

APPLICATION OF THE AUTOMATION READINESS CHECK (ARC) – METHOD OF QUICK ASSESMENT OF THE ENTERPRISE’S READINESS FOR AUTOMATION – CASE STUDY

ABSTRACT

Background: The turbulent environment in which production companies operate today has forced them to constantly improve processes. Fast-paced technological advancement bring new and strong wave of disruption. New business models emerges, customization of products is increasing and the supply chain is getting shorter. Taking into account lack of human workforce, to successfully compete in such environment, production companies are investing in the industrial automation. Implementation of such solutions require knowledge not only in the technological and IT areas, but it also require a broader insight into the management, finance and human resources. Based on company’s study, authors of the article show the rapid and repeatable method of assessment all of the indicated areas.

Method: Authors built audit method based on lean management, six-sigma, change management and theory of constraints problem identification, using interviews and observation mixed with data gathering and analysis from the ERP class system.

Result: Audit report which indicates main areas that need to be improved before implementing industrial automation solutions with the sequence of these improvements.

Conclusion: Considering quickness and repeatability of the Automation Readiness Check method in data gathering and analytical areas it brings clear view of constraints and risks that are shown to the enterprise in such a manner, which gives a clear direction of the process and management improvement efforts. Usage of proposed method gives the enterprise capability of assessing the business benefits and risks associated with industrial automation on a multithreaded basis.

Keywords: industrial automation, automation, audit, process improvement, Industry 4.0, change management

INTRODUCTION

This article is presented as a business case. Business means that organization is pursuing goals measured by its performance, for example by EBITDA or any other commonly related to profit [Paris, 2017]. One of the key ingredients to become and stay profitable is to utilize the innovative technological advantage aligned with the company's strategy goals [Bisack, 2013]. Decision about technological advancement should be considered after ensuring that there is no known other option to reach company's goal in the faster and more efficient manner, including maintaining older technologies [Chambers, 2004]. It may be efforts targeted at internal operations, for example Six Sigma to reduce errors [Antony, Forthun, Trakulsunti, Farrington, McFarlane, Brennan, Dempsey, 2019] or external conditions, like remaining in line with market demands by changing the offering. When company reach clarity strong enough to choose technological advancement - and this decision can be accelerated by using OODA loop [Eisenbart, Ranscombe, Vettorello, 2019] - it should proceed with momentum and be sure that it is prepared on the multithread basis, considering finance, human resources, processes and IT readiness. The Automation Readiness Check method presented in this article give the company fast and clear answer what and when should be improve to start fast and efficient technological change and achieve benefits aligned with strategy goals.

AUTOMATION READINESS CHECK (ARC) METHOD DESCRIPTION AND IMPLEMENTATION

The purpose of the analysis is to indicate what and when should be changed to achieve readiness for automation. Value for the entrepreneur is not only the assessment of the current state, but also the ability to verify progress and the possibility of comparative analysis with other companies. For this reason, the entire analysis has been reduced to one number showing the current level of readiness for automation. This number is the average derived from the assessments of the five main areas studied by the ARC method: management, people, processes, IT and finance. Individual grades are in the range of zero to five with one decimal place, where 5 is the top score and indicates that organization is in the state of readiness to implement rapidly automation of processes and where 0 means that organization has to work through the whole spectrum of organizational and management changes to be able to invest in industrial automation without losses in profit and without putting at risk morale of the whole crew [Korbelak, Dressel, Band, Blanchard, 2018]. Description of each of the strengths and weaknesses is attached to the assessment of each category. The next pages of the article will present in detail the research methods used in each category. In addition to numerical assessment, one of the main elements of

the report's results is the automation road map. It indicates specific actions in the above-mentioned five main categories. Combining these activities on one document allows for a holistic view of the required changes in the enterprise along with their placement on the timeline. The automation roadmap [Reitze, Jürgensmeyer, Lier, Kohnke, Riese, Grünwald, 2018] is being prepared as the last element due to the required expertise of professionals involved in business transformation. Automation road map does not affect the assessment of mentioned above five categories on a scale of 0-5.

Management. The rating on a scale of 0-5 in the area of management is calculated on the basis of the average of four sub-areas surveyed in this category: strategic goals, main problems, main initiatives and new opportunities [Wadström, 2019].

Data on strategic goals, main problems and initiatives are collected in the form of structured interview. The frame for filling in the data is the "strategic development tree". Filling the tree consists of collecting answers during three series of questions addressed to senior management:

1. What are the strategic goals and what measures indicate their achievement?
2. What are the main problems affecting the effective implementation of the above objectives and how are their impact measured?
3. What are the main initiatives the company undertakes to overcome problems affecting the implementation of strategic goals and how is the progress of the initiatives implementation measured?

The assessment of this area is based on the correlation between goals, problems and current and planned initiatives as well as the existence and selection of indicators assessing their effectiveness.

Gathering information about new opportunities is done by means of unstructured interview and brainstorming, which results in a list of ideas for the use of future automated production. The assessment of this area is based on a range of ideas that define the top and middle management awareness of the benefits resulting from automation.

People. The key ingredient to any change initiative are people. People have a limit to participation in change [Georgalis, Samaratunge, Kimberley, Lu, 2015]. Therefore, when launching subsequent initiatives, it is necessary to specify where the limit is, whether and when it will be exceeded, and how to regulate its level [Cummings, Bridgman, Brown, 2016]. To answer this question and assess people's willingness to change on a scale of 0-5, the study draws an average of the ratings of individual areas such as: the limit of assimilation of changes, method and frequency of communication, readiness to work with machines, readiness to change position

and work mode, dismissal process [Wyonch, 2018]. In addition to bring boarder perspective, ARC shows the type and scale of change resistance [Campbell, Carmichael, Naidoo, 2015] using the tree map chart. Each area is assessed during structured interview.

