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The Role of Artificial Intelligence, Big Data Analytics, and Strategic Leadership in Building Competitive Advantage

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ABSTRACT
The speed at which digital technologies are developing are influencing how organizations compete. One of these technologies is artificial intelligence (AI) along with big data analytics. AI and big data are great at improving decision making, operational efficiency, and creating value over time. This article looks at AI and big data analytics, and the role of strategic leadership in sustaining a competitive advantage, primarily within the Malaysian Manufacturing and Automation Sector. This study incorporates the Resource-Based View and the Dynamic Capabilities frameworks and conceptualizes Big Data Analytics Capability (BDAC) as a strategic organizational resource that consists of technology, people, and organizational assets. The analysis identifies the supports and challenges that AI and analytics offer competitive differentiation, cost leadership, innovation, and strategic agility as well as the supports and challenges of data governance, cybersecurity, talent shortages, and ethics. The author of the article suggests that the adoption of AI and big data analytics does not sustain competitive advantage, however, strategic leadership does as it brings cohesion between technology, people, and processes. The study provides the Malaysian policy context, the national smart factory agenda and organizational practices to show that strong leadership, governance, and capability development, are the key to digital investments being converted into desirable strategic results
Keywords: Artificial Intelligence (AI); Big Data Analytics; Big Data Analytics Capability (BDAC); Strategic Leadership; Competitive Advantage; Digital Transformation, Women Leadership..

1. INTRODUCTION:

The last few decades' notable patterns in the business environment include the rapid increase in technology, global competition, and constant economic and operational volatility (Shah et al., 2023). From the supply chain to the end user, the market is characterized by instability, complexity, and rapid changes in technology, and in the case of artificial intelligence and big data analytics, rapid changes in technology. Companies have to run in such environments, and in response to such challenges, they have begun to use available digital technologies—especially artificial intelligence (AI) and big data analytics—strategically to make better decisions, increase operational effectiveness, and create sustainable value (Zeng & Yi, 2023). These technologies are no longer seen as operational technologies; they are seen as essential technologies and sources of enduring competitive advantage in the digital economy. On their own, artificial intelligence and big data analytics fundamentally change the ways in which organizations gather, process, and use information (Zamani et al., 2023). AI systems, for example, allow computers to mimic certain functions of the human brain, such as learning, reasoning, and self-correction. Big data analytics, on the other hand, provide firms with the ability to obtain actionable value from large amounts of data, both structured and unstructured (Modgil et al., 2022). When these technologies are combined, they provide the ability to create systems that are predictive, adaptive, and act intelligently, based on continuous learning from real-time data. Thus, companies can anticipate market developments, streamline their processes, and derive actionable insights from new risks and opportunities. In this new paradigm, companies can escape the burden of reactive decision-making and embrace proven, strategic management.

In Malaysia, the rapid adoption of digital transformation, particularly in the manufacturing and automation sectors, has been unprecedented (Gupta et al., 2021; Jusoh & Abd Razak, 2025; Iqbal & Abdul Rahim, 2025). The government has recognized Industry 4.0 technologies as a driver of national economic competitiveness and industrial sustainability. The National Policy on Industry 4.0 and the New Industrial Master Plan 2030 (NIMP 2030) initiatives highlight the value of Artificial Intelligence (AI), big data analytics, the Internet of Things (IoT), and automation. NIMP 2030 aims to transform 3,000 manufacturing facilities into smart factories. This position aims to make Malaysia a high-value, innovation-driven industrial economy. The vision of these smart factories encompasses integrated cyber-physical systems

(Attah et al., 2024). These systems include digital connectivity, smart automation, and advanced analytics to boost productivity, resilience, and sustainability. Despite the increasing adoption of digital transformation and policy support from the government in Malaysia, firms across the country are still behind on the adoption of AI and big data analytics. This is partly a result of firms across the country still struggling to transform technological potential into strategic outcomes (Ding et al., 2023). Analytics systems require precise data which adds to the consistency and timeliness of the data required. Disintegrated legacy systems, data governance, and limited cross-functional integrations usually damage analytic initiatives (Techanamurthy et al., 2025; Hisham et al., 2025). Additionally, there are still deficits in the skilled talent pool, most noticeably data scientist, AI engineer and analytics savvy manager which constrain effect implementations most notably in small and medium-sized enterprises.

The lack of digital transformation has been attributed to the concern of privacy and security of data. Digital transformation is evidenced by the use of interconnected systems and cloud-based platforms, which leaves organizations increasing vulnerable to cyber threats; while a lack of cyber security leaves operational and customer data vulnerable, as well as the organization's reputation and the strict adherence to compliance. Moreover, organizational readiness remains a critical concern, as change, digital culture, and a lack of leadership commitment result in AI initiatives being implemented as isolated pilot projects. This article aims to show the strategies that AI and Big Data analytics can provide in building a competitive edge within the construction and automation market in Malaysia. By using Resource Based View and Dynamic Capabilities, the study aims to analyze the effect of analytics based functioning resources and persistent performance, as well as the strong influence of leadership in achieving the integration of technology, people, and processes to facilitate effective digital transformation (Iqbal & Abdul Rahim, 2025).

Figure 2: Business Roadmap, Vision, and Mission of DNC Automation

2. LITERATURE REVIEW

The new literature proves that artificial intelligence (AI), big data analytics, and business intelligence have become urgent factors of strategic management, innovation, and sustainable competitive advantage in any industry. Research underlines that AI tools can help improve strategic decision-making because they allow analyzing complex data much faster and more accurately, which facilitates the maintenance of long-term competitive positions when it is combined with the overall work of an organization (Aloosi, 2025). In line with this opinion, the literature on business intelligence and big data analytics also emphasizes the idea that these methods can convert raw data into actionable insights, which can enhance the agility of organizations, their responsiveness to the market, and their efficiency, but also points to the fact that the challenges associated with these processes include quality of data, security, and skills gaps (Adewusi et al., 2024). The systematic reviews also affirm that the implementation of data analytics and AI can positively influence the quality of decisions, relationships with customers, and the overall performance of firms but a successful implementation requires attentive approaches to privacy issues, high expenses, and gaps in the ability of the workforce (Donthireddy, 2024). The empirical data of sector-specific research indicate that intellectual capital and service innovation is a boon to competitive advantage, especially when it is backed up with robust big data analytics tools (Alkhatib and Valeri, 2024). Equally, studies based on the dynamic capabilities viewpoint show that AI-based big data analytics affect strategic agility and innovation performance positively, particularly in the presence of high market turbulence (Alghamdi and Agag, 2023). Resource-based perspective AI implementation redefines the sources of competitive advantage through establishing new human-machine capabilities, which directly replace and complement traditional skills, and in turn determine performance outcomes in a new way (Krakowski et al., 2023). The literature further emphasizes the relevance of firm-specific information, applications tailored to analytics, and absorptive capacity to obtain a lasting competitive edge based on big data projects (Dahiya et al., 2022). Furthermore, AI driven by big data has been demonstrated to improve customer, user, and external market knowledge generation, thereby, reinforcing the rational decision-making and firm performance (Bag et al., 2021). These findings are further supported at the industry level, where the evidence shows that the organizations that utilize AI and analytics effectively outperform their peers in terms of innovation, growth in revenue, and profitability (Berman et al., 2020), and industry-specific research, including the study on digital banking, demonstrates that AI and big data analytics play a vital role in facilitating customer-focused strategies and digital transformation (Indrasari et al., 2019).

