiness in adopting big data. According to these authors, common challenges such as resistance to change, inability of IT infrastructure, and worries related to data privacy are those hurdles that, when cleared, can allow the smooth implementation of big data adoption in any organisation.

Maroufkhani et al. (2023) investigate SMEs' big data adoption curve through barriers to successful organisational culture and perceived benefits. Along this line of argument, their study realises the need for an innovative culture with increased awareness of the essence of big data. This implies breaking the cultural barriers of digital technologies in the Somali environment through pilot projects or effective cases of big data. There is also the challenge of the availability and quality of the data. Coleman et al. (2016) stated that SMEs are usually challenged by accessing applicable and dependable data because of a lack of resources and capacity. For Somali SMEs, these challenges become overwhelmingly greater because of the absence of good digital infrastructure, which grossly limits access to data and makes for ineffective utilisation of analytics tools. The mitigation of these shortfalls will, therefore, necessitate heavy investment in infrastructure and capacity building.

2.4. Impact of Big Data on Business Growth

Big data adoption has been associated with improvements in various performance metrics, revenue improvements, enhancements in operational efficiencies, and improved customer satisfaction. According to Coleman et al. 2016, big data improves quality management and reduces waste, enabling SMEs to enhance the delivery of their respective products and services. The result of their study suggests that in seeking long-term growth and sustainability, a data-driven implementation strategy is important. Polkowski and Nycz 2016 note that big data applications will increase the ability of SMEs to foresee customer behaviors, monitor emerging trends, and model their offerings to meet the needs of the marketplace; for instance, to know what products to stock, optimise pricing, and enhance their marketing toward increasing revenues.

The ability to anticipate and actualise such a need for customers would be especially beneficial to Somali SMEs, given the highly competitive and fast-paced environment. Kgakatsi et al. (2024) provide a systematic review on the influence of big data on the better performance of SMEs and note therein how this can offer competitive advantages by means of improved decision-making and responsiveness to markets. These findings have very relevant implications for SMEs in Somalia, since they deal with survival and growth through an enabling ability to act quickly in changing market conditions. Indeed, big data allows Somali SMEs to understand their customers better, be more effective in their operations, and find opportunities for new business.

2.5. The Case for Somali SMEs

While the literature on big data adoption in this area is instrumental, it needs to be adopted from a global perspective. However, the challenges faced by SMEs are very peculiar and, hence, demand context-specific solutions. All in all, some of the most important critical barriers that need redress to unlock the potential of big data in the case of SMEs are still low levels of digital infrastructure and literacy and cultural resistance against changing the traditional way of doing business.

The same literature illustrates the need for tailored interventions reflected in some current works: Iqbal et al. 2018; Wang and Wang 2020. Increasing initiatives towards digital literacy, affordable access to technological infrastructure, and an innovation culture are significant in improving big data adoption readiness in Somali SMEs. Further, such cooperation by international organisations and technology providers would help overcome resource barriers for the SMEs in the Somali context. A step-by-step approach toward big data adoption allows these firms to build up the required capacity and infrastructure over time to harvest the full potential offered by big data.

3. Methodology

3.1. Research Design

This study has adopted a quantitative approach that identifies potential benefits and barriers in relation to the adoption of big data by SMEs in Somalia. These methods involve data collection and analysis expressed in numerical form and are unbiased in the presentation of the prevalence and effects of big data use. The theoretical framework for this study has been embedded in existing theories and findings from literature, including those developed by Willetts et al. (2020) and Falahat et al. (2022).

3.2. Data Collection

A structured survey was the data collection tool. Such a survey attempted to elicit information on the following issues: Adoption Levels, Perceived Benefits, Challenges, and Performance Impact. The questionnaire was, therefore, adapted from previously validated instruments of Shah et al. (2017), Wessels & Jokonya (2022), and Lutfi et al. (2022). This study applied a Likert-scale question to measure the degree of agreement over statements relative to big data opportunities and challenges; hence, multiple-choice and numerical questions were applied to capture quantitative metrics.

