The impact of technological development and innovation on corporate management and governance in Algerian companies.

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Abstract

In this paper, we will shed light on the impact of technological development on the management of Algerian companies, and its role in enhancing managerial practices. We will use different statistics and reports to describe and understand the current technological situation of Algerian companies and their management. The research shows that Algerian companies have a very deep technological deficiency, and that the Algerian environment does not fulfill the conditions to trigger a technological boom. It appears that technology has a significant impact on the managerial practice as a whole, pushing and enhancing performance in a significant manner. Unfortunately, Algerian companies do not profit from such enhancements and upgrades.

✓ Keywords : Technology, Algeria, corporate management

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1. INTRODUCTION

The question of technological development in Algeria is always in the frame of researchers, institutions and the media, always debated and always questioned. It is also a hot topic when it comes to the Algerian companies and their management and finances as a whole. Technology is obviously a major factor in the performance of companies, and their impact on the economy and overall development of the country is unquestionable. However, it is not clear how Algerian companies perform when it comes to management and technology, or how the Algerian social and economical environment itself affects the development of the Algerian companies and their management. There are different systemic loops and connections when it comes to technological development and management: the government funds and boost companies, the companies will use current finances and technologies to produce eventually new technologies and advanced management skills and techniques, creating more value for themselves and for the economy and society. These loops can put the researcher in a very difficult spot in order for them to start structuring a critical thinking. Most researchers might get confused because they could be influenced by the ruckus of academic and common opinions. The shared thought being that the technological development in Algeria is benign, that most Algerian companies have weak management skills; therefore, that Algerians do not profit or use recent available technologies to optimize their situation through a technologically boosted management. In this paper, we want to precisely describe the state and the technological factors influencing management. We intend to put numbers on the realities, and understand how management might benefit or be crippled by the lack of technologies, especially when it comes to globalization and international competition or exportations.

The problematic will be set as it follows:

- What is the impact of the technological factor on the management and governance of Algerian companies? In addition, what is the role of technology in improving managerial skills?

First, we will shed light on the technological development of Algeria over the years to understand the environment the Algerian companies deal with and what technological level we might expect, then we will discuss the management of Algerian companies, their characteristics and specificities using different reports and statistics. Finally, we will try to explain how the technological deficiencies or efficiencies might influence the management of the Algerian companies, and propose solutions to the current situation.

2. Algeria's technological development.

According to the Global Innovation Index 2022 (which focuses on technology and R&D), Algeria ranked 115th out of 132 countries with a score of 30 in innovation. Algeria's innovation performance has been declining over the past few years as well. Enrollment in technical and vocational programs was 6.4% in Algeria in 2016. This is lower than the average of 20% for upper middle-income countries (organization, 2022). Algeria ranks 100th out of 131 countries in the Network Readiness Index 2022 (NRI), a measure of the propensity for countries to exploit the opportunities of information and communications technologies (Portulans institue, 2022). In 2019, Algeria spends about 0.15% of GDP on scientific research and development which ranks among the lowest ratios in the world. The U.S. spends 2.8% and China spends 2.1% by comparison (Statistics, 2022). According to (statista, 2023), Algeria has spent o,5% of its GDP as expenditure in R&D in 2020,2021 and 2022. However, we do not know how much exactly is spent on the technological RD due to the lack of data and official reports. According to the International trade administration, "Algeria's Information and Communications Technology (ICT) sector is dynamic and continuously evolving and serves as the pillar of the country's digital transformation

program. The ICT sector will also play a significant role in Algeria's export diversification strategy away from oil and gas. From 2010 to 2019, the government invested more than $3.7 billion in its ICT infrastructure, and from 2015 to 2019, ICT equipment imports totaled $22 billion. Despite these outlays and significant progress in ICT infrastructure development over the last decade, Algeria lags behind other African countries… The IT segment of Algeria's ICT industry is well organized, with specialized distributors, integrators, and nationwide distribution channels that provide products, solutions, and services. Today, between 10 and 15 percent of all professional investments are IT investments" (international trade administration, 2023) as we can see, the resources generated or used in the technological field are limited especially if we compare them with foreign countries. The lack of data and statistics for recent years cripples our ability to set a clear image for the recent years. This lack indicates the existence of gaps in Algeria's technology measurement and reporting systems. More focused data collection and disclosure efforts are likely needed to improve the availability of information on technological capabilities and performance at the company and industry levels

Algeria applied for just 231 patents in 2019, according to WIPO data. By comparison, Morocco applied for 1150 patents and Egypt applied for 2130 patents in the same year, three five less than the number of Moroccan patent and ten less times than Egypt (Organization, 2020). Algeria had 16 researchers per million inhabitants in 2016 according to World Bank data, and WIPO's World Intellectual Property Report from 2020 cites that Algeria had 0.66 researchers (headcount) per 1000 inhabitants in 2018, up slightly from 0.63 in 2015. This is lower than the average of 663 researchers per million for upper middle-income countries. This indicates that Algeria does not invest in human resources to promote technological skill.