Table 1: Key Studies on AI, Big Data Analytics, and Competitive Advantage

Author(s) & Year	Focus Area	Methodology	Key Findings	Contribution to Competitive Advantage
Aloosi (2025)	AI and Strategic Management	Descriptive–analytical	AI enhances strategic decision-making accuracy, speed, and sustainability	AI is a core strategic tool for achieving sustainable competitive advantage
Adewusi et al. (2024)	Business Intelligence & Big Data	Conceptual review	BI tools transform big data into actionable intelligence; challenges include data quality and skills	BI–Big Data integration improves agility and informed decision-making
Donthireddy (2024)	Data Analytics & AI in Business	Systematic literature review	AI and analytics improve efficiency, decision-making, and customer engagement; implementation barriers exist	Highlights transformative potential of AI with implementation constraints
Alkhatib & Valeri (2024)	Intellectual Capital, Service Innovation & BDA	Survey (SmartPLS, SEM)	IC positively affects competitive advantage via service innovation; BDA moderates the relationship	Demonstrates mediating and moderating roles of innovation and analytics
Alghamdi & Agag (2023)	AI-driven Big Data & Innovation	Quantitative (SEM, AMOS)	AI-driven BDA enhances innovation through strategic agility; market turbulence strengthens effects	Shows strategic agility as a key mechanism for AI-enabled advantage
Krakowski et al. (2023)	AI Adoption & Competitive Capabilities	Resource-based empirical study	AI creates new human–machine capabilities, replacing traditional skills	Redefines sources of competitive advantage in AI-integrated environments
Dahiya et al. (2022)	Firm-Specific BDA Capabilities	Conceptual framework & cases	Customized analytics and proprietary data enable sustained advantage	Emphasizes RBV and absorptive capacity in BDA success
Bag et al. (2021)	AI-powered Big Data in B2B Marketing	Survey-based empirical study	AI enhances customer, user, and market knowledge, improving firm performance	Links knowledge creation to rational decision-making and performance
Berman et al. (2020)	AI, Analytics & Executive Strategy	Global executive survey	Data-driven firms outperform peers in innovation, revenue,	Demonstrates real-world business value of AI and analytics

			and profitability	
Indriasari et al. (2019)	AI & Big Data in Digital Banking	Qualitative (interviews & review)	AI and BDA enable customer-centric digital transformation	Highlights sector-specific application of AI for service excellence

2. STRATEGIC IMPLICATIONS OF AI AND BIG DATA ANALYTICS

2.1 Competitive Differentiation

Competitive differentiation is the capacity of an organization to provide a distinct value, which makes it stand out among others within a given market. Artificial intelligence (AI) and big data analytics in the digital transformation era are effective differentiator drivers as they help companies go beyond the standardized products and services and into intelligent, adjustable, and data-driven solutions (Dzreke & Dzreke, 2025). Contrary to the conservative automation systems that work based on set rules, AI-based systems constantly learn based on data thereby enabling organizations to be more precise, flexible, and customized. Predictive maintenance is one of the most important differentiating capabilities that AI made possible **(Dzreke, 2025)**; **(Horowitz et al., 2022)**. Using the historical and real-time machine data, AI models can anticipate equipment failures before they happen, thus decreasing unexpected downtime, as well as the expenditure on maintenance. Such an ability enables not only improved reliability in the operations but also it adds value to the customers because production interruptions are reduced. Likewise, computer vision and machine learning-driven real-time quality inspection systems can allow companies to identify defects immediately and enhance the product consistency and decrease wastes. This type of advanced quality control increases the customer confidence and brand name (Berman et al., 2020).

Astute time scheduling and flexible production scheduling also enhance differentiation. The AI based scheduling systems have the ability to dynamically update the production plans based on any change in demands, supply chain disturbances or machine availability. This agility enables companies to provide reduced lead times, greater delivery consistency and tailored production batches, which are becoming more and more desirable in competitive production settings. Consequently, customers will view the firms using AI as a technologic and customer-focused firm. In the case of automation solution suppliers, AI and big data analytics can provide a strategic shift by enabling them to be not just equipment suppliers but also offer an end-to-end smart manufacturing solution. Instead of selling individual machines, companies are able to sell integrated systems which include hardware, software, analytics, and continuous optimization services (Nikzat, 2025). This change generates switching costs to the customers and enhances long-term relations, which consolidates the competitive positioning. Strategically, competitors find it challenging to imitate AI and analytics-based differentiation since it is not just about investing in technology but also organizational learning, information building, and experience in the field have been established over the years. In turn, AI-based differentiation will be a self-sustaining competitive advantage source, allowing companies to charge high prices, increase consumer loyalty, and reinforce their position in the market in a digitalizing economy (Gnizy, 2020).

2.2 Operational Efficiency and Cost Leadership

Cost leadership and operational efficiency are key goals to organizations that operate in highly competitive and price sensitive business environments. Big data analytics is significant in ensuring that these goals are realized since it allows companies to systematically analyze high amounts of operational data to determine inefficiencies, process optimization, and cost reduction (Dahiya et al., 2022). With the help of data-driven insights, organizations will be able to move away in reactionary problem-solving and proactive and preventive operational management. Predictive analytics can bring one of the most noticeable efficiency improvements. Using the data of machines, sensor measurements, and past performance data, companies can be highly accurate in predicting equipment breakdowns and the need to service them. This minimizes the instances of unplanned downtime, decreases the costs of repair, and increases the life cycle of assets (Chong et al., 2024). Predictive maintenance does not only reduce the direct maintenance costs but also enhances production continuity which increases overall effectiveness of equipment. The optimization of the workflow is also optimized through the use of big data analytics to determine the bottlenecks, idle periods, and misallocation of resources in the production processes. The innovative analytics models may also suggest the best process settings so that companies could maximize the throughput and reduce the energy usage and material waste. This kind of optimization of the process directly leads to the reduction of costs and promotes the concept of lean manufacturing (Olayinka, 2019).