3.3. Target Population and Sampling

The target population consists of SMEs in Somalia, while the representatives specifically targeted those in Mogadishu and from these key sectors: retail, agriculture, and technology. Respondents for the survey were obtained using a stratified random sampling; therefore, different industries and firm sizes were represented. Considering a sample of 200 SMEs, this sampling size fell in line with other quantitative studies

investigating big data adoption among SMEs. For instance, such samples were used by Kalan & Ünalir (2016) and Willetts et al. (2020). It ensured statistical reliability and generalizability of the findings within the SMEs context.

3.4. Data Collection Process

The survey was administered online via Google Form, but for those SMEs that cannot access digital facilities, it was administered physically. Also, pretesting of 20 respondents was conducted prior to proper dissemination of the survey instrument to validate the clarity of the questionnaire, as suggested by Lutfi et al. (2022).

3.5. Data Analysis & Statistical Methods

The collected data were analysed using Python software. Analytical techniques also included descriptive statistics, cross tabulations, and data visualisations. Data gathered were analysed applying descriptive statistics in the form of means, standard deviations, and frequency distributions to explain the characteristics, awareness, levels of adoption, perceived benefits, and challenges of big data in SMEs. Although a sample of 200 SMEs fairly represents key industries, some limitations are recognised. The use of self-reported survey data risks response bias, and the high proportion of micro-enterprises (fewer than 10 employees).

3.6. Limitations

Potential limitations include response bias and the inability to capture full data for SMEs not having access to technologies, those who are not from such industries, or those who are not present in Mogadishu. In order to have a high response rate, a number of follow-ups were carried out.

These included informed consent from respondents, anonymity, and confidentiality of responses, and adhering to any other ethics that were considered by the earlier studies voiced in Rajabion, 2018; Lutfi et al., 2022. Additionally, the difficulty in reaching SMEs without stable internet connectivity may have meant that some views were omitted. Despite these limitations, the data offers a useful examination of the current trends in big data adoption in Somali SMEs.

4. Results

The results of the survey among Somali SMEs are to explore opportunities and challenges in adopting big data. They are based on the descriptive statistics, visualisations, and the analysis of the survey data that provides insights on various aspects, including the respondents' demographic characteristics, their levels of awareness and adoption, perceived benefits and challenges, and the associations with performance impacts of big data technologies.

4.1. Demographics

The survey included responses from 200 SMEs representing a range of industries, operational durations, and business sizes.

Table 3. SMEs demographics

Industry Distribution	**Industry**	**Frequency**	**Percentage**
	Technology	91	45.5
	Retail	45	22.5
	Agriculture	42	21.0
	Others	22	11.0
Employee Count	**Number of Employees**	**Frequency**	**Percentage**
	Fewer than 10	175	87.5
	10 - 50	25	12.5
Operational Duration	**Operation Time**	**Frequency**	**Percentage**
	1 - 5 Years	118	59.0
	Less than 1 Year	82	41.0

This points to important trends regarding the industry distribution, employee count, and operational duration of the surveyed SMEs. The industry distribution indicates that the technology sector leads with 45.5% of the respondents, followed by retail at 22.5% and agriculture at 21%, while 11% of the SMEs fall under other industries. This is an indication of a higher presence of technology-driven business enterprises, which possibly demonstrates readiness to adopt innovations like big data. Most SMEs, or 87.5%, have less than 10 employees, hence showing that within the dataset, the prevalence is for micro and small enterprises; only 12.5% employ between 10 and 50 workers. This may indicate the existence of constrained resources and capacity, which might have implications for the ability of these businesses to adopt and implement big data solutions. For operational duration, 59% of SMEs have been in operation for 1–5 years, which shows a peak of relatively new businesses, while 41% have been in operation for less than one year. This shows a growing entrepreneurial ecosystem with many businesses still in the early stages of development, which may have implications for their awareness, adoption, and use of advanced technologies such as big data.

4.2. Awareness and Adoption

SMEs' level of awareness and adoption of big data technologies portrays how familiar businesses are with these technologies and to what extent they have been integrated within their operations. While awareness shows whether SMEs recognise the existence of, and the potential of, big data, adoption indicates actual implementation and use of such technologies within business processes. Knowing these aspects will be instrumental in identifying the gaps and barriers in leveraging big data for organisational growth and competitiveness. The analysis looks not only at what proportion of SMEs are aware of and adopting big data but also at the duration of use among adopters, hence giving a comprehensive overview of the current state of big data integration within the SMEs.

