DIGITALIZATION IMPACTS ON INDIVIDUAL AND ORGANIZATIONAL BEHAVIORS IN FACTORIES: HOW DO GENERATIONAL APPROACH AND MANAGERIAL SUPPORT MEDIATE THE CHANGE'S SUCCESS?

Pascal NAHAS
Université Paul Valéry Montpellier 3
(France)

ABSTRACT:

The research aims at analysing the Industry 4.0, with a focus on how digitalization and production in real time impact the operators' behaviours within the organization. The study illustrates the concept of Industry 4.0, the real time manufacturing, and the needs to shift to that new vision of production in the factories. The introduction of 'Industry 4.0' digital technology requires more than involvement in corporatist arrangements; it also requires the creation of strategies. (Haipeter, 2020). This research investigated how the implementation of a new digitalized manufacturing system along with the reshuffling of the workstations would improve the factory productivity by increasing the output and reducing the hidden cost. Four generations of employees interact and adapt with the fundamental changes differently. Management should contribute in a direct way to mediate and moderate the negative impacts of that transformation.

Keywords: Factory productivity, digitalization, individual and organizational impact, user generation, management support.

1. INTRODUCTION

Industry 4.0 has been the focus for the governments of the top highest industrial outputs in Europe as France, Germany, and Italy. The EU supports industrial change through its industrial policy and through research and infrastructure funding. Member States are also sponsoring national initiatives such as Industry 4.0[1] (Briefing 2015). The research fields associated with Industry 4.0 concentrate on the establishment intelligent goods and methods of development. Factories must cope with projected demand with the need for quick product growth, flexible manufacturing, and dynamic environments. (Vyatkin, Salcic, Roop, Fitzgerald, 2007). According to McKinsey[2], Factory

[1] Briefing, Industry 4.0 Digitalization for productivity and growth, Sept 2015
[2] The consulting firm hired to identify and confirm the problem or challenge facing the company.

"M"[3] which was a part of the study scope, confirmed the maturity of the company A shift to Industry 4.0. The move to digital is one of the improvements that company A wanted to make, and it is an incredibly challenging task. One of the main parts of the Industry 4.0 is the digitalization which is becoming increasingly essential for most industries to be more productive, competitive, and efficient. A company specialized in manufacturing industrial air conditioning which has presence and factories around the globe, is currently undergoing such transformation in its structure. This requires a lot of understanding about its progressivity and advancement. Digital factory design is becoming popular-business processes of the appropriate sort and/or the way they are combined to produce high technological decisions, owing to which new competitive new generation products can be produced within a short period of time. (Dolchinkov & Tarnovo, 2018)

Digital technology can help businesses, among other things, to enhance product design and development processes, automate routine tasks, remotely execute cert ain tasks, and facilitate relationships with suppliers and customers. The study deploys a mixed method research approach; quantitative, to survey local management, operators, and transformation team, as well as a qualitative approach, to collect labors' feedback on the productivity's aspect in several and repetitive phases by representing a sample up to 50% on each transformation selected. This study reflects the existing literature by determining the impact on the individual and organizational behaviors in the factory and how do generational approach & managerial mediate the change's success. The absence of leadership in the transformation cycle would lead to a lack in modernization of issues that appears from different reasons; The way how different generations react with the change or how individuals and organizations are impacted by new technology. Management learns from the experience of transformation on the pilot factory and would apply changes in their future strategy. Those fine tuning will permit management to facilitate the organizations and prepare the factory's maturity for the readiness on the fundamental change.

2. LITERATURE

2.1 Shift to industry 4.0

The productivity uses the resources properly, that will help to reduce the cost of production and improve the competitiveness. Once the business is in a competitive position, it may enable the enterprise to reduce its prices and thereby increase its market share by increasing sales, therefore it means higher profit. The first definition of "Industry 4.0" published in an academic outlet dated back to 2014 (Drath and Horch, 2014) and is a review by two German professionals issued in the IEEE Industrial Electronics Magazine. The shift to industry 4.0 requires several types of transformation, one of which is the digitalization. Organizations struggle to effectively incorporate emerging technology in their current technologies, sometimes operations lose money due to a failure if

[3] Factory "M" is one of the factories for a major player corporation (company A) that manufactures industrial air conditioning worldwide was selected as the factory Test for Change Implementation for the production in real time.

implementing new system or new advances structures. (Poulymenakou & Serafeimidis, 1997). Changes require involvement of employees from all levels, providing all staff within the enterprise with the required digital technologies and well-functioning assistance systems is an important and necessary step in introducing Industry 4.0 (Thun et al., 2019)