Another strategic area with critical issues where cost leadership through analytics can be attained is supply chain efficiency (Kamel, 2023). The combination of supplier, logistics providers, and in-house information will help companies to enhance demand forecasting, inventory, and procurement planning. Right forecasts decrease surplus stock and out of stock, decrease holding costs and enhance cash flow. Also, analytics helps companies detect supplier risks in time as well as reacting efficiently to disruptions to improve supply chain resilience. Strategically, the cost leadership which is attained via the use of analytics is especially good since cost leaderships do not depend on one aspect only, which is cost reduction or scale economies. Rather, it is motivated by excellent information processing and decision-making skills. Companies that integrate analytics into their daily operations are able to always beat competition in terms of being the cheapest in the business without compromising on service quality. Notably, the

service reliability and customer satisfaction also enhance operational efficiency that is realized with the help of big data analytics. Poor downtime, on-time deliveries and quality reduce the total customer experience. Therefore, cost leadership and customer value creation do not exclude each other, but are complementary results of analytics-based operational excellence.

2.3 Strategic Decision-Making and Innovation

The capacity to process dynamic and complex information is becoming an important aspect of strategic decision making within modern organizations. Big data analytics and AI play a big role in supporting the managerial decision-making process by turning raw data into actionable information. Conventional methods of decision making usually make use of intuition, experience or historical averages and this may not be adequate in turbulent and unpredictable settings. Conversely, the analytics-based decision-making allows real-time data-based and predictive intelligence-based evidence-based strategies (Behl, 2022). The AI-driven analytics systems offer the managers with the advanced forecasting data that allows them to predict the market trends, customer behavior, and operational risks. Predictive models have the ability of simulating various scenarios in the strategy, which enables the decision-makers to know what may happen to the strategy before they allocate resources. This minimizes uncertainty and enhances the quality of strategic decision-making regarding investments, market expansion and capacity planning. Another important area that has been impacted by AI and analytics is innovation. Advanced simulation tools like digital twins enable organizations to develop virtual copies of physical systems, processes or a whole factory. With such digital environments, firms can experiment with novel designs, production processes, or ways of functioning without interfering with the real-world operations. This makes experimentation not only faster, cheaper and less risky but also innovation cycles are shortened (Oluoha et al., 2022).

Innovation is another area where AI comes in as it helps reveal concealed trends and insights within big data that would not have been visible using conventional methods. As a case in point, customer statistics will be able to show the unmet needs or the new preferences and direct the development of new products and services. Process analytics has the ability to offer incremental and radical process innovation opportunities, which are more productive and flexible (Trunk et al., 2020). AI-based decision-making contributes to organizational agility, which is strategic. Firms are able to react fast to the environment, adapt strategy in a dynamic way and keep on perfecting their competitive position. This agility is mostly useful in this type of industries that are highly competitive and technologically changing at high rates. Finally, AI and analytics will turn decision-making into a forward-thinking and strategic and not a retrospective and reactive activity. Organizations are able to enhance coherence of strategic planning, decrease risk, and provide sustainable growth over a complicated business world by integrating analytics into strategic planning and innovation processes.

2.4 Organizational Capability and Readiness

The effective implementation of AI and big data analytics requires both technological investment and organizational competence and preparation. Even though most organizations are known to obtain advanced technologies, they are unable to achieve their entire strategic worth because of lack of human capital, poor data infrastructure, or cultural obstacles (Hossain et al., 2024). Thus, the organizational preparedness is one of the most important factors of digital transformation success. One of the preconditions of analytics-based strategy is a well-developed data infrastructure. This will involve the use of trusted data collection systems, built-in databases, cloud computing systems, and safeguarded data storage systems. The AI systems cannot produce meaningful insights without quality, available, and controlled data. The problem of data silos and disjointed systems tends to sabotage analytics efforts and the importance of integration at the enterprise level is highlighted. Human capital is also important. Organizations need trained specialists like data scientists, designers, and analytics capable managers who can make sense of the data and convert it into strategic moves (Binsaeed et al., 2023). Technical expertise is however not enough. The employees in the functional areas should be made data literate so that they are able to utilize analytics in their day-to-day decision making. Constant training and building of capabilities is thus necessary.

Organizational culture is a determining factor to preparedness. A data-based culture promotes experimentation, use of evidence based decisions and failure learning. On the contrary, strict hierarchies and change resistance may become barriers to the adoption of analytics. The strategies that have been used in change management such as effective communication, leadership, and employee involvement play important roles in overcoming resistance and developing acceptance. Leadership commitment also has an effect on preparedness. Ones strategy should be to clearly express a digital vision, distribute resources through the best strategic allocation, and get incentives in line with the objectives of transformation (Arshad et al., 2024). The lack of leadership sponsorship means that any AI projects may languish as single projects and not as a part of overall strategic capabilities. organizational readiness is a multidimensional concept that includes infrastructure, skills, culture, and leadership. Companies that invest in the development of such capabilities have a better chance to capitalize on AI and analytics in a strategic manner so that the implementation of technology results in long-term competitive advantage (Ghaleb et al., 2021).

2.5 Risk Management and Compliance

Although AI and big data analytics can have a significant strategic advantage, they also pose a significant risk that has to be managed carefully. The problem of computer security, data privacy, regulatory compliance, and accountability is growing in significance as organizations are becoming more dependent on data-driven systems. The inability to manage these risks may harm credibility, leave the firms prone to legal consequences, and decrease the competitive edge. One of the most important issues in analytics-based environments is the risk of cybersecurity. The presence of AI systems and interconnected devices

increases the threat of digital attack surface thus exposing organizations to data breaches, ransomware, and system disruptions. Tight cybersecurity measures must be involved in continuous monitoring, secure system architecture, and risk assessment to prevent sensitive operational and customer information (Shah et al., 2023). Another issue is data privacy and compliance with regulation. The organizations should adhere to the data protection laws and industry regulations on data collection, storage, and use. Failure to comply satisfactorily may lead to financial fines and image. By creating transparent data governance frameworks, accountability, transparency and legal data practices are guaranteed. The aspect of ethics concerning the use of AI is becoming a significant issue. Untraceable and biased algorithms, automatic decision-making without human oversight, may have unfair and harmful consequences. Fairness, transparency, and accountability are ethical AI practices that are necessary in stakeholder trust and social legitimacy.