4.2.1. Awareness Levels

This Figure 3 indicates the level of awareness of big data technologies among the surveyed SMEs. A very large majority (78.5%) of the respondents answered that they are unaware of big data technologies, while only 21.5% are aware of them. This difference points out a huge knowledge gap within the SMEs when it comes to advanced technological solutions like big data. This may be a consequence of the lack of access to educational resources, technology expertise, and leading-edge practices in innovation for the SME ecosystem. Filling this gap is essential for increasing the adoption rate of big data technologies and data-driven decision-making.

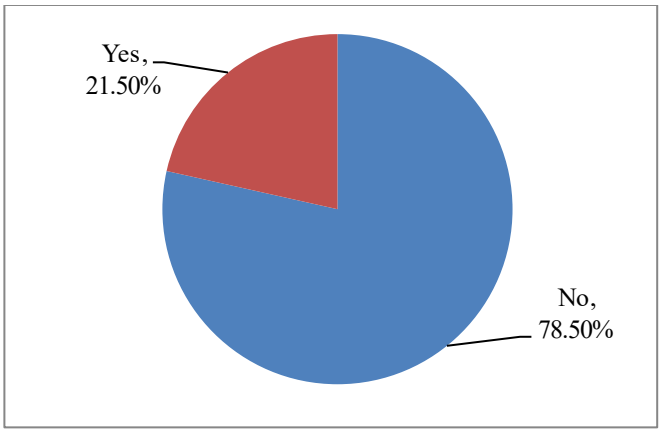

Fig. 3 Awareness levels

4.2.2. Adoption Levels

This chart shows the adoption levels of big data technology by SMEs. A good number of SMEs (more than 160) have reported not adopting big data, while only a small proportion (less than 40 SMEs) have shown adoption. This indicates that even if some level of awareness does exist, the transition from awareness to adoption remains a considerable challenge for most SMEs.

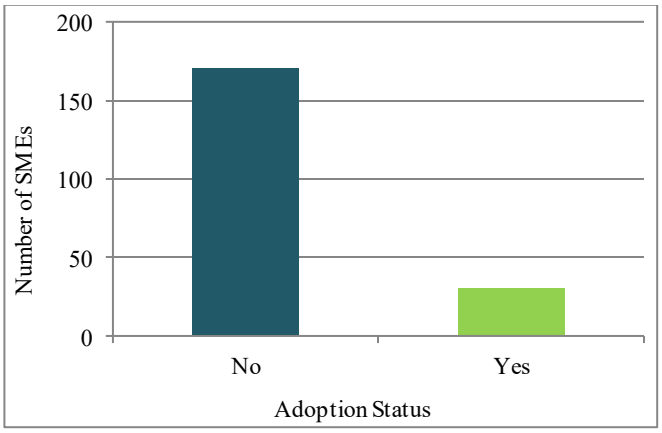

Fig. 4 Adoption levels

The slow adoption of these technologies in SMEs is partly explained by some of the barriers: the high cost of implementation, a lack of technical expertise, and perceptions about the irrelevance of big data to their operations. This underlines the need for targeted support systems to increase big data adoption, including subsidies, training programs, and tailored technological solutions.

4.2.3. Big Data Use

This reflects the duration of time that SMEs have used big data. Over 100 respondents reported "never used" big data technologies, whereas fewer than 80 reported use for less than one year. This reveals the developing nature of big data adoption by the SME sector. In this regard, the adopters were concentrated at the early stage, indicating that for most enterprises, the implementation of big data is still a recent venture. This implies that increased exposure of SMEs to big data and its benefits, if supported with relevant enabling factors to reduce the identified barriers, may increase adoption rates.

