**A survey study on Industry 4.0 for Moroccan manufacturing**
Bilad Assia, Zaim Mounia, Zaim Faical

# A survey study on Industry 4.0 for Moroccan manufacturing

**Bilad Assia**
LASTIMI Laboratory, Higher School of Technology, Mohammed V University, Avenue Prince Héritier -BP 227 Sale Médina, Sale, 11000, Morocco, assia.bilad@gmail.com (corresponding author)
**Zaim Mounia**
LASTIMI Laboratory, Higher School of Technology, Mohammed V University, Avenue Prince Héritier -BP 227 Sale Médina, Sale, 11000, Morocco, zaim.mounia@yahoo.fr
**Zaim Faical**
REMTEX & CELOG Laboratory, School of textile and clothing industries, Hassan II University, Route El Jadida Km 8, BP: 7731, Quartier Laymoune, Casablanca, 20190, Morocco, zaim@esith.ac.ma

***Keywords:*** Industry 4.0, survey, smart factory, technology implementation.
***Abstract:*** In this article, a field study is conducted to analyze the state of enterprises in Morocco in the face of digitalization by studying large, small, and medium-sized enterprises. This study focuses mainly on researching the factors that influence their decision to adopt a digital strategy. Using the AHP multi-criterion method, a precise selection was made based on the opinions of experts in the field. To make this choice, a precise methodology was used: brainstorming and a weighted vote. An online survey was conducted, and 34 companies were interviewed to analyze the ways in which they are adopting digitalization, to present the most commonly used digital tools, and to study the impact, benefits, and obstacles of a digital strategy. A data analysis was applied by combining R with SPSS. The findings of this study show that Morocco is beginning to incorporate digitization into its practices, and more precisely, into the supply chain's operations, but that this use is still quite limited to certain tools and practices. They emphasize the underlying causes, highlight the benefits of digitization, and compare the levels of corporate maturity compared to digital. Six factors have been identified to influence this decision. This article contributes to an existing gap in empirical studies that highlight the integration of digital strategies, focusing on the case of Morocco. It provides useful data that can significantly improve management methods and encourage the integration of digital strategies, regardless of their size, making it a significant contribution to researchers and even industries.

## 1    Introduction

Today's companies face numerous constraints and challenges daily, requiring flexibility and innovation to remain competitive.

With the advent of the fourth industrial revolution, companies of all sizes face the challenge of digitizing their processes, which enables them to exchange data in real time, increase productivity, enhance process quality, and achieve financial gains (1-2). This challenge has prompted many companies to join the digital transformation over the past ten years.

After a bibliographical study, we noted that some works were published that treat the state of the companies compared to the digital in various countries, like the works of (3), which focus on the SME of New Zealand; the works of (4), which work on the case of the Italian SME, for example; and (5), which work on German SMEs. However, no work has been found in Morocco, which motivates us to work in this direction. However, this work is unique in that it deals with the same theme, is based on the case of Morocco, and focuses on large companies and SMEs at the same time.

In this paper, we study the current state of digital companies in Morocco to find out where they stand regarding Industry 4.0, why companies resist introducing it for several reasons, and how they can move towards a "4.0" environment efficiently. Companies adopt digitization strategies by focusing on the factors that influence the use of various digitization tools in the supply chain. This study examines these tools and the influencing factors.

We surveyed large companies and SMEs to collect data on the state of digitization in Moroccan companies. Our population consists of industrial executives with extensive knowledge and visibility into their companies' digitization strategies.

This work's primary goal is to examine the state of companies in Morocco facing digitalization. We have set up two research questions to clarify our main problem.

RQ1: In terms of 4.0, where are Moroccan enterprises?
RQ2: What are the digitization tools used by these companies?

This document is organized into sections. Section 2 presents the survey methodology used to achieve the study objectives, the sample characteristics, and the data collection and analysis process. Section 3 presents detailed results concerning our target's organizational factors, the various impacts and benefits of adopting digitization 4.0 tools, a vision of the digital strategy adopted, and the different elements influencing the latter's choice.

Section 4 presents a discussion of the results, the main conclusions of the interviews, and future developments.

**A survey study on Industry 4.0 for Moroccan manufacturing**
Bilad Assia, Zaim Mounia, Zaim Faical

## 2    Literature review

The term Industry 4.0 appeared for the first time in the German strategic plan for new technologies (5–6). It designates the fourth industrial revolution, which is characterized by data analysis, the automation of manufacturing processes, and the integration of digital technologies such as the Internet of Things (6). It encompasses several digital tools whose objective is to provide digitalized solutions (7). Then comes the use of digital tools and technologies such as robots, artificial intelligence, the Internet of Things, big data, 3D printing, and machine learning. (8)

Some authors describe Industry 4.0 as systems that communicate and cooperate, but also with humans, in order to decentralize decision-making (9).

Industry 4.0 is also known as digitization, which involves replacing humans with machines and digitizing all processes, thus making manufacturing systems and the supply chain intelligent (10).

Several authors, such as (11), have focused their studies on the impact of Industry 4.0 on quality management and the challenges facing a transformation to Quality 4.0, whereas others, such as (12), have focused on data management and solutions based on the two digital tools, deep learning and machine learning. (13) designed a survey to study the application of smart supply chain technologies in Moroccan industry, so (5) in turn studied the state of manufacturing companies, more specifically small and medium enterprises in Germany. This study, using the results of the survey, allowed for a better understanding of digital technologies by managers and the state of advancement in digital.

With the aim of identifying the factors that influence companies to adopt a 4.0 strategy in their practices, we launched a study to make this choice. When there is only one evaluation criterion, choosing influencing factors is obvious, but taking several criteria into account makes things more complicated and complex. Various multi-criteria classification methods have been presented in the literature, but in our case, we're going to focus on the AHP multi-criteria method.