Risk management is not a limiting concept but an enabler of sustainable digital transformation in a strategic management viewpoint. Effective governance frameworks enable organizations to undertake innovations with a lot of confidence and reduce the possible adverse impacts. The incorporation of risk management into the strategic planning process will ascertain that AI and analytics projects take into account organizational values and long-term goals. no efficient risk management and compliance systems can be used to take advantage of AI and big data analytics without considering the responsible usage. Those organizations that take the initiative to deal with these issues can insure the strategic resources, develop trust with the stakeholders and ensure the competitive edge in the business environment that is more and more regulated and data-driven (Elumilade et al., 2023; Gazi et al, 2025).

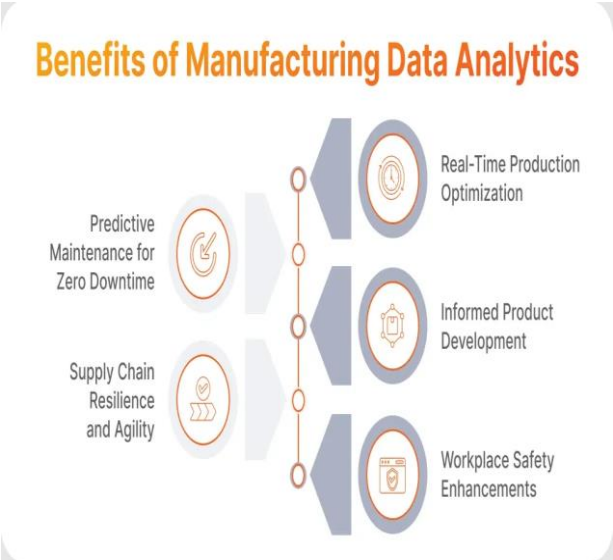

Figure 3: Benefits of Manufacturing Data Analytics

3. Theoretical Foundations: Resource-Based View and Dynamic Capabilities

The strategic management theory offers useful guidelines on the manner in which organizations can gain and maintain competitive advantage in ever more sophisticated and technologically oriented environments. One of the most powerful schools of thought is the Resource-Based View (RBV) and the Dynamic Capabilities approach. Collectively, these theories present a powerful conceptual framework of the role of artificial intelligence (AI) and big data analytics in long-term firm performance and strategic differentiation. The RBV provides the view of competitive advantage as a product of the firm-specific resources and capabilities that are valuable, rare, inimitable, and non-substitutable (VRIN). RBV maintains that the success of organizations over their competitors is not merely due to good market conditions but rather because it has distinct internal resources that are difficult to buy or imitate by their competitors. Digital economy: The traditional physical assets like machinery or physical infrastructure cease to be sources of sustained advantage. Rather, less material resources, including data, analytics knowledge, organizational practices, and learning abilities, are now at the center (Kero & Bogale, 2023).

Big Data Analytics Capability (BDAC) is quite consistent with the RBV framework. The technological infrastructure is only one of the areas that BDAC focuses on, but a bundle of physical resources (data platforms, cloud infrastructure, IoT system), human resources (data scientists, engineers, analytics-literate managers), and organizational resources (data governance structures, decision-making routines, and a data-driven culture) are the focus of BDAC. Integrated well, BDAC would be a useful tool as it facilitates the making of better decisions, streamline processes, and innovations. It is not common as the creation of sophisticated analytics functionalities takes a lot of funds, time, and knowledge (Nayak et al., 2023). It is non-substitutable given that the strategic advantages of it cannot be easily replicated by other resources, and it is hard to imitate given that it is a socially complicated and path-dependent resource. Nonetheless, RBV helps to explain the presence of the competitive advantage, but it is not very useful when considering how companies respond to the changing environment that is fast. Dynamic Capabilities framework resolves this limitation by further developing RBV with an increased focus on the capacity of the firm to reconfigure and renew its resources to react to environmental change. Dynamic capabilities are the organizational processes that help firms to perceive opportunities and threats and take the opportunities by making strategic investments and changing or restructuring the resources to ensure that they stay competitive with time.

The artificial intelligence and big data analytics prove to be really advantageous to improve the dynamical capabilities, as it reinforces all these three processes. To begin with, analytics-based sensing enables businesses to detect new trends, market preferences, operational risk, and changes in the market using real-time analytics. With advanced AI models, it is possible to identify patterns and anomalies that could not be observed before, allowing to act on a strategic level and not have to adjust to it. Second, AI enhances the capitalization of the opportunity through

strategic decision-making and the allocation of resources. Predictive analytics and simulation of scenarios helps managers to weigh different strategies and choose those that have the most potential value. This minimizes the level of uncertainty and improves efficiency of strategic investments in digital transformation, product development, and market expansion. Third, AI and analytics provide the possibility of resource reconfiguration as continuous learning and organizational adaptation becomes possible. The insights derived using data enable companies to redesign and restructure processes and revise business models with evolving environmental conditions. Indicatively, automation based on analytics can transform organizations into product-centric models to service and platform-based business models, which have greater long-term resilience.

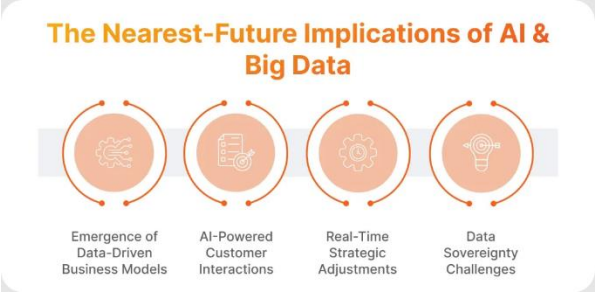

Figure 4: The Nearest-Future Implications of AI & Big Data

Notably, the combination of RBV and Dynamic Capabilities can give a comprehensive picture of the strategic role of AI and BDAC. Whereas RBV is used to explain the ways in which analytics capabilities can create competitive advantage, dynamic capabilities are used to explain how firms can be able to maintain that advantage in unstable and uncertain environments. It is actually the case that AI-enabled firms are in a better position not only to perform better but also to evolve, change and survive in a fast-changing technological environment. Combining RBV and Dynamic Capabilities is a potentially potent theoretical framework to study the strategic value of AI and big data analytics. Firms can develop resilient and sustainable competitive advantage in the digital age by integrating BDAC as an organizational resource and using AI to ensure enhanced sensing, seizing, and reconfiguring processes.

