Reactions of Market Entities to Crisis Situations

edited by Aniela Styś

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Contents

Preface

In the presented monograph selected important problems related to the perception of crisis situations are considered. These issues are important, as in recent years we have experienced numerous crisis situations in Poland. They have spread over the entire economy, affecting all entities within it. The importance of research on all crisis aspects is due to the fact that it disturbs the equilibrium state and negatively influences the level of safety of both people and the environment. That is why actions to minimize threats are important. These activities aim at the reconstruction of the environment, in the context of perceived economic and social relations, also with considerable support from various stakeholders.

This monograph contains research on ways in which various crisis situations are perceived, and includes also the discussion of undertaken attempts to minimize their effects. It has been written by the employees of the WSB Merito University in Wrocław. The idea to present such choice of topics was to accentuate how different can be the reactions of market entities to the symptoms of crisis. Quite often they may be not obvious and lead to undesirable behaviours.

In the first chapter its author (T. Gospodarek) describes market behaviour patterns under the conditions of micro-macro imbalance. Basic definition of crisis situation is presented, and the ways to optimize the organization's market activities in crisis conditions. The author emphasizes the importance of knowledge and key competences in this aspect.

In the next part (written by A. Styś) are discussed the results of direct research on the perception of crisis situations by enterprises, and the nature of actions undertaken to minimize threats. A list of detailed expectations is presented, what indicates the need to appoint some entities that can offer support for appropriate activities.

Third part (authors K. Łobos and R. Majkut) involves the diagnosis of the state of relationships inside the organization. They can vary – from the dominance of oppression to some symbolic power. The authors point out that diversified management processes are of a social nature, thus perceive them in the perspective of ethics, morality and respect for other people. Lack of recognition of these values can be the cause of the crisis in the relations of employees with management staff. Any crisis situation can significantly affect this perception, so increased care would be needed.

In the next part of monograph (written by J. Tomaszewski) the role of higher education in overcoming crisis situations has been highlighted. The author analyses here the achievements of a number of universities from several selected countries in terms of their efficiency and quality, indicating the specificity of competences expected on the market.

He argues that they must be related to the internationalization process – which will help overcome crises.

A curious form of reaction to crisis situations is cryptojacking. As the author (T. Hetmańczuk) explains, this is a cybercrime associated with mining of cryptocurrency. It involves the illegal takeover of computing power of computer hardware and its involvement in the mining of new mineable cryptocurrency blocks. Malicious software in the operating system works in the background of operations performed by the computer, without the user's knowledge and consent. The author's considerations show that the dynamic process of developing information technology, in addition to undoubted positives, can also bring considerable negative effects.

The authors express hope that the content presented in the monograph will enrich readers' knowledge about crisis situations and ways of counteracting their effects.

Aniela Styś

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1 Market Behaviour under Micro-Macro Imbalances

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In order to improve something – you need to be able to change it,
To change this – you need to be able to understand it,
To understand this – you need to be able to measure it,
And what will be measured – can be considered to have been done.

Peter Drucker

1.1. Introduction

The most important message for achieving the effectiveness of any business activity, like all human activities, is its optimization. This is due to the general laws of nature, where the principles of minimum energy, the shortest path of light or the highest energy efficiency of prey hunting by predators do govern events observed on a daily basis. In economics, we are happy to use the analogy-based conclusions and to build metaphorical cognitive models, either justified or not, that are based on natural sciences. In theory, the physicalist approach for economic phenomena, based on the optimization of the function of the purpose of action has appeared, which has its deep justification, especially for measurable or possible to monetize processes. Moreover, mathematical models for the description of economic activities, based on the results of operational research (linear, nonlinear, Data Development Analysis – DEA, queue systems – QoS or Monte Carlo simulations) make

a widely used instrument set for conscious management, and one of the central issues of management theory. Le Châtelier moved the rule of contradiction directly from chemistry to describe behaviour in economics. Its content (corresponding to economic applications) can be reduced to the following sentence: *The economic system, which is deviated from its equilibrium, takes measures to minimize the effects of the disturbance of the current state*. This is the main idea of negative feedback in human activity. If a person steps on someone's foot, then the one being stepped will impulsively move it back. This action minimizes the pain resulting from the action that disturbed previous well-being.

One of the most useful approaches to the issue of economic optimization is the use of negative feedback when making management decisions controlling behaviours, processes, and entire business projects. This is the foundation of economic optimization, which is worth paying special attention to in any crisis situations. This is particularly true for market behaviour, where a delicate balance is the result of a set of non-zero-sum games between suppliers of goods and consumers, played under conditions set by the environment (Gospodarek, 2020). Regardless of the economic situation prevailing now and here on the market and the type of product, *you can only consume as much as can be produced*, even having a mountain of money. This is the content of the common law on general balance (Debreu, 1959). This balance can be disturbed by the actions of both the environment and the player, offering the allocation of goods at his disposal.

The issue of general self-organization of the market is an example of the search for optimal solutions for a set of double games against an environment with a non-zero sum (Gospodarek, 2018a). The negative feedback becomes a key defence tool, leading to reduction of the intention-behaviour gap associated with the effects of allocation of some good or game rule in the environment, and above all the effects of adverse consequences for the player. Both macro and micro behaviours can be considered in this respect. In the case of macro ones, there are market phenomena, subject to fluctuations according to the economic situation. In some part, these may be reactions to the business cycles, but in other part, to violent deviation from the dynamic equilibrium position, caused by excessive impulses. In this way, crisis situations arise, which on a macro scale require long-term actions and the involvement of significant resources in the global supply chain to restore stability of the market.

An example of macro action which disrupts the micro-macro balance are tax changes in the environment. Any change can be treated as a multiplayer game which can be reduced to a system of coupled double games against the environment (the whole group of micro objects affected by the tax is playing against the state which is taking away some part of their income). The strategy of the state is to obtain the highest possible revenue, while the micro strategy is to minimize the burden. There is a fairly thin line of tribute acceptance by the micro sphere and the unrestrained intention of the macro side to take *ad hoc* as much as possible, preferably immediately. The environment, where both the macro and micro sides are active, sets the rules of the market game, defining what is a positive solution, for which it is worth taking action. In the environment, there are economic measures of profitability and efficiency of action, which are objective restrictions on prize in such a game. If the tax is

100%, then no one will produce, because the profitability of the action would then be zero. If it is minimal, the natural reaction of the micro side is the increasing of production, because it pays off, but it is possible until the market balance of supply and demand is reached (constraints imposed by the environment in advance). This phenomenon can be graphically represented by a Laffer's curve (Figure 1.1) which has a local maximum due to its continuity. The shape of the curve from Figure 1 does not necessarily have to be symmetrical. Depending on the tax on the given good, country and economic situation, the function graph can be asymmetrical (oblique), with a maximum shifted either toward low tax rates or high rates.

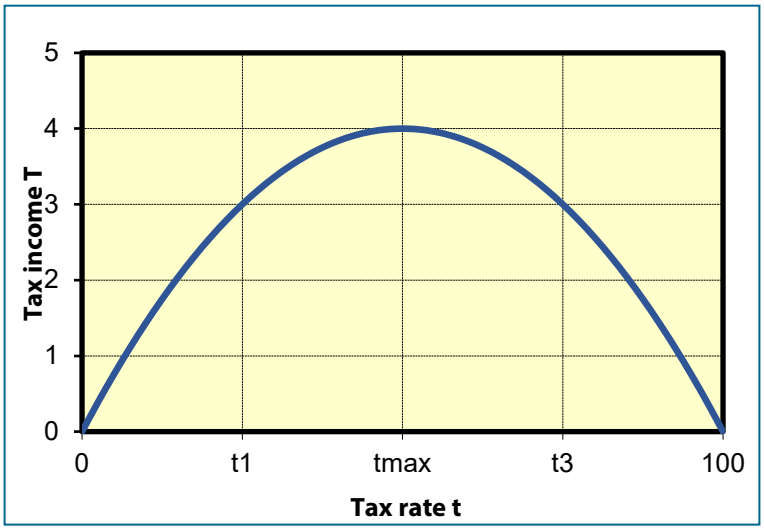

Figure 1.1. Market behaviour for variable rate of income tax (Laffer's curve)

Source: based on (Gahvari, 1989).

The Laffer's curve is well known in economics, although not necessarily to authorities and politicians. Therefore, strange tax changes are emerging, upsetting the market, increasing the grey economy, tax crime and optimization activities, in line with the above-mentioned rule of contradiction. Each example, whether it is an increase in excise duty or income tax, generates a strong negative feedback action on the micro-level. It is worth recalling at this point the quote from Reagan: *If it moves tax it. If its keeps moving, regulate it. And if it stops moving – subsidize it* (Brainy Quote, n.d.). These are macro actions, against which the micro object must find a recipe for further functioning on the market being characterized by a dynamic unstable balance.

The model of market behaviour on a macro scale, corresponding to rapid changes in the micro scale, causing crisis deviation from the position of micro-macro equilibrium, may be the economic cycle phase.

Figure 1.2 presents optimal market behaviour depending on the market situation. These are typical defensive reactions catalogued in graphical form, suggested to investors in order to protect their capital. Unfortunately, this calendar does not say anything about

the current market situation. It only shows some indicator trends, from which you can infer what is happening, what are good practices, and make some decisions in advance. Certainly, you can derive a general paradigm of market behaviour: *Buy when it is cheap, sell when it is expensive*. But is this entirely true in crisis conditions? It is no longer so simple and obvious. You can buy a lot of goods cheaply and stay with them for a long time. This is the market risk.

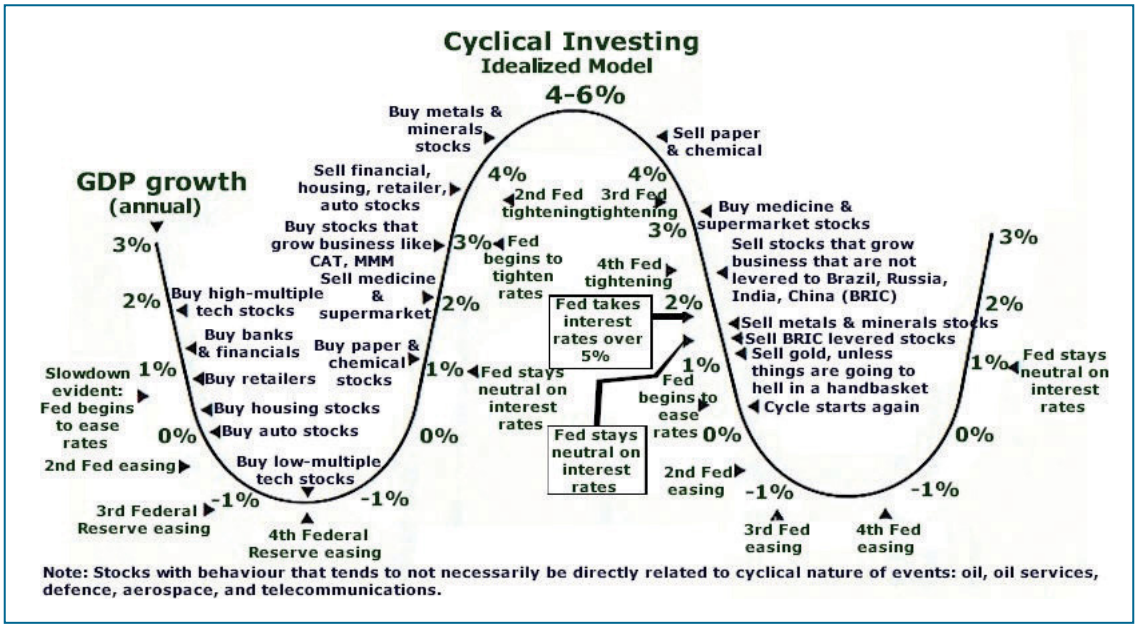

Figure 1.2. Cyclical Investing

Source: http://www.sectormarketwatch.com/mainpageimages/cyclicalpic.jpg

In order to find out what awaits a potential business player in the near future, you need to find a forecast model that offers indicators that can anticipate the economic situation. These include the Purchasing Manager's Index (PMI), supported by IHS Markit (S&P Global, n.d.) The PMI index is the weighted average of the group of purchase indicators affecting the size of production, number of new orders, employment, etc. The source data comes from managers responsible for purchasing in industrial organizations, which have a significant impact on GDP in 50 countries. Therefore, it precedes the business cycle and is very valuable from the point of view of the behaviours suggested by the economic calendar. The PMI can theoretically take values from 0 to 100 (in practice usually between 40 and 60 points). Values higher than 50 points indicate an increase in economic activity in the sector under consideration, and below its decrease.[1]

[1] S&P PMI global for Poland in August 2022 fell to 40.9, suggesting a large decrease in production and consequently GNP in about 3–4 months. This is the lowest reading since 2020, while the maximum observed value of June 2021 was 59.4. This marks the beginning of recession and crisis (Bankier.pl, 2023; Trading Economics, 2023).

Presently, in the domestic and European market we observe microscale activities consisting in securing capital, suspending investment and purchase of valuable goods, cost restrictions, withhold of cost-intensive projects, etc. These are micro-responses to macro signals, which are based on negative feedback.