The limit of assimilation of changes. To assess the level of adaptation to changes, a list of initiatives collected during the management area research is used. Each of the initiatives is assessed during an interview with top management in terms of: impact on the level of employment, sense of stability of employment, morale and commitment, skills development. The above features are described as an increase (1), no change (0) or a decrease (-1). If the sum of the four traits is equal to or lower than zero, the initiative is marked as reducing the level of absorption of changes. In addition, each of the initiatives is applied to the timeline, thanks to which an image is created indicating specific areas in time in which the number and nature of initiatives significantly exceeds the level of stress associated with changes (in which case the overall score is reduced) and indicates the time when the introduction of activities related to preparation for automation is optimal.

Method and frequency of communication . To assign scores to methods and frequency of communication a list of initiatives collected during the management area research is used again. Each of initiatives is assessed during an interview with top management in terms of type of communication and frequency. The types of assigned messages are sorted according to the effectiveness of reaching, from the most effective (score 5) to less effective (score 0): learning through practice, workshop, training, meeting, teleconference, telephone conversation, e-mail. Frequency of the assigned message: none (score 0), once, once a month, once a week, on a regular basis (score 5). The type and frequency of communication form a matrix on which the evaluated initiatives are placed. An average is drawn from each axis, from which the average is the result used as a component of the result of the entire area of the assessment of people's preparation for automation.

Readiness to work with the machines. This area of the study is evaluated by an interview with the production or shift manager who has direct contact with production employees. Based on the manager's assessment and the existence of skills management tools, such as a skill matrix or work culture based on mentor-student relationships, the areas are rated on a 0-5 scale.

Readiness to change position and work mode. Although the method of assessing the indicated area is identical to the one described in the previous point, the difference is that the previous area focuses on the employees' skills to handle more advanced operations. This area, in turn, assesses how efficiently employees are able to change jobs, regardless of the difference in

the difficulty of performing tasks and the environment, such as changing brigades, switching to night work, etc.

Dismissal process. This area score is the sum of five sub-areas. Each of them is marked as 0 or 1, depending on its existence in the organization. Interview is conducted with top HR manager and the production director. Five sub-areas are: a written and functioning employee dismissal process; cooperation with employment agencies when looking for a new job for a dismissed employee; methods for verifying employee needs met by employment agencies; security package for dismissed employees (e.g. periodic, longer than the statutory continuation of health insurance); written and functioning process of transferring employees to another position or to another company unit.

Type and scale of change resistance using the tree map chart. This assessment does not affect overall People area score, it has opinion-forming value and it is used by the experts to form automation road map. List of resistance to change is created. Then each of resistance is scored from 1-5 and the type of resistance is assigned, which are:

1. Technical resistance - a part of the methods used, the acquisition or understanding of which is crucial in implementing changes may constitute a barrier for future participants.
2. Management resistance - arises as a result of an inefficient way of managing change, e.g. imposing change and communicating change, e.g. when the message about upcoming initiatives is not clear, but passed between employees by guess.
3. Organizational resistance - is born among employees who, noticing the process of change being started in their environment, feel anxiety caused by the fact that they are not the authors of the implemented solutions. In their opinion, it risks losing control and prestige.
4. Individual resistance - the nature of this resistance is related to the level of stress in the life of each employee. If the employee is overloaded with stress in his private life, he will look for a sense of stability at work. If he doesn't find him here, he'll resist the changes ahead. Such resistance can be fueled for example, gossip passed on between employees regarding changes, excessive workload of the employee, etc.

Each type of resistance is marked by specific color. In this way the tree map chart represent score in form of surface area of each type of resistance combined with surface color.

Processes. Processes are assessed in terms of: process automation potential on a 0-5 scale, the financial potential of automation on a 0-5 scale. The results are presented in the form of a simplified layout of the hall with marked processes. The average of both types of features

indicated above for each workstation is drawn. From the individual assessments obtained in this way, an average is derived, representing the overall assessment of the process area.

Process automation potential. To assess the process potential of automation, each workstation is evaluated on a 0-5 scale for:

- **Stability.** Data collected during observation; existence of a process management system such as standards, process change management, process maps, visual management, 5S, CI, TQM, WCM, Lean, 6S, PDCA, exception management; data collected: number of failures, downtimes [Ibrahim, Chassapis, 2017].
- **Repeatability.** collected data from the system or during observation: the number and time of changeovers for another type of the same product, the number and time of changeover for another product.
- **Flow efficiency.** Data collected during observation or from the system. How much time will it take to process stock (work in progress) accumulated before and after the workstation, whether the workstation was working during the observation (0/1). Inventory data is used in a comparative form between workstations, where a high stock of work in progress in front of the workstation indicates a potential bottleneck [Kovács, Kot, 2017].
- **Need for improvement.** Expert assessment regarding the need to introduce organizational changes to optimize work in a given work position [McLean, Antony, Dahlgard, 2017]. Based on observation and evaluation results of the previously described feature: stability.
- **The level of automation.** Data collected during observation: automated = no human intervention (rating 0-1); semi-automated = human together with the machine (rating 2-3); manual = no machine involved (rating 4-5); Collected data during the interview, which will be used in the financial assessment of the potential for automation: the number of employees per workstation + average employee cost.
- **Maintenance.** Data collected during observations and from the system: are they KPI (Maintenance Department) - if yes, what they represent, how they are managed. Visual management, way of receiving information about a failure, time from failure to notification, queuing of notifications (including priority), response time, ability to operate automated workstations, is maintenance process outsourced and if so is there a fixed response time and how it is checked.
- **Process ergonomics.** Data collected during observation, during interviews and the system: impact of the environment on employees' health (harmful body position during work,

noise, dustiness, etc.); accident in the production hall, the number of days on sick leave expressed as a percentage of available working days, salary supplements related to harmful working conditions. The better the conditions, the lower the evaluation of automation potential [Del Fabbro, Santarossa, 2016].