4. Big Data Analytics Capability and Strategic Value

The emergence of Big Data Analytics Capability (BDAC) has become one of the most important organizational capabilities in a digital economy that allows firms to turn large amounts of data into strategic actions. Compared to the conventional information systems, BDAC is not limited to data processing or reporting processes but is an embodiment of an organizational capability that has led to strategic decision-making, operational excellence, and innovation (Aljumah et al., 2021). Strategically, BDAC is a major source of competitive advantage once it is inculcated through the organization structures and in tandem with business goals. BDAC is made up of three dimensions that are interrelated, namely, human capabilities, physical infrastructure, and intangible organizational assets. The first dimension is human capabilities, which is the skills, knowledge, and expertise of those employees working on the data related activities. They consist of data scientists, data engineers, analytics experts, and domain experts that have technical expertise and business processes knowledge. The ability of humans is needed in the interpretation of analytical results, formulation of appropriate models and conversion of knowledge into strategic efforts. Even the most innovative analytics technologies do not produce any worth without the proficient staff. Additionally, managerial data literacy is also important because decision-makers need to be capable of learning and relying on analytics-driven advice (Dzreke & Dzreke, 2025).

The second BDAC dimension is the physical infrastructure which includes the technological basis needed in the collection, storage, processing, and analysis of data. These are Internet of Things (IoT) sensors, enterprise data systems, cloud computing platforms and advanced analytics applications. In the industrial and automation domain, the IoT-enabled devices produce real-time information on the operation of the equipment, which can be used to streamline production processes, better use assets, and minimize downtime (Dzreke & Dzreke, 2025). Cloud-based systems improve scalability and flexibility, which means that organizations can work with large volumes of data effectively and combine data across functional lines. A strong and agile infrastructure is needed to make sure that analytics efforts can be expanded and modified as the organization changes its requirements. The third and the most complicated aspect of BDAC concerns intangible organizational assets, including data governance frameworks, routinely standard analytics, and a culture based on data. Data governance has been used to guarantee data quality, consistency, security, and adherence to regulations. Data ownership, access and accountability are clearly defined through clear governance structures, which are critical in creating trust in analytics systems. Analytics routines are processes that have become common place where data insights are incorporated into operational and strategic decision-making on a regular basis (Su et al., 2022). A culture of data will support evidence-based decision-making, experimentation, and lifelong learning and diminish the use of intuition or seniority.

There has been empirical evidence provided to show that firms that have high BDAC are in a better position to implement both the cost leadership and differentiation strategies in the Malaysian manufacturing sector. At the cost leadership level, there are process optimization supported by analytics, predictive maintenance, and resource allocation efficiency that will help reduce operation costs and increase productivity. On the differentiation side, BDAC allows firms to provide tailor-made solutions, enhance quality of products and innovate quickly based on customer and market needs. This two-fold strategic impact underscores the message that BDAC is not just an efficiency tool, but a strategic resource which helps in competitor positioning.

Notably, the strategic worth of BDAC is that it is integrative. All three dimensions of BDAC support each other to form the synergistic ability that is hard to emulate

by the competitors. Technological investments are not sufficient unless it is accompanied by talented employees and favorable organizational designs. On the same note, it is not possible to create value using human expertise in the absence of trusted infrastructure and governance systems (Xia et al., 2024). This interdependence qualifies BDAC as a path-dependent and socially multifaceted capability, which is very similar to the attributes of sustainable competitive advantage described in the strategic management theory. Big Data Analytics Capability is a revolutionary resource in an organization that is not limited to operational analytics. BDAC can help a firm to become efficient and differentiated when properly designed and incorporated, as it assists in strategic decision-making, increases organizational agility, and enhances the agility of the organization. With the increasing digital competition, those organizations that consider BDAC as a key strategic asset, as opposed to a technical functionality, are better placed to ensure that they have sustained competitive advantage in volatile business conditions.

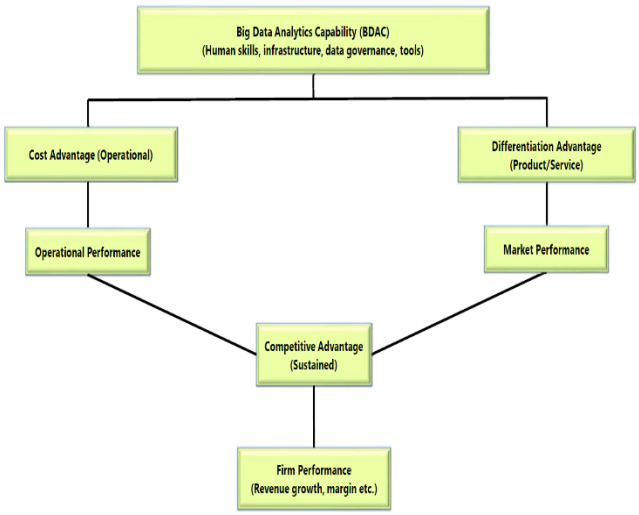

Figure 5: Conceptual Framework that Links Strategic Capabilities of AI and Big Data Analytics to Competitive Advantage in DNC Automation

5. Artificial Intelligence: Opportunities and Challenges

The advent of artificial intelligence (AI) has become a disruptive element in the manufacturing industry today and helps organizations transition to intelligent, autonomous, and data-driven services. With the help of AI and sophisticated analytics, manufacturing companies can be more productive and better able to make decisions and gain better operational resilience. When applied to Industry 4.0, AI is now regarded as a strategic enabler, not a supportive technology, and it can be used throughout the manufacturing value chain (Mathew et al., 2023).

Predictive maintenance is one of the most noticeable AI applications in the manufacturing industry. AI algorithms are able to forecast machine failures prior to their occurrence through the analysis and interpretation of the history of the machines, sensor measurements, and real-time data on the operation of the equipment. This enables organizations to move away reactive and preventive maintenance into condition-based maintenance which will help to greatly reduce the unplanned downtimes, maintenance expenses and losses during production. Predictive maintenance is also known to increase the life time of the equipment and enhance the overall effectiveness of the equipment which directly lead to productivity and cost effectiveness (Păvăloaia & Necula, 2023). Another application of high impact is AI-based visual inspection. AI systems can detect defects in products, and can do so with a high level of accuracy and speed in order to inspect a product, potentially at a speed that would not be possible in an efficient way with human operators. These systems are continuous, objective, and minimize human error and enhance consistency in quality. Consequently, defect reduction, lowering of rework and scrap rates, and increased customer satisfaction is possible due to reduced product deficiencies, as the manufactures can improve product reliability.