According to World Bank and WTO statistics, in 2019, Algeria's high-technology exports accounted between 0.4% of total merchandise exports, equivalent to $115 million. Between 2013 and 2018, Algeria's high-tech exports as a percentage of

manufactured exports remained 0.3% to 0.5%, showing little growth. Between 2013 and 2019, Algeria's high-tech imports as a percentage of total imports fluctuated 11% to 14%, with little discernible trend. In comparison, Morocco's high-tech imports as a percentage of total merchandise imports were around 20% to 25% between 2013 and 2019. This is significantly higher than Algeria.

Using simple mathematical approximation and the previous available statistics, we can determine and affirm that Algeria would likely need to invest tens of billions of dollars over many years to reach the level of development comparable to neighbor countries such as morocco or Egypt. Since technology is in constant development, assessing the gap between Algeria and these countries would precise for us the present state of technology in Algeria:

First and foremost, the digital infrastructure requires significant investment in communication with an estimate between 5 and 10 billion over 5 to 10 years. As we have seen, Algerian needs to develop its human capital, since Algeria has fewer university students in science technology engineering and math (STEM) fields as a share of the population, additional investments in education, skills and training are needed and would cost between one and two billion. Countries like morocco have incubators, research labs, startup accelerators, and funding programs to drive new tech ventures. Algeria needs to invest heavily in its startup ecosystem through funding venture capital, building co-working spaces, running incubators programs and supporting competition; we estimate the spending between 500 million and 1 billion.

Algeria needs to Increase RD spending as well, boosting RD funding in universities and companies, the estimate is 3-5 billion per year. Algeria would also need to invest in privatization and the liberalization, as well as creating financial markets and institution that are necessary for the financial development; as we know; technological development is often correlated to the financial development. Algeria

needs to launch programs, investing as in smart cities and reforms to attract international tech companies such as Google or Amazon; we estimate the cost of such programs and reforms between 15 and 25 billion.

In total, reaching technological development on par with Morocco or Egypt would cost at the very least 100 billion dollars over 10 or 20 years and beyond. Those elements provide some additional facts and statistics to demonstrate Algeria's challenges in developing a technologically-advanced and innovative economy. As we can expect, Algeria is currently unable to spend that massive amount of funding for technology even with the best intentions. To be able to hold such costs, a very extensive planing and commitment must be put in place, putting the Algerian companies in the center of the matter. Significant improvements in education, infrastructure, research funding, and adoption of technologies seem to be needed. Algeria has significant room for improvement in boosting innovation, research and development, technical skills, and digital connectivity. These numbers are relevant because we need to think using systems, the development of companies is linked to the development of the country in a way or in another. Thanks to these statistics and estimations, we already have a picture of technology levels in companies and what consequences they may draw on corporate management in this country

3. The technological and managerial state of Algerian companies

The most compelling number is the number companies in Algeria using a management information system for finance and accounting, only 6% of Algerian companies do have access to advanced informational systems, which is lower than the regional average of 23%. Furthermore, only 2% used an ERP system. (Hafida, 2017) shows how important the ERP through its correlation to performance a more recent survey of 2000 companies show a use of 40%. Most systems in use were either locally developed or older packaged software, rather than modern SaaS or cloud-based management platforms. A 2019 analysis by business consulting firm Tharawat

suggested that Algerian businesses likely make limited use of common technologies like cloud computing, customer relationship management (CRM) software, ecommerce platforms, and business intelligence tools. Cost, infrastructure challenges, and lack of skills were cited as barriers. They suggest that Algerian companies likely under-invest in management technologies compared to regional peers. Spending on enterprise software and IT relative to GDP and workforce size remains low. A 2019 report by PayNXT360 stated that 60-70% of HR departments in Algerian companies still use manual processes for activities like payroll, attendance tracking, and recruitment. Technology use for core HR and people management appears limited.