- IT infrastructure. Data collected during observation and interview: presence of sensors, controllers, control cabinets, IT connections at the workplace. Assessment of the ability to connect IT infrastructure.

The results of the automation potential are presented on a matrix in which the columns represent the features described above, and the rows represent specific processes. For easier presentation of key areas to change, gradation of colors corresponding to the rating scale was used: 0 - red, 5 - green.

The financial potential of automation. The financial potential of automation for each of the workstations is assessed on the basis of variables:

data collected during the assessment of automation potential

1. the number of employees;
2. average salary of the employees;
3. assessing whether the workstation is a potential bottleneck.

data collected from the system

assessing whether a high percentage of production at the workplace is represented by products that for the company:

4. constitute a high (using pareto chart) share in turnover
5. compared to other products, they have a high difference between the purchase price of raw materials and the sale price of the finished product.

The assessment of the above features, together with the expert assessment of the automation potential carried out in the previous step, allows assessment on a 0-5 scale of each of the tested work stations.

IT. The assessment of the readiness of the IT area for automation is based on an interview using three variables, each one placed on the 0-5 scale:

System readiness for data acquisition and processing. Interview with the IT director. The existence and use of IT systems in the enterprise, efficiency and experience in the integration of existing systems with production devices and methods of data presentation are assessed [Nwankpa, 2015].

IT infrastructure. Interview with the IT director. Skills, speed and compatibility of cabling and hardware are assessed. Existing security procedures, backup and reserves of the most important hardware components are defined.

Cooperation on the IT-Production-Maintenance line. Interview separately with each of the managers of individual departments. The following are evaluated: the precision of determining the needs for data collection and presentation, meeting these needs during implemented investments in equipment requiring data transmission via IT infrastructure.

Finance. The assessment of financial readiness is based on the assessment of two variables. The average of the following two values gives the final result of the finance area.

Readiness to invest on a 0-5 scale based on an interview with the financial director and financial data. Two limit values are defined. The minimum and maximum level of investment that the company is ready to incur with an acceptable level of return on investment [Frank, Shen, 2016]. The minimum level is determined assuming that the time of employees whose knowledge of company processes is required to carry out the investment is not part of the calculated costs. The result is presented in the form of a graph, which is additionally superimposed with lines of minimum and maximum investment cost estimated by the expert method based on a previous examination of the readiness of processes for automation. The higher the exceeding of the estimated maximum investment value over the maximum level of readiness for investment, the lower the score on a scale of 0-5, where exceeding by 100% gives a score of 0.

Fundraising on a 0-5 scale. Interview with the financial director. It is determined which investments over the last 3 years have been co-financed with the help of external sources, such as loans, leasing or co-financing from government programs. The greater the experience gained in raising funds, the higher the expert rating in the 0-5 range.

Automation Readiness Check report ends with automation road map. This is one-page blueprint for transformation to organizational readiness. Each category: strategy, people, processes, IT and finance represents separated pool of actions. Each step is designed to bring company closer to the point where investment in automation would be implemented rapidly, with strong economic value and strong correlation with strategic goals and people's development.

COMPANY DESCRIPTION AND BUSINESS CONDITIONS

The company's main activity is to produce and sell lighting products and sub-products. Production process includes among others cutting, injecting, painting, assembling and packing.

Some of the sub-processed are outsourced. Sales are international. The company has been operating for over 30 years. The company is managed by two owners and is divided into 6 departments: sales, production, logistics, quality, marketing and finance with outsourced IT.

The company's growth is stable and management is actively looking for new ways to accelerate their business. There is a noticeable lack of human workforce in the area.

RESULTS OF THE AUTOMATION READINESS CHECK (ARC)

Overall score: 2,7



Fig. 1. Overall score of main areas

Source: own work

Strengths:

a) Management – openness to changes and the ability to react quickly, beginning of the process of delegating tasks and permissions, market knowledge and knowledge of processes within the company at all levels of implementation.

b) People – a relatively large group of employees ready to take on new roles in the company, high frequency of messages about changes within the company.

c) Processes – processes with high repeatability and stability, knowledge of processes among employees.

d) IT - internal resources for developing 'hard' IT infrastructure inside the company, some of the workstations equipped with controllers.

e) Finances - high readiness to invest in new technologies, experience in obtaining funds in the form of leasing, loans and EU grants.

Weaknesses:

a) Management – lack of organizational structure consistent with the number and burden of implemented processes, two management styles of company’s owners that create a sense of instability among employees.

b) People – a sense of overload with implementation projects that are imposed by the management, lack of standard for effective implementation of new employees.

c) Processes – lack of consistent method for assessing the effectiveness and profitability of processes, lack of maintenance structure.

d) IT - little experience in designing IT solutions, the needs related to obtaining information at various levels of the organization do not translate into the IT systems used.

e) Finances - lack of experience within the company with assessing the financial legitimacy of investments in integrated management systems.