Smart planning and production forecasting are also indicators of the strategic capabilities of AI. The inability of traditional scheduling systems to use dynamic systems is due to the fact that they usually depend on the fixed rules and past averages. Scheduling systems run by AI can immediately respond to demand changes, availability of machines, labor bottlenecks, and supply chain upsets (Trakadas et al., 2020). This flexibility allows manufacturers to have a better flow of production, lower the lead times and be more responsive to market changes. On the same note, AI-based energy optimization systems can be used to study patterns of production and energy consumption and optimize energy usage to reduce costs and achieve sustainability. Although with these particularly high opportunities, there are a number of challenges in implementing AI within the manufacturing sector. Lack of skilled talent is one of the most imperative obstacles. The creation, implementation, and delivery of AI systems demand specific skills in data science, machine learning, and engineering expertise in specific areas. Such talent is not available in many organizations, especially small and medium-sized enterprises, which restrict their scale of the initiative of AI.

Another typical obstacle is fragmented implementation. The implementation of AI projects is presented as a standalone pilot project in most companies without being integrated into the main business processes or strategic goals. Consequently, these projects are not able to produce lasting values and have tendencies of discarding them after experimenting (Islam et al., 2025). The emphasis on this fragmentation is on the necessity to tie AI efforts to organizational strategy and to assure cross-functional cooperation. The problem of data governance also makes the adoption of AI even more complicated. The quality of data is very crucial to the functioning of AI systems, and the absence of good data governance will result in erroneous models, biased results, and unreliable information. The problems surrounding data ownership, data security, and regulatory compliance should be mitigated by having strong governance structures. Poor data management is not only a threat to AI performance, but also subject organizations to legal and reputational risks.

The ethical issues that are related to AI are also becoming a topic of greater attention. There is a question of ethicality and social considerations concerning algorithmic bias, absence of transparency in the decision-making process and over-automation without human supervision. These issues can influence the level of trust in the workforce, safety, and accountability in the manufacturing setting. Transparency, fairness, and explainability of ethics in AI are thus needed to be responsible in adopting them. AI presents significant prospects of changing the manufacturing processes with more efficiency, quality, and innovation. Nevertheless, AI efforts will not achieve scalability as strategic capabilities without effective leadership, governance and organizational preparedness as they may just turn into isolated experiments. The key to achieving the full potential of AI is to take a holistic approach that would embrace technology, talent, data management, and ethical concerns into the long-term strategic picture of the organization.

6. NATIONAL POLICY ENVIRONMENT: MALAYSIA'S SMART FACTORY AGENDA

National policy environment is very important in defining the rate and path of digital transformation in an economy. In Malaysia, the government has made the advanced manufacturing and Industry 4.0 technologies the key elements of economic development in the long-term, productivity increase, and global competitiveness. The most important policy tool in this sense is the New Industrial Master Plan 2030 (NIMP 2030) that suggests an overall framework to promote the use of smart manufacturing technologies that include artificial intelligence (AI), big data analytics, robotics, and the Internet of Things (IoT). NIMP 2030 sees the shift of Malaysia towards a high-value, innovation-driven industrial economy, as opposed to being a cost-driven manufacturing base. It has one of its flagship goals of transforming at least 3,000 manufacturing plants into smart factories by 2030 (AlAfnan & MohdZuki, 2024). The idea of these smart factories is that it is a smart cyber-physical system in which the digital connectivity, intelligent automation, and advanced analytics are integrated throughout the production process. The policy will facilitate this change, thus increasing productivity, enhancing supply chain resiliency, and increasing sustainability performance in the manufacturing industry.

One of the strengths of the smart factory agenda of Malaysia is holistic in nature. Instead of concentrating on the adoption of technology alone, NIMP 2030 highlights four enablers of utmost importance, which are incentives and funding, talent, infrastructure investment, and governance structures. Monetary incentives, grants, and tax allowances are meant to reduce the entry barriers to using advanced technologies especially to the small and medium-sized enterprises. These policies would motivate companies invest in AI-based automation, data analytics services, and digital integration programs that otherwise can be viewed as very risky or capital-intensive. The other pillar of the policy framework is talent development (Fui, 2022). Understanding that digital transformation is limited by the skills shortage, the government of Malaysia has placed a high priority on the digital and technical talent development through the education reform, reskilling and industry-academia partnership. Efforts to generate data scientists, AI engineers, and digitally savvy managers are an attempt to overcome one of the most enduring obstacles to AI use in manufacturing. The policy environment helps the firms to develop sustainable internal capabilities instead of having to hire new skills thereby contributing to the sustainable national talent pool.

The investment in infrastructure is also another support to the smart factory agenda of Malaysia. The digitization of infrastructure, such as high-speed networks, cloud-computing networks, and secure data networks, can allow companies to run data-intensive applications at scale. Effective AI implementation in manufacturing settings requires reliable infrastructure to collect data in real-time, integrate the system, and conduct advanced analytics, which form the basis of the latter. Simultaneously, the frameworks and standards of cybersecurity are being enhanced to protect the digital systems and foster confidence in the data-driven functions. Another aspect of the national policy environment that is critical is governance and regulatory alignment. NIMP 2030 has highlighted the need to adopt advanced technologies in a responsible and ethical manner in terms of their role in data protection, cybersecurity, and the management of AI (Wahab et al., 2024). Regulatory certainty helps companies to avoid uncertainty and offers a level playing field within which digital innovation can thrive. This is especially true of AI and big data analytics where issues of data privacy, system reliability, and accountability may be an impediment to adoption unless addressed.

With the organization strategies aligning with the national initiatives including the NIMP 2030, companies such as DNC Automation can use the policy ecosystem to boost their digital transformation process. Alignment facilitates accessibility to funding schemes, public-partnerships, shared research networks and shared innovation platforms. Most importantly, it will enable the companies to brand themselves as strategic partners to the industrial transformation in Malaysia as opposed to being isolated adopters of technology. The smart factory agenda in Malaysia offers an enabling and supportive policy environment in the strategic implementation of AI and big data analytics in manufacturing. With the combined action in incentives, talent building, infrastructure, and governance NIMP 2030 lessens transformation barriers and increases firm-level preparedness. Organizations that actively align their digital strategies to this national vision are in a better placed to attain sustainable competitive advantage as well as helping in attainment of the long term industrial and economic goals of Malaysia (Hammad et al., 2025).

7. STRATEGIC LEADERSHIP AND COMPETITIVE ADVANTAGE

7.1 The Nature of Strategic Leadership

Strategic leadership is a very important organizational competence that helps the firms to attain and maintain competitive advantage in complex, uncertain and high-changing conditions. As opposed to operational leadership where the primary emphasis is on short-term

productivity, performance of tasks, and solving daily problems, strategic one is based on long-term perspective, vision, flexibility, and creation of value. Strategic leaders have the role of defining the overall organizational direction, alignment of the resources with strategic goals and also making the firm resilient to environmental turbulence (Willis et al., 2022).

