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We are evidently living in time of revolutions. The contemporary revolutions are occurring in almost all areas of human live and activities. The revolutionary changes can be observed – for instance – in area of acquisition, collection, processing and use data, information and knowledge (Jorgenson D., Vu K., 2016). Another example is the revolution which changes deeply urbanized areas i.e. the revolution which is usually named as "Smart City" (<https://smartcities.media.mit.edu/>, Guallart, V., 2015 Karwot J. et al. 2016). Among others, the revolutionary phenomena appear also in economy and industry.

If an appearance of revolution is considered, we have to expect a significant set of changes which are and will appear in reality covered ("burdened") by revolutionary changes. Therefore, the question is worth to be asked about nature of possible effects of such revolutionary changes. Hypothetically, we can assume that changes of revolutionary origin can affect the reality in two main ways: positively as well as negatively.

French revolutionist Pierre Vergniaud (https://en.wikipedia.org/wiki/Pierre_Victournien_Vergniaud) stated far ago (in 1793) that "It is to be feared that a revolution, like Saturn, can devour all of its children one by one". If he was right, or even if only some children of particular revolutions are at risk of being devoured, also contemporary appearing revolutions are charged by this rule. On the other words, they are bringing a lot of positive effects ("goods") for the family of their beneficiaries, but can also bring more or less significant dangers for particular members in this family.

Among others, the revolutionary phenomena have appeared and appear also in economy and industry. In this paper, the special attention is paid for the key symptoms end effects of the "fourth industrial evolution" called usually "Industry 4.0". The question appears: who and what – if any - can "be devoured" by Industry 4.0?

**SUBJECTIVE REVIEW OF PROBLEMS OF IMPLEMENTING INDUSTRY 4.0
ELEMENTS IN PARTICULAR PRACTICE OF SME'S**

In the history of the worldwide industry so far, new technologies have fundamentally were changing the rules of the game at least three times. These key-points of

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industrial development, named often as industrial revolutions, are usually named (https://en.wikipedia.org/wiki/Industry_4.0) as:

1. **Industry 1.0** – mechanization: Industry 1.0 was based mainly on the invention and implementation of a steam engine that introduced production from the era of craft workshops into the era of industrialization;
2. **Industry 2.0** – electrification: Industry 2.0 was based mainly on wider use of electricity that ousted **steam** engines, therefore production lines could produce goods in large series;
3. **Industry 3.0** – digitization: Industry 3.0 was based on use for the needs of industry more and more efficient computers and data processing tools and systems. They have **enabled** machine control using software. Thanks to this, the machines gained greater efficiency, precision and flexibility, and the digitization process made it possible to achieve higher and higher degrees of automation. Planning and control systems were established to coordinate activities within production.

Currently we are observing the fourth wave of revolutionary changes which are considered as:

4. **Industry 4.0** - integration of systems and networking: Industry 4.0 integrates people and digitally controlled machines with the Internet and information technologies. Materials/components produced or used for production can **always** be identified, they also have the ability to independently communicate with each other. The flow of information is carried out vertically: from individual components to the IT department of the company and from the IT department to components. The second direction of information flow is implemented horizontally: between the people and machines involved in the production process and the company's production system.

The Industry 4.0 idea assumes – first of all – existence of new models of cooperation between economic entities. Considering the structure of contemporary industry, it is a necessity to take into account the functioning and cooperating of both large, medium, small and micro-scale industrial enterprises. Certainly, the demands of various nature (technical, logistic, personal/intellectual, ICT-based), created by the necessity of cooperation between large ones and smaller units has also to be considered.

Therefore, it was decided SME's to be taken into account in this paper in more detailed manner. The author of this paper tried – basing firstly on literature data – to make a subjective review of potential advantages and disadvantages which are caused by Industry 4.0 package of solution to be implemented and utilized in micro, small and medium sized enterprises.

The number of publications focused on various aspects of Industry 4.0 is relatively big (eg. From Brettel M., et al., 2014, Schuh G., et al., 2012). Considering the described in obtainable literature problems it has been stated, that the Micro, Small and Medium size enterprises (SME's) treated as a specific group of participants of the contemporary industrial activities can be considered as "the group of special attention" in a perspective of increasing changes caused by Industry 4.0. Anyway, the set of publications which present the problems of a relationship "Industry 4.0 – SME's" is not very reach.