1.2. Micro Behaviour Resulting from Macro Market Disturbances

As already mentioned above, the environment and macro players have a significant impact on micro-actions. The first and in principle the base model illustrating such relations (influence) is the model of adaptive behaviours of optimization of the organization management structure in accordance with the theory of contingency (Burns & Stalker, 1961; Gospodarek, 2012) (Figure 1.3). The model starts to work when the type of environment (e.g., market, sector) is determined, and whether it can be treated as stable or variable. If it is variable, is it predictable or unpredictable (stochastic). For a given type of response, a specific management model will be effective (Figure 1.3).

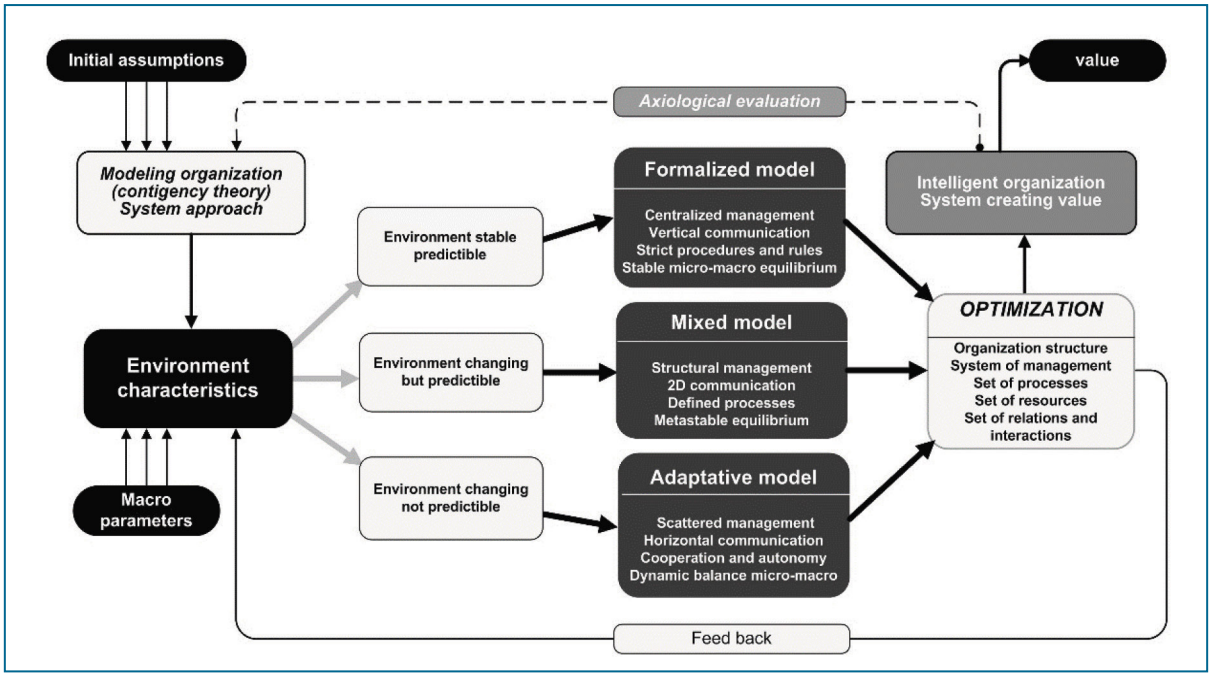

Figure 1.3. Adaptive structuring of organization management according to the theory of contingence

Source: (Gospodarek, 2012).

In crisis situations, as easy to predict, the environment becomes completely unpredictable. In order to cope with the disruptive stochastic impulses from the macro side, the organization must adopt a highly adaptive reaction form in the micro-scale. This applies

to its market behaviours, process maps, value chain and local supply chain. The micro-macro balance is then dynamic and only *ad hoc* actions and emerging strategies can effectively adjust the actions to match the micro-macro balance according to the Le Chatelier principle.

Two elements of the organization become then the variables: the local supply chain and the value chain. The local supply chain is responsible for the flexibility of logistics (especially the external one) and its costs. The optimization of this element of the organization's operation in correlation with the market situation is a critical requirement. The global supply chain always provides the resources necessary for business, but in crisis conditions there appear mainly logistical, protectionist and financial impediments. Modify the local supply chain that is always embedded in the global one (Gospodarek, 2018a), is mainly about reducing supply uncertainty and the cost of raw materials and services. Market expansion issues are rarely relevant in crisis conditions. Reverse actions – restrictions and optimization of the organization's market share, are much more often observed.

If we want to modify the *ad-hoc* value chain, we have a number of variables that we can optimize depending on the situation. And since, according to the theory, there is no single, best way to manage the organization, and the required result can be achieved in numerous ways, taking into account the extended model of the value chain (Gospodarek, 2018b), the following aspects become crucial.

1. Satisfaction of stakeholders (analysis of expectations and opportunities in relation to the map of stakeholders – market activities are here related to customer satisfaction and marketing).
2. Protection of the result (withdrawal from long-term and low cost-effective projects – market activities are related to cost and efficiency optimization in terms of profitability and cost of capital of Weighted Average Cost of Capital – WACC).
3. Reduction of costs (reduction of obligations, limited outsourcing, reduction of redundant resources, implementation of more effective technologies – in terms of market impact we are dealing with a reduction in the cost of our own sales and marketing costs).
4. Optimization of assets and liabilities (warehouses, fixed assets – conversion to high-liquid assets, where possible, reduction of long-term liabilities; market activities at this point are associated with optimization of sales financing, reduction of WACC, while increasing stock rotation).
5. Portfolio optimization (typical market activity results from Pareto-Lorentz analyses and elimination of low-turnover and low-margin positions in the sales portfolio. Analysis of McKinsey and BCG allow to supplement information and increase the level of certainty of optimization decisions).
6. Logistics optimization (abandonment of inefficient supply and distribution channels, changes in the local supply chain).
7. Risk mitigation (verification of risk policy in accordance with ISO 31000:2009, transfer of externally-oriented third-party risk).

8. Change of marketing strategy (taking into account market restrictions, changes in preferences of buyers and optimization of the used marketing mix while maintaining the model 4P-4C (Kotler & Armstrong, 2016, p. 48).
9. Increase of key competences and knowledge content in the offer (sales of potential instead of generic products (Levitt, 1980), emphasis on the development of socio--technical systems related to the process map (Suder & Gospodarek, 2022).
10. Increasing the role of automation and the involvement of AI at the expense of human resources, especially those generating costs for organizations (re-engineering of processes mapped in the organization).

This is the adaptive market activity in a crisis situation. The more unpredictable the environment becomes, the more careful and defensive market action is to be considered rational. One of the fundamental laws of the open systems, which includes organizations, is the purposefulness of existence in time and the continuity of maintaining the micro-macro balance (Gospodarek, 2012). It is also important to remember the fundamental purpose of business activity, being important not only in a situation of danger, but also in a period of prosperity: *Business is not gambling, but the most secure way of earning money*. This requires aware market actions, backed by reliable information, knowledge, and data leading to such decisions, where the degree of uncertainty has been reduced to a minimum and the effects of materialization are predictable.

When the purpose of business and the precautionary principle during its running (which can be expressed as the Ovid principle – the sentence: *Whatever you do, do it carefully and look to the end*) have been defined, we come to the question of an Intentional--Consequential Gap (ICG). Its reduction is the more important, the greater the market uncertainty appears.

1.3. Intentional-Consequential Gap

Let us imagine a situation in which the intention was made to take some action changing the impact on the organization's market. At the time-moment t_1 we have a certain intention (e.g., to introduce a new product to the market). Let us assume that this intention materializes as an action within a specified time interval Δt. At $t_2 > t_1$, the consequences of this action are revealed, which could at most be only predicted at the moment t_1. During the Δt time interval, there is a knowledge gap concerning how to describe this future consequential state, which should occur at $t_2 > t_1$ with knowledge accessible at a while t_1 (intentional state). In philosophy, a similar problem is called Hume guillotine. As can be easily seen, in any crisis situations, this knowledge gap is significantly increasing, and in addition, the time-duration of a rational level of certainty of the forecasted consequences is drastically reduced. Under these conditions, strategic management is no longer relevant and must be replaced by adaptive and tactical *ad hoc* strategies on the market. The Intentional-Consequential Gap (ICG)

becomes then a key issue in managing the organization, if the risk of action is to be kept to a minimum, in accordance with the imperative of the manager's function.

From the considerations of management in uncertainty concerning the macro situation (Gospodarek, 2021) the following judgements arise concerning the character of a good paradigm in the sense of Kuhn (Gospodarek, 2009; Kuhn, 1970).

1. *A good paradigm of rational action*: The imperative of rational action is to achieve a minimum of the intentional-consequential gap associated with it. This applies to the rationality of the impact on the market, whether in the form of allocation of goods, withdrawal, or undertaking marketing activities requiring capital involvement. Knowledge and information resources are needed in all these cases.
2. *A good methodological paradigm of ICG*: The systemic approach to the issue of the Intentional-Consequential Gap makes a rational methodological basis. The use of systems theory and its laws, related to the fact that a given object can be considered as a system (an organization is an open system), allows to model market activities even when a large degree of complexity of interactions with the environment appears.
3. *A good paradigm for estimating ICG*: The model of game against the environment is rational to estimate the intentional-consequential gap in a systemic approach.

The above three sentences constitute the starting point for describing and modelling the market behaviour of an organization in a fast-changing environment, and the overriding aspect is the minimization of ICG. How to achieve this? There is no universal answer, but if the organization is treated as an open system playing the non-zero sum game against its environment, we have to our disposal some tools from the area of system theory (Bertalanffy, 1998; Gospodarek, 2012). This attributes the issues of minimizing the ICG to measurable changes in system behaviour parameters, while the support from game theory allows for building criteria for rationality of actions and adopted goal functions.

There are three important claims that can be made following the application of these operating principles (Gospodarek, 2021):

1. Decisions may be considered reasonable if related to them ICG value is minimal.
2. This strategy of action is better, for which ICG is smaller.
3. Each praxeologically optimal action is associated with the minimization of ICG.

In crisis situations, these claims are gaining special importance, because ICG is much more difficult to define and minimize. In practice, there is an increasing managers' interest in the environmental data and global economic indicators. In other words, market activities are rationalized on a micro scale, because on a macro scale crises cause unreasonable behaviours of authorities, global systems and markets. An example of this is the spectacular fall of Isaak Newton on the London Stock Exchange, related to the crack of the South See speculative bubble (1720). He then said a famous sentence[2]: *I can predict the movement of stars, but never the madness of a man*.

[2] Harvard Business School, Baker Library; Encyclopaedia NationMaster.com; Rollins.edu; aequi-libria.com; Oxford Dictionary of National Biographies.

A separate issue is the economic phenomenon metaphorically called "black swan" or "black elephant" (Taleb, 2007), where the emergence of a crisis situation can be compared to a sudden hurricane. In this regard, even the examination of the intentional-consequential gap may prove to be ineffective. It is worth referring to the 2019 crisis caused by the COVID-19 pandemic. The reaction of governments and all powers was inadequate to the threat, which we can assess today. No one at that time studied ICG, but took *ad hoc* actions, in line with the recommendations of big pharma and the stakeholders of the erroneous concept of "Zero--COVID", which were the beneficiaries of introducing chaos, fear among societies and lockdown. Their impact on the pharmaceutical market was an example of an emerging strategy and taking the opportunity, with the transfer of all resources to the immediate allocation of their own products. That is why the COVID-19 pandemic was not an economic "black swan", but rather a "black elephant" of a certain interest and market pressure on the sale of expensive preparations with suspicious effectiveness. No one wanted to notice this business, and the effects of market activities of big pharma on a macro scale we will experience for several years on a micro scale. A deeper reflection on the ICG of macro decisions taken by the environment could have completely differently guided the global economy.

1.4. Some Epistemological Aspects of a Crisis

The term "crisis" typically refers to a situation of intense difficulty, danger, or uncertainty that has the potential to cause significant disruption, harm, or negative consequences. Crises can occur in various contexts, such as personal, social, economic, political, environmental, or organizational. Understanding the term "crisis" involves grasping its key characteristics, stages, and potential impacts. The occurrence may be sudden or unanticipated, but the consequences for the organization and its publics are not.

Characteristics of a crisis

- Urgency: Crises demand swift action due to their time-sensitive nature.
- Uncertainty: Crises are often accompanied by a lack of clear information, leading to confusion.
- Disruption: They disrupt normal operations and can cause chaos or instability.
- Impact: Crises have a significant impact on people, systems, or environments.
- Escalation: If not managed properly, crises can escalate and worsen over time.
- Decision Pressure: Decisions made during a crisis can have far-reaching.

Stages of a crisis

- Pre-crisis: Signals and warning signs are present, but the crisis has not fully unfolded.
- Crisis onset: The crisis becomes evident and its impact is felt.
- Response: Decisions and actions are taken to manage the crisis and mitigate its effects.

- Recovery: Efforts to stabilize the situation and restore normalcy begin.
- Learning: After the crisis, an evaluation of the response takes place to learn from the experience.