MANAGEMENT

Overall score: 2,5 / 5

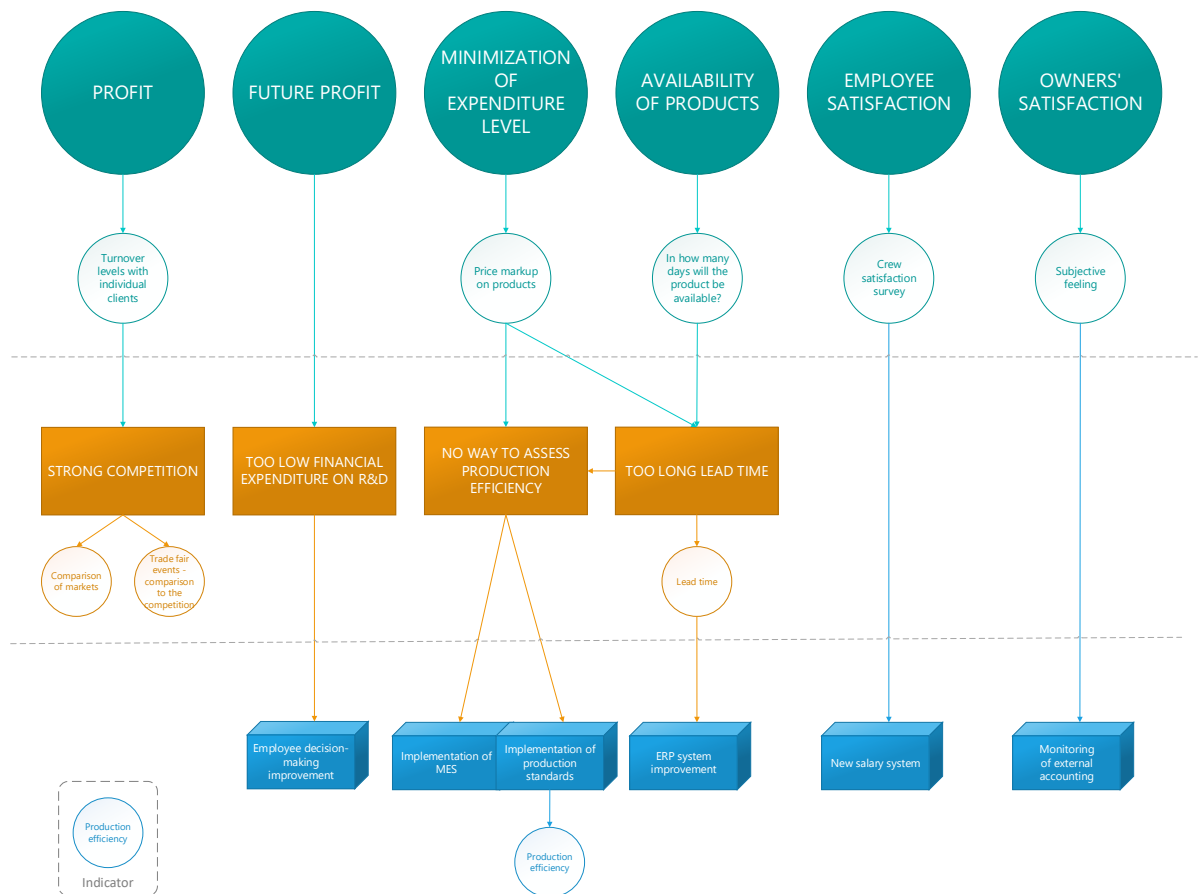


Fig. 2. Strategic development tree

Source: own work

Strategic goals:

Score: 1 / 5

Strategic goals are expressed in measurable form (such as profit) and in the form of course of action. Measurable goals are not directly translated into individual management levels.

Recommendations: Strengthening the structure of setting, delegating and monitoring strategic goals.

Main problems:

Score: 3 / 5

High awareness of the company's problems. Lack of effective mechanisms indicating priorities in relation to the new projects.

Recommendations: Adding a processing index based on a bottleneck analysis to calculations based on revenues, costs, margin (sales price - production cost).

Main initiatives:

Score: 2 / 5

Accurate selection of started projects to solve the main problems affecting strategic goals.

Recommendations: Maintaining the direction of work on the roles and rights in the company; treating these changes as a priority, because most of the initiatives launched are based on the emerging coherent management system, employee involvement and new competences related to automation and IT systems; implementation of the internal project management method (including the resources assigned to them) due to project overload and lack of ownership of implementations by implementers, which affects the unused potential of initiatives and projects, and reduces the efficiency of operational tasks.

New opportunities:

Score: 4 / 5

High awareness of high- and middle-level managers about the benefits of automation. The benefits listed are:

- quality and time repeatability of the product,
- enforcing standardization,
- processes easier to manage, organized,
- the crew is more competent,
- changing the nature of the crew from production to maintenance,
- changing the character of the production crew from more to Maintenance,
- more people at middle management level (instead of at higher level),

- a more balanced, multi-stage recruitment method - employing people with higher competences (people who have already worked in the company will be trained),
- supervision of real efficiency (it is more difficult with a human),
- easier determination of production capacity and capabilities, production planning.

Recommendations: using automation projects and understanding their benefits as tools of internal marketing (promotion of new technologies) as well as external (image of a modern company).