The AHP method, or Analytical Hierarchy Process, was developed by (21) and is one of the best-known and most widely used multi-criteria classification approaches. Its aim is to solve complex multi-criteria decision problems with several alternatives and by applying several criteria simultaneously, according to (22- 23). This method's particularity lies in its ability to structure factors while offering a relatively simple solution to decision-making problems. It uses pairwise comparison questions to obtain a matrix of judgments about the relative preference between each pair of alternatives in relation to each attribute, as well as a matrix of judgments about the relative importance of each pair of attributes. According to (24-25), it offers the possibility of analyzing a problem logically, moving from a higher to a lower level until a simple comparison is obtained for each pair of criteria. Then, we can go back to the top level to make a decision.

The main advantage of the AHP technique is that it offers systematic steps for synthesizing information using a structured hierarchy. According to (26), the hierarchy groups together criteria and sub-criteria, which can facilitate the understanding and simplification of a problem by offering better focus when assigning priorities to criteria and sub-criteria.

## 3    Methodology

This article presents a field investigation of Industry 4.0 for Moroccan enterprises. The study collected the opinions of industrial managers in companies on the state of the latter's digital transformation.

A group of research professors who had already worked on similar subjects and industry professionals drew up the initial list of questions. We made the selection of the initial list of questions during a brainstorming session, and then we applied a weighted vote.

After several rounds of discussions and corrections, we completed the final questionnaire, comprising 31 questions and covering several aspects, including the level of digitalization of Moroccan companies, the digitalization tools used to date, the main benefits of digital strategy, and the impacts and obstacles of digital tools on the organization.

To select the six influencing factors, we held an online brainstorming meeting with 10 managers from companies that have already adopted a digital strategy. Once a list of factors had been collected, a weighted vote was held to finalize the list of influencing factors for choosing to implement a digital strategy. We then used the multi-criteria method to analyze the results of this section.

A survey approach has been adopted, a survey structured on a website for data collection. It's an online survey and polling platform and software that allows the creation of surveys to which an unlimited number of users can contribute.

We collected a database of companies in Morocco, filtered the companies to remove duplicates, and then decided to focus on large companies and SMEs. To complete this project and obtain consistent and accurate statistics, the questionnaire was sent and distributed to 72 industry professionals. The survey must be completed by people with knowledge and visibility on the digitalization strategy used by their companies.

We then proceeded to contact our target group, sending out emails and, after several reminders, collecting 56 responses, giving us a response rate of 84%. However, we only took into account completed questionnaires, giving us 34 companies that responded in full to the questionnaire, which will be stored for later analysis. The survey responses were collected between December 2022 and July 2023.

**A survey study on Industry 4.0 for Moroccan manufacturing**
Bilad Assia, Zaim Mounia, Zaim Faical

Data analysis was carried out using R software and SPSS, and the section dealing with influencing factors was analyzed using the AHP multi-criteria method.

This questionnaire was designed to find out whether companies in Morocco are adopting Industry 4.0 measures and possibly to understand the reasons why companies would be slow to introduce Industry 4.0 into their practices.

This work would also enable us to find out where companies in Morocco stand with 4.0 and what digitization tools they are using.
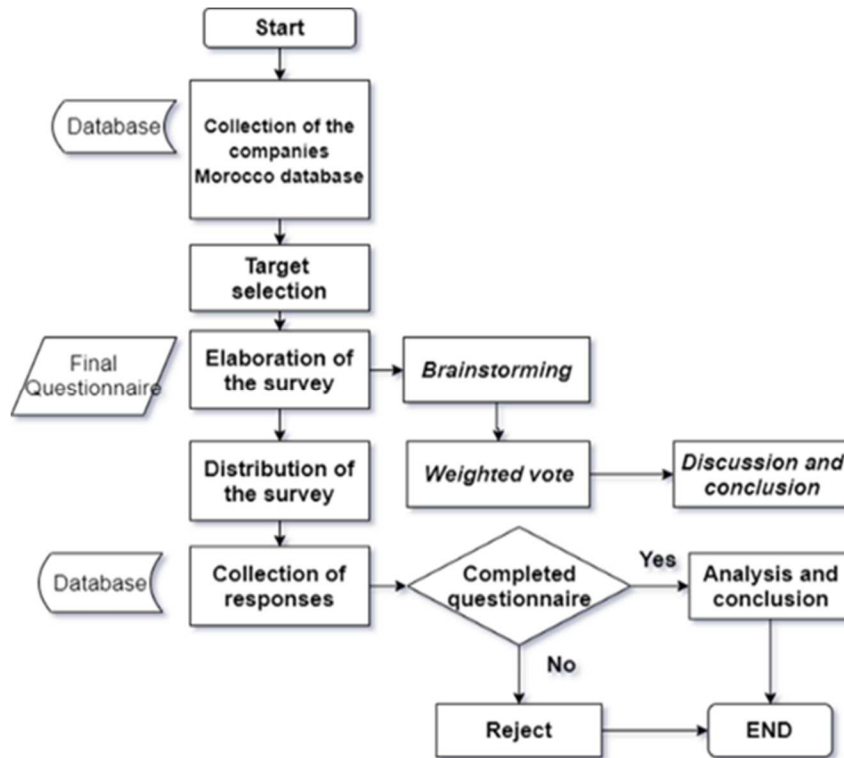


*Figure 1 Structure of the survey*

# 4    Results and discussion

This section aims to describe and analyze the questions we asked in our survey.

To ensure reliable results, we have kept the names of the companies confidential. We decided to contact the company managers, as they are the people best suited to answering our survey.

## 4.1    General analysis

Table 1 contains all the demographic data for the companies surveyed, including their distribution by size, business sector, and business area.

For the breakdown of respondents by company size, the total sample is made up of 34 companies, divided into 58.8% small and medium-sized companies, with the remainder being 41.2% large companies.

With regard to the breakdown by company sector, we decided to diversify the sectors of activity of the companies that took part in our survey and found that 41.2% belonged to the manufacturing industry, 23.5% to the transport and warehousing sector, 14.7% to the trade sector, 11.8% to the automotive and manufacturing industry, and 8.8% to the consultancy sector.

The results of the breakdown by business area show that 26.5% of our population is involved in industrial production, 23.5% in purchasing, logistics, and IT, 14.7% in technical services, and the remaining 11.8% in R&D. We can therefore say that digitization applies to the company's various processes, which shows that all parts of the company are concerned with digitization.