The author of (Sommer L.: 2015) is considering very "catastrophic" scenario, according to that the SME's can be "victims" of Industry 4.0. The elements of impact

of Industry 4.0 revolution on SME's are also discussed in (Mittal S., et al. 2018). On the other hand, some more optimistic perspectives for SME's, connected with industry 4.0, are discussed by authors of (Müller J., et al., 2018; Nowotarski P., Paslawski J., 2017).

Finally, it is possible to state that the mentioned group of industrial units is perspective very sensitive to deep (essential) changes. The main thesis of considerations, as introduced in this paper, are formulated as follows:

- A. the thorough and careful recognition and analysis of the impact on them by processes that are inducing to the Industry paradigm 4.0 is needed,
- B. business entities which belong to the micro, small and medium sized enterprises sector require special attention and appropriate support in view of being participants of Industry 4.0 processes.

Considering the involvement of the selected above type of participants in processes that are currently observed in almost all branches of industry, it is worth to recognize – first of all – the level of understanding the needs and challenges posed by the 4.0 revolution by owners, managers and employees of these companies.

Secondly, in addition to recognizing and understanding by them the positive effects of this revolution, also its negative effects (if they exist at all) have to be recognized and understood. In particular, the impact of the mentioned factors should be counted on the category of local economy entities in question (Faller C, Feldmüller D., 2015). And thirdly – "last but not least" – it is worth considering the possible ways of protecting the above-mentioned units against negative effects while at the same time consolidating the positive effects.

Let's formulate a set of key questions for the needs of analyzing the above mentioned area of problems:

Key question 1: are and will be micro, small and medium enterprises able independently (by "own competencies and resources") to face up to their challenges related to the implementation of the Industry 4.0 paradigm in practice?

Key question 2: whether and to what extent micro-enterprises and small and medium-sized enterprises can and ought to be supported by "external forces" due to Industry 4.0 challenges?

Key question 3: are SME's ready to ask for and to utilize a topic-dedicated external support (e.g. expert opinions, dedicated trainings, assistance in implementing innovative technological and ICT solutions)?

Basing on the above formulated questions a survey has been planned and performed as described in the next part of this paper.

PRELIMINARY INVESTIGATION OF PROBLEMS CREATED BY THE INDUSTRY 4.0 FOR SME'S: A CASE STUDY IN POLAND

The thesis as formulated in the previous chapter were the basis for an initial survey which was carried out in the Region of Upper Silesia (more precisely: in the area of GZM Metropolis) between October 2018 and January 2019. Location of the Silesian Voivodeship in Poland is illustrated in Fig. 1. Respectively, Fig. 2 shows the location of GZM Metropolis in Silesian Voivodeship (https://pl.wikipedia.org/wiki/Województwo_śląskie).



Fig. 1 Location of the Silesian Voivodeship in Poland



Fig. 2 Location of the GZM Metropolis in Silesian Voivodeship

The decision about such a limitation of the survey area needs to be briefly explained and justified. If we try to compare the administrative areas:

- 1) Poland: administrative area 312696 km²,
- 2) Silesian Voivodeship: administrative area 12333,09 km²,
- 3) GZM Metropolis: administrative area 2553 km²,

it is evidently clear that the area covered by the research described below is very small in comparison with areas of the country (0.817%) or even of the whole Silesian region (20.7%). But, because the area of the GZM Metropolis is heavy urbanized and strongly saturated with production companies, especially small and medium ones it

was assumed, that the results of initial survey focused on problems considered in this article may be treated as representative on the current stage of the research.

The essential assumptions of the survey were as follows:

- The questionnaire was addressed exclusively to micro-, small and medium sized enterprises,
- The group of respondents was assumed to be limited to owners and/or managers of the examined units,
- The area of activity(range of activities/services, branch of industry etc.) wasn't taken into account on this stage of survey (it is assumed to be considered this factor in further research),
- The questionnaire was designed as being as simple as possible to be filled in for respondents,
- The number of questions was limited,
- Each of the questions gave the respondent the opportunity to make a single choice of an answer,
- Each of the answers provided allowed to supplement this answer with a commentary, which, however, was not obligatory,
- Each of the respondents could provide information about their company in the survey or could remain anonymous,
- The questionnaire was distributed exclusively by volunteers who were pre-trained to help respondents fill in the questionnaire,
- The (subjective) choice of respondents was made by the volunteers,
- The results of survey have been documented in the paper form.