2.2 Theoratical background

The acceptance of a new technology could be a challenge for management and would not be a success story in all the cases. It could be a cause of fear for the operators as it might cause a loss for their job, and that would lead to some anxiety and worries, therefore, that might be a huge cost on the company if the operators start to do mistakes due to their stressful and emotional syndrome. (Davis, 1994). The value of diversity among employees has been recognized by most organizations that want a happy and efficient workforce, as well as financial viability and competitiveness. An inclusive culture is seen as the best way to take advantage of the benefits that diversity can bring (Peterson, 2015). Advanced technology will open the opportunities for studying and adapting to new ways of working, while at the same time getting a long career path becomes less relevant. That is particularly troublesome for aged employees because of declines in processing speed and learning ability linked to age (Baltes and Lindenberger 1997, Hoyer and Lincourt 1998). In several organizations, introduction of new technology has failed mainly for reasons of organizational and individual aspects, irrespective of the level of technology. Several reports indicate that the application of technology is more likely to work while the problems of technology, organization, and people were planned to complement each other and therefore such inclusive planning is hardly carried out. (Preece, 1995; King & Anderson, 1995). In the implementation of new technological system, there is a big tendency to have a drop in the performance of the operators at the first reaction and that is considered as a normal responsiveness to the changes as part of the resistance to accept new technology, moreover, when the operators will be using the systems on day-to-day basis, it will become as part of their life, and it will be part of their normal daywork. Such risk of resistance could be eliminated by improving the communication and explaining the benefit of the new technology and how that will be a positive integration in their tasks. (Chattopadhyay & Pareek, 1982). In my study, it was seen that new technology is a reason to boost the performance of the operators when it is associated with improvements to the structures of the organizations and the employees. These studies show that the introduction of technology is more likely to be effective when the challenges of technology, organization, and personnel are structured to balance and align with each other. The lack of awareness of operational and human resources improvements that could be expected for modern technologies may be attributed to high failure rates of technical transition. (Ghani & Jayabalan, 2000) Factories cannot do from one day to another a change in their manufacturing platform without taking the sufficient time and study all the aspects before starting to implement the changes, especially when we talk about new technology, which might impact all the layers of the organization. According to Nemetz & Fry (1988), to ensure the work satisfaction and the motivation of the operators, effective adoption of new technologies requires consistency with the organizational structure. Age cannot be a barrier to digital

skills' development. As we enter a digital era, local leaders need to make sure that every single resident in their territory can get digital knowledge in the short and long term. In a world where technologies are becoming ubiquitous, there are simply no alternatives to digital literacy.

The below is how the world today look at the last 4 generations based on the year of birth.

Generation Z: born 1996 and after

Millennials or Generation Y: born 1977 to 1995.

Generation X: born 1965 to 1976.

Baby Boomers: born 1946 to 1964.

Traditionalists: born 1945 and before

The aim of reflecting the generations is to identify their characteristics, how each generation adapt with the digital transformation, and what the empirical study will show on those generations, are they productive? Are there any barriers for them to learn, does it impact the blueprint of the changes, would they create any resistance to the change? Based on studies that was conducted on age-cognition, the results showed that the reasoning and speed are highly impacted with age. (Verhaeghen & Salthouse, 1997). The method in the research done by Salthouse has taken the group of age from 30 to 60 years old with an evaluation on 5 cognitive variables (speed, primary-working memory, episodic memory, reasoning, and spatial ability). Also, another study conducted on 2 groups for below and above 50 years old. Salthouse were the only source to publish such study where the results showed that there is strong correlation between age and cognitive variables (speed and reasoning). Some other success reviews not just from supervisors, but it can be extended to engineers in the factories, In the massive changes, employees are experiencing rapid technological, tested in six major corporations, the productivity of the engineers and their supervisors is extremely high in the age of 30s and do the most advanced technical work however engineers pass into their 40s and beyond, it shows that productivity starts to decrease. (Dalton and Thompson,1971). There is little solid evidence supporting generationally based differences however the workforce varies a lot between the generations. Studies reveals that there is still a great divergence in how Boomers and Millennials experience the workplace and handle their lives at work and at home, it is obvious that various types of technology are viewed as an aid or barrier (Psychological Task Control) to job fulfillment and work-life balance satisfaction, based on the worker's age. (Haeger & Lingham, 2014). There is no evidence about how productivity can be impacted by age, most of the studies are made by assumptions where no valid data to prove the opposite. (Skirbekk, 2004). Despite that we cannot assure that there is no correlation between age and productivity, but data shows that the cognitive ability has an inverse relationship with age, 91 studies that explain how life-span mental abilities evolve. Such experiments show that by the age of 50, important cognitive skills, like reasoning, speed, and episodic memory, decrease dramatically. (Verhaegen and Salthouse, 1997). Cognitive ability might be different from one segment to another, knowledge and vocabulary remains strong unlikely to other capacities like performance and speed are highly impacted with age. (Horn and Cattell 1966, 1967). On the other hand, identifying hidden cost or to work on reducing it is a big task which requires lot of investigations and research to understand the business Model. Hidden Costs

costs are evaluated by identifying the consequences of dysfunctions called "regulatory acts". Regulation is how the work situation absorbs and corrects the impact of a dysfunction (Savall & Cappelletti, 2018). The expected working hours are mainly called standard hours and they are estimated based on counting the chronological steps that are needed to complete a specific task which leads to a complete manufactured unit. Most of the hidden costs come from developments where the organization needs to further refine the current process formula, resulting in the subsequent procurement of new production equipment, technical updates, and advancements in automation, as well as the element of yield loss that has a major impact on the economic process. (Price & Around, 2017)

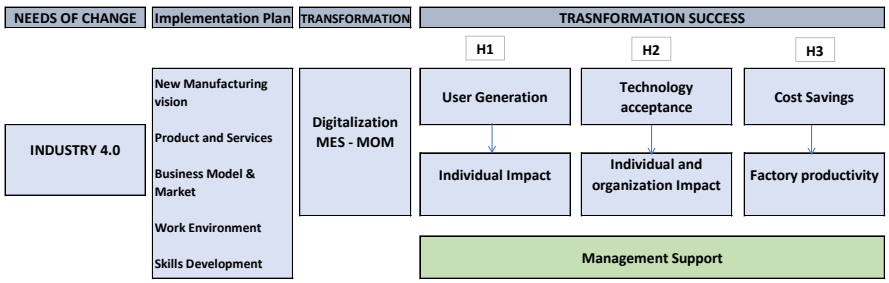


Figure 1: Conceptual Framework

The hypotheses based on the research question, are the following (see Figure 1The Conceptual Model):

H1: Age and generation are related to the interaction with the change such that older operators will be less satisfied and motivated with the change.