One of the most important features of strategic leadership is a person who is able to predict future opportunities and threats but not simply respond to the existing conditions. Such future orientation would ensure that leaders help organizations navigate technological discontinuity, market unpredictability and competitive stress (Adoli & Kilika, 2020). Within the frames of the digital transformation, strategic leaders are considered key on how the technologies like artificial intelligence (AI) and the use of big data analytics could be incorporated into the strategy of the firm. Strategic leaders do not consider digital technologies as single-purpose items but place them at the core of the long-term organizational vision and competitive standing. Another basic aspect of strategic leadership is resource alignment. Strategic priorities require leaders to distribute financial, human and technological resources in a way that underpins them (Geke, 2021; Kisinga, 2022). This means making tough trade-offs between operational needs both in the short term and long-term capacity building and investing in assets that bring value in the long run. This is not only in the digital infrastructure, but also in talent development, data governance, and organizational learning in AI-enabled organizations.

Strategic leadership is also about the capacity to avoid uncertainty and deal with risk. Digital transformation projects are usually typified by a great degree of uncertainty, changeability, and possible failure. The strategic leaders should thus create a culture of experimentation, learning and reasoned risk-taking whilst upholding accountability and moral values. This way, they allow organizations to be innovative at all times without losing any stability or trust. Finally, strategic leadership also leads to competitive advantage by establishing organizational sense of purpose, developing unique capabilities and providing strategic coherence through time. Under a condition of technologies and competition changing at a fast pace, leadership is a determining factor, whether firms are able only to embrace some new technology or to use it in a strategic manner, to generate a lasting value (Kharub et al., 2019).

7.2 Case Insight: Leadership at DNC Automation (M) Sdn Bhd

The example of DNC Automation leadership can be viewed as an effective example of how strategic leadership can lead to the development of the organization and sustainable digital transformation. Leadership within the company portrays a number of fundamental qualities that relate to effective strategic leadership, such as excellent strategic vision, participative management, decision making, which is based on experience, resilience, and ethics oriented. One of the key strengths of leadership in DNC Automation is its vision, which is understood and oriented towards the future (Felker, 2025). The leadership has continually ensured that its strategic focus of the company is aligned with the Industry 4.0 overall agenda by ensuring that DNC Automation is no longer an automation equipment supplier, but rather an offer of coordinated smart manufacturing solutions. The vision has influenced investments in AI-enabled automation, data analytics and digital integration so that technological initiatives would support the long-term competitive positioning and not the short-term benefits. Another characteristic of the organization is participative leadership. Instead of using the top down method of making decisions, the leadership of DNC Automation engages employees in problem solving and innovation. Technical personnel and engineers are motivated to share ideas, test new solutions and own projects. This involvement method encourages employee involvement, promotes trust and improves the ability of the organization to embrace technological change.

Strategic leadership at the firm is further enhanced by the experience-based decision-making. The decisions of the leaders are based on profound technical knowledge and industry experience, which enables the organization to evaluate risks in a realistic manner and select opportunities selectively (Kisinga, 2022). This golden mean will help DNC Automation to innovate without having to expose itself to too much risk, which is highly important in work-intensive technologies. The leadership practices of the company are also characterized by resilience and a will to keep learning. The management focuses on skills, training and mentorship and understands that human capital is at the core of digital transformation. DNC Automation can decrease external knowledge reliance and develop long-term organization competence through external talent cultivation and the establishment of a culture of learning.

Lastly, the leadership decisions rely on ethical orientation, specifically in the spheres concerning data governance and system reliability as well as responsible AI use. This moral principle will increase stakeholder confidence and strengthen the image of the organisation as a stable and proactive partner. the leadership of DNC Automation shows how strategic leadership can conversion of technological opportunities to a competitive advantage that can last over the long term (Adoli & Kilika, 2020). Leadership, which incorporates vision, participation, experience, resilience, and ethics, makes efforts of digital transformation initiatives ensure that these initiatives are long-term sustainable in addition to being successful.

8. DEVELOPING STRATEGIC LEADERSHIP WITHIN ORGANIZATIONS

The need to create strategic leadership in organizations is vital in maintaining the competitive edge in a fast changing, uncertain, and growingly complex technology environment. The competitive landscape and business model are changing due to the digital transformation, and organizations cannot afford to use only technical skills or operational effectiveness (Mahdi & Nassar, 2021). They should instead develop leaders that have strategic foresight, flexibility and the capability to combine technology, people and processes around the long-term value creation. Structured leadership development

programs are one of the best strategies that can be used in nurturing strategic leadership. Such programs are expected to go beyond the conventional managerial training, and emphasize on strategic thinking, systems perspective and long-term planning. Scenario analysis, strategic simulation and foresight exercises also enable up and coming leaders to learn how change in external forces like technological shock, regulatory change and market volatility affect organizational strategy. The exposure to the actual strategic problems helps the leaders acquire the ability to judge, have analytical skills, and grow confidence to make decisions in the uncertain environment (Adobor et al., 2021).

Mentorship and coaching are important in hastening the process of strategic development of leaders. Organizations can help in transfer of tacit knowledge, strategic insight and organizational values by matching high potential workers with senior leaders who have a lot of experience. Through mentorship, aspiring leaders gain knowledge through a real-life experience, and they are able to contemplate on their complicated decision-making and they can become resilient to failures. Coaching also improves self-awareness and effectiveness in leadership through personalized feedback and advice. Mentorship and coaching can be used together to develop leaders with a rich background, as well as maintain continuity in their strategic direction. Another relevant process of building strategic leadership is the creation of platforms of experimentation (Cortes & Herrmann, 2021). The use of innovation laboratories, pilot projects, cross-functional task forces are safe spaces where leaders can experiment with new ideas, make calculated risks and learn how to fail. In these platforms, there is exploration, creativeness, and this leads to accountability and discipline in learning. Experimentation in the setting of digital transformation allows leaders to be hands-on and have experience in the emerging technologies, including artificial intelligence, analytics, and automation, which empower them to be able to test and scale digital initiatives in a strategic way.

Strategic leadership development is based on continuous learning. Considering the swift speed of technological and market shifts, the leaders have to be undertaking a continuous education process to stay active. The organizations must promote the use of executive education programs, industry conferences as well as professional certifications concerning strategy, digital transformation, and leadership. The knowledge-sharing sessions, learning communities and reflective forums internally assist in internalizing learning and fostering collective thinking in strategic thinking. A high level of learning culture will also ensure that leadership skills are developed according to organizational and environmental needs. The education of ethical governance is gaining significance in the creation of strategic leaders, especially in a digital enabled organization. As leaders make data, AI, and automation decisions, they should think of the ethical consequences of such decisions concerning privacy, fairness, accountability, and social impact. The alignment of ethics, cybersecurity awareness, and responsible usage of technologies through leadership development programs will assist leaders to strike the right balance between innovation and trust and compliance. Ethical leadership does not only save organizations reputational risks and regulatory risks but also enhances trust and credibility of the stakeholders and long time legitimacy (Elali, 2021).