List of the questions has been preceded by a short (1 page) introduction presenting the key-points in the Industry 4.0 paradigm. The following questions were asked in the described survey:

1. Have you met already with the idea of the "fourth industrial revolution INDUSTRY 4.0":
 - a. yes?
 - b. no?
2. Do you think that INDUSTRY 4.0 is already affecting or will affect the functioning of your company in the near future?
 - a. yes?
 - b. no?
3. If the answer to question 2 is affirmative: Does the impact of the "INDUSTRY 4.0" on the functioning of your company is/will be:
 - a. significant?
 - b. negligible?
4. If the impact of the "INDUSTRY 4.0" on the functioning of your company is/will be significant, whether this applies in particular to:
 - a. The internal organization and functioning of the company?
 - b. Co-operation of the company with external partners?
 - c. Both of the above-mentioned factors?
5. Does the impact of the "INDUSTRY 4.0" on the functioning of your company require or will require taking by you (by your firm) any measures or adjustments?
 - a. yes?

- b. no?
6. If the answer to question 5 is affirmative: Will the necessary measures/adjustments to be undertaken include – in your opinion – primarily reinforcement (development, extension):
- Knowledge and competencies of the company management?
 - Knowledge and competencies of all employees?
 - Technical and/or ICT equipment?
 - Two of the above-mentioned factors (which ones and why)?
 - All the above-mentioned factors?
7. Is it necessary for your company - in your opinion - to initiate and to carry out some measures focused out the activities/adjustments related to the "INDUSTRY 4.0":
- By the company in your own range (utilizing your "own forces")?
 - With the use of external support for the full extent of previously identified needs?
 - With the use of external support in a selected scope of needs?
 - Other solution (which one?):
8. Will the detailed recognition (inventory) of your company's needs in the implementation of solutions related to the "INDUSTRY 4.0" model, in your opinion, be carried out:
- By the company in your own range (utilizing your "own forces")?
 - With the use of external support?
 - By a combined team of company's staff and external experts/advisors?
 - Other solution (which one?):

In the course of the reported survey, two hundred questionnaires were distributed. Finally, seventy-four positive answers were obtained (37%). A detailed analysis of the survey results leads to many interesting statements.

BRIEF DISCUSSION OF RESULTS OF INITIAL SURVEY OF PROBLEMS CONNECTED WITH IMPLEMENTING "INDUSTRY 4.0" IN SME'S: EXAMPLE IN GZM METROPOLIS (POLAND)

For the needs of analyzing result of presented survey, the principle "step by step" was adopted, according to which the answers given to subsequent questions were assessed. Additionally, the answers given by the respondents to the previous questions were taken into account.

Already the answers given to question 1 were – in a part – quite unexpected. It was stated – in particular – that a relatively high percentage of respondents (46%) declaring the ignorance of the Industry 4.0 concept.

This result, however, became less puzzling in comparison with the answers received on question 2. This question, regarding the significance of the impact of Industry 4.0 on the functioning of the surveyed entity, was gotten over 70% of positive responses stating that such impact will be significant.

Analyzing subsequently the comments to the answers to questions 1 and 2, it was found that many respondents who answered negatively to question 1 and positively to question 2 explained that they understand the challenges of modern times in the economy and industry, but have not yet encountered the terms like "fourth industrial revolution" and/or "Industry 4.0".

These results evidently indicates that up to now too little attention was and is devoted to educating, in the wide range of problems generated by the Industry 4.0 concept and connected with this concept, all stakeholders whose this concept includes. It seems an inappropriate and demanding improvement the situation, in which only big economic players and scientific circles are familiar with and discuss about Industry 4.0, but for significant group of smaller players, not possessing a proper knowledge, this discussion is not fully understood.

Negative effects of this situation (lack of knowledge about the concept of "Industry 4.0") are confirmed by further results of the presented survey. About 10% of respondents declaring knowledge of the concept Industry 4.0 and 64% of those who declare ignorance of this concept believe that its impact on the functioning of the examined entity will be negligible or none.

The arguments of respondents providing such answers (in the comments) are quite similar. The most frequently repeated statement is that "my company is too small to feel the effects of the industrial revolution". There are also arguments like "signed contracts with external partners guarantee me stable operation without having to make any changes in my company" or "my business activity is a niche then the industrial revolution will not affect my company".

Finally, 22 answers (30%) were found in the analyzed set of questionnaires, in which, after the negative answer to question 2, no further questions were answered. Because of that, for the purposes of further analysis steps, only the remaining 52 responses (70%) were taken into account.