H2a: Technology acceptance has an impact on individual. The knowledge of the system, admitting the new tasks and contributing to the changes that the company is implementing, would have an impact on the success of the transformation.

H2b: Technology acceptance has an impact on organizational behavior. Obstacles in the implementation, readiness of the system and technical problems might show an incoherence on the goals and objectives of the organization.

H3: Cost savings would lead to a better factory productivity. Identifying the hidden costs and putting in place processes to reduce the hidden cost contributes to increase the output with lower manufacturing costs.
In the three hypotheses, we will be verifying in parallel the impact of the leadership through managerial support in each of the above, the achievement of a successful transformation may be difficult without leadership support.
Those transformation should secure a higher productivity for factory "M" which is translated by higher output with less cost versus prior period, higher productivity means more output and potential more profit for the company.

3. ROLE OF LEADERSHIP

There are many studies done about leadership style and change of management, however Industry 4.0 varies from Industry1.0 and 2.0, the relationship among operators will give a good sign about leaders. (Sridhar, 2019) Bases on prior research about Industry 4.0, it is known that the transformation could have an impact on the social and technological sides of the job, therefore leader should have the ability to drive strategies and being innovate in putting new cultures, there are always a risk of silent groups that works in the factories that might impact any process of change. (Ernst & Yip, 2009). Industry 4.0 environment is well known as a dynamic and has lot of changes where strict hierarchy and vertical communication could create some gaps in the implementation of the digitalization and all the aspects of Industry 4.0. There is no one perfect model, there should be a several options and each depends on the situation to be used. (Shamim et al., 2016)

There are too many studies about the best fit for managerial structure, most of the research were focusing on the technical side then the specificity of the structure.

Integrity and innovation in the managerial style is a necessity to influence all the stakeholders and secure the shift to the aimed results. Disconnected management from the scope of transformation could put heavy burden on individuals as well as on the organizations and the results of the project, consequently, leaders should adopt the best strategy to empower employees and get them well integrated into the changes without any major implication on the business. Studies showed that several indicators of changes practices, the scope of the changes and the activities that promote it, that to be done takes time and done in phases, the oriented and collaborative leadership studies asked respondents to determine the degree to which leaders participated in such practices at just one stage rather than on many occasions as the transition progressed. (Ford & Ford, 2012)

4. COMPATIBILITY TO INDUSTRY 4.0

The decentralization seen earlier in the literature review reflecting in a way the Taylorism[4] (Frederick, 1911) and considered is a must for Industry 4.0. Taylorism has already influenced the decision making on the managerial level and contributed massively to the economy by achieving big gains and started to be used widely worldwide (Drucker,1998)

The three structures[5] and its characteristics and which one can fit better in the Industry 4.0 along with Lewin's [6]model on the change of management with a linking thought of the type of managerial style for Industry 4.0 are all creating a framework to integrate the knowledge between operators and managers to

[4] Taylorism stands to Taylor theory which is linked to the concept of centralized and decentralized approach in the factories.

[5] 3 different types of structures not in the scope of the study which should be aligned with the decentralization and the change to secure a compatibility on Industry 4.0.

[6] Lewin concept in 1947 elaborated the three steps during the changes, Unfreeze, Change, Freeze

facilitate the shift for a best fit and good compatibility with the concept of Industry 4.0.

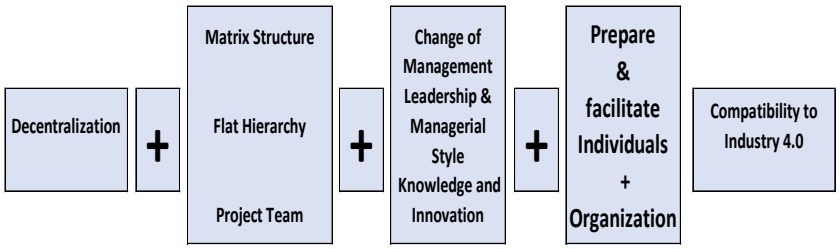


Figure 2 : Compatibility to Industry 4

5. METHODOLOGY

5.1 Research design and management instrument

All the hypotheses will be tested in an empirical study in a factory with 180 operators working on the production lines, out of which we will be testing samples of 50% representing 90 operators. In the data collection we are using an observation and mixed method along with collecting primary and secondary data. The Saunders Research onion illustrates the stages involved in the development of a research work and was developed by Saunders et al, (2007). There are many elements in the onion that could be used to do the research each one is based on the specificity of the field as well as the availability of the data. In the case of factory "M", the collection of data will rely of the five below elements (Mark Saunders, Phillip Lewis, Adrian Thornhill, 2007)

- Interpretive philosophy with no preconfigured assumptions.
- Mixed method methodology (both qualitative & quantitative with more focus on quantitative)
- Semi-structured interview techniques, survey, and archival research.
- Analysis of both qualitative & quantitative data
- Technique and procedures (special procedures for Factory M) with intervention research, interviews, using primary and secondary data from the factory.