Some aspects of a crisis management

- Assessment: Understanding the nature, scope, and potential impact of the crisis.
- Decision-making: Making informed and effective decisions under pressure.
- Communication: Keeping stakeholders informed, managing public perception, and dispelling rumours.
- Resource Allocation: Properly allocating resources to address the crisis.
- Adaptability: Being flexible and adaptable to changing circumstances.
- Collaboration: Coordinating efforts among different stakeholders, organizations, or government bodies.
- Long-term Planning: Thinking beyond the immediate crisis to plan for recovery and prevention.

Examples of crises

- Natural disasters (earthquakes, hurricanes, etc.).
- Public health emergencies (pandemics, disease outbreaks).
- Economic downturns or financial collapses.
- Political crises (widespread protests, conflicts).
- Environmental crises (pollution, climate change impacts).
- Technological crises (cyberattacks, infrastructure failures).

Impacts of a crisis

- Human Impact: Crises can result in physical injuries, loss of life, psychological trauma, and emotional distress for individuals affected.
- Economic Impact: Crises can lead to financial losses, reduced economic activity, job losses, and disruptions to supply chains.
- Reputational Impact: Organizations and individuals can suffer reputational damage if their responses to crises are perceived as inadequate or inappropriate.
- Social and Political Impact: Crises can lead to shifts in public opinion, changes in policies, and alterations in the social and political landscape.
- Environmental Impact: Some crises, such as natural disasters, have significant environmental repercussions, including damage to ecosystems and habitats.

Literature positions related to a crisis provide diverse perspectives from various disciplines, as: sociology (Tierney, 2019), political science (Shantz, 2016), economics and financial (Claessens & Kose, 2013), psychology (Richardson, 2023), communication studies

(Zaremba, 2010), environmental studies (Robinson, 2023; UN Environment Programme [UNEP], n.d.), health sciences, each contributing to a holistic understanding of the term "crisis" and its implications in different contexts (Cordero et al., 2016).

1.5. Key Performance Indicators in a Crisis Situation

Among the tools to assess correctly the state of the organization and changes observed as a result of all its strategic and tactical transitions there are Key Performance Indicators (KPIs) (Gospodarek, 2018a; Parmenter, 2015). Measuring the state defined with their help over time allows to monitor the changes and evaluate the effects of the intentions taken after the results of the action are revealed. This is the best method of reducing the Intentional--Consequential Gap, which can additionally be supported by integrated ERP-class IT systems implemented in the organization, which are *de facto* measuring devices for the assessment of the feedback power of micro changes (Gospodarek, 2018a) in relation to occurring macro changes. The more macro data will be taken into account in designing the measurement parameters and key performance indicators, the smaller ICG is expected. In crisis situations, having such a tool allows for a quick orientation in the macro situation and taking advance actions on a micro scale, protecting the business from externally oriented risks and market turbulence. At the same time, the monitoring of the risk map can be organized, because in the KPI set there are always indicators related to this issue.

Indicators from the KPI catalogue should have a measure and scale (Gospodarek, 2018a), which allows for the use of methods of their consolidation, comparison, determining the significance of differences, ordering, etc. After all, from a set of variables an integral measure should be obtained (Gospodarek, 2018a). From the point of view of changes in the value chain over time, it should be assumed that the appropriate set of KPIs creates a system of the 10 pillars of comparison presented above, to which appropriate measurement methods should be assigned, taken from the management theory instruments set. For example, you can use the indicators described in Clear Point Strategy (Jackson, 2023). What is the most important is that the integrated IT system supporting management used by the organization has reports with defined indicators that can be calculated *ad hoc* (availability under the online key after closing the processing period, e.g., day, week, month of posting, etc.). It is pretty easy to obtain financial and turnover data from the level of financial and accounting systems, provided the implementation of an intelligent chart of accounts, which gives financial data on the projects carried out and their cost effectiveness in the cost accounting calculation variant. It is more difficult with the examination of the level of satisfaction or customer service, because it cannot be obtained without the participation of the party declaring the value (survey). However, modern CRM systems cope with this problem during *quasi*-online time.

Some indicators related to the market behaviours of organizations require the use of measurement methods from the set of management instruments (Gospodarek, 2018a). These include:

- PEST (LE) analysis – assessment of the environment and the market, with the forecast and scenario of the development of the external situation,
- SWOT/TOWS analysis – a version including the forecast of the development of the values of factors and their interaction, enabling the calculation of an integral measure of the probability of success in the market,
- McKinsey analysis part A –attractiveness indicator of the sector, which is necessary to respond quickly to market trends,
- Analysis of 5 forces – quantitative multi-criteria approach with integrated indicators,
- Pareto-Lorentz analysis – quantitative ranking of stock turnover, sales of goods, employee efficiency,
- BCG analysis – an image of the organization's portfolio,
- Monte Carlo simulation – a forecast of the market result with the existence of a stochastic variable as an objective function.

The aim of the above examples was to show that a close relationship must be established between the set of monitored KPIs and the management instrument related to the interaction of the organization with the market. In this case, it is possible to monitor the quantitative changes both in the environment and within the organization. Such an action in the crisis period should be defined, because attempts to implement it just-in-time are not realistic. The markets in these conditions are changing too quickly and irreversibly over time. Therefore, any economic experiment can be done only once, since it is impossible to recreate the conditions of the environment from the past. One should be aware of this and plan market activities as well as possible. Operational research methods are well developed for most market and feasibility studies. They are also suitable for optimizing resources directly linked to sales. It is enough to start applying them, and business activities during the crisis will be easier.

1.6. Conclusions

When optimizing the organization's market activities in crisis conditions, consideration should be given to the applicability of the Le Châtelier rule and the minimization of the Intentional-Consequential Gap. The rule of contradiction, especially in actions done in advance of economic changes, allows for appropriate resource, capital and project reductions done in time. It minimizes the costs of operations while maintaining market potential. Particularly important is to concentrate knowledge and key competences, which allows for reducing the decision uncertainty and ICG. Increasing the importance of knowledge store in the organization allows for increasing the added value of products and products, which in crisis conditions can save the market position.

The tool supporting optimal operations are integrated IT systems of the ERP class, which not only enable to monitor key performance indicators and assess feedback, but also allow for creating professional groups having the status of social engineering systems within the organization. ICG can be monitored by comparing the relevant indicators over time. That is why it is worth preparing the organization for transition toward smart market behaviour with an emerging strategy that minimizes externally-oriented risk during the crisis. This is what offers management being based on ICG minimization combined with negative feedback monitoring.

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2 Crisis Situations in Enterprises – Symptoms and Expected Support

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2.1. Introduction

Crisis situations are not a new phenomenon. They occur at different times and with different intensity. They also have different character and scope – from the global level, through macroeconomic to microeconomic one. Research on this phenomenon has been conducted for years dealing with various areas, entities and their market situation. We also see various measures of this phenomenon: from changes in the market share, in sales level, up to the employment level and so on. New activities appear aimed at minimizing adverse phenomena. These activities may concern specific managerial practices, where some general principles to manage any crisis can be formulated (Nichols et al., 2020). Each case has, however, some specific features and needs that are calling for the most adequate reaction. These are not only the actions of the enterprise itself, but also the expected changes in the environment, as clearly results from the research described in this chapter.

2.2. Perception of Crisis Situations

It is worth noting that crisis situations reveal the nature and strength of the relationship of individual entities being under their influence (Batóg, 2016). Interesting insight into these phenomena together with some applicable recommendations can be found in literature

(Orłowski et al., 2010). Their research done in 2009 in the SME sector gave a thorough analysis of the situation of the surveyed companies of selected industries, considered by the European Commission to be particularly sensitive to the negative impact of the economic crisis. At the time of the research, the world economy was struggling with a serious crisis, and one of its symptoms was a significant decrease in the level of confidence in individual market institutions.

In recent years in Poland we have experienced a number of various crisis situations. As never before, they cover the entire economy, including all actors within the economy. The importance of studying crisis is due to the fact that it has a strongly felt negative impact on the level of safety of people. It affects also the environment. Since quite often the proper measures are lacking, the actions to minimize risks are limited. Research on crisis situations, or the crisis itself, can be conducted on a different scale: from the macroeconomic scale (when the whole economy is concerned), to the meso one (regional economy) to the micro--economic scale. In this latter sense, it refers to the market behaviour of enterprises and other market participants. Each of these scales has a significant cognitive, diagnostic and application significance (Sobczyk, 2010; Steinerowska-Streb, 2017). Especially the recommendations for crisis management are important. The complicated nature of crisis requires a differentiated approach to the system of action in each of these different areas. An extended analysis of crisis situations and the nature of the crisis itself is presented in (Piwowarski et al., 2019). The most important findings are that any crisis should be treated as a violation of the state of balance. It is often stressed that the crisis itself is a result of an earlier crisis situation – the culmination of certain events leading to the negative impact on society and individuals. Therefore, the care is required to minimize these negative events. There is therefore a strong interest in the establishment of statutory crisis management measures (Zamiar & Wełyczko, 2012; Żebrowski, 2012).

Recently, there has been in Poland a clear intensification of crisis phenomena of unprecedented scale – accumulation of such events as the COVID-19 pandemic, the war in Ukraine and increasing inflation. They determine the behaviour of market participants. It is worth returning to the previously discussed problems related to these behaviours. It turns out that they are permanent and determined primarily by:

- possibilities of action conditioned by resources,
- complexity of the environment,
- reliable information about phenomena,
- a network of multiple interconnections (Styś, 2016).

This unprecedented scale of threats verifies the approach to many (seemingly obvious) theoretical findings. The usual market objectives are starting to be seen differently. One of them was building a competitive advantage. It can be assumed, with a high probability, that this ceases to be the main goal. In its place comes the need to survive. This change determines market behaviours. Their nature changes the relationship between economic and social criteria of action. The scale of threats also changes the approach to the perception of the target markets. Market activities are clearly reduced. This applies to companies with which

cooperation can be established, but also to consumers who face difficult choices. The disparity between economic and social criteria is widening. There is growing concern about implementing the principles of corporate social responsibility. The issue of market policy for both economic operators and the external authorities needs to be re-examined. Unfortunately, we observe adverse effects which reflect the gap between the objectives and possibilities of market policy at the basic level, and policy at the higher organizational levels of the state. The lowest tier in the economic pyramid requires a particular interest from the central actors in the policy. These are measures to reduce poverty, reduce unemployment and thus promote stability and security. Otherwise, adverse effects may have irreversible consequences. The theory of restrictions should be reconsidered, in this sense also the previous findings of the Pareto rule that 80% of the restrictions are in individuals, including enterprises, and 20% are outside them (Tracy, 2004) should be verified.

2.3. Business Market Behaviour – Results of Direct Research

The problems discussed contributed to a new research initiative on market behaviour of enterprises in crisis situations. Such research was carried out at the WSB University in Wrocław in cooperation with IBS Pro Research. A questionnaire was used with a large number of closed questions and some open questions, where answers are difficult to standardize and where intuitive opinions are important. The interviews were conducted by experienced interviewers, whose work was constantly controlled by the coordinators. The sample consisted of 204 companies of different sizes (from micro, through small and medium-sized to large), different geographical scale (regional/local, national, international and different types of activities (trade, services, production). The research was of national scope. Taking into account the specificity of the studied groups (their availability and willingness to participate in the research), as well as ensuring the comfort of answering, the research was carried out by telephone interview technique using the questionnaire. Thanks to such a research method, the speed of project implementation was increased together with the quality of research, and the risk of making mistakes was reduced. The questionnaire questions concerned market behaviour in crisis situations. It included 11 questions in the basic part and 3 in the metric part. The answers of the respondents obtained during the research were declarative. The study was conducted during the June–August 2022 period.

The aim of the study was to recognize the perception of crisis situations and the system of actions taken to minimize their effects. In particular, the focus was on:

- learning how to perceive crisis situations taking into account various characteristics of enterprises, i.e., their size, scope of operation, nature of activity,
- identification and assessment of the emergency situation in the opinion of the management of companies,
- identification of the nature of work on crisis situations, mainly to minimize their effects,

- learning the results of work on crisis situations,
- identifying possible expectations and supporting entities.

On the basis of such objectives, the following research hypotheses were formulated:

- the perception of crisis situations varies, depending on the characteristics of enterprises disclosed in the metric,
- in enterprises actions have been implemented to minimize the impact of crisis situations, they vary depending on the characteristics of the enterprise,
- among companies there is a different assessment of the situations identified as the state of danger,
- companies expect support to overcome threats.

Of the companies surveyed, micro-enterprises accounted for around 34%, more than 28% were small enterprises, 24% medium-sized enterprises, and about 14% large ones. With quite comparable proportion (about 30%) appeared companies with international and national scope of activity, while slightly higher was the share of regional companies (about 38%). Among the industries surveyed there was a predominance of service providers (54%) and production companies (about 38%). Only about 7% were trade companies.

A number of answers were given to the important question – how the crisis situations are perceived, they are listed in Tables 2.1–2.4.