We analyzed the distribution of companies according to sector and size. In Table 2, we found that 43% (n = 6) of the large companies belong to the transport and warehousing sector, 21% (n = 3) to the manufacturing and trade sectors, and 7% (n = 1) to the consulting and automotive sectors.

We found that 55% (n = 11) of SMEs belong to the manufacturing industry sector, 15% (n = 3) to the automotive industry sector, and 10% (n = 2) to the trade, transport, warehousing, and consulting sectors.

We can therefore conclude that digital transformation encompasses all sectors of activity and is not limited to a few.

Acta logistica  - International Scientific Journal about Logistics
Volume: 11  2024  Issue: 3  Pages: 397-407  ISSN 1339-5629

**A survey study on Industry 4.0 for Moroccan manufacturing**
Bilad Assia, Zaim Mounia, Zaim Faical

*Table 1 Respondents' descriptive statistics*

|  |  | Frequency | Percentage |
|---|---|---|---|
| **Size of company** | Large company | 14 | 41.2 |
|  | Small & medium-sized companies | 20 | 58.8 |
| **Business sector** | Manufacturing Industry | 14 | 41.2 |
|  | Trade | 5 | 14.7 |
|  | Transport and storage | 8 | 23.5 |
|  | Automotive industry | 4 | 11.8 |
|  | Consulting | 3 | 8.8 |
| **Business Area** | Studies, R&D | 4 | 11.8 |
|  | Logistics, Purchasing | 8 | 23.5 |
|  | Technical services | 5 | 14.7 |
|  | Industrial production | 9 | 26.5 |
|  | IT | 8 | 23.5 |

*Table 2 Distribution by sector of activity & size of company*

|  |  | Large company | Small & medium sized companies |
|---|---|---|---|
| **Business sector** | Manufacturing Industry | 21% | 55% |
|  | Trade | 21% | 10% |
|  | Transport and storage | 43% | 10% |
|  | Automotive industry | 7% | 15% |
|  | Consulting | 7% | 10% |

### 4.2 Factors for adopting a digital strategy

We chose 10 expert managers in companies already using a digital strategy, the aim being to involve experts who already apply digital in their jobs in this work, so a brainstorming meeting was held to collect all the experts' opinions and views, and a list of 14 factors was taken into consideration. Given that the number of factors was rather large, and to keep only what was important according to our experts, we used a weighted vote to rank all the factors in order of importance and influence. Finally, a six-factor list was applied to this work. In addition, it is perceived as an effective method for identifying and eliminating imperfections (27).

For the AHP method, we used the following factors:
- ✓ Productivity increase (PI)
- ✓ Cost reduction (CR)
- ✓ Job creation (JC)
- ✓ Improved customer satisfaction (CS)
- ✓ Improved margins (IM)
- ✓ Enhanced data security (DS).

The factors selected above were arranged in a hierarchy based on the AHP technique. We have placed the work objective at the first level of the hierarchy, followed by the evaluation criteria at the next level.

The factors chosen by the experts are used to build the hierarchy for applying the AHP. A group meeting was organized to set up the AHP. Adapting the guidelines of (28-29), we tried to apply the first step of the AHP, which is the construction of comparison matrices for each pair of criteria. Each expert is then asked to make a pairwise comparison between the different factors by constructing a matrix specifying a scale ranging from 1/9 to 9 according to the importance of the parameter (table 3). At this level, the involvement of the 10 managers is critical, as they are in the best position to assess the relative importance of the criteria in pairs.

*Table 3 Saaty scale AHP*

| Numerical value | Definition |
|---|---|
| 1 | Equal importance |
| 3 | Moderate importance |
| 5 | Strong importance |
| 7 | Demonstrated importance |
| 9 | Absolute importance |
| 2, 4, 6, 8 | Intermediate values |

Equation (1) allows us to calculate the number of pairwise comparisons required for each matrix.

Pairwise comparisons in each matrix (1)

$$= \frac{n(n-1)}{2} \qquad (1)$$

$n$ is the number of criteria in the matrix.

To understand this, let's take the case of our study: we've detected six factors that influence the choice of companies to adopt a digital strategy, so n = 6, applying equation (1), 6(6-1)/2 = 15 pairwise comparisons.

**A survey study on Industry 4.0 for Moroccan manufacturing**
Bilad Assia, Zaim Mounia, Zaim Faical

Table 4 shows a pairwise comparison of our different criteria. The diagonal elements of the matrix have been assigned the value 1, as aij=1 when i=j.

The matrix that contains all of the criteria coefficients is as follows:

*Table 4 AHP starting matrix*

| Factors | PI | CR | CS | IM | DS | JC |
|---|---|---|---|---|---|---|
| **PI** | 1 | 2 | 1/2 | 1/4 | 2 | 3 |
| **CR** | 1/2 | 1 | 1/4 | 1/2 | 3 | 3 |
| **CS** | 2 | 4 | 1 | 3 | 3 | 5 |
| **IM** | 4 | 2 | 1/3 | 1 | 2 | 3 |
| **DS** | 1/2 | 1/3 | 1/3 | 1/2 | 1 | 2 |
| **JC** | 1/3 | 1/3 | 1/5 | 1/3 | 1/2 | 1 |

Once the pairwise comparisons had been completed, they were summarized to determine priority. To accomplish this, geometric mean normalization was employed (30). To determine priority, the n elements of each line were multiplied, and the nth root was calculated. The resulting figures were then standardized.

Before calculating the weighted scores, it is essential to test the consistency of pairwise comparisons at the matrix level by calculating the CR consistency ratio using the following equation (2):

$$CR = \frac{CI}{RI} \qquad (2)$$

With CI, the coherence index is calculated using the equation below (3):

$$CI = \frac{\lambda max - n}{n - 1} \qquad (3)$$

with λ max: maximum eigenvalue of each factor in the matrix table and n the matrix size.

RI is the random index developed by SAATY in 1977, as shown in table 5.