An inductive approach to theory development, here we are moving from specific observations to broader overviews and theories. A mixed method is implemented by mixing qualitative and quantitative research. Management sciences are action sciences whose objective is to improve the performance of the organizations. (Savall et Zardet, 2004), however the intervention research fits more on the object and the cause of the research. It is an approach that incorporates basic science and to co-produce information with partners. In an intervention research, the researchers are responsible to introduce and acclimate management procedures and instruments, but also for bringing in lasting improvements in the way the organization works. (Plane, 2000). Intersubjectivity contradictory is a

"relevant solution, which consists of addressing the points of view" of each of the actors 'relative and subjective, by organizing and provoking interactions between actors with partially convergent and partially different points of view, even with different viewpoints conflicting with the players in the field, information is co-constructed, exchanges with them arise from awareness, this is the cognitive interactivity theory. Finally, generic contingency determines the potential mix of contingency and universalism: a hard generalized information heart, complemented by periphery knowledge contextual '. In fact, the application of this theory is made possible through adoption.

5.2 Sampling and data collection

It is necessary to acknowledge that philosophical differences are an inevitable part of business and management research to establish your own theory and plan your research project. (Saunders 2007). Looking at the facts that we rely on some theories and information from consultants and studies claiming that Industry 4.0 is the best path for a better profitability, that is a positivism approach. The study has been done on one sample. The sample is considered as a pilot which was the starting of the transformation in the factory, it represents 50% of the operators who works on the pilot line, total operators are 180 operators, 50% of them will be tested in two steps. Using quantitative and qualitative methods, with considering 9 months gap between the first and the second test. On top of that, interviews with 6 directors[7] took place, as well as focus group discussion with the transformation team. The Corporation started to invest in many dimensions in its structure, one of the changes is to put in place a digital system which allow to get a real time reporting on all the activities by each workstation and by each employee or manager working on the production line. A planning process with a deep dive study was presented to the senior management showing the benefits of implementing a fundamental shift in production. Therefore, the study will revolve on the output of the project and the feasibility on going further with other phases. In the research, we will be testing the impact of the transformation on the employees, how they will adapt on the changes and what is the level of success on the full aspect of the company, starting from the change of management to the cost of the investment and the productivity with all its associated costs. Having low reliable prior studies on how the factor of generations could play a role in the results on digital transformation and its impact on productivity, a mix method where it will combine the quantitative and qualitative data collection is more suitable. The triangulation concept stands for the usage of more than one method to validate and reassure that the information and the analysis and interpret them in a fairly matter. (Campbell & Fiske, 1959). The combination of quantitative and quantitative factor is the minimum prerequisite for a research to count as mixed techniques to be considered as a mixed method. Design, blended data and complementing analysis is not that much used frequently in the real practice. (Bazeley, 2009) It is especially important to properly prepare a primary mixed method research question. According to Mertens (2007), it is a necessity to design the research question in a mixed method to avoid facing a struggle in using a mixed method while the questions are designed to be either solo

[7] The interviews with the 6 directors are not in the scope of the paper.

qualitative or quantitative. Approaching the people on the field in the right way, collecting the information from different angles and in many aspects with a deep planning will facilitate the steps on analyzing those data. Why mixed methods and no single method? Other than the methodology and the epistemological foundations that might impact the method, the mixed methods could bring richness to the study by offsetting the weaknesses of each single method in complementing it with the strength of the other method, that is in a way or another a reduction of the risk of the non-reliable information (Jick,1979). The mixed method can help also to detect some unseen contradiction or even to find convergence in different angles which will turn the research more credible and valid (Denzin, 1978)

Factory "M", a manufacturer for industrial air conditioning has an average of 200 labors between permanent and temporary that are working on the production lines, that number includes supervisors, and managers. The thesis will work on a digital transformation which will take place from the fourth quarter of 2019 and will continue until its completion around the end of the year 2020. During our study, we will take into consideration the age, gender, experience of each of the labor and their interaction with the transformation. The distribution of labors is reported as the following and that will be the base numbers for our study.

Permanent field labor distribution for total factory

	Full year average headcount		
Age	Female	Male	Total
20-25	1	6	7
25-30	3	8	11
30-35	1	9	10
35-40		13	13
40-45	2	17	19
45-50	2	31	33
50-55	2	39	41
55-60	2	24	26
60-65		3	3
65-70		1	1
Total	13	151	164

Table 1 : Factory Headcount

The above numbers are the permanent employees, and we add around 43 temporary employees out of which 13% are females. The factory has 15 lines of production for different type of products, all the lines will be digitalized even with those there were not in the initial plan that doesn't have high volume to be considered feasible for such transformation. In the first phase, the sample will be limited to three lines and 3 sublines.

4.3 Data analysis

The data collection was done on several layers which covers managerial level, transformation team and archived data. The paper will focus on the semi-interviews and surveys with the operators that took place on one sample in two different timing and to revalidate the employee's adaptability on the system. Five variables were tested to validate the hypotheses. First variable is the generation of the operators, second variable is the experience of the operators, third variable is the individual impact by measuring the satisfactions and the motivations of the operators, last variable is the technology acceptance which measures the interaction and the knowledge of the operators on the new systems. All the variables were measured in questionnaire using specific instruments in Likert scale. The quantitative data was analyzed in SPSS system for the same sample on repetitive basis representing 50% of the operators.