Table 2.1. The perception of crisis situations for the enterprise, overall answers

Answers	Number of indications
Loss/lack of financial liquidity	83
Lack of staff – transition to competition, change of employer, difficulties in retaining an employee	71
No orders – loss of contracts	67
Financial crisis – inflation, fuel prices, costs of services, raw materials and operations	61
Pandemic – lockdown	57
Lack of goods – broken supply chains, lack of spare parts – more and more difficult materials available on the market and their rising from-day-to-day prices, which extends implementation and increases its costs, many contracts are not renegotiated – work at cost	53
No customers	44
Material price change (price increase)	41
War – blockade of the Russian market	33
The situation on the energy market – an increase in the price of raw materials, fuel, lack of general long-term predictability in the energy market	29
Company debt	22
Volatility of tax rules, very frequent changes to the rules of the game introduced without consultation and appropriate transitional periods, giving the opportunity to calmly adapt to the new rules	17

Source: own study based on survey research.

Table 2.2. The perception of crisis situations for the enterprise, according to the enterprise size

Answers	Scope of activity and number of indications			
	total	regional/ local	national	international
loss/lack of financial liquidity	83	27	27	29
Lack of staff – leaving to competition, change of employer, difficulties in retaining an employee	71	22	21	28
No orders – loss of contracts	67	25	24	18
Financial crisis – inflation, fuel prices, costs of services, raw materials and operations	61	17	20	24
Pandemic – lockdown	57	19	17	21
Lack of goods – broken supply chains, lack of spare parts – more and more difficult materials available on the market and their rising from--day-to-day prices, which extends implementation and increases its costs, many contracts are not renegotiated – work at cost	53	16	11	26
No customers	44	17	13	14
Change in material prices (price increase)	41	11	13	17
War – blockade of the Russian market	33	6	9	18
The situation on the energy market – an increase in the price of raw materials, fuel, lack of general long-term predictability in the energy market	29	10	9	10
Company debt	22	7	7	8
Volatility of tax rules, very frequent changes to the rules of the game introduced without consultation and appropriate transitional periods, giving the opportunity to calmly adapt to the new rules	17	5	6	6

Source: own study based on survey research.

Table 2.3. The perception of crisis situations for the enterprise, according to the scope of activity of the company in the market

Answers	Enterprise size and number of indications				
	total	micro	small	medium	large
Loss/lack of financial liquidity	83	25	27	19	12
Lack of staff – leaving to competition, change of employer, difficulties in retaining an employee	71	18	17	19	17
No orders – loss of contracts	67	22	21	16	8
Financial crisis – inflation, fuel prices, costs of services, raw materials and operations	61	10	14	18	19
Pandemic – lockdown	57	15	13	18	11

Lack of goods – broken supply chains, lack of spare parts – more and more difficult materials available on the market and their rising from-day-to-day prices, which extends implementation and increases its costs, many contracts are not renegotiated – work at cost	53	12	5	15	21
No customers	44	15	11	13	5
Change in material prices (price increase)	41	8	10	12	11
War – blockade of the Russian market	33	4	5	13	11
The situation on the energy market – an increase in the price of raw materials, fuel, lack of general long-term predictability in the energy market	29	10	7	7	5
Company debt	22	7	6	5	4
Volatility of tax rules, very frequent changes to the rules of the game introduced without consultation and appropriate transitional periods, giving the opportunity to calmly adapt to the new rules	17	3	3	5	6

Source: own study based on survey research.

Table 2.4. The perception of crisis situations for the enterprise, according to the industry type

Answers	Industry type and number of indications			
	total	production	services	trade
loss/lack of financial liquidity	83	35	37	11
Lack of staff – leaving to competition, change of employer, difficulties in retaining an employee	71	36	32	3
No orders – loss of contracts	67	17	48	2
Financial crisis – inflation, fuel prices, costs of services, raw materials and operations	61	27	30	4
Pandemic – lockdown	57	15	40	2
Lack of goods – broken supply chains, lack of spare parts – more and more difficult materials available on the market and their rising from-day-to-day prices, which extends implementation and increases its costs, many contracts are not renegotiated – work at cost	53	31	18	4
No customers	44	19	19	6
Change in material prices (price increase)	41	17	19	5
War – blockade of the Russian market	33	13	17	3
The situation on the energy market – an increase in the price of raw materials, fuel, lack of general long-term predictability in the energy market	29	12	15	2
Company debt	22	8	13	1
Volatility of tax rules, very frequent changes to the rules of the game introduced without consultation and appropriate transitional periods, giving the opportunity to calmly adapt to the new rules	17	7	9	1

Source: own study based on survey research.

In total answers, most indications refer to the loss of financial liquidity (83). Further indications are the lack of staff (71), lack of orders, loss of contractors (67), financial crisis related to inflation, fuel prices, costs of services, raw materials and business operations (61), pandemic (57), broken supply chains, lack of spare parts, rising from-day-to-day prices (53), lack of customers (44). It is surprising that there are relatively fewer indications (17) concerning the volatility of tax regulations, very frequent changes in the rules of the game introduced without consultation and appropriate transitional periods, which could give the possibility of calm adaptation to the new rules.

There are some differences in the perception of crisis situations depending on the characteristics of the enterprise: more indications of loss of financial liquidity appear in small and micro enterprises (27 and 25). On this scale, there are also more indications regarding the loss of counterparties (21, 22). This is almost three times more than for large companies. Similar disproportions of indications concern loss of customers. Large companies are more affected by supply chain interruptions and financial crises. This is almost twice as many indications as in small enterprises. Similar differences in indications apply to companies with international scope of activity, compared to those with national or regional scope. A clear majority of indications for crisis situations related to loss of financial liquidity, lack of staff, financial crisis, broken supply chains was revealed in production companies. In the light of the results obtained, trading companies indicate in a relatively small degree the volatility to the crisis situations.

In answers to the question concerning the undertaking of work on crisis situations more than 64% of all surveyed enterprises confirmed that some activities in this area have been undertaken. Quite important differences could, however, have been observed when we take into consideration such features of the enterprise as its size, location in the market, and industry. These results are presented in Figures 2.1–2.3.

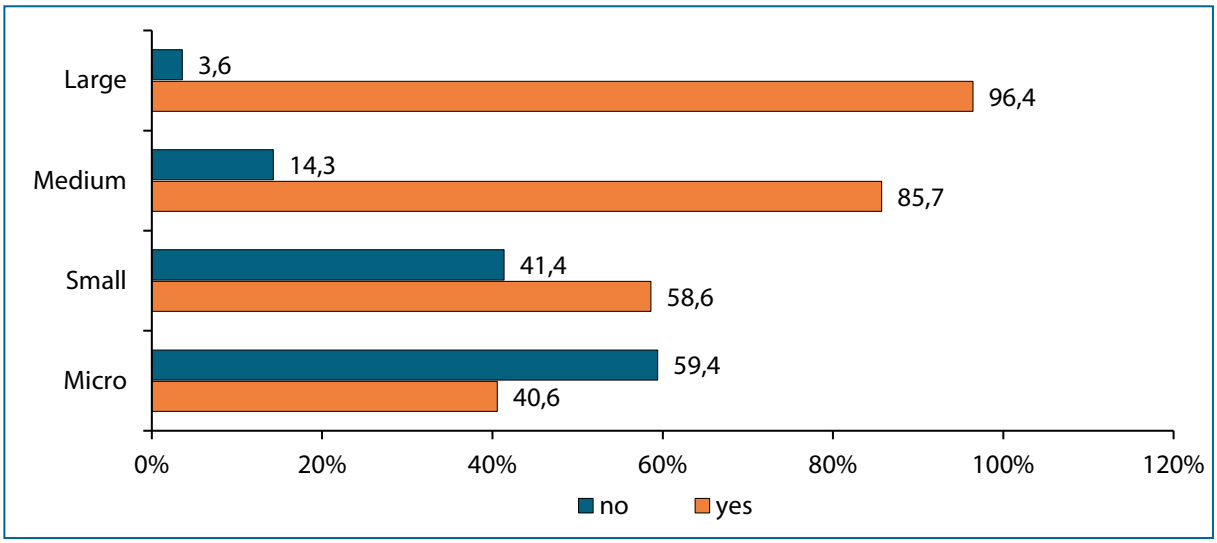


Figure 2.1. Activities undertaken by businesses in crisis situations, according to the size of the enterprise

Source: own elaboration.

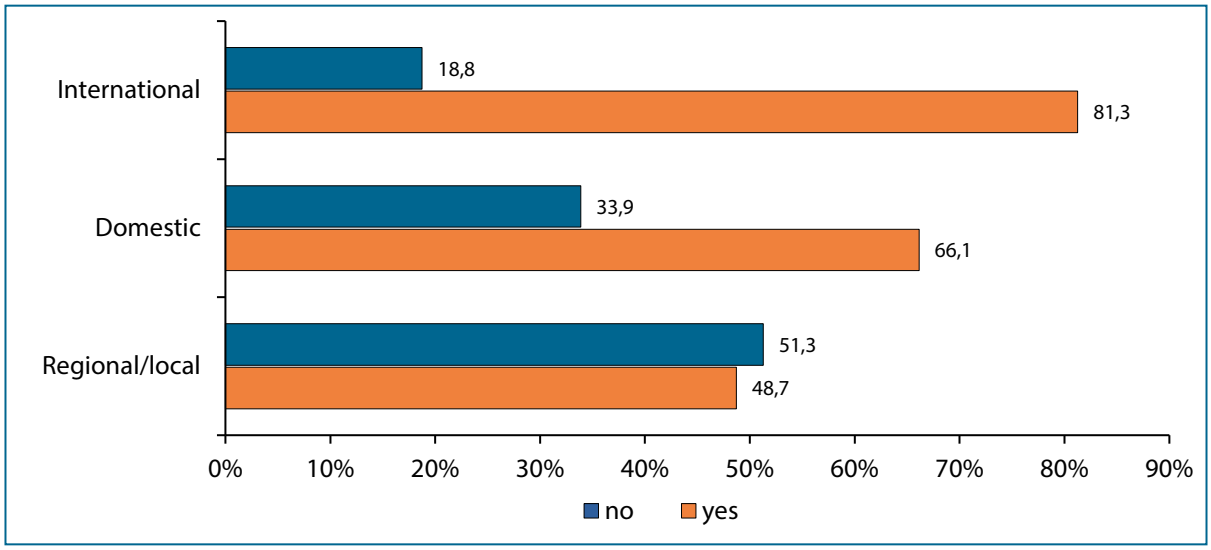


Figure 2.2. Activities undertaken by businesses in crisis situations, according to the location of the company in the market

Source: own elaboration.

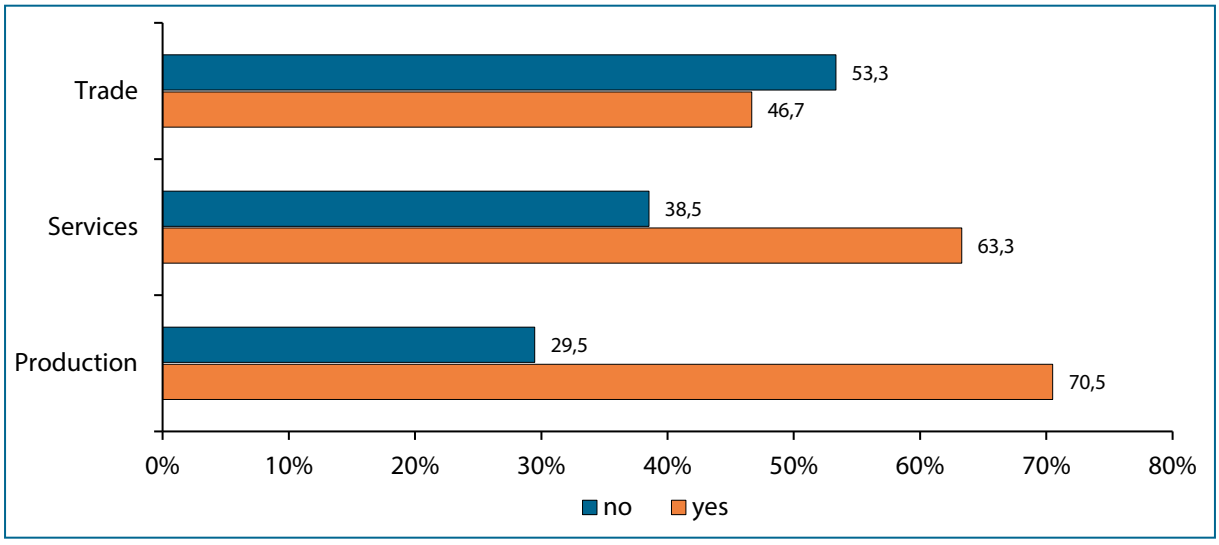


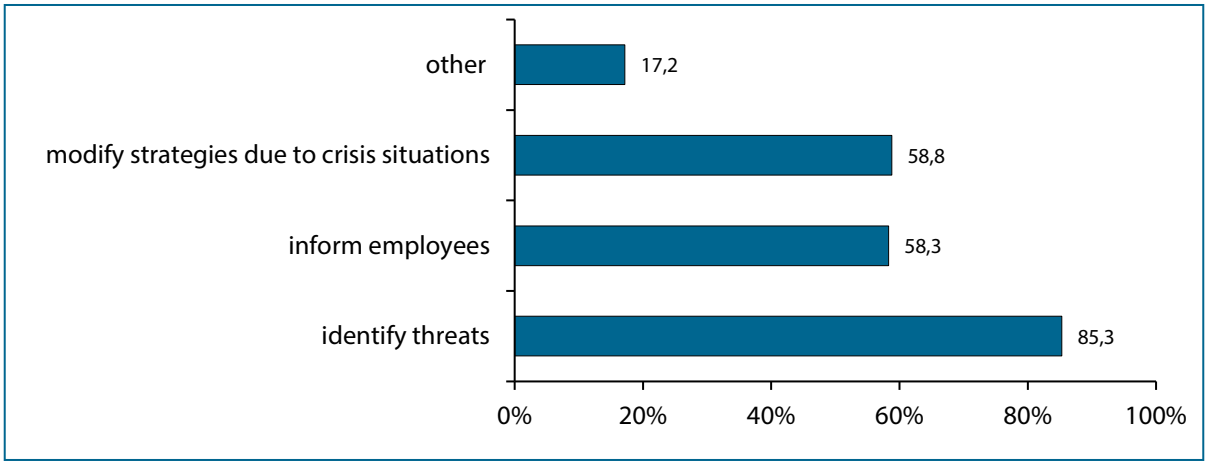
Figure 2.3. Activities undertaken by businesses in crisis situations, according to the industry

Source: own elaboration.