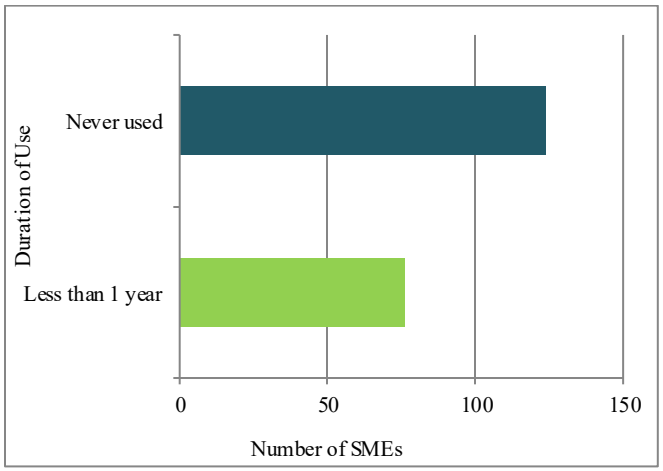

Fig. 5 Big data use

4.3. Perceived Benefits

The below Table 4 depicts the main benefits rated by the SMEs, along with their respective mean score, standard deviation, and top rating. The highest-rated benefit was "Improved decision-making" with a mean of 4.2 and an SD of 0.8. The respondents generally agreed on its positive influence, showing a consensus over big data's role in enhancing strategic decisions. "Better understanding of customers" and "Improved operational efficiency" ranked next with high scores of 4.0 (SD = 0.9) and 3.8 (SD = 1.0), respectively, underlining firm drivers of customers' insights and operational efficiencies. "Increased revenue/profitability" reached a mean of 3.5 with an SD of 1.1, reflecting moderate agreement and hence its perceived economic impact. "Exploration of new markets" had the lowest score, with its mean at 3.2 and SD at 1.2, given a neutral top rating, suggesting that the SMEs view market expansion as one of the less immediate benefits of big data. From this, it can be generalised that SMEs perceive big data mainly because of its operational and decision-making advantages, but its role in the exploration of new markets is limited.

Table 4. Big data perceptions

Perceived Benefit	Mean	SD	Top Rating
Improved decision-making	4.2	0.8	Agree
Better understanding of customers	4.0	0.9	Agree
Improved operational efficiency	3.8	1.o	Agree
Increased revenue/profitability	3.5	1.1	Agree
Exploration of new markets	3.2	1.2	Neutral

4.4. Adoption Challenges

The high cost of implementation was viewed as the greatest challenge in adopting big data technologies, with a mean of 4.0 (SD = 1.0), hence highly agreed upon by the respondents. This is followed by a lack of technical expertise, rated with a mean of 3.8 (SD = 0.9), and data privacy and security concerns that received a mean of 3.6 (SD = 0.8); all are viewed as major obstacles. The insufficient reliable data challenge was rated with a mean of 3.5 (SD = 1.1), showing a near-neutral response. Finally, resistance to organisational or cultural change received the lowest rating, with an average of 2.5 (SD = 1.2), hence indicating relatively lower concerns. These indicate that cost and expertise are major hurdles for SMEs, while organisational resistance is much lower.

Table 5. Big data adoption challenges

Challenge	Mean	SD	Top Rating
High implementation costs	4.0	1.0	Agree
Lack of technical expertise	3.8	0.9	Agree
Data privacy/security concerns	3.6	0.8	Agree
Insufficient reliable data	3.5	1.1	Neutral
Resistance to organisational change/culture change	2.5	1.2	Agree

4.5. Performance Impact

This Table 6 shows performance implications of big data adoption, where respondents rated improved customer satisfaction highest; thus, this is an area of great consensus in terms of perceived value (mean = 4.0, SD = 0.9). This is followed closely by enhanced competitive advantage (mean = 3.9, SD = 1.0) and better forecasting and planning (mean = 3.5, SD = 0.8), both seen as critical advantages. Reduced operational costs are considered to have a significant impact, with a mean of 3.7 and a standard deviation of 1.0.

The overall performance improvement is the lowest score, with a mean of 3.2 and a standard deviation of 1.1, indicating a slightly more varied perception by respondents.

These findings suggest that big data is most valuable for improving customer relationships and competitive positioning, although broad performance improvements are secondary considerations.

Table 6. Big data perceived impact

Performance Metric	Mean	SD	Top Rating
Improved customer satisfaction	4.0	0.9	Agree
Enhanced competitive advantage	3.9	1.0	Agree
Better forecasting/planning	3.5	0.8	Agree
Reduced operational costs	3.7	1.0	Neutral
Overall performance improvement	3.2	1.1	Agree

4.6. Industry Comparison

These comparative insights show huge variations in the awareness and adoption of big data technologies across industries. Technology verticals have the highest rate of awareness, 85%, and adoption, 34%, which is reflected well in the nature of the sector, which is more attuned to data-driven practices. Retail comes second, with reasonable awareness of 60% and adoption of 26%, thus showing big data findings that increase usage in improving operational and customer experience dimensions. Agriculture has shown low awareness 25% and adoption 18% presumably because of impediments of an infrastructural and technological nature. The category of all other industries has the lowest awareness 21% and adoption 17% thus highlighting the challenges faced by less conventional or resource-poor sectors. These findings signal that there is a need for the development of targeted strategies, considering specific industry challenges in the adoption process.