4.4 Findings and discussion

The below results are preliminary and not yet fully analyzed, we assume using them as a first cut of the study with a link to the hypothetical overview. 20% of operators has never used an IPAD or Smart Phone in their lives. That number was significant results seeing the numbers of operators tested in the sample and taking into consideration of their experience in the factory M and their experience in life. When trying to correlate the operators that have never used a smart device, they were all falling under the category of >20 years of work experience and they are born between born 1946 to 1964 which are called the baby boomers.

We have split the sample into two groups, Group A who is considering that the system is exceptionally reliable, it has lot of benefits of having all the database digitalized and not needed to be used on hard copies, however it is sometimes creating delays due to technical issues that should be resolved in the coming future.

Group B who believes that the system is not reliable, it brings lot of complexity, and they prefer the old method using hard copies and signing off their work on papers. When looking at that group, it was mainly the same 20% that are not happy with the changes and resisting the changes for many reasons:

- Not able to adapt on new tool due to their age.
- Worried about losing their job or their losing their power on the production lines which is sourced from their own experience and knowledge on the production line.
- The system is creating lot of technical problems that they are not able to tolerate.

Those 2 groups were measured also on their motivation and their anxiety due to the technical issues despite the reliability of the program.

2 operators who were demotivated are mainly the same that were resisting the changes.

Int the qualitative (semi- interviews) 52% of the operators are motivated and enthusiastic, and 40% of the operators are worried and anxious which is a significant ratio but mostly expected as a reaction after a short period of the transformation.

The perception of the operators about the communication, training, and knowledge. To validate that the trainings and communications were held properly during the transformation period on the transformed lines, couple of questions were asked to understand the operators 'opinion. The results showed that only 4% were not satisfied with the communication and 8% not happy with the level of training. Both ratios are considerably low. On the other hand, all of them were claiming that they have good knowledge on the system after two weeks of going live. That means even those that they were not satisfied with the trainings, they were able to gain knowledge on the system, which contradicts with the idea the system is not intuitive or not easy.
The issue that during the first month and even until we were doing the quantitative research, the system is causing lot of technical problems. In the first two weeks and as per the operators, 84% confirmed that they are facing anomalies and out of those anomalies, 72% is due to technicality of the system and very few are due to quality or knowledge on the system. 100% confirmed that they were supported fairly by the transformation team whenever they have faced a technical issue or other obstacles.

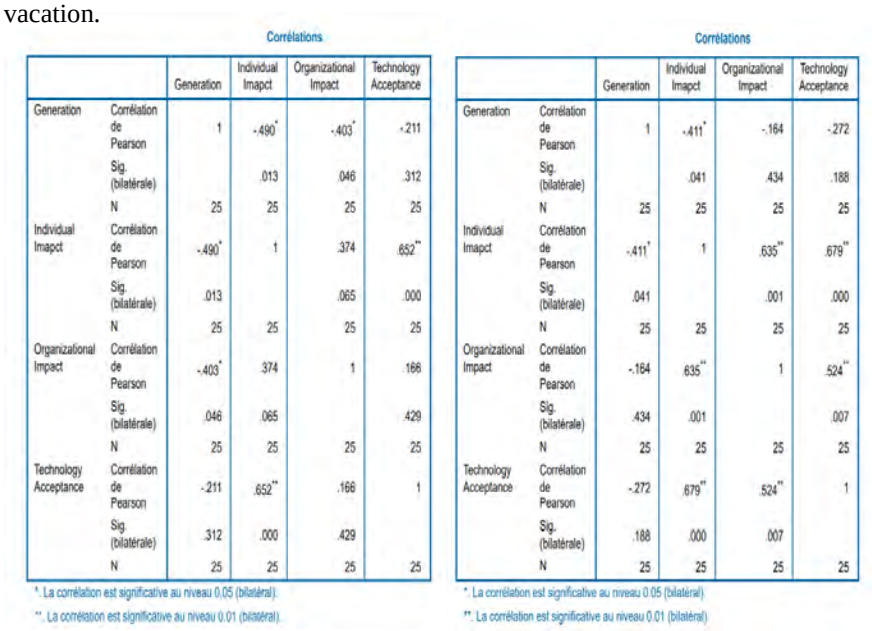
The perception of the operators concerning the management's decision.
In that part the operators were asked about their opinion if the company has gained or lost productivity due to the transformation and if such shift were good for the company.
There is a serious problem on the productivity from the perspective of the operators. The majority are facing serious obstacles during the production cycle, mainly due to technical problems, rules on the methodology of production and some elements which was not properly linked to the engineering system.
The above obstacles were tackled by the transformation team after that period and were resolved gradually by enhancing the system to get the aimed results.
Despite the conceptual results on losing productivity, 100% of the operators agrees that the new system should bring a strong improvement to the company, but the implementation is missing some steps. As per the operators, most of them claimed that the transformation team never heard to their proposals or did not involve them in the design phase where they could have avoided those problems.
Other observation from the field, more than 50% of the operators believes that the delay that is happening on lines of production is caused by their colleagues who are not admirably adapted or well trained to the system. Therefore, in the open-ended questions, 56% believes that the company took the right decision in implementing the system now and they feel proud to have their job changed to be more intelligent, 28% think that they are a bit late, where other companies has already shifted to some advanced systems since a while, only 16% did not have any opinion on such question.
Operators has proposed bunch of points during the discussions with them where most of them has agreed on carrying more tests before Going Live when they will implement the changes in the next phases.
Also, they do strongly recommend involving operators and consider their expectations, as mentioned above, that would help by reducing the blocking stage during the production cycle.
Another proposal is to increase the flexibility of the system where it should for example: allow having more than one operator on a workstation as it was the

case in the past, however the digital system is not permitting that now due to the rigidity of the system of for because of safety reason like having a welder and electrician working at the same time on the machine. (that was allowed in the past)

For some of the operators, additional training is extremely helpful to gain more knowledge and improve the speed of their colleagues.