Algeria's business environment remains dominated by micro, small and medium enterprises only about 6500 companies have more than 200 employees according to government statistics. The issues facing Algerian companies are very redundant: difficulty accessing financing, economic environment uncertainty, and lack of skilled labor. There is a lack of large private conglomerate in Algeria to lead economic growth, according to Forbes, as of 2019 there is no Algerian company among the 2000 largest public companies in the world (Forbes, 2022). According to the world economic forum, global competitiveness report 2019, Algeria ranks 134th out of 141 countries regarding the adoption of the latest technologies in businesses, innovation management is very weak in Algeria (Schwab, 2019). Too centralized and bureaucratic in the decision making, Algerian managers need to delegate more authority and empower middle managers and employees, there is a lack of strategic planning and risk management in Algerian companies, many companies operate based on short term thinking rather than long term strategic vision.

Articles such as (Dris, Ahmed, & Rabah, 2022), show that over 80% companies are SME's, but they contribute only by 30% due to the lack of technological access and managerial skills. The management culture in Algeria remains influenced by its French colonial legacy, however, in recent years more advanced American

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management practices around innovation, empowerment and performance management are increasingly influencing new generations of Algerian managers. The government launched various initiatives to modernize the Algerian company management practices including management training programs and reforms for the commercial law. However, we cannot expect SME to have high value technologies usage because of their limited funds. According to (Bouazza, Ardjouman, & Abada, 2015), "Algerian SMEs acquire foreign technology licenses because local patents are scare and difficult for SMEs to obtain, only a small portion of SMEs (about 13.3 percent) have acquired technology licenses, they cannot afford expensive new technology or spend on R&D activities". Substantial gaps and weaknesses with respect to technology adoption, management practices, leadership, and skills in Algerian companies can be noticed.

4. The link between technology and management

Technology and corporate management are closely intertwined. New technologies are constantly arising that provide both opportunities and challenges for modern businesses. Effective corporate management requires an understanding of how technology can be harnessed to improve business operations, customer experiences and competitive advantage. Technology affects every department of an organization, from financial management, operations and supply chain management to marketing, sales and human resources. Technologies like cloud computing, artificial intelligence, and automation impact things like efficiency, costs, accuracy, and decision-making capabilities. Companies that adopt the right technologies at the right time can gain significant productivity and efficiency benefits. However, new technologies also require management skills to implement and integrate them in a way that adds real value.

The role of corporate managers is therefore evolving, demanding a combination of both technical skills and soft skills. Technology is fundamentally changing the nature

of work and the skill sets required of employees at all levels. Corporate managers must develop an understanding of basic technological concepts and how to identify technologies that align with business goals and strategies. At the same time, they still need good communication, project management and leadership skills to implement change and empower human workers. For corporate managers specifically, technology presents an opportunity to automate repetitive tasks, access data-driven insights, and make more fact-based decisions. Tools like business analytics and AI are providing corporate managers with vast amounts of information that can improve strategic thinking and help allocate resources more efficiently. However, technology cannot replace the human skills needed for tasks like strategic planning, team-building and vision-setting that remain at the heart of corporate management.

Advances in business intelligence and analytics tools are providing corporate managers with unprecedented amounts of data and insights into business operations. Technologies like data mining, predictive analytics and dashboards give managers a real-time view into key performance indicators, workflow efficiencies, customer behaviors and potential risks. Managers can more easily identify inefficiencies, spot opportunities and adjust strategies based on data-backed analysis. This has fundamentally changed the role of corporate managers. In the past, managers often made decisions based on experience, gut instinct and limited information. Now data and analytics tools are empowering fact-based decision making. Managers spend more time analyzing metrics and reports, less time on routine tasks. They need to understand how to leverage tools like business intelligence platforms and configure dashboards to meet their information needs.

For example, a retail manager may use real-time sales data and predictive models to determine optimal product placement and pricing strategies. An operations manager may use analytics to identify bottlenecks in the production process and implement changes to improve throughput. Such advantages were not possible before today's

business intelligence and analytics tools. We can cite many other examples: Technologies like video conferencing, online chat, team collaboration software and project management tools allow managers to more easily communicate and coordinate with team members, even if they are in different locations. This can improve efficiency, information sharing and knowledge transfer within organizations. In the other hand, technologies such as sensors, RFID, machine data and business intelligence software give managers access to real-time data and performance metrics for processes, products and people. This allows managers to make decisions based on up-to-date information and data-driven insights. They can more quickly identify issues, opportunities and trends that affect business objectives. Cloud computing, automation software and remote access tools enable more flexible work environments where employees can work from anywhere. This helps organizations retain and attract talented workers who value flexibility. It can also improve productivity by reducing wasted time spent on repetitive tasks and information searching.