Table 7. Industry comparison

Industry	Awareness (%)	Adoption (%)
Agriculture	25	18
Retail	60	26
Technology	85	34
Other	21	17

These findings have consequently put into focus considerable opportunities and challenges regarding big data adoption among Somali SMEs. Big data awareness is low, with only 21.5% of the SMEs realising its potential, while the rates of adoption are also below, with less than 40 SMEs reporting its active use. However, even with these barriers, SMEs perceive big data as an important tool with which to enhance decision-making (Mean = 4.2) and operational efficiency (Mean = 3.8), though not necessarily as a means to explore new markets (Mean = 3.2). The inhibitors were mainly associated with high implementation costs (Mean = 4.0) and a lack of technical expertise (Mean = 3.8). All these indicate targeted interventions to mitigate these inhibitors. Influences on performance were most significant regarding improving customer satisfaction (Mean = 4.0) and competitive advantage (Mean = 3.9); once again, this reveals the transformative potential of big data if taken on board effectively. The technology sector has shown higher levels of both awareness

(85%) and adoption (34%) compared with agriculture and other industries, bringing out sectoral disparities in readiness and resources. These findings have shown the critical need for tailored support mechanisms to bridge the gap in big data utilisation for maximum benefits accruing to Somali SMEs.

4.7. Further Analysis

SMEs with high levels of adoption indicated key benefits, such as better decision-making (Mean = 4.2, SD = 0.8) and greater customer insight (Mean = 4.0, SD = 0.9). In contrast, new market exploration was less highly rated (Mean = 3.2, SD = 1.2). The main obstacles mentioned were high costs of implementation (Mean = 4.0, SD = 1.0) and a lack of technical skills (Mean = 3.8, SD = 0.9), while organisational resistance was considered less critical (Mean = 2.5, SD = 1.2). These results highlight that skills and resource deficiencies remain key obstructions to adoption.

5. Case Studies

Although the concept of big data is in its early stages in Somalia, a number of enterprises are already showing its potential in specific sectors. In the telecom sector, operators such as Hormuud Telecom and Somtel are unlocking digital access to other enterprises while utilising data analytics within their businesses. These operators track customer usage patterns, streamline network performance, and develop targeted marketing campaigns according to user behavior. In the ride-hailing sector, companies such as Rikaab and Dhaweeye leverage real-time data in order to effectively match riders and drivers, optimise routes, and predict demand changes, thereby maximising service effectiveness. Similarly, new sectors such as finance and e-commerce are just starting to tap into big data technologies; widespread use is still uncommon. Despite such motivating examples, more widespread adoption by SMEs is usually held back by limited availability of skilled personnel, infrastructural shortcomings, and the prohibitive expense of advanced analytics solutions. Even so, such early adopters provide valuable illustrations of innovation through data despite being in resource-constrained settings.

6. Regulatory Framework

Somalia has made advances in establishing an adequate data governance structure through its Data Protection Authority (DPA). The agency works to oversee data privacy and security, which is a large move towards digital trust. However, there is weak enforcement due to low institutional capacity, limited resources, and poor legal frameworks. Many SMEs operate without adequate guidelines on data handling, raising fears about privacy breaches and consumer trust. Lack of robust enforcement once more exposes firms to reputational and economic harm in case of misuse of data. As the digital economy of Somalia expands, there will be a need to enhance regulatory enforcement and provide practical compliance support. Failure to do so risks compromising both consumer protection and business confidence in the age of big data.