Most importantly, the process of leadership development must be tightly linked with the digital transformation efforts. In the event that leadership development is applied in isolation, there is a danger of not matching strategy with technology implementation in a way that this means an organization is at risk of being misaligned. With the integration of leadership development into the digital transformation programs, organizations will be able to make leaders aware on the strategic reasons and operational changes of the digital initiatives. The integration allows the leaders to better align their technology investments and organizational goals, deal with change effectively, and cultivate a culture of data-driven culture throughout the enterprise. The process of developing strategic leadership needs a long-term and systematic approach that is a combination of structured development programs, mentorship, experimentation, lifelong learning, and education on ethical governance learning. Organizations will be able to better integrate strategy, technology, and people by combining leadership development and digital transformation. This is essential in aligning with uncertainty, and the strategic use of advanced technologies to gain a sustainable competitive advantage in an even more complex business environment.

9. CHALLENGES OF STRATEGIC LEADERSHIP IN MALAYSIA

Strategic leadership is very important in facilitating organizations to overcome the digital transformation and maintain a competitive edge. Nonetheless, strategic leadership development and practice have various structural, cultural and ability constraints in the Malaysian context. The issues tend to restrict the value of leadership programs and reduce the rate at which institutions can adjust to technological and competition threats (Veeraya et al., 2024).

Hierarchical organizational structures have also been one of the greatest challenges. Most Malaysian companies use traditional management structures that are centralized, with strict reporting structures and few empowerment tiers. Though this type of structure can offer operational control and stability, it can suppress strategic thinking, creativity and the open lines of communication. Strategic leadership involves making decisions inclusively and working cross-functionally, yet hierarchical cultures tend to dishearten the employees to oppose the existing conventions or present new ideas. Consequently, the decision taken by leaders might not have a wide range of views and cannot embrace emerging opportunities or threats (Noor et al., 2021).

Strategic leadership is also limited by the resources available to the organization, especially of the small and medium-sized enterprises (SMEs) that make up a good percentage of the Malaysian business. Investment in leadership development programs, digital infrastructure and talent acquisition is curtailed by financial constraints. Lack of time and other competing priorities related with

operations tend to lead to the situation whereby leadership development is given last priority with regard to short performance targets (Mahdi & Nassar, 2021). As a result, organizations cannot develop leadership skills that can help them achieve long-term strategic change.

Mismatch between digital ambition and leadership capacity is also another significant challenge. Although most organizations in Malaysia are aware of the necessity of digital transformation and want to implement more modern technologies like artificial intelligence and big data analytics, the administrations do not have the required technological expertise and strategic knowledge to steer such endeavors. The result of this gap is often fragmented digital projects that are not aligned to organizational strategy. In the absence of leaders that can incorporate digital tools in the process of strategic planning and value creation, the digital initiatives would be as an isolated experiment with little impact.

The resistance to change due to culture is also a big challenge. Digital transformation can be seen as a threat to employees (job security or work practices), thus, resulting in resistance and lack of engagement (Tawfig & Kamarudin, 2021). Employees might not feel included in the transformation activities in the top-down environment where communication takes place, which only increases the resistance. It is thus important that strategic leaders have good change management skills to approach matters with concern, build trust, and create a common vision of change.

The high rate of technology change also adds more complexity. Leaders must take strategic decisions under conditions of uncertainty, imperfect information and changing regulatory environments. This complexity may lead to either the risk-aversion tendency or the slowness of decision-making among a number of leaders who have limited exposure to digital technologies. This sort of indecisiveness can slow down the agility of the organization and decrease their competitiveness amid rapidly operating markets (Senadjki et al., 2024). These hurdles should only be overcome with the long-term dedication of the top management and a conscious effort to transform the leadership practice. Hierarchical barriers can be overcome with the assistance of inclusive leadership styles that promote participation, cooperation, and knowledge sharing. The gap between ambition and capability can only be bridged by investing in leadership development programs which span the connection between strategic thinking and technological literacy. Moreover, organizations should synchronize leadership development with digital transformation efforts to make sure that there is coherence between strategy and execution. To sum up, strategic leadership in Malaysia is challenged by several issues that are connected to hierarchical levels, shortage of resources, cultural resistance, and capability gaps. To tackle such challenges, it would take long-term commitment and inclusive leadership practices and incorporation of both strategic and technological competencies. By breaking these obstacles, Malaysian organizations will be able to empower their leadership ability and will be better placed in a more digitalized and competitive business environment.

10. CONCLUSION

The high rate of the spread of digital technologies has transformed the principles of competitive advantage in modern organizations. This paper has looked at how artificial intelligence (AI), big data analytics, and strategic leadership can play a strategic part in developing sustainable competitive advantage based on the example of the Malaysian manufacturing and automation industry. Basing the analysis on the Resource-Based View and the Dynamic Capabilities framework, the analysis shows that AI and Big Data Analytics Capability (BDAC) turns out to be strategic resources in case of their successful integration into organizational structures, processes, and culture. The results show that AI and big data analytics can be useful in a competitive differentiation, cost leadership, innovation and evidence-based strategic decision making. Technological capability is however not enough to create sustained value. The readiness of the organization, including highly qualified human resources, well-developed data infrastructure, governance, and data-oriented culture is necessary to translate digital investments into strategic deliverables. In addition, issues like the risk of cybersecurity, the problem of data privacy, the problem of ethics, and the lack of talents indicate that the use of advanced technologies should be implemented in a responsible and well-managed manner. One of the key findings of this paper is that strategic leadership is a key component of digital transformation success. Strategic leaders offer the opportunity of vision in the long term, and they make sure that they align the resources with strategic priorities and address any uncertainty posed by new technologies. The practices of leadership which underscore participation, constant learning, resilience, and ethical orientation can be useful to ensure that AI initiatives transform a single experiment into scalable strategic capabilities. DNC Automation (M) Sdn Bhd is an example of successfully using AI and analytics in a competitive strategy and developing internal capability with the help of effective leadership as it builds internal trust. To sum up, the strategic combination of AI, big data analytics, and leadership is the key to sustainable competitive advantage in the digital age. Companies that effectively synchronize technology, people and strategy are in a better place to be resilient, creative and competitive in an ever-shifting uncertain business world

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