This is why Managers must develop new skills to effectively lead in a technology-driven workplace. This includes skills like digital literacy, data analysis and interpretation, technological change management and the ability to motivate a distributed workforce that spends less face time together. Managers to adopt a more facilitative and coaching style of management instead of direct oversight. They must empower employees to make decisions using the real-time insights technologies provide and coach them to develop new skills for a digitized work environment. While new technologies present many benefits for managers, they also require changes to skills, management styles and processes to maximize those benefits. Effective technology adoption depends on managers adapting to utilize the new tools in ways that improve business outcomes.

Advances in technology have given corporate managers access to more and better information that can improve decision making, strategy and performance management. However, the valuable insights provided by these tools also create new

demands on managers in terms of technical skills, data literacy and understanding of how the tools work and what questions to ask of the data. Technology has shifted managers from an intuitive, experience-based approach toward a more data-driven style of management. The link between corporate management and technology is one of mutual influence and co-evolution. Technology is transforming how businesses operate at every level, placing new demands on managers for technical skills and knowledge. At the same time, management skills are still needed to ensure technology adoption aligns with business goals and enhances, rather than replaces, human capabilities. As both management and technology continue to develop, their intersection will remain a key driver of organizational effectiveness and competitiveness in the modern economy.

5. The link between technological developments in Algeria and the management practice

Many articles have spoken about the impact of technology on the management of Algerian companies, such as (Abdallah, 2021). The lack of technological development in Algeria affects companies in several ways:

Algerian companies struggle to compete globally due to a lack of technological sophistication. They cannot adopt the advanced technologies, processes and business models that international competitors use. Many Algerian companies still rely on outdated and manual processes due to a lack of automation technologies and digitization. Even if many companies start applying such techs, it is still very benign. This makes their operations less efficient and productive. They do not have systems in place to capture and analyze large amounts of data that could provide insights to improve decision making and performance. This limits their ability to manage strategically, especially during financial constrained periods.

Managers and employees in Algerian companies often lack the technological skills needed to operate in a digitally transforming economy. They need training to develop

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new digital and data competencies. Moreover, Most Algerian companies cannot innovate and develop new technologies, products and business models because they lack the necessary R&D capabilities, talent and culture of experimentation and risk-taking. Most Algerian companies do not have systems in place to digitize operations, collect and analyze large amounts of data. This means managers lack insights into key performance indicators, customer behavior, supply chain issues, etc. They cannot make truly informed decisions. These topics have been discussed many times by Algerian scholars, especially the supply-chain, because it represent a key factor in economic development, however, it remains an issues especially when it comes to the technology used. They rely heavily on manual and paper-based processes with little automation. This makes operations slow, prone to errors and lack agility to adapt quickly to changes. Managers struggle to improve performance.

Taken together, these issues cause Algerian companies to fall further behind global competitors in competitiveness and the ability to adapt, threatening their viability and market share over time. The lack of Algeria's overall technological development has significant negative implications for the management of local companies. Adopting new technologies, developing digital skills and building a culture of innovation will be crucial for Algerian businesses to remain competitive in the future.

Many Algerian companies cannot effectively manage remote and distributed workforces because they lack technologies to facilitate communication, collaboration and task management across locations. This hurts productivity and team cohesion. Algerian companies' technological constraints limit their ability to innovate, develop new business models and identify opportunities for growth. Managers cannot proactively steer companies in emerging directions. The failure of most Algerian companies to adopt basic cyber security measures and technologies leaves them vulnerable to threats like data breaches, fraud and system disruptions. Managers struggle to mitigate these risks. The lack a vision for how new technologies could

transform their businesses. They have not identified specific technological and data-driven goals that would help achieve strategic objectives.

So in precise terms, the core issues affecting Algerian company management stem from a lack of technological enablers - including digitized processes, data and analytics, appropriate skills, tools and measures - that could empower managers to operate strategically and transform their businesses for the digital era.

However, a few Algerian companies have made progress in adopting new technologies:

• Djezzy: the Algeria's second largest mobile operator. It has invested in 4G LTE networks, mobile apps and digital services to improve its operations and customer experience.

• Cevital: the Algerian conglomerate with businesses in agribusiness, steel and food processing. It has implemented automation technologies, robotics and data analytics systems to improve productivity and efficiency.

• Arregh: the Algerian startup that provides an online platform for architects, engineers and contractors to collaborate on projects. It uses technologies like cloud computing, mobile apps and 3D modeling software.