When we consider this group of responses to surveys as given by respondents who know something about Industry 4.0 not only in the general dimension, but also in practical one, some astonishment is aroused by the answers given to question 4.

As expected, the majority of respondents (56%) were choosing the answer "c" indicating that the impact of the Industry 4.0 concept will concern both the improvement of the internal organization and functioning of the company and its cooperation with external partners. About 35% of respondents choose answer "a" or "b". From comment to these answer it is possible to conclude that these respondents assumes that their companies are at the moment relatively well-prepared for challenges of Industry 4.0 but their relations with external units/partners need to be improved (answer "b") or the external relations are in the proper state but "the interior" of the company needs some corrections/changes (answer "a").

A kind of surprising is the lack of any answer to question 4 in 19% of questionnaires. The comments (or rather the lack of comments) do not indicate in particular that, according to the respondent, both the "internal" and "external" situation of the company does not require changes in the Industry 4.0 perspective.

Which is promising, the vast majority of surveyed entrepreneurs see the need to take actions focused on adapting their companies to the requirements resulting from the current industrial revolution.

Analyzing the answers for questions from 5 to 8 in the reported survey it is evidently seen that the owners of the SME's as well as their managers are aware of the necessity to undertake affirmative actions. Most of them are also of the opinion that are not and will not be able to realize such actions with "their own forces", thus they are expecting some external support in this range.

CONCLUSIONS

Concluding the considerations presented in the previous parts of this paper it seems to be evident, that the expected support ought to cover – first of all – the activities focused on completing knowledge of SME's owners and staff in the field covering needs of "Industry 4.0". Such a knowledge will establish the proper circumstances for implementing necessary changes in functioning of the units, with a special attention paid to their cooperation with "external world".

The general problem of educating the variety of participants of complex and interdisciplinary processes is not easy to be solved. This statement seems to be especially true in the case of educating for needs of modern concepts, like "Technology Assessment TA" (Kaźmierczak J., 2014), "Smart City" (Kaźmierczak J., et al., 2018) or "Internet of Things".

Probably in each case of educational problems, the possible solutions are of some similar types:

- 1) We try create a new target-dedicated educational system, oriented on recognized needs,
- 2) We try to adopt for these needs some existing systems, with necessary modifications as well as extensions.

In (Kaźmierczak J., Stecuła K., 2017) author of this paper presented some reflections focused on a new look at the Engineering, seen as a one of the areas which can offer the "educational background" for the needs concerned with more advanced areas. This approach is also illustrated in (Kaźmierczak J., 2014), which the special educational needs are discussed dedicated to the processes of assessing social impact of new products and technologies (TA).

It is also possible to conclude – basing on results of survey as described above – that the proper recognizing and describing of needs is if key-importance for designing the target-oriented educational project. Some thoughts concerning the problem of needs are also presented in previous works of the author of this paper (Kaźmierczak J., 2016; Kaźmierczak J., 2017).

The considerations as presented in this paper are certainly not complete (and perhaps a bit chaotic), but – in the assumption of the author – should rather open a new field of research as well as some new manner of thinking than to give solutions "ready-to-be-applied".

The introduced above area problems creates significant challenges. The challenge for decision makers, who are expected to be competent and rational. The challenge for experts, who ought to combine the experience and knowledge with an adequate ethical behavior. The challenge for „final consumers”, who should be ready and competent in taking active (participatory) part in the processes. And in general: the challenge for systems of education, seen as a synergy of interdisciplinary contents, modern curricula and teaching media and – last but not least – people who can effectively ply the role of "educators".

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Abstract. In this paper the author tries to present and analyze some results of his researches focused on surveying the expectations and needs as well as troubles and difficulties concerned with confronting small and medium size enterprises (SME's) with various challenges generated by the fourth industrial revolution (Industry 4.0). After presenting in the first part of the paper a listing and some subjective discussion of general as well as particular problems of implementing the Industry 4.0 approach in practice of the contemporary industry, in next chapters the adopted assumptions as well as obtained results of the SME's oriented survey are introduced together with a short presentation and discussion of used methods and tools of research. The cases of Polish SME's are illustrated by results of investigating a limited group of firms, which fulfil SME criteria and are located and operating in Metropolis GZM (Silesian Voivodeship, Poland). In the last part of the papers the author summarizes obtained results and proposes some next steps of further research.

Keywords: SME's, Industry 4.0 connected challenges, expectations and needs, consultancy and support