Here, we observe a very clear advantage for large companies (over 96%) and medium--sized enterprises (about 86%). Micro and small enterprises were in the range between 40% to 58.6%. Companies operating on the international market are also doing much better in dealing with crisis situations (81.3%). Production companies (70.5%) have advantage over

other companies. This is undoubtedly linked to the earlier remedial action already taken by these companies. It seemed interesting to know the nature of these activities. The respondents mentioned organizing *ad hoc* meetings and creating separate organizational unit for such work. The clear advantage of the indications was related to *ad hoc* meetings (over 81%). This also applies to the distinctive characteristics of enterprises. International companies in more than 34% of cases also point to the establishment of an organizational unit dealing with this problem. Production companies also took some measures 30%.

Among the results of activities undertaken in crisis situations were listed: the identification of threats (more than 85% of indications), the introduction of a modified the strategy after their occurrence (about 59% of indications). Taking into account the characteristics of enterprises, it is possible to conclude that the strategy has been modified to the greatest extent by companies with international scope of activity, and also by large and medium-sized enterprises (78% and 75%, respectively). See Figures 2.4–2.7 for detailed results.

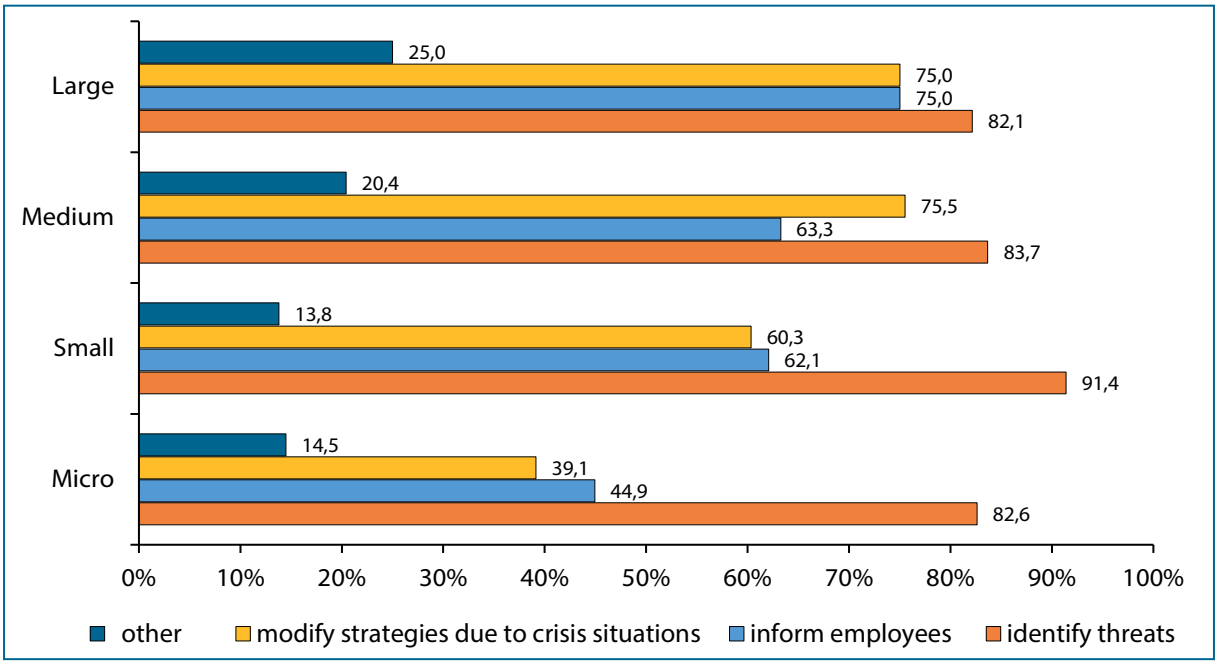


The percentage does not add up to 100% since respondents could indicate more than one answer.

Figure 2.4. Activities undertaken during crisis situations, answers in general

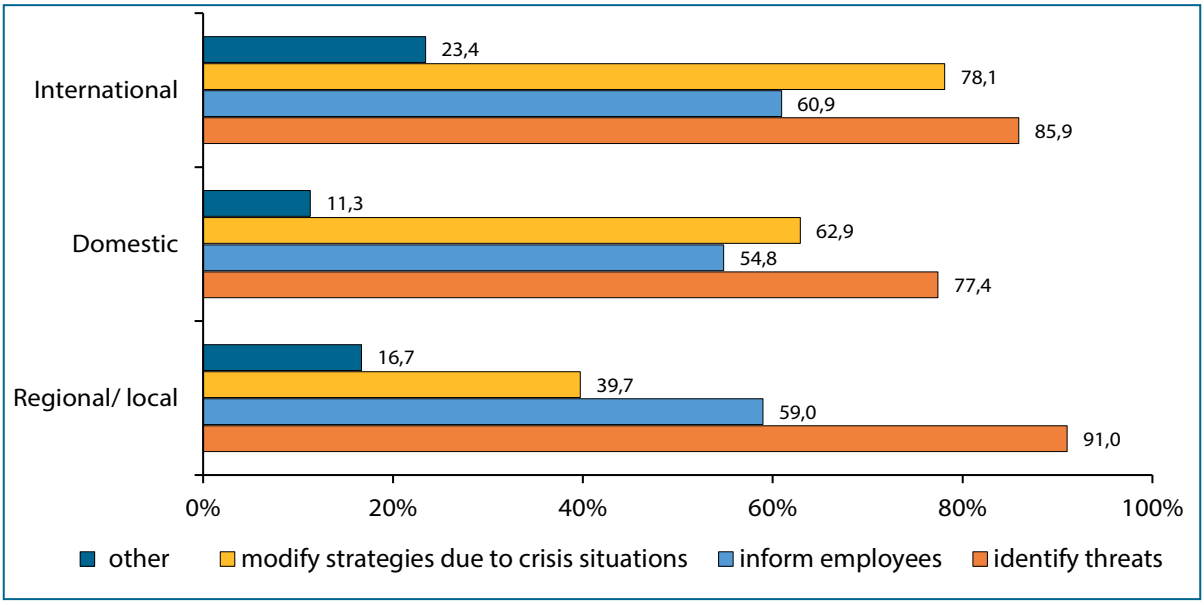
Source: own elaboration.

The answers are important, since all the surveyed companies have mostly identified the risk situation as significant (from 65 to 78% of the indications) and medium-term (more than 80% of the companies). The more precise characteristics of the activities undertaken to minimize the risk allow to distinguish three main groups: reorganization of the company, introduction of new technologies, and reduction of the target market. The reorganization of the company is significant for every type of company. This is described in detail in Figures 2.8–2.11.



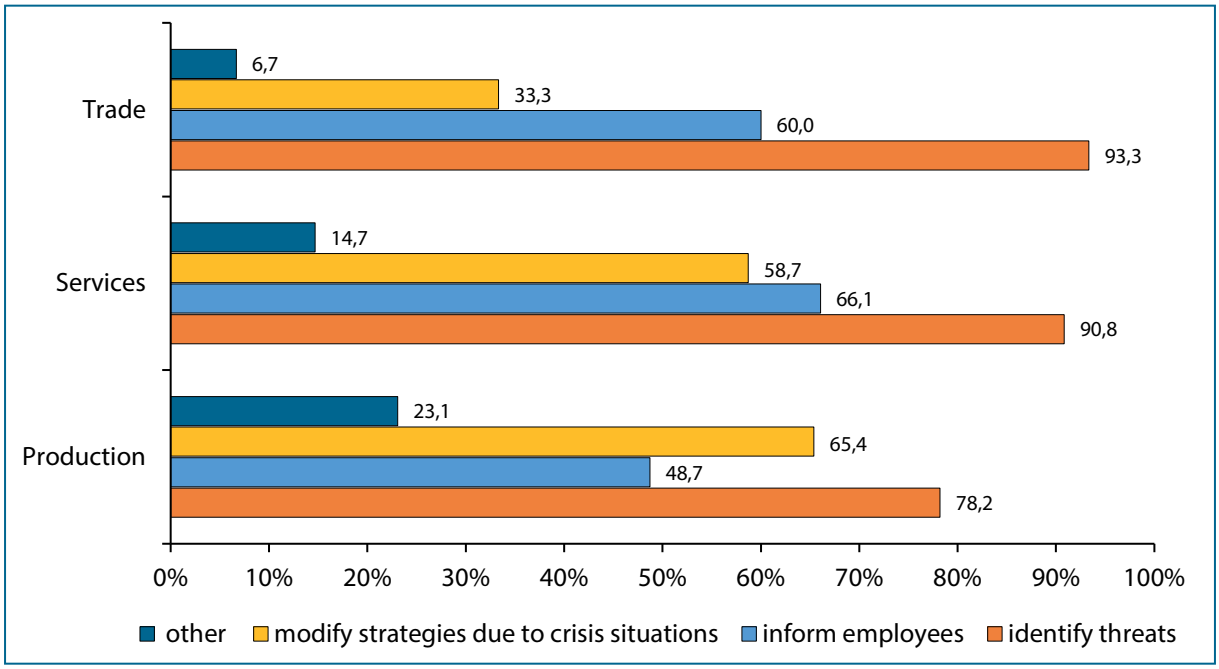
The percentage does not add up to 100% since respondents could indicate more than one answer.

Figure 2.5. Activities undertaken during crisis situations according to the size of the enterprise
Source: own elaboration.



The percentage does not add up to 100% since respondents could indicate more than one answer.

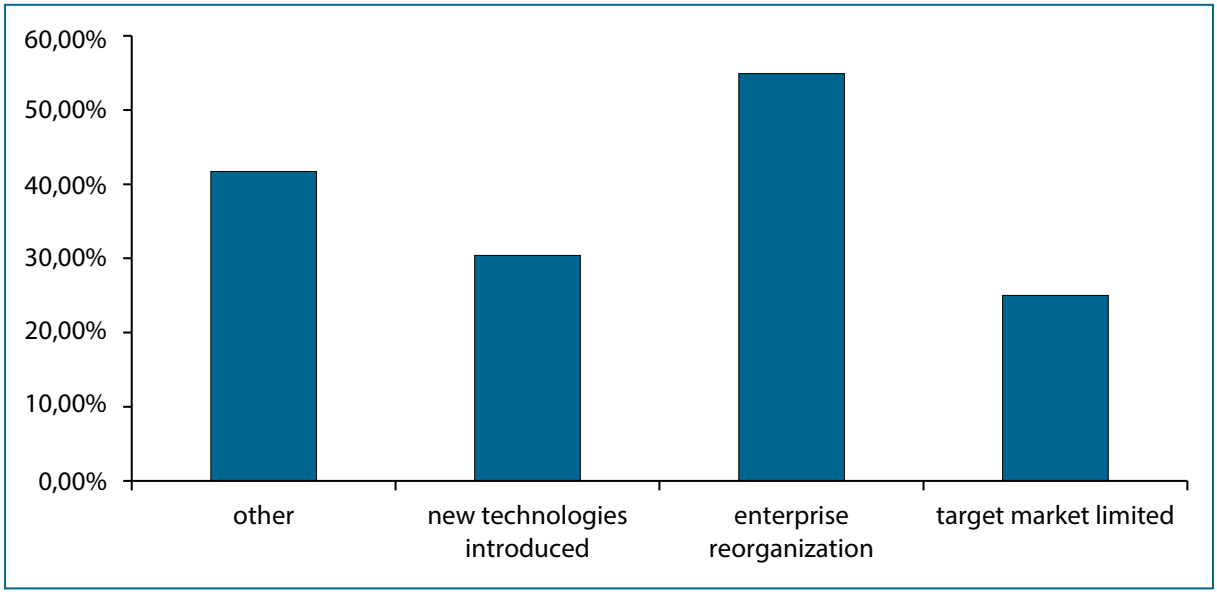
Figure 2.6. Activities undertaken during crisis situations, according to the location of the company on the market
Source: own elaboration.