• Yassir: the on-demand delivery startup in Algeria that uses a smartphone app, digital payments and GPS tracking to connect customers with delivery providers. The company has scaled up significantly since launching in 2017.

• Sonelgaz: Algeria's state-owned electric utility company has invested in "smart grid" technologies using sensors, data analytics and automation to improve the reliability and efficiency of its power distribution network.

• Huawei: The Chinese telecom giant has partnered with Algerian companies to implement new technologies like 5G networks, cloud computing and AI. It has opened an innovation center in Algeria to help local firms adopt these technologies.

While these examples show some progress, much more needs to be done for Algeria to develop a thriving tech sector that can drive economic growth and job creation. Government policies that support tech entrepreneurship, access to venture capital funding, and improvements in IT education will be key to help transform more Algerian companies.

However, these are typically very large companies with ready-to-use funding and investing capabilities, unlike the common Algerian company.

6. Proposed Solutions

Algeria can take several steps to improve technological development and its impact on company management:

The very first solution that readers would expect is to increase government investments in technology and infrastructure - This includes funding for broadband expansion, 5G networks, research institutions, technology parks, and innovation centers. As well as to Provide financing for technology companies - The government and private sector can create investment funds, venture capital firms, and loan programs specifically for technology and digital businesses. This will help them secure the capital needed to scale up.

The government can provide incentives for technology adoption. In the same time, Algeria needs to revamp its education system to produce more graduates with technology skills like coding, data analytics, AI, and cyber security. Both university curricula and vocational training programs require an upgrade. Algeria can establish programs to support and fund technology startups. This will help nurture a local tech entrepreneurship ecosystem that drives innovation. Training programs focused on areas like digital literacy, data analysis, change management and remote team leadership can help existing managers develop the skills to lead in a technology-driven workplace.

Algeria needs a regulatory environment that makes it easier for technology companies to operate, hire talent, secure permits and licenses, and bring in foreign investment, because excessive red tape currently hampers the sector. The government can incentivize established companies to invest in technologies, this will help improve their operations, management processes and strategic planning. Algeria needs to develop an environment where risk-taking, experimentation and creativity are encouraged and rewarded. This will help companies identify new technological opportunities for growth and competitive advantage.

In short, a combination of investments, policy reforms, skills development initiatives, financing options and cultural changes are all needed to truly improve Algeria's technological development and optimize the impact of new technologies on company management and performance. A holistic national strategy is required to tackle these complex, interconnected issues. Algerian companies should focus on specific technologies that offer the most impact rather than trying to implement every new technology, Algerian companies should identify which ones have the potential to generate the greatest benefits for their specific needs. Because they lack experience implementing new technologies, they should start with pilot projects to test and learn before scaling company-wide. This helps build internal skills and expertise over time. Successful pilots can then be replicated and expanded.

The moment these conditions are met companies can initiate the technological transformation. The companies can adopt technologies such as Cloud computing, storage and applications that can help them improve efficiency, security, flexibility and productivity. The cloud provides scalable IT infrastructure and software that is easy to access and manage remotely. It reduces upfront capital costs. They can even implement automation and Industry 4.0 technologies such as Technologies like robotics, AI, IoT, 3D printing and advanced manufacturing solutions can automate manual and repetitive processes. This boosts output, lowers costs and frees up

workers for higher value tasks. These technologies can also gather, organize and analyze data from operations, customers and other sources to provide key insights for management decision making. They can optimize processes, improve efficiency and identify new opportunities. Finally, Foster innovation and risk-taking with An innovative culture that embraces experimentation, collaboration and learning from failures is essential for Algerian companies to develop new technological solutions that drive business growth.

Overall, Algerian companies need roadmaps for how they will harness technologies to transform core aspects of their businesses like products, customer experiences, business models, workflows and management processes. This requires strategic vision and planning. They need to keep in mind that transforming company management through technology requires changing behaviors, processes, job roles and mindsets. Algerian businesses must implement change management strategies to help employees adapt and embrace technological transformations. Training and communication are key. These solutions could provide some ways for how Algerian companies can leverage various technologies to transform and improve the performance of their management teams

7. Conclusion

This research paper has proved the unquestionable role of technology in creating new and more efficient management skills and techniques. Algeria seems to lack a genuine technological baseline for the implementation of new technologies in management, taking steps is absolutely necessary for the country in order to create value and a competitive drive in the globalization era. The management of Algerian companies suffers from the lack and deficiencies of their environment and do not benefit from technological innovations.

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