PEOPLE

Overall score: 2,3 / 5

Initiatives impact on people:

Score: 2 / 5

Initiatives	Employment level	Sense of employment stability	Morale / commitment	Competence development
Change how tasks are delegated	—	↓	↑	↑
Implementation of production standards	—	—	↑	↑
ERP system improvement	—	↓	—	↑
Potential expansion of the production hall	↑	↑	↑	—
New workstation / machine	—	—	↑	↑
Change of information transfer logic	—	—	↑	—
MES system implementation	↓	↓	—	—

Fig. 3. The limit of assimilation to change – impact on employees

Source: own work

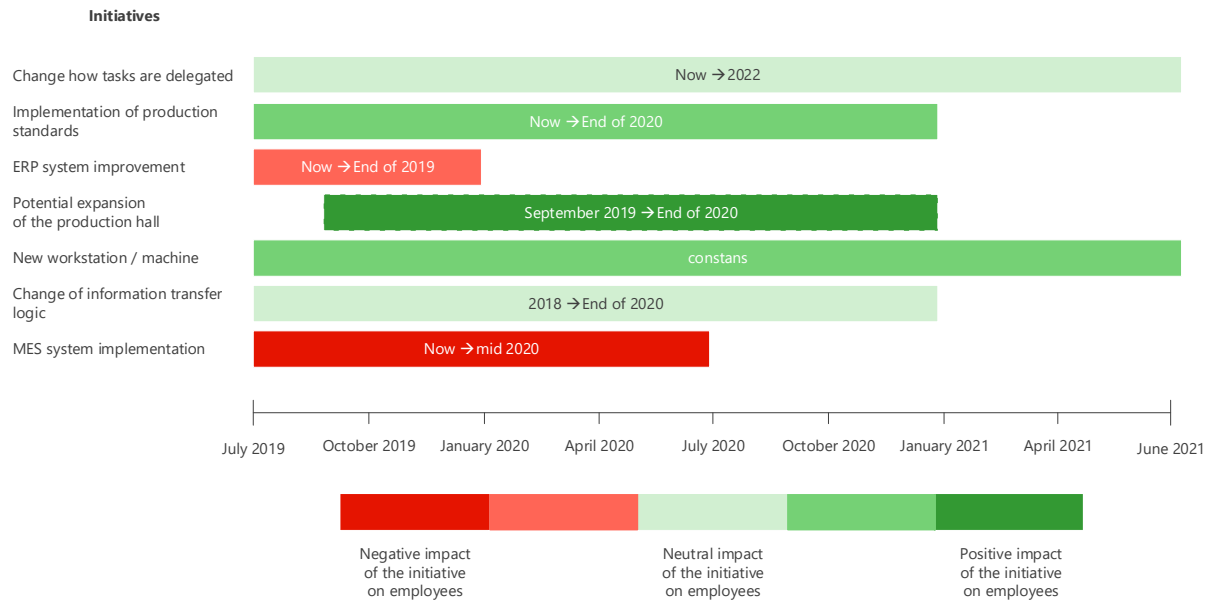


Fig. 4. The limit of assimilation to change – impact timeline

Source: own work

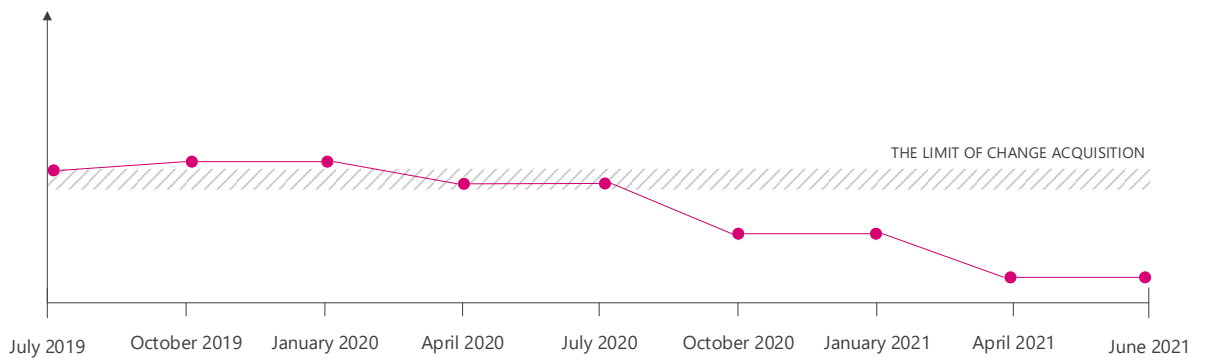


Fig. 5. The limit of assimilation to change – stress point

Source: own work

Quality and frequency of messages:

Score: 3,5/5

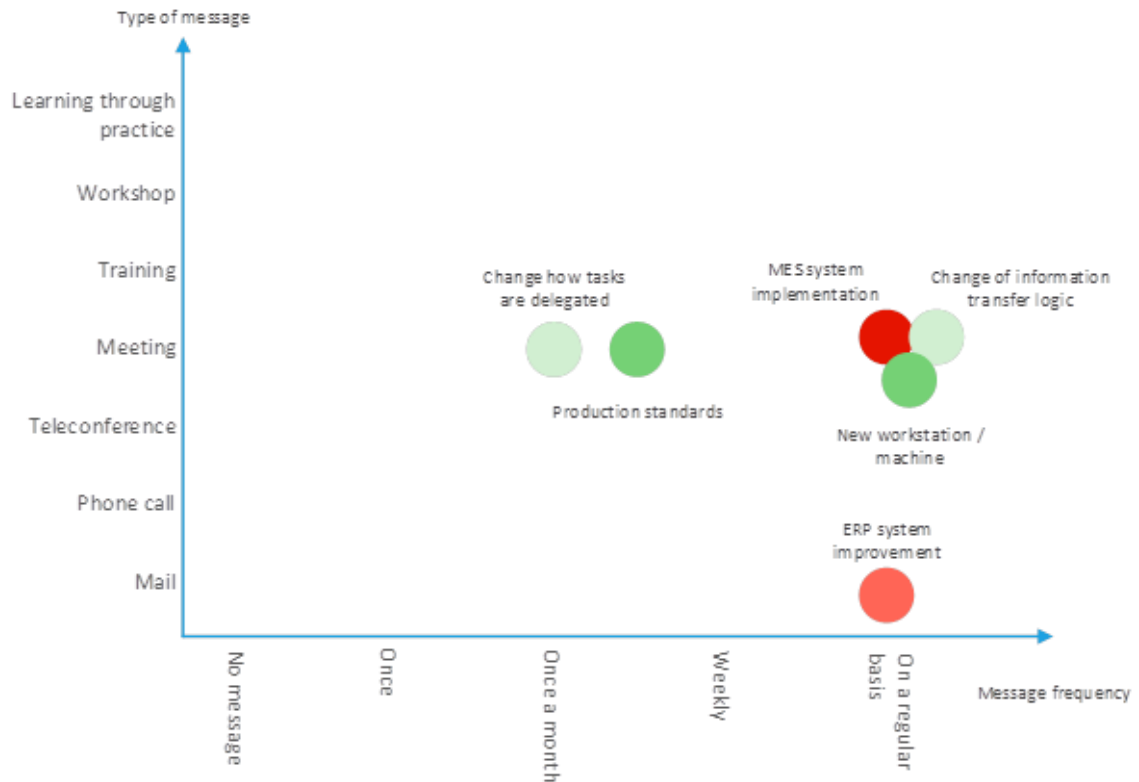


Fig. 6. Communication matrix

Source: own work

The colors of the matrix of individual circles determine the impact of a given initiative on people (same logic applied as on the previous graph).

Quality score: 2,5 / 5

Frequency score: 4,5 / 5

The frequency of messages regarding ongoing changes and projects in the company is at a high level. Employees regularly receive information about ongoing projects. The information, however, does not apply to all changes - sometimes employees find out about changes once decisions have been made – there is no employee impact on areas that relate to their jobs and processes, both among line workers and middle-level staff.

Resistance to change:



Fig. 7. Resistance tree map chart

Source: own work

Legend: orange color represents management resistance, dark blue individual resistance, light blue organizational resistance and green technical resistance.

Particular attention should be paid to the resistance resulting from the management method. Seemingly obvious human fears of something unknown resulting from the fact that: they are not the authors of changes, their time commitment will increase or they will hear rumors about new initiatives that do not always coincide with reality, should not occur in the face of the upcoming change, if effective way of managing not only change, but also the entire organization is applied. Lack of this efficiency is manifested by imposing changes on employees, without determining the purpose and benefits of these changes, or by excessive interference in the activities of employees, especially resulting from their own initiatives. The change management should be based on a clear, understandable message for employees, which will limit or extinguish resistance at source.

Readiness to work with machines:

Score: 2 / 5

There is a high probability that people who will have to work with a new machine will not be satisfied by that. The employees themselves have the potential to undertake new initiatives,

but their fear of taking responsibility and decision-making in connection with new tasks is limited. The company has people competent to operate new devices, willing to "absorb" new knowledge, but they only constitute about 30% of the crew - the rest would prefer to stick to simple work, as is the case today.

Readiness to change the workstation:

Score: 2 / 5

The company lacks the preparation of employees to change positions and work mode. There is no specific standard for conducting operator training. Employees are implemented through initial training, during which they become acquainted with the threats and the basics of work in a given position. The advantage is the implementation of the employee through practice - the leader of the workstation gradually introduces a new person to the new position, starting with simple work, then implementing him in ever newer areas.

Outplacement:

Score: 2 / 5

The company implemented the process of transferring employees to another position and provides dismissed employees with a security package. However, it lacks outplacement process and does not cooperate with employment agencies.

PROCESSES

Overall score: 2,5 / 5

Automation potential:

Workstation / Parameter	P1	P2	P3	P4	P5	P6	P7	P8	P9	SCORE
W1	3	2	2	3	2	2	2	2		2,2
W2	3	3	5	2	2	3	4	3	0	3
W3	2,5	2	2,5	2,5	2	3,5	2	2		2,3
W4	4	3	4	3	2	3	3	2		2,9
W5	4	3	4	3	2	3	3	2		2,9
W6	2,5	4	3	3	2	5	3,5	2	1	3,2
W7	4	4	3	4	2	5	4	2,5	1	3,6
W8	2	1	5	2	2	4	3	2	1	2,7
W9	4	2	3	4	2	4	3,5	2,5	1	3,2
W10	5	4	2,5	5	2	2	3	2	1	3,2
W11	3	4	5	5	3	3,5	2	5	1	3,8
W12	2	5	1,5	1	2,5	2	2	3		2,3
W13	3	5	3	4	2	2	2	3		2,9
W14	3	5	1	4	2	2	3	2	0	2,7
W15	3	3	5	2	2	3	2	2		2,7
SCORE	3,2	3,3	3,3	3,2	2,1	3,1	2,8	2,5	0,8	

Fig. 8. The automation potential of workstations matrix

Source: own work

Legend:

P1 - Stability

P2 - Repeatability

P3 – Flow efficiency

P4 – Need for organizational improvements

P5 - Maintenance

P6 – Process ergonomics

P7 – IT infrastructure

P8 - Transport

P9 - Employees' knowledge about the process

Financial potential:

Workstation	Number of operators	Bottleneck score	Sale price - price of material score	Turnover score	Arithmetic average
W1	3	1	-----	-----	1,4
W2	5	4	5	-----	4,7
W3	3	1	-----	-----	1,4
W4	1	3	-----	-----	1,4
W5	1	3	-----	-----	1,4
W6	1	1	5	-----	2,4
W7	1	1	-----	5	2,4
W8	1	0	-----	-----	0,4
W9	1	1	-----	-----	0,7
W10	1	1	-----	-----	0,7
W11	5	4	-----	-----	3,0
W12	3	0	5	-----	2,7
W13	3	1	-----	-----	1,4
W14	3	0	5	-----	2,7
W15	3	5	5	-----	4,4

Table 1. Financial potential of automation per workstation

Source: own work

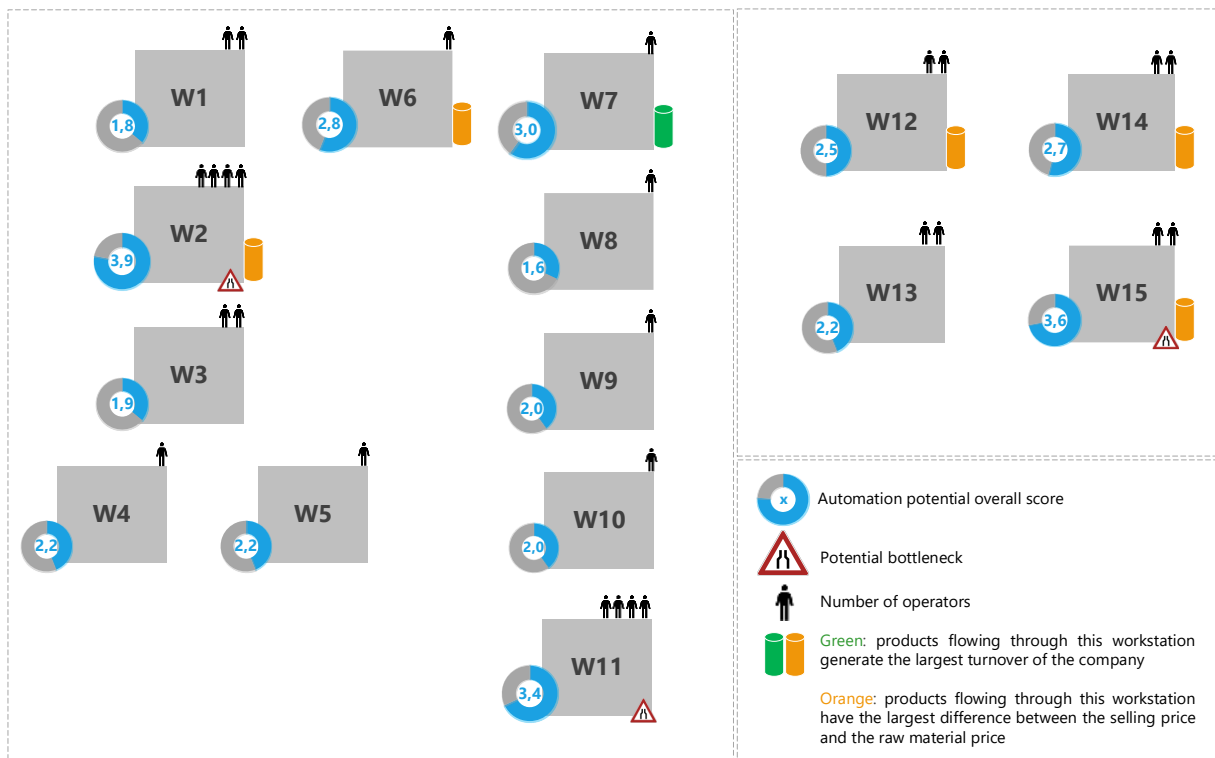


Fig. 9. Workstation's score summary

Source: own work

IT

Overall score: 2 / 5

Readiness of systems to gather and process data:

Score: 2 / 5

There is readiness and need to collect and analyze data from production workstations. The existing ERP system is not integrated with existing machines, there is no information on the data exchange protocols used. The data is entered manually into the system at production stations. The MES class system is being implemented.

Recommendation: Introduction of competences related to the implementation and maintenance of integrated management systems focused on integration with machines.

IT infrastructure:

Score: 2 / 5

High ability to prepare cabling, easy to connect to individual stations.

Recommendation: Strengthening infrastructure in case of a failure (spare data transmission devices) and in the area of network security. For some of the workstations at which there is no infrastructure to collect and transfer data, the company will have to install sensors and controllers.

IT – Production – Maintenance cooperation:

Score: 2 / 5

The company has a common understanding of the objectives related to data collection and analysis, and expectations in area of production are clearly defined (listed: determination of production capacity, capabilities, standards, a visible pool of orders assigned to workstations, scheduling and prioritization). Previous implementations of systems and new machines / production lines were based on the competence of external experts. There is also lack of experience within the company in the field of automatic data collection and analysis.

Recommendation: Creation of dedicated IT positions, maintenance department in the field of automation of technological processes and data processing.