The percentage does not add up to 100% because respondents could indicate more than one answer.

Figure 2.7. Activities undertaken during crisis situations, according to industry

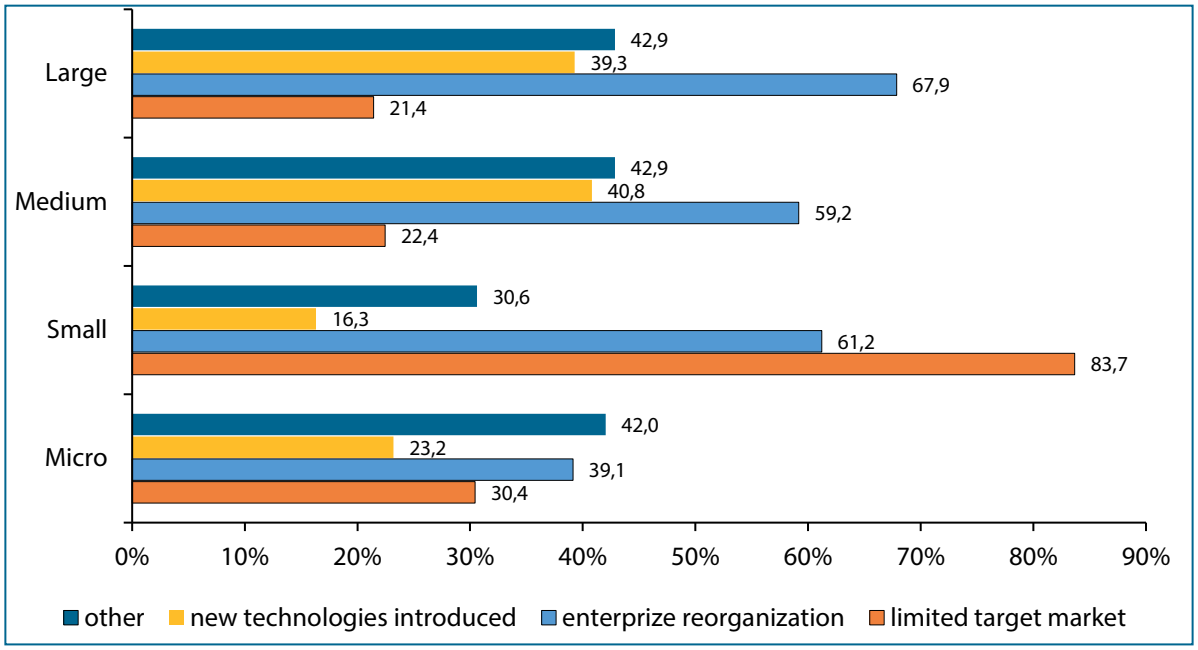
Source: own elaboration.



The percentage does not add up to 100% because respondents could indicate more than one answer.

Figure 2.8. Activities undertaken to minimize risks, overall

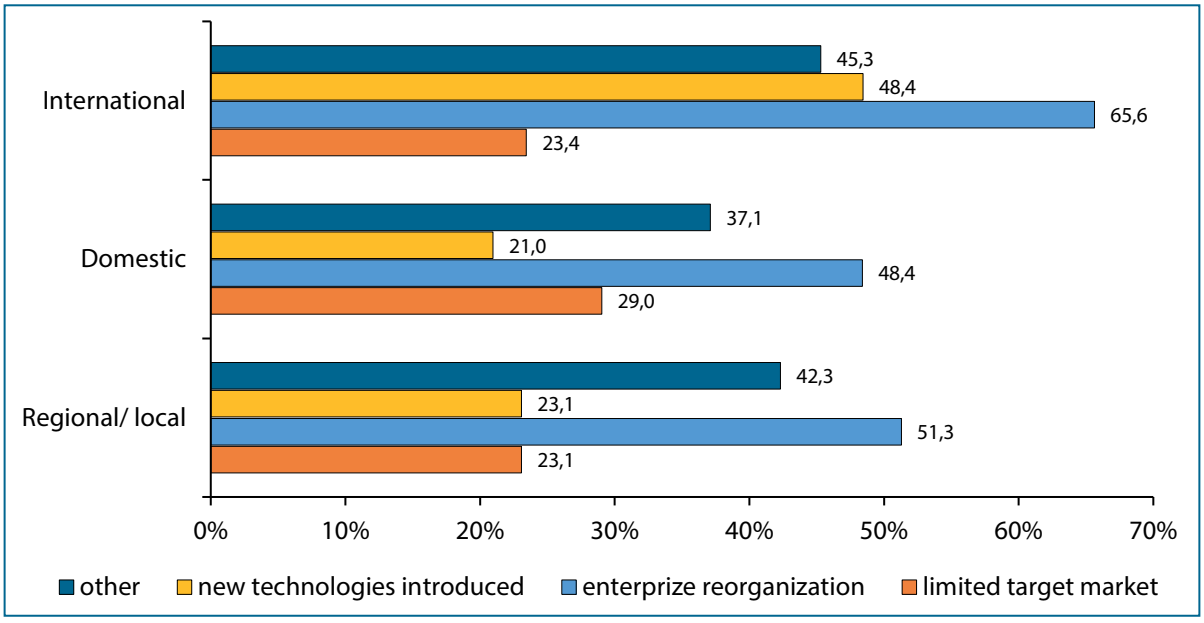
Source: own elaboration.



The percentage does not add up to 100% because respondents could indicate more than one answer.

Figure 2.9. Activities undertaken to minimize risks, according to the enterprise size

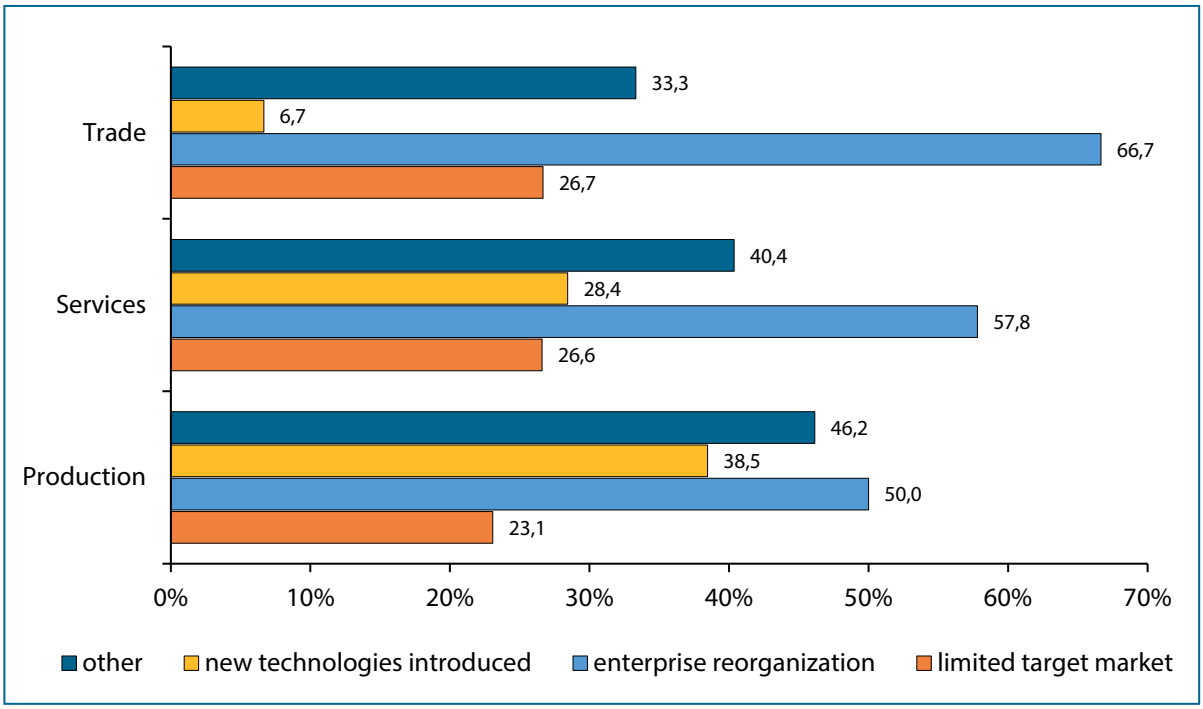
Source: own elaboration.



The percentage does not add up to 100% because respondents could indicate more than one answer.

Figure 2.10. Activities undertaken to minimize risks, according to the location of the company in the market

Source: own elaboration.



The percentage does not add up to 100% because respondents could indicate more than one answer.

Figure 2.11. Activities undertaken to minimize risks, according to the industry

Source: own elaboration.

The large share of responses related to the reduction of the target market in small enterprises (83.7%) is surprising. This indicates the greatest problems associated with crisis situations among these enterprises. Interesting are also responses concerning other activities. They have a much smaller share, but it is worth paying attention to their number. More than 76% of the surveyed companies reported the need for support to overcome threats. The largest percentage was found among small enterprises (more than 84%) and regional enterprises (more than 82%). To the greatest extent the need for support is expected by entrepreneurs from central offices and local governments (78.7 and 60.6%). A big proportion of large enterprises (80%) and international enterprises (80.9%) are waiting to be supported and the nature of the expected support is quite differentiated. Most of them are of an application nature. The research shows that the biggest impact on risk minimization activities have the owners of enterprises (76 indications), top management staff (57% indications) and lower-rank management staff (27 indications).

Among the indications connected with the expected external support, three groups of problems appeared. First group concerned the general policy of the state. Here the following issues have been raised:

- in general, government support for the entrepreneur related to the pandemic situation, more effective in measurable and economic sense than the "anti-crisis shields" used so far,
- obtaining funding for R&D activities within the National Centre for Research and Development or Polish Agency for Enterprise Development.

Second group of expectations concerned easier financing system, not only in terms of money access, but also more transparent rules and avoiding bureaucracy. Here, the following demands appeared:

- abolition of dumped prices – or some funding from international institutions, e.g., The World Bank, the Institute of International Energy, large international holding companies,
- facilitation and less bureaucracy in the area of EU funding,
- possibilities of financial support of statutory activities accompanied by more stable and predictable legal and tax system in Poland,
- stabilization in the field of tax regulations, predictability of Polish law, reduction of burdens and donations to the state, flexible tax tools,
- simplified procedures for access to EU funds, more open selection criteria,
- maintaining transparent rules for distribution of funds and minimizing the bureaucracy of subsidies.

Relatively large number of indications for expected support concerned staff policy, in particular trainings and forming new generation of workers in the presence of enormous volatility of the work force market. Here are examples of these issues:

- educational support (co-financing) in expanding knowledge about economic processes, tax changes, legislation related to conducting business activity,
- co-financing for rational development and retraining of employees, co-financing and tools and systemic support in the field of building a new generation of employees,
- the possibility of obtaining funds or co-financing for the implementation of training for individuals, simpler procedures for obtaining these funds, training carried out not according to top-down criteria, and based on the analysis of training needs,
- stabilization of regulations concerning business activity, in particular wage-related employment costs,
- more emphasis on practical education in schools, improved cooperation between schools and employers,
- lower contributions and taxes (or even freezing them), which would allow for overcoming the current situation,
- establishment of training companies and advisory system for raising awareness of crisis management,
- education for the needs of the labour market.

2.4. Conclusions

The presented results of the research allow for stating that the already formulated in management sciences 4 basic behaviours that help leaders manage a crisis decide with speed over precision, adapt boldly, reliably manage with the culture of accountability, and engage for impact in connection with individual team members (Nichols et al., 2020) – are no more sufficient. Crisis situations require the reconstruction of environment, what obviously concerns also economic and social relations. It has been clearly demonstrated that external support for enterprises is widely expected, through actions aimed at minimizing threats. Worth stressing is the need to continue research on crisis situations in various aspects: starting from the way they are perceived, up to the required changes in the environment. This is of particular importance, since in both areas, the risks may lead to catastrophe, so must be prevented at all costs.