*Table 5 Random coherence index (SAATY, 1977)*

| n | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| **R.I** | 0 | 0 | 0.58 | 0.90 | 1.12 | 1.24 | 1.32 | 1.41 |

After calculation, we find (4):

$$CR = \frac{\frac{\lambda max - n}{n-1}}{RI} = \frac{\frac{6,5887 - 6}{6 - 1}}{1,24} = 0,0094 \qquad (4)$$

The consistency ratio is well below 0.1, confirming that judgments are consistent at the matrix level. The calculation of the scores for the various factors and their multi-criteria classification are presented in the following table 6.

Based on the AHP multi-criteria method results, the CS factor has the biggest impact on companies' use of digital tools, with a percentage of 35.5%. The IM factor comes in second, with a rate of 22.4%, and then PI with a rate of 15.3%, based on the assigned judgments. Finally, JC with 5.3% rounds out the top five.

*Table 6 AHP final matrix*

| Factors | PI | CR | CS | IM | DS | JC |
|---|---|---|---|---|---|---|
| **PI** | 1 | 2 | 1/2 | 1/4 | 2 | 3 |
| **CR** | 1/2 | 1 | 1/4 | 1/2 | 3 | 3 |
| **CS** | 2 | 4 | 1 | 3 | 3 | 5 |
| **IM** | 4 | 2 | 1/3 | 1 | 2 | 3 |
| **DS** | 1/2 | 1/3 | 1/3 | 1/2 | 1 | 2 |
| **JC** | 1/3 | 1/3 | 1/5 | 1/3 | 1/2 | 1 |
| **Normalized weight** | 0.153 | 0.131 | 0.355 | 0.224 | 0.086 | 0.053 |
| **RC = 0.094** | | | | | | |

## 4.3 Specific analysis
### 4.3.1 Axes adopted in the digital transformation

All the participants demonstrated that their companies have a digital strategy and that they are aware of this transformation strategy, and they mentioned that to have a digital strategy, it is necessary to acquire and integrate new knowledge and skills to implement the company's digital transformation.

We presented our stakeholders with a list of axes that the company can adopt as part of its digital transformation strategy, with a scale of 5: Absolutely, partially, not really, not at all, and the company is not concerned. According to the results obtained, we can see that the development of digital innovations and the big data policy are the most used with a rate of 100% of our target, then comes the development of the company's presence on social networks at 85% and the digitalization of sales and distribution networks with a rate of 76%, then we find the adoption of cloud computing offers with a rate of 58% and the use of a smart data policy at 44% of responses (Figure 2).

On the other hand, 14.7% of our population are against the adoption of cloud computing offers as an axis adopted by digital transformation, as well as 11.8% against smart policy data and 8.8% against digitalization of the customer experience.
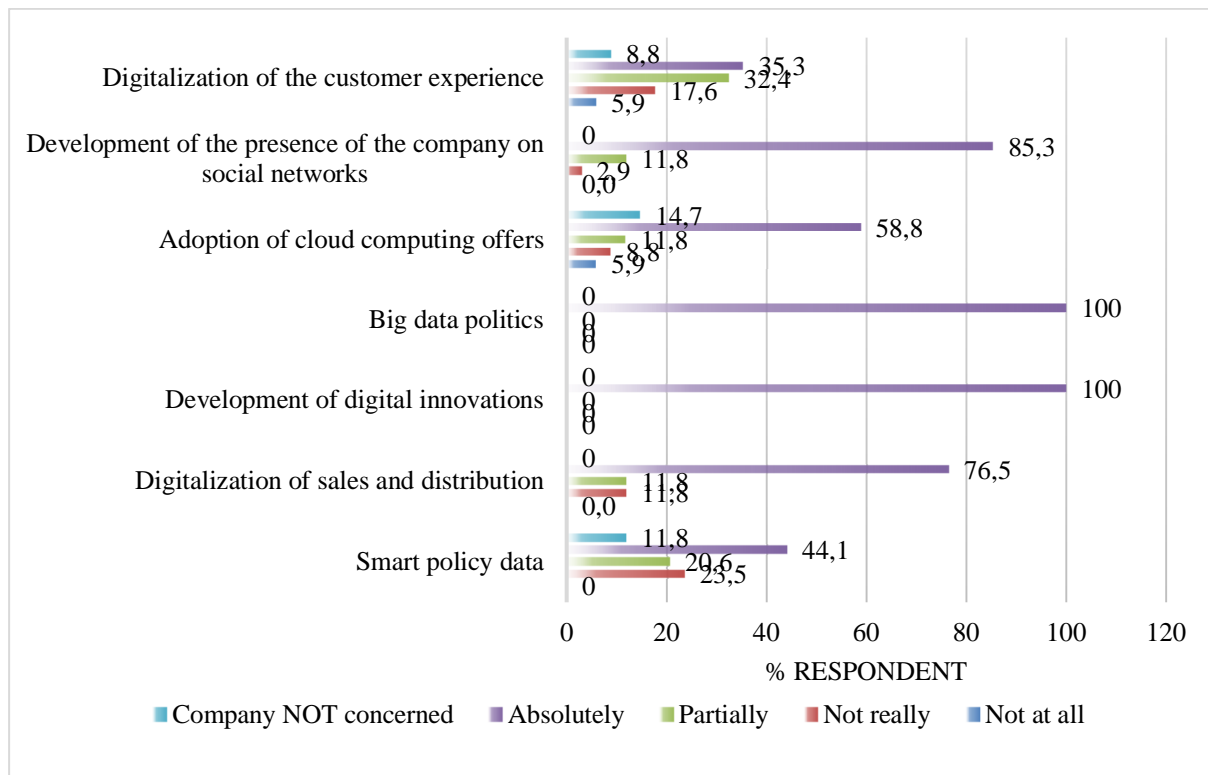
**A survey study on Industry 4.0 for Moroccan manufacturing**
Bilad Assia, Zaim Mounia, Zaim Faical