Finally, some additional training sessions for the operators who could not join the standard training session. It is essential to do it even if that will shift the timing of

going live on the system, it is preferable to have extra session than going live with operators that have never seen the system because they were sick or on vacation.



Corrélations

		Generation	Individual Imapct	Organizational Impact	Technology Acceptance
Generation	Corrélation de Pearson	1	-.490*	-.403*	-.211
	Sig. (bilatérale)		.013	.046	.312
	N	25	25	25	25
Individual Imapct	Corrélation de Pearson	-.490*	1	.374	.652**
	Sig. (bilatérale)	.013		.065	.000
	N	25	25	25	25
Organizational Impact	Corrélation de Pearson	-.403*	.374	1	.166
	Sig. (bilatérale)	.046	.065		.429
	N	25	25	25	25
Technology Acceptance	Corrélation de Pearson	-.211	.652**	.166	1
	Sig. (bilatérale)	.312	.000	.429	
	N	25	25	25	25

*. La corrélation est significative au niveau 0,05 (bilatéral).

**. La corrélation est significative au niveau 0,01 (bilatéral).

Corrélations

		Generation	Individual Imapct	Organizational Impact	Technology Acceptance
Generation	Corrélation de Pearson	1	-.411*	-.164	-.272
	Sig. (bilatérale)		.041	.434	.188
	N	25	25	25	25
Individual Imapct	Corrélation de Pearson	-.411*	1	.635**	.679**
	Sig. (bilatérale)	.041		.001	.000
	N	25	25	25	25
Organizational Impact	Corrélation de Pearson	-.164	.635**	1	.524**
	Sig. (bilatérale)	.434	.001		.007
	N	25	25	25	25
Technology Acceptance	Corrélation de Pearson	-.272	.679**	.524**	1
	Sig. (bilatérale)	.188	.000	.007	
	N	25	25	25	25

*. La corrélation est significative au niveau 0,05 (bilatéral).

**. La corrélation est significative au niveau 0,01 (bilatéral).

Test 1 – After 2 weeks **Test 2 – After 9 months**

Table 2 : SPSS calculation

The correlation reflects an increase of decrease on the variables identified in the hypotheses, the increase indicates a positive impact where the decrease has a negative impact.

Results Test 1 - correlation between Generation and Individual impact

The result of the correlation was examined based on an alpha value of 0.05. A significant negative correlation was observed between Generation and Individual Impact (r_p = -0.49, p = .013, 95% CI [-0.74, -0.12]). The correlation coefficient between Generation and Individual Impact was -0.49, indicating a moderate effect size. This correlation indicates that as Generation increases, Individual Impact tends to decrease.

Hypothesis 1 is accepted.

Results Test 1 - correlation between Technology Acceptance and Individual impact. The result of the correlations was examined using Holm corrections to

adjust for multiple comparisons based on an alpha value of 0.05. A significant positive correlation was observed between Technology Acceptance and Individual Impact (r_p = 0.65, p < .001, 95% CI [0.35, 0.83]). The correlation coefficient between Technology Acceptance and Individual Impact was 0.65, indicating a large effect size. This correlation indicates that as Technology Acceptance increases, Individual Impact tends to increase. No other significant correlations were found.
Hypothesis 2a is accepted.
Results Test 2 Sample A - correlation between Generation and Individual impact
The result of the correlation was examined based on an alpha value of 0.05. A significant negative correlation was observed between Generation and Individual Impact (r_p = -0.41, p = .041, 95% CI [-0.69, -0.02]). The correlation coefficient between Generation and Individual Impact was -0.41, indicating a moderate effect size. This correlation indicates that as Generation increases, Individual Impact tends to decrease.
Hypothesis 1 is accepted.
Results Test 2 Sample A - correlation between Technology Acceptance and Individual impact & Organizational impact
The result of the correlations was examined using Holm corrections to adjust for multiple comparisons based on an alpha value of 0.05. A significant positive correlation was observed between Technology Acceptance and Individual Impact (r_p = 0.68, p < .001, 95% CI [0.39, 0.85]). The correlation coefficient between Technology Acceptance and Individual Impact was 0.68, indicating a large effect size. This correlation indicates that as Technology Acceptance increases, Individual Impact tends to increase.

Hypothesis 2a is accepted.
A significant positive correlation was observed between Technology Acceptance and Organizational Impact (r_p = 0.52, p = .007, 95% CI [0.16, 0.76]). The correlation coefficient between Technology Acceptance and Organizational Impact was 0.52, indicating a large effect size. This correlation indicates that as Technology Acceptance increases, Organizational Impact tends to increase.
Hypothesis 2b is accepted.