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3 An Employee as Object or Subject – Either a Bond with the Enterprise or Pragmatic Instrumentalism. Case Study of the Crisis of Relations in Market Entities in the Light of Critical Management Studies

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3.1. Introduction

The Critical Management Studies (CMS), which inspired the realisation of this research, is a viewpoint rarely used as a theoretical base in studies on market players in domestic economic reality. This is a viewpoint that is fundamentally different from the functional one. The latter in the simplest approach, puts the researcher in the position of the one who objectively recognizes the existing reality in order to propose solutions that increase the economic efficiency of market entities and the rent obtained by their owners and its representatives (e.g., a group of executives, especially senior management). As a result, the researcher "enters the shoes" of the manager and is pressed to prove as an expert, who has to know at least not less than the manager, how to efficiently manage organizations. He becomes a "specialist" in the practical management of a market entity, not a scientist who formulates a reflection on

management. Sometimes however reality verifies inadequate ambitions. Advices for practice can be disappointing, and the gap between practice and theory, although it is assumed to be non-existent, becomes clear. This has been pointed out by Ghoshal (2005) in his critical article on management theory. Contrary to this viewpoint, CMS identifies the other, perhaps even the true nature of various managerial practices. In the so-called humanized management practices perceives the control reaching deeper than the bureaucratic one. It extends to the level of beliefs, attitudes, and values. It is referred to as post-bureaucratic control. Seemingly it is milder than the bureaucratic control, because it is not based on hard, unambiguous and sometimes severe orders or prohibitions, but rather on persuasion and inculcation. It is *de facto* more sophisticated and effective, because it shapes a person accepting the system. In the face of benefits and solutions aimed at welfare, the consent to function in the system proposed by privileged actors (business owners, staff) becomes natural. An alternative to the system generally does not appear in such conditions. It is therefore not the main thesis of the CMS that there exist economically disadvantaged groups, like the former working class, which are used in economic processes, but that these potential groups do not see it at all. Their members are functioning in a closed, effective and free market-oriented universe, beyond which they will never mentally get out. The slaves of the developed industrial civilization are sublime slaves, but indeed slaves, because slavery is determined neither by obedience nor hardship of labour, but by the instrumental status, reduction of man to the status of a things (Perroux, 1958, as cited in Marcuse, 1991). Under CMS, the researcher takes a reflection free from the constraint of practical and effective usefulness.

Given the above context, it should be clarified that authors are *a priori* distancing themselves from the possible interpretation, that among the players in domestic market discriminatory groups can be identified, which should be made aware of and offered aid, for example in the context of intervention studies carried out in a participatory perspective. On the contrary – only the subject of research is important, and even more – the authors are inclined to believe that utilitarian optics camouflaged in post-bureaucratic control is accompanied with adequate pragmatism, or perhaps even cynicism, of the also utilitarian oriented contemporary "working class", which indicates a specific crisis of human capital relations between market entities. The ethical qualifications of this group are probably statistically adequate for their utilitarian treatment. What is the source of this, remains unknown. Whether it is a subconscious reaction to the camouflaged actions of the "system organizers", a sense of "otherness" toward groups with different demographic characteristics, or rather a vision of interpersonal relations and the world created during the socialization process. In one of the sociological studies devoted to private business universities, which were created on a large scale during the 90s, it has been stated that it is not the teaching staff of the university, but rather the administrative staff who accept the system to the greatest extent.

It is obvious to them that the owner has the right to decide on everything, control the work of all paid by himself people, charge them with financial responsibility, and even to dismiss from work without giving a reason. The decisive argument for them is that, as the one who gives them a job, the Owner, can dictate the conditions, because "this is the essence of capitalism" (Nałęcz, 1996, p. 102).

Thirty years later, on the employee's market, not the employer's one, and in the context of the relative easing of the system, any resistance against the veiled, although still existing subject treatment of the employee may appear small, and its reason of being – difficult to explain. Such an attitude can also be typical in circles with no humanistic illusions, where the estimation of an individual's value is based solely on the function and a set of possible useful gains he/she can offer. In effect, the party organizing the system may be even more sophisticated than the manipulated one requires. The new "working class" can be therefore more cynical than business owners and senior management.

Another problem is the position of the management team. It is traditionally the owner's agent that has influence on the attitudes of employees. But how far does this impact go down in the organizational hierarchy? Are the managers of the lower levels more representatives of the crew, of senior staff, or perhaps solely, adequate to the rules of the game adopted in the system, keep an attitude that maximizes their own utility. A study previously carried out by one of the authors of the work (K.Ł.) concluded that the lower-level management showed an optics closer rather to the regular employees (the same concerns, attitudes toward engagement) than to the senior staff (Łobos & Szewczyk, 2016). So, who is implementing this inculcation in practice, and to what extent, if at all? It is likely that today it takes depersonalized forms, being saved in official company documents, electronic circulars, applications for employees. Therefore, if the official corporate ideology reaches an ordinary employee mainly or solely through depersonalized information channels and established general organizational rules, it can be expected that it is strange and alien for employees. If at all it is instilled, it is not taken seriously. As a result, there is no internalization, identification, commitment, internal motivation or sense of community. Instead, it is pragmatic instrumentalism which corresponds to the statement of one of the ordinary, surveyed employees, that "he never even saw the owner of the entire factory".

This study attempts to answer the questions whether: (1) the ethical competence of a group of employees can be considered sufficient to treat them in return as suggested in the so-called humanized management concepts, (2) the employees are instilled by the official corporate ideology, and if it works effectively, (3) unethical management practices do take place and to what extent they are common.

3.2. Methodology of Research and Characteristics of the Examined Population

The aim of the research was to determine the conditions of the relationship of domination, oppression or symbolic power in the organization.

These conditions are considered to be the components of such cultural pathologies as the manager-centred ideology, instrumental approach to man or hegemony of economics. By showing these syndromes in a negative light, the critical trend is guided by the intention

to improve working conditions with a concern for the reflective and emancipatory dimension of human being in the organization (Zawadzki, 2014, p. 14).

The diagnosis, which is the core of the research described in this work, indicates that the management processes are multifaceted and have a social character, and therefore should be considered in the perspective of such values as: ethics, morality and respect for another person (Sułkowski, 2014). Moreover, the consequences of this are of socio-psychological character, manifested, among others, in the sense of community with other people in the organization, identification with company goals and in general with the organization itself, which is reflected in perceiving the employee's place and role in the organization not in terms of alienation. In such a theoretical perspective, survey research was carried out, the aim of which was to empirically verify assumptions related to critical management theory.

The study was conducted using the survey technique in a large industrial plant located in lower Silesia, and involved 100 persons. Their socio-demographic profile reflected the general characteristics of the persons employed in the investigated enterprise (Figure 3.1). Among the respondents, there was a slight predominance of women, as their participation in the sample was 55%. The age structure of the respondents showed the majority of people with significant professional experience, since 85% of respondents were over 31 years old.

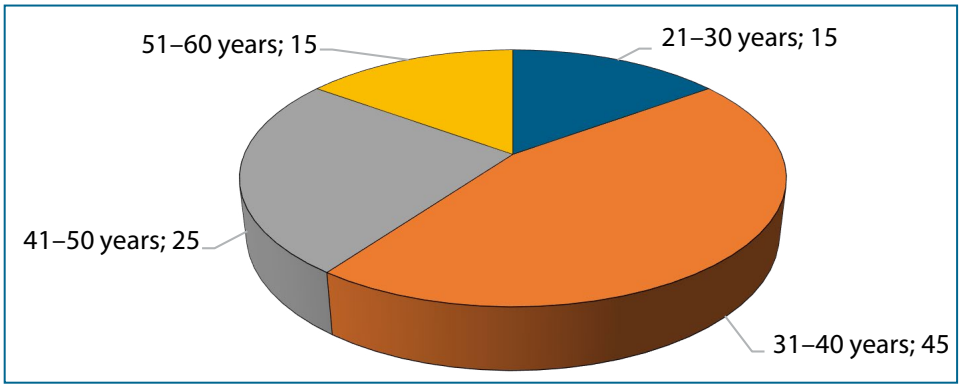

Figure 3.1. Age structure of investigated persons (in %)

Source: own elaboration.

In view of the fact that the entity under consideration was a manufacturing company, where the staff was dominated by people from the production department, who usually had secondary education, this had to be reflected in the sample. Thus, 75% of the respondents also had secondary education. In turn, basic education had 5% of respondents, also 5% of respondents indicated that they completed their first degree (bachelor or engineering). The rest of respondents (15%) held the second degree (master studies).

In addition to education, the second significant variable in the sample, which gave the essence of real characteristics of the workforce, was remuneration (Figure 3.2). Half of the respondents indicated the monthly net remuneration received in the range of 3001–4000 PLN.

30% of the respondents declared receiving higher remuneration than the prevailing in the sample, in this 10% indicated monthly remuneration above PLN 6001 net, 5% of respondents – 5001–6000, while 15% indicated remuneration of PLN 4001–5000. As much as 1/5 participants of the study declared to receive net monthly remuneration lower than PLN 3000.

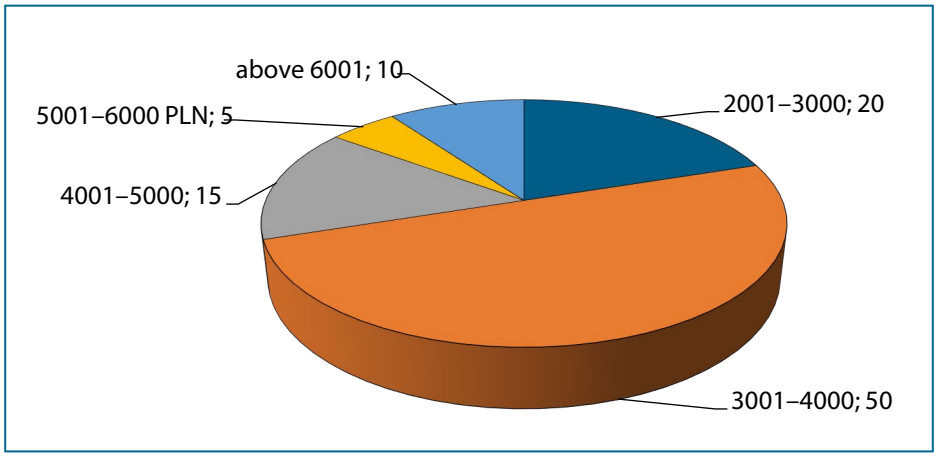

Figure 3.2. Percentage structure of net monthly salaries (in PLN)

Source: own elaboration.

It is worth emphasizing that the sample under consideration included wide range of positions linked to the processes taking place in the investigated enterprise, so the obtained results can be regarded as truly representative in the context of research problems, which is their advantage.

3.3. Results of Investigations

The first fundamental issue analysed in the survey was perceiving management as persons who want to create an organizational culture based on building the identity and loyalty of employees, by raising awareness of the goals and interests of all members of the staff. This issue was raised in a question, which was: Does the management of your company presents a vision of common goals and interests of employees, managers and owners of your company. The structure of obtained answers indicated that most of the respondents (55%) either denied it, or did not have such awareness. Thus, a minority, 45% of the respondents, approved this statement. This result allows us to conclude that the activities of the management of the investigated company were insufficient to obtain employees participation and to make them involved with common goals of the company. This probably does not help the staff to identify with the company itself.

The indicated problem was additionally reinforced with two questions.

1) What are the opinions of the respondents concerning the vision of the company presented by the managers – in the context of its acceptance or rejection?
2) Is some necessity resulting, for example, from financial obligations of the worker, such as having a loan, is an incentive for the respondents to engage in work.

The responses to the question 1 (Figure 3.3) show that the dominant opinion (for 40% of respondents) is that *it is a vision that is mainly good for managers*. An additional 10% of responses point to the view that *this is a vision that is mainly good for business owners*. These responses constitute an important indicator of alienation of downstream workers from the processes of strategic management, as well as employees' participation in the company under consideration. Only a quarter of the opinions obtained indicate that the company's vision is accepted as a factor influencing the identification of personnel with the company and building an employee community. This is evidenced by the responses (26%) which indicate *that this is a vision that is good for both employees and managers of the company and the owners of the company*.

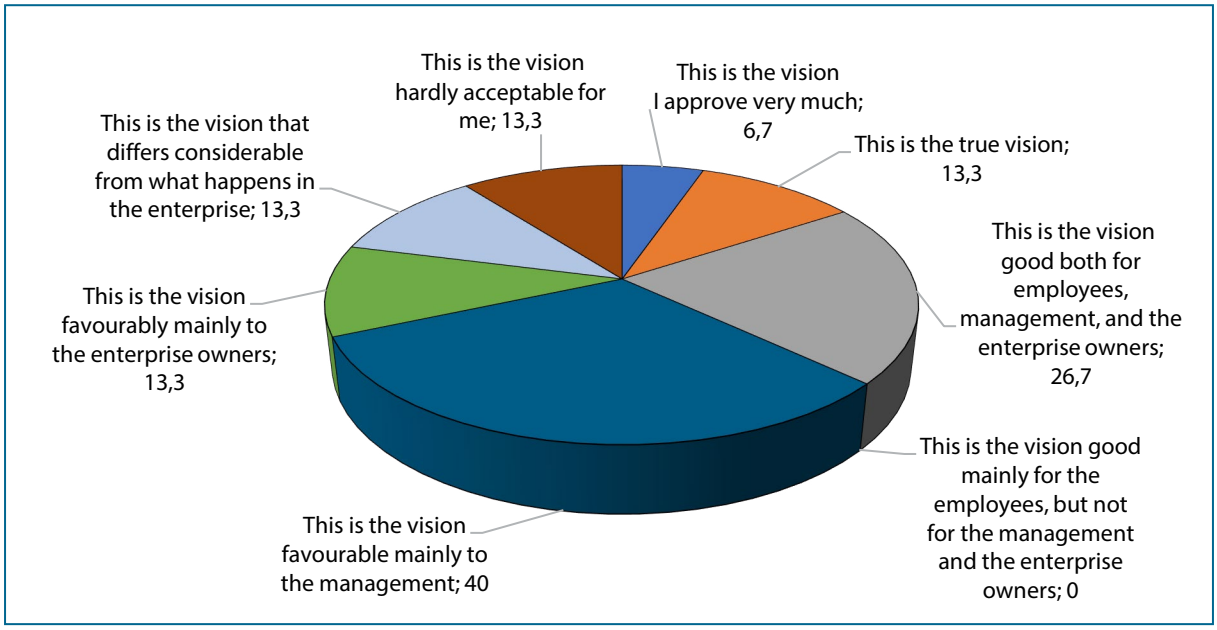

Figure 3.3. Answers to the question: *What is your opinion on the enterprise vision presented by the management* (please mark not more than the 2 most important opinions) (answers in %, *N* = 100)

Source: own elaboration.