*Figure 2 Axes adopted in the digital transformation*

#### 4.3.2 The impact of digital transformation & frequency of use of 4.0 tools

Moving on to present the impacts that digital transformation has had, or will have in the future (figure 8), within these companies: 93% see the creation of new jobs as a challenge of digital transformation, 90% for changes in working practices, 87% for the development of employees' technological skills (including training), 72% for strengthening the information systems function, 65% for investment in R&D, and investment in new design and production technologies.
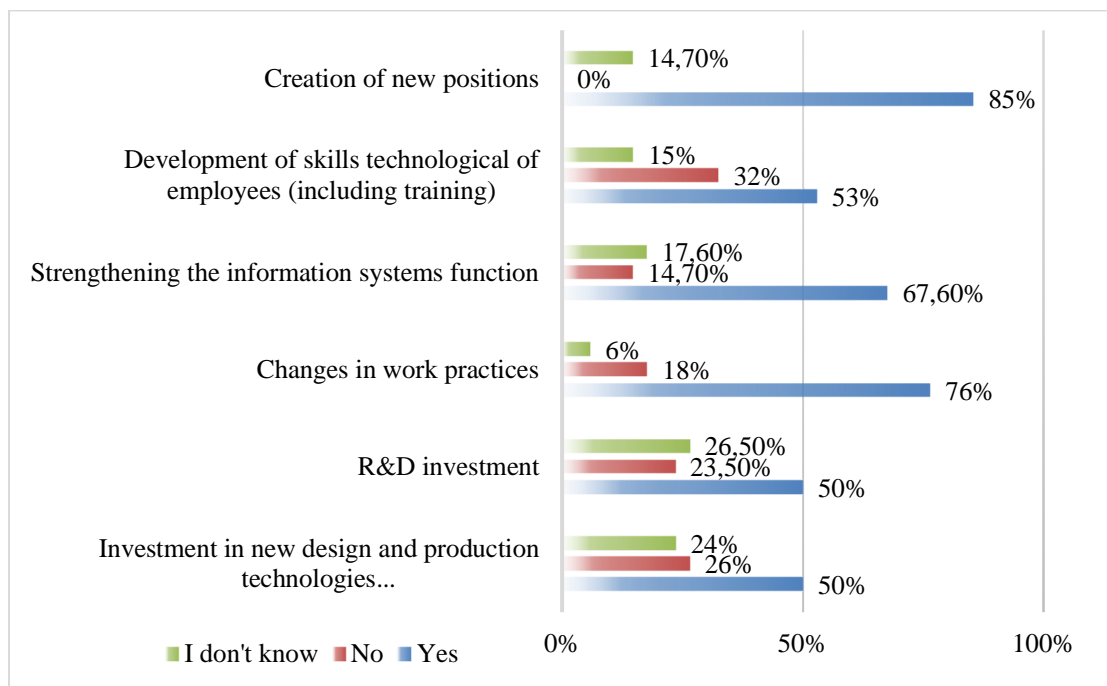


*Figure 3 The impact of digital transformation*

**A survey study on Industry 4.0 for Moroccan manufacturing**
Bilad Assia, Zaim Mounia, Zaim Faical

We presented a set of digitization tools to our respondents to find out what digital tools these companies use, so we found that all participating companies use social media, 31 companies use ERP, 21 with IOT, big data, big data analytics, and BI, 29 use simulation software, 17 exploit e-commerce in their practices, 12 among the target practice artificial intelligence, 15 use CAD/CAM and intelligent supply chains, and 13 employ Production Management Systems (MES). In addition to the use of CRM by 18 companies and 11 for predictive maintenance, we note the absence of several digital tools, namely: crowd, additive manufacturing, cloud computing, M2M, and Cobots. The lack of use of several digitalization tools by these companies shows that we are still in the implementation phase of a few tools to test the feasibility of this transformation.

### 4.3.3 The benefits and obstacles of digital strategy

Although implementing a digital strategy within companies is costly, it has positive impacts and benefits for the organization. According to the results of this questionnaire, we can say that our entire target group affirms that the transformation has improved image and reputation with customers, as well as customer satisfaction, then 75% of the population confirms as a benefit: improvement in ability to respond to market opportunities and also in the success rate of new products, but on the other hand the remaining 25% partially agree with this statement, then we have the whole target partially agree with the improvement in sales, 50% agree with the improvement in the rate of introduction of new products as a benefit and the remaining 50% partially agree, and towards the end, 75% totally agree with the improvement in ability to respond to market opportunities and in the success rate of new products and 25% partially agree.

After calculating the average, we can deduce that more than 85% of our target audience agrees totally or partially with the various benefits presented in the study.

*Table 7 The benefits of digital transformation*

|  | Not at all | Not really | Partially | Absolutely |
|---|---|---|---|---|
| **Improvement margins** | 8.80% | 17.60% | 26.50% | 47.10% |
| **Improved success rate of new products** | 5.90% | 11.80% | 29.40% | 52.90% |
| **Improved ability to respond to market opportunities** | - | - | 38.20% | 61.80% |
| **Improved image and reputation with customers** | 5.90% | 17.60% | 50% | 26.50% |
| **Improved image and reputation with customers** | - | 11.80% | 26.50% | 61.80% |
| **Improved customer satisfaction** | - | - | 41.20% | 58.80% |
| **Improvement sales** | - | - | - | 100% |
| **Average** | 2.94% | 8.40% | 30.26% | 58.41% |