Companies do not always succeed to implement new technologies on their production lines, that would not let them achieve the aimed return on investment from the new systems and which will result to a system that is underused. (Poulymenakou & Serafeimidis,1997).
To summarize the upper points, we can consider that the second qualitative test has validated the results, and it has given the same results after 9 months of the implementation. Clearly, the implementation of the new technology has faced some major obstacles by having from one side is negatively on the individuals driven by the generations and on the organization driven by the technology itself. The individuals have been impacted a lot by the generations where both the qualitative and quantitative results have validated the theory of reasoning and speed are highly influenced with age in the studies of Salthouse 1997, also the observations from the operators on the productions lines when they see how their colleagues are slower than the others and they are blocking the production lines due to their low adaptation on the system.

Also, the study of (Dalton and Thompson,1971) that described how the operators starts to lose their productivity from the age of 40s and more. The ambiguity stays on the satisfaction of the operators where all of them are open for the change, they want to work in a smart factory and have an up-to-date position, that trigger us as researchers to go further and check what was the role of leadership here, how did they alleviate and facilitate the transformation for different generations along with checking what was the impact of technology on the individuals.

Results showed in both test that the impact of technology acceptance was correlated positively with the digitalization and the move to Industry 4.0. That confirms two things, from one side that most of the operators are accepting the new technology except the baby boomers where they more not easily adapting to have everything digitalized and they do prefer to go back to their papers and noting down using pen, and the second thing the theory of responsiveness to new knowledge to daily work improve the productivity by being more motivated during the working hour (Rosenberg, 1965). Part of the change of management, the majority operators has appreciated the support of the transformation team and they were happy and satisfied in the level of training, communication, and support during anomalies on the production lines. Management has put lot of efforts by doubling the shifts, increase the presence of the transformation team by being present on the production lines from 5:00 am and be available for any issues that might to avoid any delay on the production.

Last portion on reading the result was the impact of technology acceptance of the organization. The result was having an inverse relationship where the questions showed that the technology has been well accepted, the implementation was fairly recognized from all levels, however that has affected the organization negatively.

Diving into the causes, the major reasons is due to dysfunction of the system which has led to a big loss in the total factory productivity. The factory productivity is measured in the level of the output of the manufactured machines. The operators are open for the changes, they want to system to work efficiently however there are many steps which are missing in the implementations. As per the operators, the low batteries of the tablets, the non-coherence between the digital steps and the manufacturing methods and the flexibility of the system were the main causes that has delayed the manufacturing process. Those issues were a strong driver for the operators to avoid the connectivity on the system and try to continue working on the old method, however they do connect at the end of the task by updating manually the system which is fully contradicting with the purpose of having the digitalization and the concept of the Industry 4.0. Major implication will be by creating a gap between working hours and connected hours, that is another mindset that the management needs to work on with the operators to convince them how important to be connected and keep the live manufacturing system.

The dysfunction of the system and the impact on the organization has a strong link with the third hypothesis; how management control the cost savings where at the same time they are stuck in a loop with the problem on the system which is directly impacting the productivity. Here we go back to the theory of regulation is how the work situation absorbs and corrects the impact of a dysfunction (Savall & Cappelletti, 2018). The calculation of the hidden cost is not in the

scope of the paper, nevertheless, the analysis of the system dysfunction will help to identify the problem on the current processes and improve them. Such process improvement will require a strong involvement of the management within the same time of the study. Management must be aware of the obstacles, work and rectify them within the transformation itself.

6. CONCLUSIONS

The papers were focused on the transformation to Industry 4.0 concept with a focus on digitalization. The studies reflected how strong managerial skills and lot of preparations prior to the transformation is essentially required. Management is supposed to facilitate the environment and study the implications of each step that could recur due to the shift. This research did not find sufficient empirical proof about the factory productivity which derives the profitability and the return on the investment. Probably factory M is still premature and not ready to secure a full operational transformation, therefore the harvest of profitability is early to be measure. The paper encourages potential observational studies on the impact of organizational behavior, productivity, and consistency. Longitudinal studies would be helpful in analyzing the results in technologies on both people and the company. Managerial practices and philosophy will be needed to support the change of processes, facilitating a better shift on the whole method of infrastructure decision-making, from planning to execution to respect the frame of the compatibility to Industry 4.0.

REFERENCES

Baltes, P. B. and U. Lindenberger 1997. “Emergence ofa Powerful Connection Be- tween Sensory and Cognitive Functions Across the Adult Life Span. AnewWin- dow to the Study of Cognitive Aging?”, Psychology and Aging, Vol. 12, No. 1, pp. 12–21.

Bazeley, P. (2009), “Editorial: integrating data analyses in mixed methods research”, Journal of Mixed Methods Research, Vol. 3 No. 3, pp. 203-7

Campbell, D.T. and Fiske, D.W. (1959), “Convergent and discriminant validation by the multitrait-multimethod matrix”, Psychological Bulletin, Vol. 56, pp. 81-105.

Chattopathyay, S., & Pareek, U.R.(1982). Implementation ofchange in organizations, manag- ing organizational change, Oxford & IBH

Dalton, G. W. and P. H. Thompson 1971. “Accelerating Obsolence of Older Engi- neers.”, Harvard Business Review, Vol. 49, No. 5, pp. 57–67

Davis, K. (1994). Human behaviour at work. New Delhi: Tata McGraw Hill

Denzin, N.K. (1978), The Research Act, McGraw-Hill, New York, NY

Dolchinkov, N., & Tarnovo, V. (2018). Сертификат Industry 4.0. January, 34–36.