7. Future Trends

Big data for the growth of Somali SMEs is expected to gain considerably more importance. As internet connectivity increases and cloud services become available and cheaper, more SMEs will have access to sophisticated analytical tools. The potential adoption of artificial intelligence and machine learning for business operations will also enable predictive analytics and automation for smaller firms. Moreover, mobile data is also going to continue as a key driver for understanding consumer behavior in sectors like retail and financial technology. Public-private partnerships are also likely to improve data literacy and infrastructure development. Regional integration and cross-border trade are going to force SMEs to adopt data-driven approaches to stay competitive. Altogether, big data will transform from a source of competitive advantage to an essential factor for businesses.

8. Comparative Analysis

Somalia's SMEs face various obstacles similar to those of their counterparts elsewhere on the African continent, such as a lack of digital infrastructure, high technology expense, and shortages of skilled human capital. Nevertheless, Somalia faces unique challenges, such as a precarious political situation, a lack of regulatory enforcement, and a lack of internet connectivity compared to other countries like Kenya and South Africa. For example, SMEs in Kenya draw on established fintech ecosystems and state-backed digital innovation centers, while South African SMEs have access to more fully developed legal systems and higher availability of finance. In spite of these limiting factors, Somalia has an active entrepreneurial tradition, and extensive use of mobile money provides a solid foundation for rapid digital expansion pending removal of systemic bottlenecks. Tailored interventions inspired by experiential models can help Somali SMEs overcome both extensive and local obstacles.

9. Conclusion

This study has examined avenues and threats related to the adoption of big data among Somali SMEs at the awareness level, perceived benefit, barriers, and performance impacts. While big data has huge potential in enhancing decision-making, operational efficiency, and customer satisfaction, the actual level of adoption remains low because of the large challenges that exist in the adoption process, such as implementation costs and a shortage of technical skills. It has also highlighted the imbalance in the rate at which big data is adopted across different industries, with the technology sector being the most aware and integrated sector, whereas agriculture and other sectors are lagging behind. These hint at tailored interventions that can help in reaping the transformational benefits accruing to Somali SMEs. These findings have deep implications. Policymakers should put more emphasis on digital literacy programs, subsidise technology infrastructure, and provide training programs to fill knowledge gaps and enhance the technical capacity of

SMEs. On the other hand, a phased approach toward implementing big data within a business enterprise may reduce both cost and resource barriers while ensuring progressive matching with their business needs.

Some critics might say that big data technologies cannot be practical for resource-constrained SMEs, but big data adopters showed significant performance advantages even in the nascent stages of adoption. Coordinated efforts by the government, private sector actors, and international organisations are needed to unleash the full power of big data for Somali SMEs.

9.1. Recommendation

To ensure the adoption of big data, Small and Medium Enterprises (SMEs) in Somalia need to invest in basic digital literacy and data handling training for employees. The government can make this happen by offering subsidies for training and initiating campaigns. International partnerships can present affordable technologies suitable for SMEs and reduce upfront expenditure. In addition, the government needs to improve the enforcement of existing data privacy laws to instil trust among customers and enterprises. SMEs need to start with small steps, such as implementing data analytics for a couple of areas of operation for rapid success before wider adoption. Establishing data analytics consulting agencies for SMEs, which can furnish technical support and shared analytics interfaces, can lower entry barriers and democratise access to big data technology.The study calls for immediate action to establish enabling ecosystems that allow SMEs to overcome current challenges of big data and realise their potential as an enabler of sustainable growth and increased competitiveness of enterprises in Somalia's fast-changing business environment.

References

[1] Adekunle Abiola Abdul et al., "Leveraging Big Data for SME Growth and Competitiveness: A Literature Review," *i TECH MAG*, vol. 5, pp. 26-33, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[2] Shirley Coleman et al.., "How Can Smes Benefit from Big Data? Challenges and a Path Forward," *Quality and Reliability Engineering International*, vol. 32, no. 6, pp. 2151-2164, 2016. [CrossRef] [Google Scholar] [Publisher Link]

[3] Muhammad Iqbal et al., "A Study of Big Data for Business Growth in Smes: Opportunities & Challenges," *2018 International Conference on Computing, Mathematics and Engineering Technologies (iCoMET)*, Sukkur, Pakistan, pp. 1-7, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[4] Rishabh Mishra, and Rakesh Sharma, "Big Data: Opportunities and Challenges," *Journal of Big Data Analytics*, vol. 4, no. 6, pp. 27-35, 2015. [Google Scholar] [Publisher Link]

