# Managers' Insights on Industry 4.0: Benefits, Strategies and Obstacles

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**Abstract.** Industry 4.0 as a transformative approach imposes organizations to integrate new technologies such as artificial intelligent (AI), Internet of things (IOT) and big data. Recognizing the potential of these advancements, Morocco is making a concerted effort to embrace this industrial revolution, aiming to boost the competitiveness and efficiency of its manufacturing sector. This study examines how Industry 4.0 initiatives are being integrated into Moroccan industries. It highlights the identified benefits of this integration, outlines strategic priorities for companies looking to embark on this revolution, and lists the obstacles preventing others from moving forward with the industry 4.0. The research methodology we used combines a comprehensive literature review and a focus group discussion with industry managers. The results have profound implications for both academic research and practical management, providing critical points to be taken into consideration for future efforts to enhance Industry 4.0 integration in Moroccan industries. This study will be beneficial for future researchers to highlight the benefits and advantages of organizations currently implementing Industry 4.0, guide those planning to start, and find solutions for those facing challenges - to effectively prepare for this industrial revolution.

**Keywords:** Industry 4.0, Industry 4.0 models, fourth revolution benefits, strategic priorities, obstacles.

## Introduction

Industry 4.0 is defined by the convergence of technologies, which includes different digital technologies, new materials and processes [1]. The topic of integrating the initiatives of this revolution has gained an exponential increase in interest among scholars, managers, and policymakers in recent years [2].

Like many countries, Morocco has also recognized the importance of engaging in the industry 4.0 revolution to boost economic growth and improve overall competitiveness by developing initiatives aimed at modernizing its industrial sector according to the Morocco's Industrial Acceleration Plan 2014-2020 [3]. To realize the vision of digitalization and the success of the latest plan and the "Plan 2030," the Moroccan government has initiated several key measures, beginning with the establishment of the Digital Development Agency (DDA). This agency is designed to coordinate efforts between

public and private sector stakeholders, serve as a liaison for foreign investors, and foster the growth of the Moroccan digital ecosystem [3].

Even though it is the most attractive, the best prospective country for international investment [4] and the fifth economy of the African continent [5] as well as among 30% of industries have been transformed to Industry 4.0 as the ex-minister of industry said [6], Morocco's path towards the fourth revolution still confronts many challenges and obstacles to reaching or keeping up with the international level of this transition.

This research work aims to identify the benefits of this integration, outlines strategic priorities for companies wishing to launch this revolution, and highlights the obstacles preventing others from adopting Industry 4.0. The rest of this article is structured to present in detail the concept of industry 4.0 and its pillars as well as a brief view on existing Industry 4.0 models, followed by a section of the methodology adopted and then the various guidelines deduced from companies that are aiming to implement or that have already implemented Industry 4.0 and finally a conclusion and perspectives.

## Literature review

### 1.1 Industry4.0 & Pillars

The "Industry 4.0" term; introduced by the German government at Hanover in 2011; refers to the ongoing fourth industrial revolution. It involves the integration of cyber-physical systems (CPS) in manufacturing, along with the use of automation, digitization, and artificial intelligence to create value [7]. So, the concept is to integrate the aspect of physical cyber systems, in order to network several devices that will make information and services available. Among the pillar of this revolution, we can find [8]:

**Augmented reality:** aims to analyze the existing environment and enhances it with additional information to create a new artificial intelligent environment.

**Additive manufacturing:** This technology is employed to produce prototypes and smaller machine components, enabling the creation of customized and complex designs.

**Big Data:** The objective of this pillar is to collect data from various sources involved in manufacturing, correlate and process this data, and use it to improve failure rates and customer relations, thereby enabling informed business decisions.

**Cloud computing:** involves providing computing services via the internet, encompassing servers, storage, databases, networking, software, analytics, and intelligence. This delivery method facilitates rapid innovation, adaptable resource allocation, and cost efficiencies on a scalable platform.

**Internet of things (IOT):** refers to a system comprising physical devices, vehicles, household appliances, and other objects equipped with sensors, software, and connectivity. These elements are capable of connecting and exchanging data with each other.