We have now turned to the obstacles that can disrupt digital transformation. Based on our target audience's experience, we found that 25% of our target population strongly agree that the need for a global overhaul of the company's information system is an obstacle to digital transformation, while the remaining 75% partially agree. 25% of our target group still agrees with the complexity of digital transformation projects, the lack of technological skills, and the lack of legal skills, while 25% strongly disagrees with the lack of technological, managerial, and legal skills as obstacles. We can therefore deduce that, when it comes to implementing a digital strategy in a company, several obstacles will stand in the way.
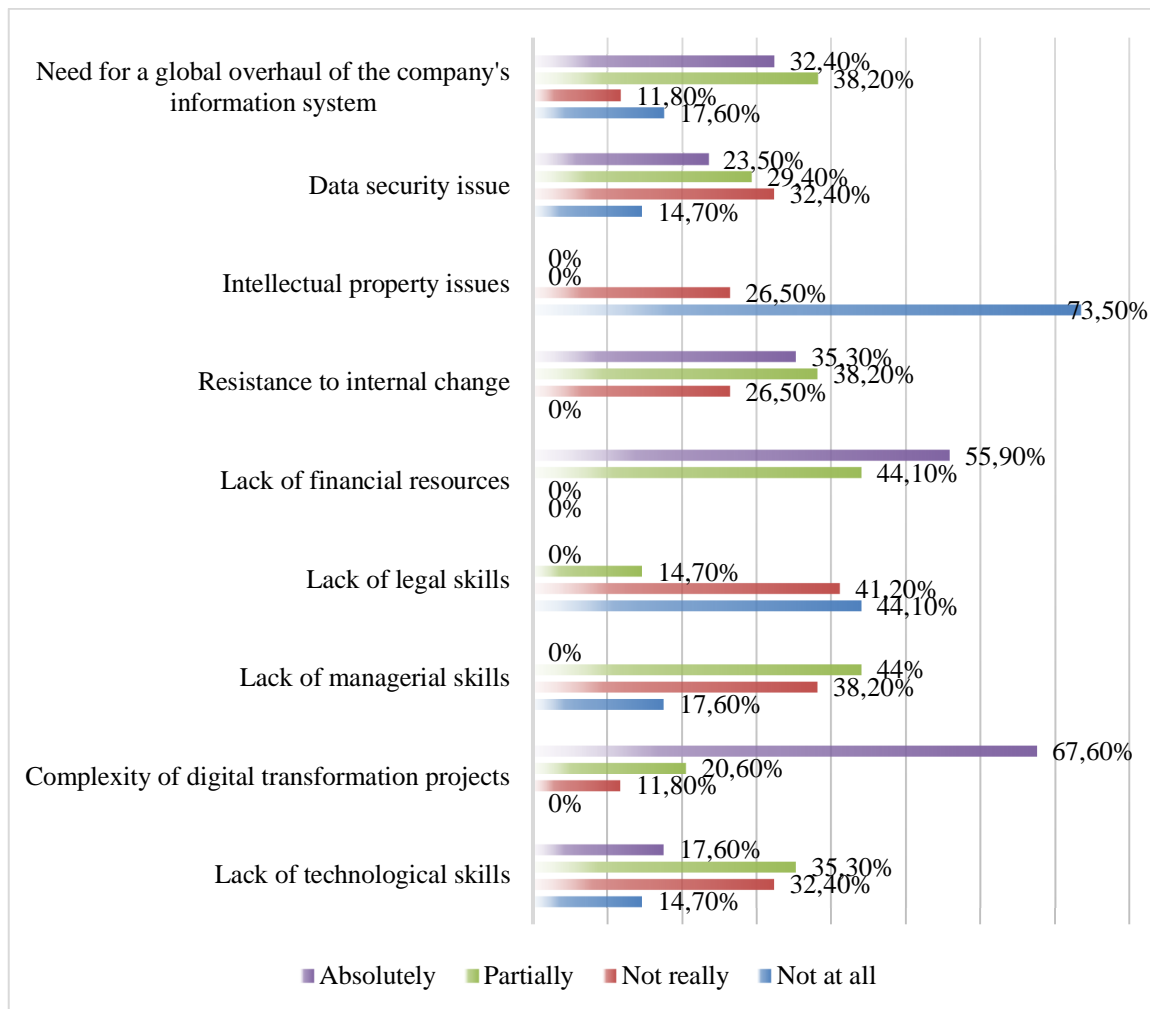
**A survey study on Industry 4.0 for Moroccan manufacturing**
Bilad Assia, Zaim Mounia, Zaim Faical



*Figure 4 Digital transformation obstacles*

### 4.3.4 Jobs created and Types of training adopted by the digital strategy

As part of the digital transformation of companies, the latter claimed that several new positions have been created. 90% of our target sees that the position of data scientist has been created thanks to digital transformation; 75% sees the creation of the position of chief digital officer and community manager; and on the other hand, all the target sees the non-creation of the position of agile coach, so we can see that digital transformation creates job offers and opportunities.

To implement the company's digital transformation, it is then necessary to acquire new knowledge and skills. According to our respondents, the entire target group has carried out in-house training and online training (e-learning, MOOCs), so 88% of the population has used external training organizations, and 10% has carried out self-instruction.

We found that our population uses daily means of communication even before the implementation of digital transformation, such as email, SMS/MMS, videoconferencing systems, and instant messaging/chat.

During our survey, we focused on digital security, so we devoted several questions to understanding whether these companies are securing the digital tools they have at their disposal. We found that the entire population has a digital policy either implemented or in the process of being implemented, and the person responsible for this digital security policy is the IT department, according to 90% of the target, and the rest is a subsidiary of the company that takes care of it.

## 5 Conclusions

The results of this survey indicate that Morocco has begun to introduce the basics of Industry 4.0 into its industry practices, including large companies and SMEs, while taking into consideration the various existing sectors.

The results show that, regardless of company size or sector of activity, companies adopt a digital strategy or begin to introduce it into their practices. Our target is aware that to adopt digitalization, it is necessary to acquire new knowledge and skills, which are necessary to succeed in the digitization of processes. These skills must be acquired

Acta logistica    - International Scientific Journal about Logistics
Volume: 11   2024   Issue: 3   Pages: 397-407   ISSN 1339-5629

**A survey study on Industry 4.0 for Moroccan manufacturing**
Bilad Assia, Zaim Mounia, Zaim Faical

either through training organized by the enterprise or even through self-training.

By analyzing the level of use of digital technologies, it appears that most of our population is not taking the full measure of 4.0 technologies, and this is due to the lack of knowledge and overall understanding of the 4.0 concept by our target, which shows that industry 4. 0 in Morocco in its entirety is limited to the use of social networks, e-commerce, software simulation, ERP, and the use of the two digital tools IOT and big data, which then requires investment in the implementation of other digital tools that will help companies win in terms of productivity and financial gains, in addition to the need to develop the knowledge and skills of staff to make better use of emerging technologies and gain mass and continuous benefits from this digital transformation.