[5] Doruk Sen, Melike Ozturk, and Ozalp Vayvay, "An Overview of Big Data for Growth in SMEs," *Procedia - Social and Behavioral Sciences*, vol. 235, pp. 159-167, 2016. [CrossRef] [Google Scholar] [Publisher Link]

[6] Pasquale Del Vecchio et al., "Big Data for Open Innovation in Smes and Large Corporations: Trends, Opportunities, and Challenges," *Creativity and Innovation Management*, vol. 27, no. 1, pp. 6-22, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[7] Satya Shah, C. Bardon Sorian, and A.D. Coutroubis, "Is Big Data for Everyone? The Challenges of Big Data Adoption in SMEs," *2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Singapore, pp. 803-807, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[8] Shouhong Wang, and Hai Wang, "Big Data for Small and Medium-Sized Enterprises (SME): A Knowledge Management Model," *Journal of Knowledge Management*, vol. 24, no. 4, pp. 881-897, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[9] Mahdi Nasrollahi, Javaneh Ramezani, and Mahmoud Sadraei, "The Impact of Big Data Adoption on SMEs' Performance," *Big Data and Cognitive Computing*, vol. 5, no. 4, pp. 1-15, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[10] Parisa Maroufkhani, Mohammad Iranmanesh, and Morteza Ghobakhloo, "Determinants of Big Data Analytics Adoption in Small and Medium-Sized Enterprises (SMEs)," *Industrial Management & Data Systems*, vol. 123, no. 1, pp. 278-301, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[11] Zdzislaw Polkowski, and Malgorzata Nycz, "Big Data Applications in SMEs," Scientific Bulletin-Economic Sciences, vol. 15, pp. 13-24, 2016. [Google Scholar] [Publisher Link]

[12] Mpho Kgakatsi et al., "The Impact of Big Data on SME Performance: A Systematic Review," *Businesses*, vol. 4, no. 4, pp. 632-695, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[13] Lila Rajabion, "Application and Adoption of Big Data Technologies in SMEs," *2018 International Conference on Computational Science and Computational Intelligence (CSCI)*, Las Vegas, NV, USA, pp. 1133-1135, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[14] Reza Shokri Kalan, and Murat Osman Ünalir, "Leveraging Big Data Technology for Small and Medium-Sized Enterprises (SMEs)," *2016 6th International Conference on Computer and Knowledge Engineering (ICCKE)*, Mashhad, Iran, pp. 1-6, 2016. [CrossRef] [Google Scholar] [Publisher Link]

[15] Tayla Wessels, and Osden Jokonya, "Factors Affecting the Adoption of Big Data as a Service in SMEs," *Procedia Computer Science*, vol. 196, pp. 332-339, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[16] Anthony Soroka et al., "Big Data Driven Customer Insights for SMEs in Redistributed Manufacturing," *Procedia CIRP*, vol. 63, pp. 692-697, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[17] Abdalwali Lutfi et al., "Factors Influencing the Adoption of Big Data Analytics in the Digital Transformation Era: Case Study of Jordanian SMEs," *Sustainability*, vol. 14, no. 3, pp. 1-17, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[18] Matthew Willetts, A.S. Atkins, and Clare Stanier, "A Strategic Big Data Analytics Framework to Provide Opportunities for SMEs," *14th International Technology, Education and Development Conference*, Valencia, Spain, pp. 3033-3042, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[19] Matthew Willetts, Anthony S. Atkins, and Clare Stanier, "Barriers to SMEs Adoption of Big Data Analytics for Competitive Advantage," *2020 Fourth International Conference on Intelligent Computing in Data Sciences (ICDS)*, Fez, Morocco, pp. 1-8, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[20] Mohammad Falahat et al., "Big Data Analytics Capability Ecosystem Model for SMEs," *Sustainability*, vol. 15, no. 1, pp. 1-23, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[21] Patrick Mbassegue, Ma-Lorena Escandon-Quintanilla, and Mickaël Gardoni, "Knowledge Management and Big Data: Opportunities and Challenges for Small and Medium Enterprises (SME)," *IFIP International Conference on Product Lifecycle Management (PLM 2016)*, Columbia, SC, USA, pp. 22-31, 2016. [CrossRef] [Google Scholar] [Publisher Link]