**Cyber security**: seeks to the practice of protecting computer systems, networks, and data from digital attacks by the implementation of firewalls, encryption, antivirus software…

**Simulation:** refers to the representation of a physical problem or a real process through a computer model.

The integration of new technologies in Moroccan industries is making significant progress, although challenges remain. According to the barometer of Moroccan industry presented by the Ministry of Industry in 2024, Moroccan industry has recorded significant growth in terms of turnover and added value [9]. In parallel, the 2021-2025 Industrial Acceleration Plan (PAI) focuses on digitalization and the adoption of cutting-edge technologies such as the Internet of Things (IoT) to modernize the industrial sector.[10]

### 1.2 Industry 4.0 models

To make a successful transition to Industry 4.0, companies always have the choice of adopting established models or creating their own models based on their specific internal strategies. In this way, it is possible to respond specifically to the needs and objectives of each company by integrating the pillars of Industry 4.0 described above according to a pre-defined standard. By combining these elements with in-depth strategic analysis, companies can optimize their processes, improve operational efficiency and strengthen their competitiveness in the global marketplace. These models can take the form of frameworks, roadmaps, readiness assessment or maturity models [11].

The table [1] below summarize some of those models, their type, dimensions and maturity levels:

**Table 1. Some of adopted models**

| Model name | Type | Dimensions | Maturity level | Source |
|---|---|---|---|---|
| Impuls | Maturity Model | -Strategy and organization<br>-Smart factory<br>-Smart operations<br>-Smart products<br>-Data-driven services<br>-Employees | Outsiders;<br>Beginner;<br>Intermediate;<br>Experienced;<br>Expert;<br>Top performers | [12] |
| A categorical framework of manufacturing for Industry 4.0 and beyond | Framework | -Factory,<br>-Business,<br>- Process<br>-Customers | -single-station automated cells,<br>-automated assembly system,<br>-flexible manufacturing system, | [13] |

| | | | | |
|---|---|---|---|---|
| | | | -computer-integrated manufacturing system,<br>-reconfigurable manufacturing system | |
| An overview of a smart manufacturing system readiness assessment | Readiness Assessment | - Organizational maturity,<br>- IT maturity,<br>-Performance management maturity,<br>-Information connectivity maturity. | Not determined | [14] |
| Three-stage maturity model in SME's towards Industry 4.0 | Maturity model | - Vision 4.0<br>- Enable,<br>- Transform | - Initial,<br>- Managed,<br>- Defined,<br>- Transform<br>- Detailed Business Model | [15] |

## Methodology

This paper aims to provide an overview on the benefits of companies already implementing Industry 4.0, the strategic priorities for organizations wishing to go towards this transition, and the obstacles preventing other enterprises from moving towards this revolution.

Considering the novelty and the importance of the subject, in the Moroccan sector, and the need for in-depth exploration, as well as the time constraints in terms of waiting for responses from managers via questionnaires, we adopted the focus group method in order to benefit from it and make surveys as and when the discussion progressed. This method has been developed and widely adopted in the fields of medical research and marketing, but it is now recognized as established even in the social sciences [16].

A purposive sample of 12 managers representing various departments and regions within different sectors (automotive, aeronautics, IT& holdings) was selected to participate in the focus group discussions, using a ZOOM meeting. Through structured and interactive questions, this approach enabled us to gather rich qualitative data by encouraging participants to share their experiences and perspectives.

To gather insights from managers, a structured methodology was implemented, comprising several key steps:

- **Preparation of questions**: Questions were carefully prepared based on a comprehensive literature review; structured, semi-structured, or unstructured.

- **Focus Group Session**: After inviting managers with relevant experience and perspectives on the subject, a focus group session lasting an hour and a half was organized by Visio conference.
- **Responses Collection**: Responses from the surveys were collected systematically as we go along for further analysis.
- **Validation Data**: Collected responses underwent thorough treatment and processing to ensure accuracy and relevance.
- **Feedback Interpretation**: The interpreted feedback was used to draw conclusions and provide perspectives for future actions.

The **fig.1** and **fig.2** below show us the methodology followed and the structure of the survey proposed:

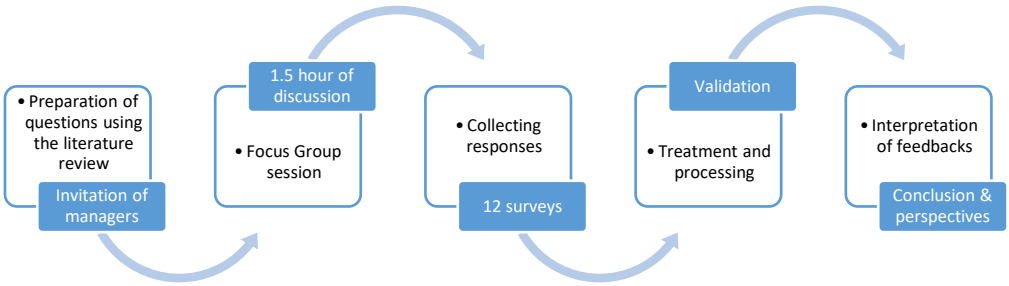


**Fig. 1.**The adopted methodology

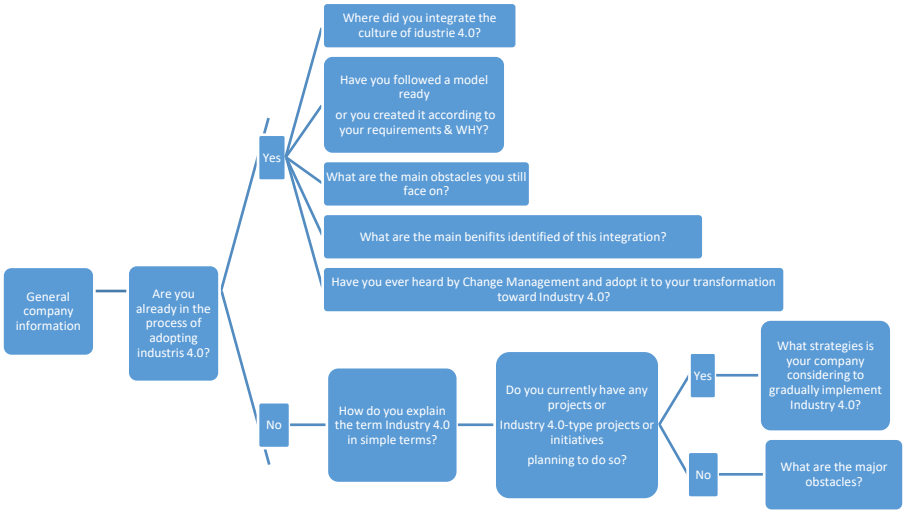


**Fig. 2.** The structure of the survey proposed to the interviews

## Results and Discussion

The focus group brought together about 12 quality, production and manufacturing managers in several fields: automotive, aeronautics, information technology and holding companies. They were divided into organizations who have already implemented Industry 4.0, those who are thinking of moving towards this revolution and those who aren't think about it while revealing their obstacles.

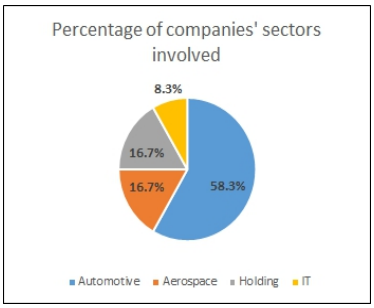


**Fig. 4.** Percentage f companies' sectors involved

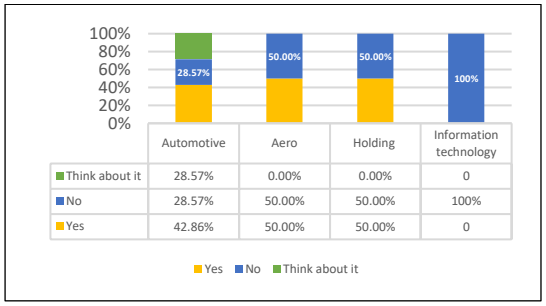


**Fig. 3.** Statut of companies involved according to I4.0 integration

58,3% of the companies interviewed are automotive, of which 42,86% have already embraced I4.0, 28,57% are thinking of doing so, and the rest don't see themselves as part of this revolution. For aeronautical organizations, which represent 16,7% of our sample, 50% have already implemented and the rest are either thinking of launching or refusing to launch, the same goes for holding companies. Finally, the IT company of this sample is neither launching nor thinking of launching into this revolution.

The dominant department in this transition for companies that have already implemented this culture is production, with a percentage of 80%, compared with 20% for the company as a whole.

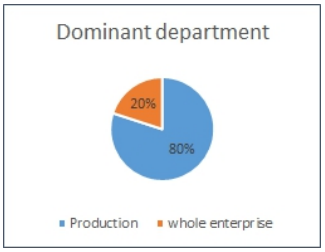


**Fig. 5.** Dominant Department

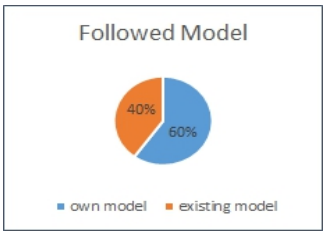


**Fig. 6.** Percentage of followed model

On the other hand, and concerning the model followed, 60% have designed their own model on the grounds that a custom model allows for great flexibility to adapt to internal and external changes as well as providing an opportunity to innovate and differentiate from the competition and could be developed taking into account the corporate culture. While others see it as preferable to use an existing model, given that exist-

ent models can offer quicker implementation and are often designed by experts specialized in Industry 4.0 as well as reducing the risks associated with designing and implementing one's own model.