For the factors influencing the choice of adoption of the digital strategy, we have found several factors that can influence this choice, except that only six have been implemented as being the most influential, the choice from this list is made taking into account the common strategic objectives among all companies whether their size or their business sectors, namely, the Productivity increase factor because the objective of each company is to increase its productivity to gain in terms of costs and produce more in the same time allocated in advance, the second factor chosen is Cost reduction & Improved margins, each enterprise seeks to minimize its costs and expenditures and maximize its profitability, increase its profit margin, which is more applicable by adopting a digital strategy. Job creation is important because it entails the emergence of new jobs in the working world. Digital experts are in high demand in the labor market. Improved customer satisfaction: as more and more customers have new requirements, they expect to be informed quickly, simply, and in a transparent way. The digitalization of the customer relationship thus enables us to meet all these expectations related to the client relationship. In the end, the factor of enhanced data security remains; it is a very sensitive factor because if enterprises do not take data security seriously, their reputation will be irreversibly degraded in the case of highly media-based attacks, without forgetting that data confidentiality is an important point to control.

Our research has certain limitations that may open the door to future work. As already presented, our study focused on companies from different industrial sectors, and we are well aware that each sector has its own characteristics, which may make future research on each sector separate.

Another important feature is the selection of factors that influence the implementation of a digital strategy. We chose factors using a brainstorming meeting and a weighted vote, so future work can choose factors studied based on a model already existing in the literature.

From the results obtained, we can therefore conclude that the adoption of new technologies necessarily requires the creation of new positions, as well as a total or partial modification of working practices, which then shows that investing only in the implementation of new technologies is not enough to gain a competitive advantage for your company, but you also need to invest in the workforce either by creating new positions or by training existing staff, because the absence of a digital culture within the company and a lack of training and skills leads directly to an unsuccessful transformation.

Digitization, then, is a mandatory and essential transformation step for companies to increase their competitiveness and flexibility in the face of change and competition. Most companies are adopting digital strategies in their practices to increase productivity. In the first instance, creating a connected factory where machines can communicate with each other, reducing risks, and improving product and process yield and quality—not to mention the gains in terms of multi-level cost reduction and improved margins achieved—are all essential factors influencing the choice of companies to implement a digital strategy in their practices.

# References

[1] LI, G., HOU, Y., WU, A.: Fourth Industrial Revolution: technological drivers, impacts and coping methods, *Chinese Geographical Science*, Vol. 27, No. 4, pp. 626-637, 2017. https://doi.org/10.1007/s11769-017-0890-x

[2] SHARMA, J., TYAGI, M., KAZANCOGLU, Y.: Impact of digital technologies on the risk assessment in food supply chain: a wake towards digitalisation, *International Journal of Food Science and Technology*, Vol. 59, No. 5, pp. 3491-3504, 2015. https://doi.org/10.1111/ijfs.17035

[3] HAMZEH, R., ZHONG, R., XU, X.W.: *A Survey Study on Industry 4.0 for New Zealand Manufacturing*, Conference Proceedings, SME North American Manufacturing Research Conference - NAMRC, College Station, Vol. 26, pp. 49-57, 2018. https://doi.org/ 10.1016/j.promfg.2018.07.007

[4] TORTORA, A.M.R., MARIA, A., VALENTINA, D.P., IANNONE, R., PIANESE, C.: *A survey study on Industry 4.0 readiness level of Italian small and medium enterprises*, Conference Proceedings, International Conference on Industry 4.0 and Smart Manufacturing, Vol. 180, pp.744-753, 2020. https://doi.org/ 10.1016/j.procs.2021.01.321

[5] YU, F., SCHWEISFURTH, T.: Industry 4.0 technology implementation in SMEs – A survey in the Danish-German border region, *International Journal of Innovation Studies*, Vol. 4, No. 3, pp. 76-84, 2020. https://doi.org/10.1016/j.ijis.2020.05.001

[6] PILLONI, V.: How data will transform industrial processes: Crowdsensing, crowdsourcing and big data as pillars of Industry 4.0, *Future Internet*, Vol. 10, No. 3, pp. 24, 2018. https://doi.org/10.3390/fi10030024

[7] BILAD, A., ZAIM, M., ZAIM, F.: *Industry 4.0 tools in the industrial sector: A Systematic Literature Review*,

Acta logistica    - International Scientific Journal about Logistics
Volume: 11  2024  Issue: 3  Pages: 397-407  ISSN 1339-5629

**A survey study on Industry 4.0 for Moroccan manufacturing**
Bilad Assia, Zaim Mounia, Zaim Faical

Conference Proceedings, International Conference of Logistics and Supply Chain Management, LOGISTIQUA, El Jadida, 2022. https://doi.org/10.1109/LOGISTIQUA55056.2022.9938070

[8] ADEL, A.: Future of industry 5.0 in society: human-centric solutions, challenges and prospective research areas, *Journal of Cloud Computing*, Vol. 11, No. 1, pp. 1-15, 2022.
https://doi.org/10.1186/s13677-022-00314-5

[9] CHEN, Y., LU, Y., BULYSHEVA, L., KATAEV, M.Y.: Applications of Blockchain in Industry 4.0: A Review, *Information Systems Frontiers,* Vol. 2022, pp. 1-15, 2022.
https://doi.org/10.1007/s10796-022-10248-7

[10] MASHALAH, H.A., HASSINI, E., GUNASEKARAN, A., BHATT (MISHRA), D.: The impact of digital transformation on supply chains through e-commerce: Literature review and a conceptual framework, *Transportation Research Part E: Logistics and Transportation Review*, Vol. 165, No. September, p. 102837, 2022.
https://doi.org/10.1016/j.tre.2022.102837

[11] CORTI, D., MASIERO, S., GLADYSZ, B.: *Impact of Industry 4.0 on Quality Management: Identification of main challenges towards a Quality 4.0 approach*, Conference Proceedings, IEEE International Conference on Engineering, Technology and Innovation, Cardiff, pp. 1-8, 2021. https://doi.org/10.1109/ICE/ITMC52061.2021.9570206

