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DIGITALIZATION IN INDUSTRY 4.0: THE ROLE OF MOBILE DEVICES

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Abstract: *We live in the era of the Fourth Industrial Revolution (I4.0), where physical development has slowed down, and digital development takes most of its place. If we look at our own lives, we see that we are using digital technologies almost every part of our life already. If we use its potential, we can highly increase our performance and efficiency. Nowadays, every part of a modern business is controlled by an Enterprise Resource Planning (ERP) system, which needs huge variety of digital devices. Most of the companies use their system access points as stationary machines or some mobile devices for higher ranking employees. In this paper we give an example what will happen if every company worker has access to the system through mobile devices, where we consider the Return of Investment based on standard data, that can be collected in every company.*

Key words: *Digitalization, Industry 4.0, Mobile devices.*

Digitalizacija u industriji 4.0: Uloga mobilnih uređaja. *Živimo u eri Četvrte industrijske revolucije (I4.0), gde se fizički razvoj usporio, a digitalni razvoj zauzima većinski deo. Ako pogledamo sopstveni život, vidimo da već skoro svaki deo svog života koristimo digitalne tehnologije. Ako koristimo njihov potencijal, možemo veoma povećati naše performanse i efikasnost. Danas je svaki deo savremenog poslovanja kontrolisan ERP (Planiranje resursa preduzeća) sistemom, za koji je potrebna ogromna raznolikost digitalnih uređaja. Većina kompanija koristi svoje sistemske pristupne tačke kao stacionarne mašine ili neke mobilne uređaje za zaposlene višeg ranga. U ovom radu dajemo primer šta se događa ako svaki radnik kompanije ima pristup sistemu preko mobilnih uređaja, pri čemu smatramo povraćaj ulaganja na osnovu standardnih podataka, koji mogu biti prikupljeni u svakoj kompaniji.*

Ključne reči: *Digitalizacija, industrija 4.0, mobilni uređaji.*

1. INTRODUCTION

The world we live in is changing faster than ever [1]. These are the keywords of new business: Smart factory, Internet of Things (IoT), mobility, Big Data, virtual & augmented reality, and social media, that took the companies into the next level in digital customer responsibilities, IT-based business processes, products, and services, M2M connection, human-machine collaboration, Digital Twin, Ai enhanced systems, High-end simulation etc…[2]. In almost every industry the digital technologies are bringing on an unprecedented transformation: changing our work and lives as we have never expected before[3]. Through the network the boundary between the physical, digital and biological principles blurs [4].

The aim of our paper to present the opportunities of the digitalization. We created an interface where each company can use the test their own personalized model variant we have created. In this paper we chose an example company, where we gathered two kinds of data [5] of the whole process: indicators and questionnaires. The indicators are mostly from production and logistic processes completed with costs. The other type of data was gathered with the help of a questionnaires and with an evaluation technique converted to quantified information. Our aim is to show how equipment from the new highly digitalized era can increase efficiency in our workplace, especially in terms of time saved.

2. DESCRIPTION OF THE METHOD

The aim of the research is to make a cost determining calculation, that can use by most of the companies with high reliability, so they can calculate their own return of investment (ROI) [6]. For this we use an example factory, to show how our model and calculation works. This chapter presents the introduction of the audited digitization in a generalized case:

1. Demand survey (employee questionnaire)
2. Market research of the devices (quality, quantity, discounts, maintenance. etc…)
3. Collection of data required for calculation (number of employees, fluctuation, wages, etc.)
4. Fill in the Excel interface
5. View results

The first step is to can determine what kind of equipment your employees need based on an assessment of employee demand. These can be: phones, tablets, mobile computers, smartwatches etc… After that, as the type of devices determined you need to find out its cost and service background in the market. The calculations must complete for both high ranking managers and other employees. Managers have the opportunity to choose premium devices, so they need another survey to determine their needs. For calculation, the pre-mentioned data must be collected, such as number of employees, fluctuation, hourly wage, etc. Once this is done, you need to fill in the Excel interface.

Immediately after the completed interface, the results are displayed as representative numbers and shows you diagrams. The monthly fee can be optimized by Solver or by trying out numbers for premium device users.

3. CASE STUDY

Based on the the model, basically any company can create these calculations for their own profile for any new device, which can save some time. We use an example company to demonstrate the model and method.