Among the benefits reported by these companies are: increased production, reduced production costs, improved quality, adaptability to change, customer satisfaction, increased competitiveness, efficient use of data and others (see **Fig.9**).

However, these companies still face a number of obstacles, such as the non-compatibility of machinery with the new technologies(O1), as well as high implementation costs(O2), insufficient telecommunications infrastructure in the country(O5), and a lack of clarity regarding the return on investment(O6). The appearance of these obstacles differs from one organization to another depending on the strategy followed, but to find out which obstacles are most frequent depending on the type of model followed, we opted for a correlation study in which we used the variables representing the obstacles (O1 to O7) (see **Fig.9)**.

| N° model | Obstacles / Model type | O1 | O2 | O3 | O4 | O5 | O6 | O7 |
|---|---|---|---|---|---|---|---|---|
| 1 | Own | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 2 | Own | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 3 | Existing | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 4 | Own | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| 5 | Existing | 0 | 0 | 0 | 1 | 0 | 0 | 1 |

**Fig.7.:** Occurrence of obstacles according to type of model

The correlation between these variables was calculated to determine the linear relationships between them. Pearson correlation coefficients were used, varying between -1 and 1, where:

1 indicates a perfect positive correlation,

-1 indicates a perfect negative correlation,

0 indicates no correlation.

The correlation coefficients are shown in the table below:

| | O1 | O2 | O3 | O4 | O5 | O6 | O7 |
|---|---|---|---|---|---|---|---|
| O1 | 1 | | | | | | |
| O2 | 0.612372 | 1 | | | | | |
| O3 | 0.666667 | 0.408248 | 1 | | | | |
| O4 | -0.66667 | -0.40825 | -0.16667 | 1 | | | |
| O5 | 0.408248 | 0.25 | -0.40825 | -0.61237 | 1 | | |
| O6 | 0.408248 | 0.25 | -0.40825 | -0.61237 | 1 | 1 | |
| O7 | -0.61237 | -1 | -0.40825 | 0.408248 | -0.25 | -0.25 | 1 |

**Fig.8**. Matrix of correlation

**Correlation between obstacles and Own Model**

-Barriers that show moderate to high positive correlations with own Model include "Machines Incompatibles with New Technologies" (O1: 0,612) and "High Implementation Costs" (O2: 0,666). This suggests that companies following their own model tend to encounter these challenges more frequently.

- On the other hand, moderate to high negative correlations are observed with blockages such as "Insufficiently Qualified Personnel" (O4: -0,666) and "Failure to Find Suppliers" (O7: -0,612), suggesting that these problems are less frequent using own models.

**Correlation between obstacles and Existing Model:**

-For the Existing Model, the correlations show opposite trends to the Own Model. For example, companies following an existing model tend to encounter fewer problems linked to machines incompatible with new technologies (O1:-0,612) and high implementation costs (O2:-1), but they may be more likely to encounter problems linked to insufficiently qualified staff (O4:0,408) or difficulty in finding suppliers (O7:1).

So, whether they follow an existing model or their own, companies will always come up against obstacles, so we had to take action on other points.

Moving now to companies who didn't implement the industry 4.0 but think about it as short or long time strategy and the strategies being considered for the gradual implementation of Industry 4 include the proactive identification of potential risks associated with the implementation of Industry 4.0, the implementation of solutions that integrate perfectly with existing systems and the adoption of an evolutionary approach with progressive investments to address the risks associated with high investment costs. At the same time, effective change management is essential to the overall success of these technological transformation initiatives. Future studies and suggestions must therefore take these strategies into consideration to produce a deliverable that is ready to be implemented for the benefit of this category.

Concerning the obstacles which prevent the last category of companies that does not see itself in this technological revolution are often: the market is still not ready (customers and suppliers), constraints linked to customer agreement and finding sup-

pliers, complexity of integrating new technologies with systems already in place, difficulty in clearly defining the tangible benefits and returns on investment of digitization, non-compatibility of machines with new technologies and challenges linked to connectivity between different equipment and system. (see **fig.9)**

## Conclusion & Perspectives

This paper examines the integration of Industry 4.0 initiatives in Moroccan industries, highlighting the benefits of this transformation, the strategies envisaged by organizations aiming for a 4.0 orientation to be taken into consideration for future research, and some of the obstacles that stand in the way of embarking on this revolution. We conducted a correlation study to determine the obstacles that can be encountered depending on the model adopted (existing or own). The results show that the choice of model can influence the frequency with which a company encounters a specific blockage, but not quite the main cause.