[12] REZAZADEGAN, R., SHARIFZADEH, M.: *Applications of Artificial Intelligence and Big Data in Industry 4.0 Technologies*, Industry 4.0 Vision for Energy and Materials: Enabling Technologies and Case Studies, wiley, 2022. https://doi.org/10.1002/9781119695868.ch5

[13] CHBAIK, N., KHIAT, A., BAHNASSE, A., OUAJJI, H.: *The Application of Smart Supply Chain Technologies in the Moroccan Logistics*, Conference Proceedings, Procedia Computer Science, International Conference on Emerging Ubiquitous Systems and Pervasive Networks, Leuven, pp. 578-583, 2021.
https://doi.org/10.1016/j.procs.2021.12.289

[14] SUZIĆ, N., SANDRIN, E., SUZIĆ, S., FORZA, C., TRENTIN, A., ANIŠIĆ, Z.: Implementation guidelines for mass customization: A researcher-oriented view, *International Journal of Industrial Engineering and Management*, Vol. 9, No. 4, pp. 229-243, 2018.
https://doi.org/10.24867/IJIEM-2018-4-229

[15] LIAO, Y., DESCHAMPS, F., LOURES, E. de F.R., RAMOS, L.F.P.: Past, present and future of Industry 4.0 - a systematic literature review and research agenda proposal, *International Journal of Production Research*, Vol. 55, No. 12, pp. 3609-3629, 2017. https://doi.org/10.1080/00207543.2017.1308576

[16] ALFANO, M., DI PASQUALE, V., IANNONE, R., MIRANDA, S., RIEMMA, S.: *Assessment and implementation of Industry 4.0 paradigm: research topics and trends*, Conference Proceedings, Proceedings of the Summer School Francesco, Turco, 2020.

[17] LASI, H., FETTKE, P., KEMPER, H-G., FELD, T., HOFFMANN, M.: Industry 4.0, *Business and Information Systems Engineering*, Vol.6, No. 4, pp. 239-242, 2014.
https://doi.org/10.1007/s12599-014-0334-4

[18] WEYER, S., SCHMITT, M., OHMER, M., GORECKY, D.: *Towards industry 4.0 - Standardization as the crucial challenge for highly modular, multi-vendor production systems*, Conference Proceedings, IFAC Symposium on Information Control Problems in Manufacturing, Ottawa, pp. 579-584, 2015.
https://doi.org/10.1016/j.ifacol.2015.06.143

[19] GENEST, M.C., GAMACHE, S.: *Prerequisites for the implementation of industry 4.0 in manufacturing SMEs*, Conference Proceedings, International Conference on Flexible Automation and Intelligent Manufacturing, Athens, pp. 1215-1220, 2021. https://doi.org/10.1016/j.promfg.2020.10.170

[20] SCHUMACHER, A., EROL, S., SIHN, W.: *A Maturity Model for Assessing Industry 4.0 Readiness and Maturity of Manufacturing Enterprises*, Conference Proceedings, International Conference on Changeable, Agile, Reconfigurable and Virtual Production, Bath, pp. 161-166, 2016.
https://doi.org/10.1016/j.procir.2016.07.040

[21] SAATY, T.L.: *The Analytic Hierarchy Process, Planning, Piority Setting, Resource Allocation,* New York, McGraw-Hill, 1980.

[22] SKIBNIEWSKI, M.J., CHAO, L.: Evaluation of advanced construction technology with AHP method, *Journal of Construction Engineering and Management,* Vol. 118, No. 3, pp. 577-93, 1992. https://doi.org/10.1061/(ASCE)0733-9364(1992)118:3(577)

[23] WONG, J.K., Li, H.: Application of the analytic hierarchy process (AHP) in multicriteria analysis of the selection of intelligent building systems, *Building and Environment*, Vol. 43, No. 1, pp. 108-25, 2007.
https://doi.org/10.1016/j.buildenv.2006.11.019

[24] AL-HARBI, K.M.A.-S.: Application of the AHP in project management, *International Journal of Project Management*, Vol. 19, No. 1, pp. 19-27, 2001. https://10.1016/S0263-7863(99)00038-1

[25] HANDFIELD, R., WALTON, S., SROUFE, R., MELNYK, S.A.: Applying environmental criteria to supplier assessment: A study in the application of the Analytical Hierarchy Process, *European Journal of*

**A survey study on Industry 4.0 for Moroccan manufacturing**
Bilad Assia, Zaim Mounia, Zaim Faical

~ 407 ~

*Operational Research*, Vol. 141, No. 1, pp. 70-87, 2002.
https://doi.org/10.1016/S0377-2217(01)00261-2

[26] ISHIZAKA, A., LABIB, A.: Review of the main developments in the Analytic Hierarchy Process, *Expert Systems with Applications*, Vol. 38, No. 11, pp. 14336-14345, 2011.
https://doi.org/10.1016/j.eswa.2011.04.143

[27] KOMURO, M., KOMODA, N.: *An explanation model for quality improvement effect of peer reviews*, Conference Proceedings, International Conference on Computational Intelligence for Modelling Control & Automation, pp. 1159-1164, 2008.
https://10.1109/CIMCA.2008.187

[28] KONTIO, J., BRAGGE, J., LEHTOLA, L.: *The focus group method as an empirical tool in software engineering*. In Shull, F. & al. (Eds.) *Guide to advanced empirical software engineering*, Springer, London, 2008.

[29] MAZZA, R., BERRE, A.: *Focus group methodology for evaluating information visualization techniques and tools,* Conference Proceedings, International Conference Information Visualization, pp. 74-80, 2007. https://doi.org/10.1109/IV.2007.51

[30] HSIAO, S.W.: Concurrent design method for developing a new product, *International Journal of Industrial Ergonomics*, Vol. 29, No. 1, pp. 41-55, 2002.
https://doi.org/10.1016/S0169-8141(01)00048-8

**Review process**
Single-blind peer review process.