FINANCES:

Overall score: 4 / 5

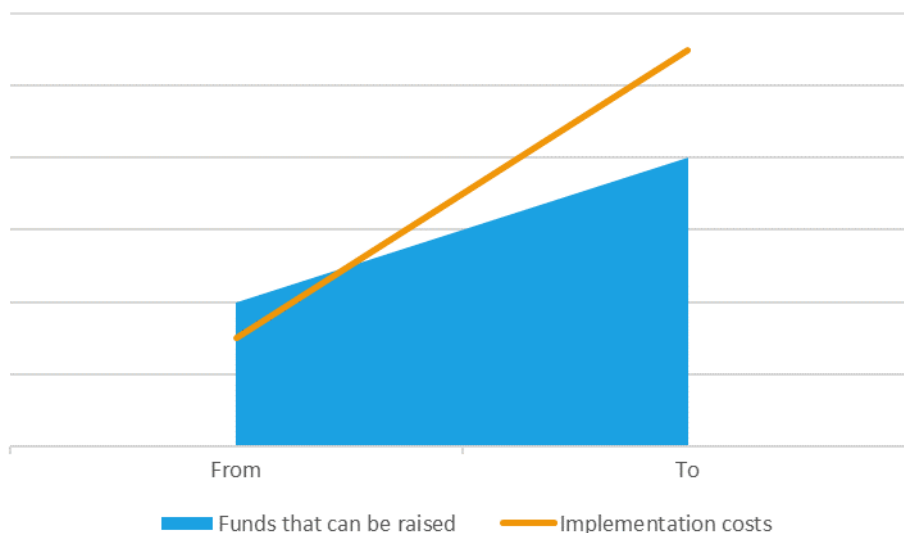


Fig. 10. Investment chart

Source: own work

Financial readiness for investment:

Score: 3 / 5

In a short time, the company is able to assign sufficient financial resources to prepare the organization for automation and introduce technological changes so that the return on investment is at a level acceptable to the Management. However, it is not able to cover the maximum assumed investment cost from its own resources. The maximum assumed cost of investment is determined by the expert method of estimating the level of costs associated with technological changes that

will not only ensure an acceptable return on investment, but will fully use the organization's ability to absorb changes.

Fundraising:

Score: 5 / 5

The company is able to successfully raise funds for investments through loans, leasing co-financing for infrastructure and machinery. Recently, funds for development have been obtained several times. In addition, the organization has experience in obtaining financial support from the European Union with an external company. The company employs people who know how such a co-financing project is carried out.

AUTOMATION ROADMAP

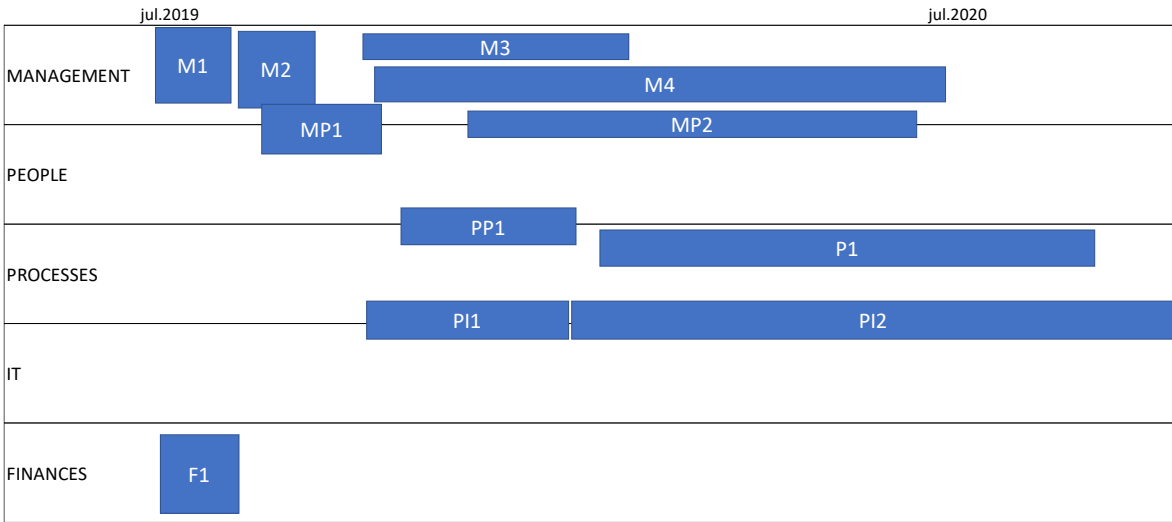


Fig. 11. Automation roadmap
Source: own work

Legend:

M1 - Creating a one-card company status overview for owners

M2 - Preparation of company's development plan according to strategic goals: what and when to do, how to measure the result

M3 - Redefining management structure and standards

M4 - Implementation of a system for monitoring the realization of goals and projects at various management levels

MP1 - Analysis of the required resources to achieve the objectives, including required vs possessed skills and competences among the crew

MP2 – Creation of transparent method of communicating goals, progress, changes and rules for starting new projects

PP1 - Concept of monitoring process efficiency and rewarding employees

P1 – Automation of selected processes: W15, W11, W2

PI1 - Creation of positions with IT and Maintenance skills in the field of production and development of integrated management systems

PI2 - Continuation of implementations according to a coherent strategy: MES system, production standards and rewarding system

F1 - Financial preparation for the investment related to the change in the management structure

CONCLUSIVE REMARKS

The automation readiness test has been designed for companies that want to quickly:

- diagnose the current state of the company in the context of preparation for automation processes;
- assess financial and organizational costs resulting from process automation;
- make the necessary changes to fully utilize the potential of automation;
- reduce the risk of unsuccessful investments and a decrease in employee involvement and morale.

The ARC study involved employees of the company for eight hours and was conducted by three researchers. The transparent structure of the study allows to identify areas for improvement and simplifies business decisions. Expert, quality assessment requires knowledge of research and management methods, the ability to communicate and empathy as well as process improvement strategies, tools and techniques in the form of work organization, material and information flow, as well as in the form of modern technologies. For this reason, the range of application of the method is limited by the availability of experts with specific knowledge. A potential solution is to conduct a study by a company using a leading auditor in the person of an employee with high communication skills, who will gather a team consisting of employees from the area of high-level management, HR, finance, production, maintenance and IT.

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