Future work aims to cover other dependencies and the importance of change management for effective and successful implementation, in order to subsequently propose a model worthy of being followed for new implementations.

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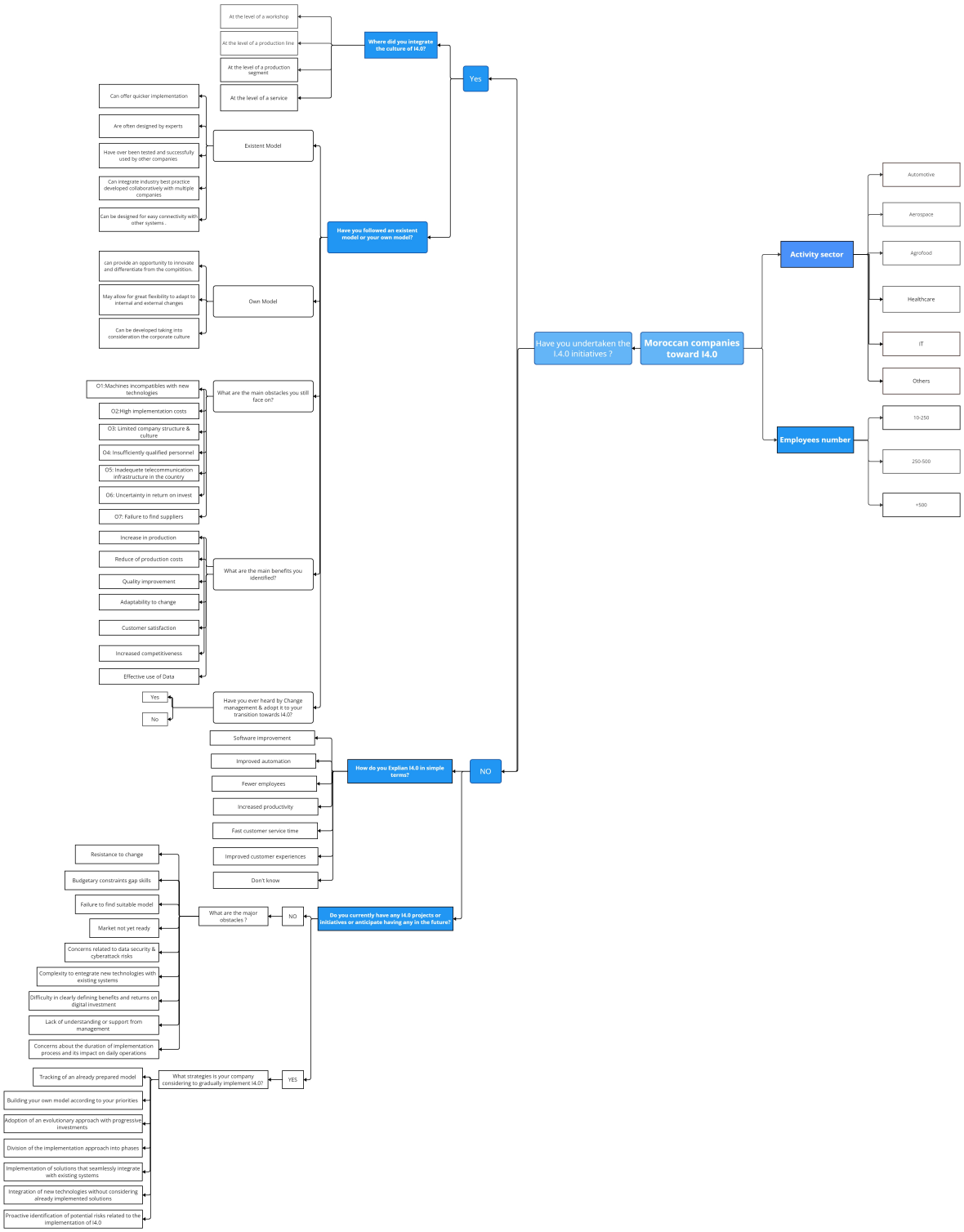


Fig.9. Mind map of the questionnaire and feedbacks selected