3.1 The organizational structure of the company

The company in average employs 1000 people:
The organizational structure:

- Director: 1 person
- Top manager: 20 people
- Middle manager: 70 people
- Team leader: 140 people
- Operators 769 people

3.2 Evaluation of the questionnaire

The aim of the research is to build a company where the full potential of digital devices is utilized, both by employees and managers. A survey of the current situation took the form of a questionnaire and a possible digitally developed company was modelled based on the responses. 139 responses were received to the survey. The first question of the survey aims at their current job and where they would like to work in the future. The result shows that 30% of the respondents work or would like to work for a multinational company. Based on this, the fictitious company we created is also multinational. The following diagram was made of the digital devices used in daily work based on the answers of the respondents:

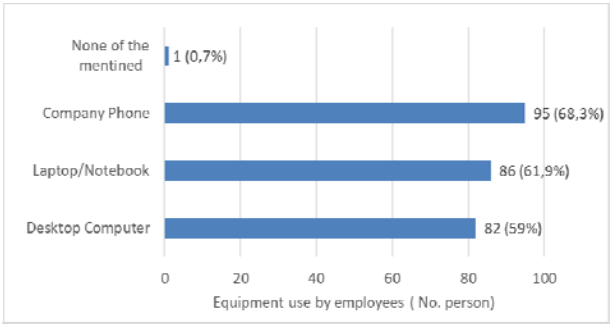

Fig. 1. The use of digital devices for work

According to the company rank, the percentage of cell phones usage:

- Top managers: 100%
- Middle managers: 100%
- Team leaders: 100%
- Operators: 61%

We wrote cell phone and not smart phone on purpose, because there are some people who don't want to use them for anything other than making phone calls, mostly in the ranks of employees.

We also considered to determine the type of cell phone in the questionnaire. Based on those who completed the questionnaire, most people chose Apple branded devices. This is important data for further calculations, as I chose devices from the Apple catalog [7].

The next question was about the usage of the phone applications. Based on the responses, the following applications were being used:

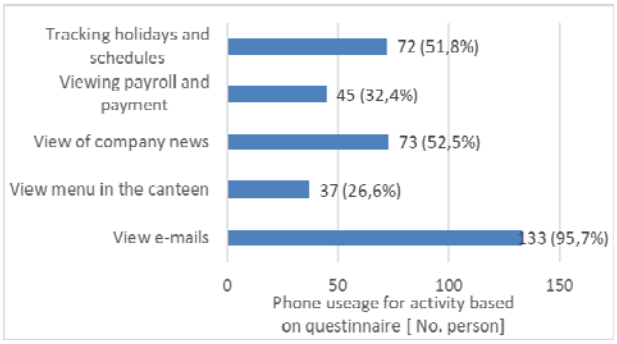

Fig. 2. Other usage of the corporate phone

4. RESULTS OF THE TESTS

With the applications mentioned above, the employees can save several minutes during the day. This way, there is no need to turn on your computer or laptop to view the email, just view it from the phone. These are the measurement of time savings with digital devices from 10 employees.

Laptop	Activity	Smart phone
862 sec=13,7 min	View e-mails	372 sec= 5 min (daily 5 times)
31,3 sec 342,6 sec (walk time)	View menu in the canteen	9,3 sec (daily 1 time) 18,2 sec (daily 2 meals)
52,6 sec	View of company news	18,6 sec (daily 2 times)
31,3 sec 321,3 sec (walk time)	Tracking payroll, holidays, schedules	9,3 sec (daily 1 time) 9,3 sec (daily 1 time)

Table 1. Application usage times

To calculate the results, we calculated the average monthly wages based on the data of the KSH (Central Statistical Organization). According to the KSH's data from August 2019, the average net salary is 680 EUR. Based on the calculations, employees receive 90% of this amount, team leaders 120%, middle managers 180% and top managers 300% [8].

Average monthly wages:

Top manager: 2170 EUR
Middle manager: 1300 EUR
Team leader: 870 EUR
Operator: 650 EUR

These average wages can be adjusted by other companies with the appropriate data.

With these data, we can calculate the average daily, monthly and yearly time saved by these devices, and after that we can determine the saving for the whole company.

Employee with a laptop:

Daily time savings: ~ 10 min
Monthly time savings: ~ 4 h
Monthly cost savings: ~ 4850 EUR

Employee without a laptop:

Daily time savings: ~ 15 min
Monthly time savings: ~ 5 h
Monthly cost savings: ~ 15100 EUR

Employee with a Phone:

As a result of the calculations, two types of phones were selected. Basic smart devices that everyone gets and high-end devices that middle managers or higher can choose for a monthly fee.

- Basic category phone: Iphone 6S 360 EUR
- High-end phone: Iphone XS 1090 EUR[7].

4.1 Creating scenarios

In the next step we defined 3 scenarios:
Scenario I: All employees choose the base unit
360000 EUR
Scenario II.: Half of the executives choose a premium category phone
392850 EUR
Scenario III.: Every leader chooses a premium phone
425700 EUR

The first scenario would be the most beneficial investment for the company, as in this case everyone among the executives would choose the base unit. The second scenario represents a more realistic case, where half of the executives would choose a premium category phone, while in the third case, all leading executives would choose a premium category phone, thus increasing the amount of investment the company invests in digitalization.

The ROI chart has been created, where the company can determine the approximate time of the return of investment in all three scenarios.

The investment in the phones would start in January of 2020, so the results are compared to that. The charts do not show the income, only the time saved by phones proportioned by the revenue.