Drath, R., Horch, A., 2014. Industry 4.0. Hit or hype? IEEE Ind. Electron. Mag. 8 (2), 56–58

Drucker, P. F. (1998). Management’s new paradigms. Forbes Magazine, 10, 98.

Ernst, C., & Yip, J. (2009). Boundary spanning leadership: Tactics for bridging

social boundaries in organization. Crossing the Divide: Intergroup Leadership in a World of Difference, 1–18.
Ford, J. D., & Ford, L. W. (2012). The leadership of organization change: A view from recent empirical evidence. Research in Organizational Change and Development, 20(July), 1–36. https://doi.org/10.1108/S0897-3016(2012)0000020004
Frederick, T. (1911). The principles of scientific management: New York: Harper and Row.
Ghani, K. A., & Jayabalan, V. (2000). Advanced manufacturing technology and planned organizational change. Journal of High Technology Management Research, 11(1), 1–18. https://doi.org/10.1016/S1047-8310(00)00018-3
Haeger, D. L., & Lingham, T. (2014). A trend toward Work-Life Fusion: A multi-generational shift in technology use at work. Technological Forecasting and Social Change, 89, 316–325. https://doi.org/10.1016/j.techfore.2014.08.009
Haipeter, T. (2020). Digitalisation, unions and participation: the German case of 'industry 4.0.' Industrial Relations Journal, 51(3), 242–260. https://doi.org/10.1111/irj.12291
Horn, J. L. and Raymond B. Cattell 1967. "Age Differences in Fluid and Crystallized Intelligence.", Acta Psychologica, No. 26, pp. 107–129
Hoyer,W. J. and A. E. Lincourt 1998. "Aging and the Development
ofLearning.", ch. 13 in M. A. Stadler ed. Handbook ofimplicit learning, Sage
Publications, US, pp. 445–470
Jick, T.D. (1979), "Mixing qualitative and quantitative methods: triangulation in
action", Administrative Science Quarterly, Vol. 24 No. 4, pp. 602-11.
Mark Saunders, Phillip Lewis, Adrian Thornhill. (2007). Research Method for Business Student, 4th edition.
Mertens, D.M. (2007), "Transformative paradigm: mixed methods and social justice", Journal of Mixed Research, Vol. 1 No. 3, pp. 212-25.
Nemetz, P.L., & Fry, L.W. (1988). Flexible manufacturing organisations: Implications for strategy formulation and organisation design. Academy of Management Review, 13, 627–638.
Peterson, E. (2015). Generations at work: what are we really talking about? Cookross.com. Retrieved August 28, 2016 from: http://cookross.com/blog/generations-at-work-what-arewe-really-talking-about/
Plane J. M., Méthodes de recherche-intervention en management, l'Harmattan, Collection Économiques, Paris, 2000, 256 pages
Poulymenakou, A. and Serafeimidis, V. (1997) Failure and Lessons Learned in Information Technology Management, Volume 1, Number 3, 1997, pp. 167-177(11)
Preece, D. (1995). Organisation and technical change. London: Routledge.
V, U., & Rosenberg, N. (1966). Adam Smith on the Division of Labour: Two Views or One? *Revista Mexicana de Sociología*, *28*(1), 196. https://doi.org/10.2307/3538874
Price, S., & Around, R. (2017). Volume 24 (1) The Impact of Hidden Costs on Production and Operations 1-20 Factors Influencing Purchase of Smart Appliances in Smart Homes 52-63. 24(April). https://doi.org/10.13140/RG.2.2.21769.75360

Rosenberg, N. (1965). Adam Smith on the division of labour: two views or one? Economica, 32(126), 127-139.

Saunders, M., Lewis, P., & Thornhill, A. (2007). Research methods for business students (4th ed.): London: Prentice Hall.

Savall, H., & Cappelletti, L. (2018). Le coût caché de l'absentéisme au travail. Institut Sapiens

Savall H., Zardet V., Savall H., Zardet V., Recherche en sciences de gestion : approche qualimétrique, observer l'objet complexe, Économica, 2004.

Shamim, S., Cang, S., Yu, H., & Li, Y. (2016). Management approaches for Industry 4.0: A human resource management perspective. 2016 IEEE Congress on Evolutionary Computation, CEC 2016, July, 5309–5316. https://doi.org/10.1109/CEC.2016.7748365

Skirbekk, V. (2004). Age and Individual Productivity: A Literature Survey. Vienna Yearbook of Population Research, 1(2004), 133–154. https://doi.org/10.1553/populationyearbook2004s133

Sridhar, S. (2019). Leadership Role in Making Effective use of Innovation in Industry 4.0. International Journal of Recent Technology and Engineering, 8(4S3), 256–260. https://doi.org/10.35940/ijrte.d1050.1284s319

Thun, S., Kamsvåg, P. F., Kløve, B., Seim, E. A., & Torvatn, H. Y. (2019). Industry 4.0: Whose revolution? The digitalization of manufacturing work processes. Nordic Journal of Working Life Studies, 9(4), 39–57. https://doi.org/10.18291/njwls.v9i4.117777

Verhaeghen, P., & Salthouse, T. A. (1997). Meta-analyses of age-cognition relations in adulthood: Estimates of linear and nonlinear age effects and structural models. Psychological Bulletin, 122(3), 231–249. https://doi.org/10.1037/0033-2909.122.3.231