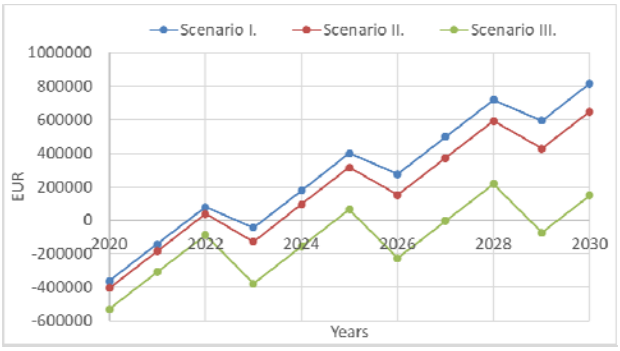

Fig. 3. Return of Investment, basic calculation

Several factors have been considered in the model, such as:

- Rate of fluctuation of the company on an annual basis. For this, we used 10% rate, so in this case, there are 100 persons leave the company and the same amount start work there.
- With the fluctuation of employees every year there are 100 used phones. There are two ways to calculate with this:
  - give the used ones to newcomers, and after the 3-year lifetime of the phone, the company buy new ones.
  - or sell the used ones to the leaving employee or third party for a fraction of its original price, then buy new phones to the newcomers. We use this perspective, where we sell the used phones for half of their price.
- Amortization of the phones. The average useable lifetime of a smartphone is around 3-4 years. In this model we calculated with a 3-year lifespan, so every 3 years new purchases occurs [9,10].

Fig 3 shows the balance between the investment in phones and the financial gain due to eliminating unnecessary working times with the 3 scenarios. Between the first and second scenarios there are no big difference, and mostly the financial gain goes upwards with time. The ROI in these cases are between 2022 and 2023, so approximately 3 years. The third scenario in the other hand shows very little gain, with a small increment each year. The ROI doesn't show up in this diagram summarizing the next 10 years. This means we don't recommend buying every higher-ranking manager premium phones, unless the company can cut somewhere the expenses.

As the price of the premium devices would be recouped with a very long time, we use another tool to make our own calculation to hasten the ROI. The SOLVER extension of the MS EXCEL program was introduced for this problem. We suggested that the savings after the 10th year be basically the same for all scenarios. Thus, whichever manager chooses the premium category device will have a monthly fee, so the two types of devices would pay off almost simultaneously. After using the SOLVER extension, we calculated that 23 EUR monthly fee is needed from premium phone users to cover the remaining expenses. This can be seen in the following chart:

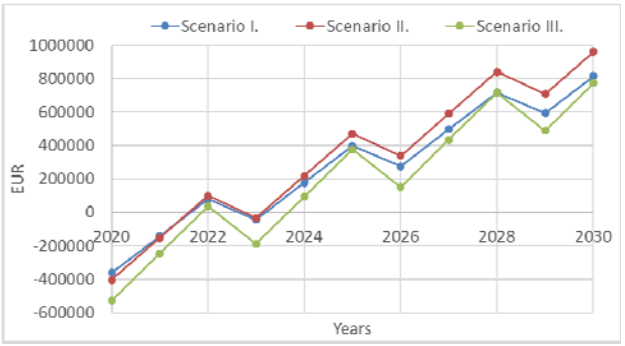

Fig. 4. Return of Investment with monthly fees

In this case, we also considered the fluctuation, the amortization of the phones and the monetization of the used phones, like in the previous case.

Fig 4 clearly shows the ROI on all scenarios between 2023 and 2024. In the case of scenario I. and II. there are almost a ROI after the second year, but the company must by the new phones in 2023.

There are two important factors that we don't built in our calculation, because it is uncertain, or it highly depends on the company. One of these are the financial changes of the value of the country's currency (inflation

or deflation). In the past years this factor was very stable, but in the early 2000's a huge market decrease occurred. Right now, the COVID-19 epidemic creates a bad mark on the whole world's economy. This can disturb the cost and wage calculation. The other important factor is the future changes in the company. We couldn't calculate with expansion or downsizing, neither with building new factories nor outsourcing activities. These are the two main factor, that we cannot calculate, but any company can easily update the spreadsheet with these information's, if they have knowledge of the future.

5. SUMMARY

The aim of the research was to illustrate and motivate the role of digitization in process development. This research cans show companies that digital devices for employees is this modern era is a must have, not just because a it is going to be a standard, but from financial gain also. We show in an example company with a very average structure, that modern devices can save time and with that also save money. In this paper we didn't include the development cost and effect of application for phones and computers develop by the company, but that is the next step. The goal of digitalization with the principles of Industry 4.0 is a fully developed and transparent system, where everyone who has permission can see the physical processes digitally (Digital Twin), and if needed the person can intervene in the process, based on indicators and feedback of the system [11,12].

This paper contains the extract of a dissertation for Scientific Student Circle Competition created in the Institute of Logistics of the University of Miskolc. This work can serve as a basis for further research.

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