In addition to the analysis above it should be noted that only 6.7% of the responses indicated that the respondents defined the company vision as a true one, while 13.3% as contrary to the company's realities, and a similar share of responses – that it is difficult to accept.

The indicated structure of the responses focuses, like in the lens, the problems highlighted by the critical theory of management, resulting from the lack of actions on the part of the management board, which would empower the lower-level staff and strengthen its identity in relation to the organization. Alienation, in the sense of community in the realization of the company vision, is a clear proof of this.

In the absence of acceptance of the enterprise vision, pragmatism becomes the main motivation. This is evident in the statements of the respondents referring to the source of motivation in performing their professional duties. These are financial needs and money necessary to satisfy them. As much as half of the respondents declared this motivation, while a minority of respondents (35%) answered that it does not motivate them, and another 15% that they feel not affected.

Creating an atmosphere of employee participation and their attachment to the company is based, among other things, on the practical implementation of the idea of talent management. The results of the research indicate that in the analysed company this activity appears rather rarely. The basis of this conclusion are the answers of the respondents, only 30% of them stated that the managers declare to use the employees' ideas to increase the efficiency of processes in the enterprise. The same number of respondents said that there were no such declarations at all. The rest of the respondents (40%) observed practices of this type very rarely.

The unwillingness toward performing employees' tasks, which is a symptom of the lack of identification with the enterprise, can also be observed in the attitudes of employees toward overtime work. The assumption here was that identification with the company, a sense of belonging to employees' group with subjective treatment of lower-level employees by management, can stimulate greater acceptance for the need to work overtime. Of course, the motivation to take up overtime is also important. Pragmatism, the need to raise additional funds, may be also a source of acceptance of overtime, but then it is difficult to talk about identifying with the company and its goals. Employees from the surveyed company said that in their company there appeared as much as 95% situations of necessity to work overtime, but for 70% these were occasional situations. Interesting are the results that show the degree of acceptance of this state of affairs (Figure 3.4). As much as 20% respondents indicated in this regard an extreme position: either a complete acceptance, or a complete lack of acceptance. Moreover, if we add the answers of those surveyed who stated that they do not accept working overtime at all, the opposition to work overtime has been stated by 25% of the respondents. The dominant attitude (of half of respondents) was moderate acceptance of overtime work.

In justifying their statements, in the form of answers to an open question, first of all there appeared arguments of those who do not accept work in overtime. Examples of such statements were: *8 hours is enough, there is nothing to overdo*, *Fatigue after 8 hours is too big to work longer*, *This is exploitation, the numbers in Excel do not agree, while employees are paid leftovers*, *Within 8 hours a person works at high speed, and 2 hours additional are tiring, there is still transport time*. In addition to these types of statements, which express the emotional

rejection of overtime work, there were also statements that rationalized the rejection of working overtime, such as: *The operator after 8 hours is less efficient*, *If there are no hands to work, let the company employ more employees, and do not ask for overtime*. The lack of approval of overtime was also justified by family matters, expressed for examples by statements like: *I have children and I can't work after hours, because I have to take care of them*, *I travel to work about 1.5 hours. If I stay for overtime, I have virtually no time for my family and I am just tired*. In the light of the opinions cited, it is difficult to see a sense of integrity of employees' attitudes with the pursuit of economic efficiency, which is the overriding goal for the management. The employee shows alienation in the context of overtime work and is only a tool used in the production process.

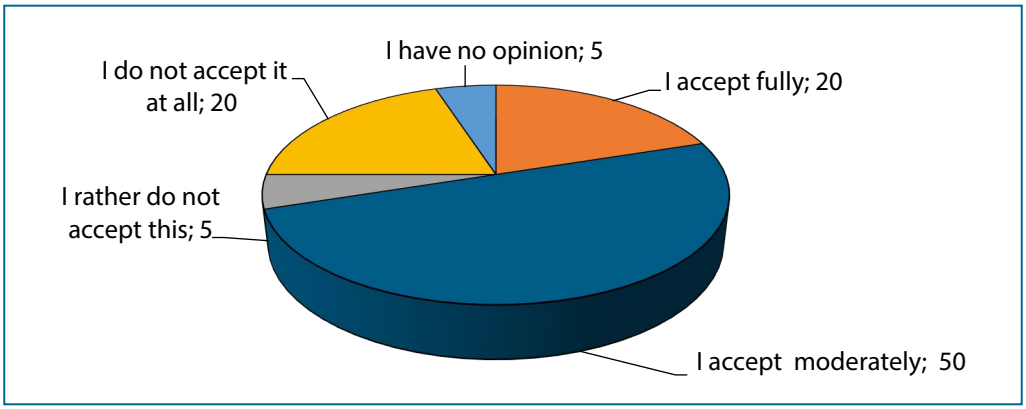

Figure 3.4. Structure of answers concerning the acceptance of the work after hours (in %, *N* = 100)

Source: own elaboration.

Pragmatism and lack of willingness of employees to engage in management processes in the company, i.e., some sense of alienation, were also reflected in their statements on the following issues:

1) whether the respondents would be interested, if they received a proposal from the supervisor, to involve into the processes of managing the enterprise,
2) whether the respondents would be willing to go through additional courses and training to be engaged by their superiors in the management of the company.

In relation to the first issue, the consent to accept the supervisor's proposal of involvement into the business management processes was declared by 25% of respondents, another 30% of them would categorically reject this proposal, while the rest of the respondents (45%) were unable to address this issue.

Concerning the second issue, in which respondents declared their willingness to undergo additional courses and training in order to be involved in management processes in the company, 40% of respondents expressed their acceptance and 30% were negative. Similarly, 30% were not able to identify their choice.

The main factor that would possibly change the attitude of the respondents, that is would increase the willingness to engage in business management, could be, according to the respondents' declarations, additional money (this is a factor indicated by 75% of respondents). Awareness of the greater impact on processes inside the company and possible non-monetary benefits played a minor role in the opinions of the respondents, respectively accounted for 15 and 10% of the indications.

The sense of alienation of employees was further highlighted in the opinions on the question: *Would you be willing to devote your free time without additional remuneration to undertake additional work in the company*? Only 5% of respondents answered positively, while 85% of respondents gave a negative answer, in this 40% categorically negated such an idea. The rest of the respondents (10%) had no opinion on this subject (Figure 3.5).

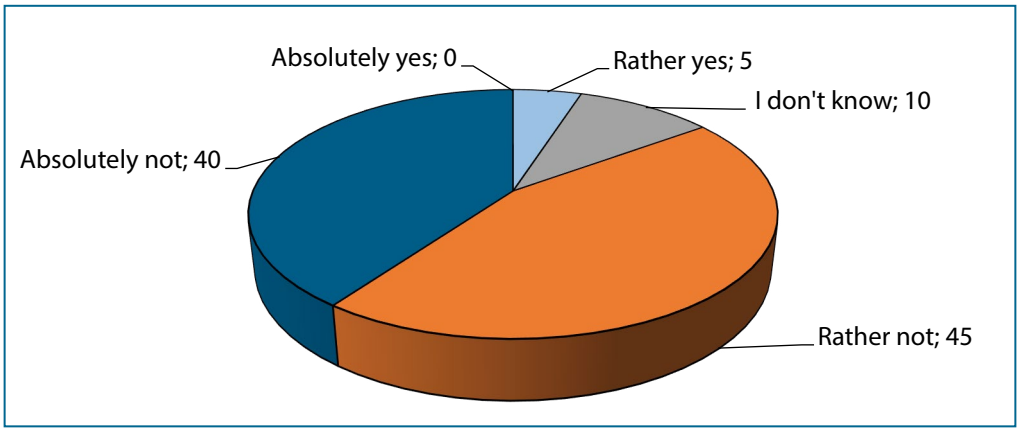

Figure 3.5. Structure of answers to the question: *Would you be willing to spend your free time and without additional remuneration for additional work in the company* (in %, *N* = 100)

Source: own elaboration.

The respondents not only showed a lack of real ties with the company, which was reflected in the answers described above, but also a lack of relationships with colleagues, because the question: *Would you be willing to devote your free time, without additional remuneration, to some extra work that helps to fulfil the duties of your colleagues* was answered negatively by 70% of the respondents (40% of them said that they were definitely not). Only 10% stated that they would rather help their colleagues and 20% of respondents were unable to address this issue.

Often observed in business practice and described in the literature as an element that motivates the employees to involve more strongly into the enterprise processes and increase the sense of belonging to the employee community, are integration trips. This also the case of the investigated company, where there were organized such trips. However, the results of the research show that in no way it positively affected the attitude of employees. The question: *Do integration trips the company in which you work motivate you to engage more*

in tasks that are in your area of responsibility as an employee, was answered negatively by as many as 70% of the respondents – it did not matter at all to them. This may be due to the fact that on these trips, as 80% of the respondents stated, the management does not discuss key, strategic issues related to the company's activities. All this can explain the fundamental issues emphasized in the critical management theory, namely the willingness of employees to take responsibility for the company and to engage in decision-making processes. Figure 3.6 shows that for 75% of respondents having more influence on the functioning of the company does not really matter.

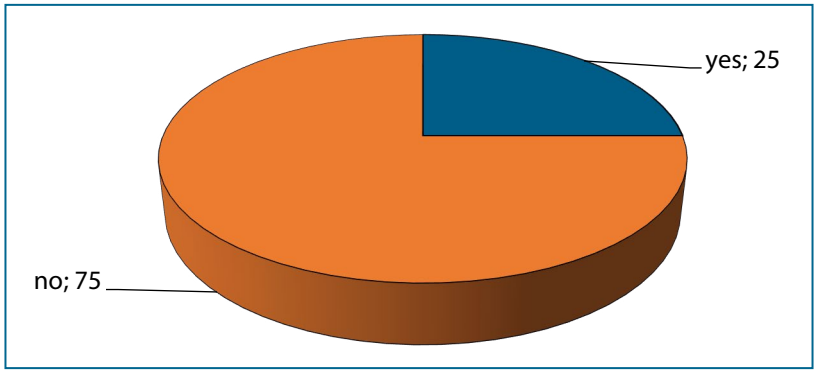

Figure 3.6. Structure of answers to the question: *Would you like to have a greater impact on the functioning of the company in which you work*? (in %, *N* = 100)

Source: own elaboration.

The respondents also indicated that they had no major impact on solving problems concerning the functioning of the company. This is demonstrated by the response structure presented in Figure 3.7.

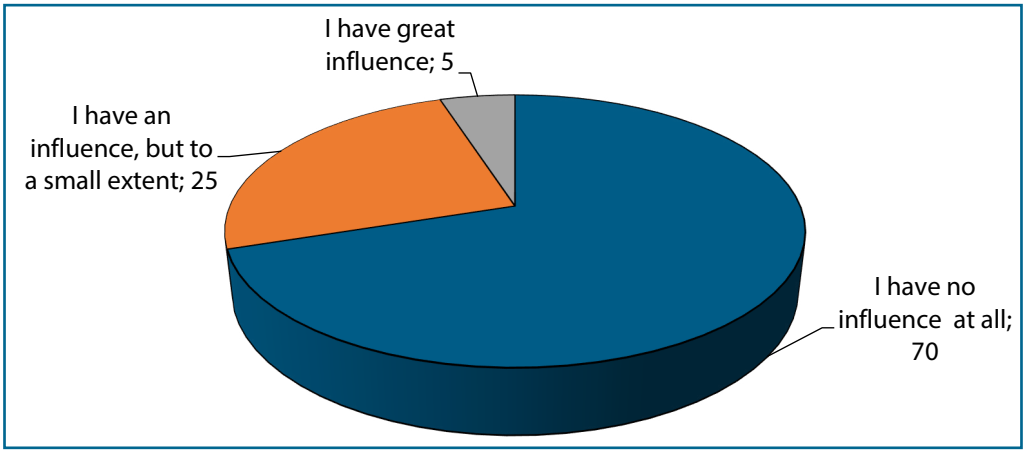

Figure 3.7. Structure of answers to the question: *To what extent do you have an influence on solving problems concerning the functioning of the company in which you are working*? (in %, *N* = 100)

Source: own elaboration.

In an open-ended question in a research survey, aimed to precise the above issue, respondents could indicate those areas where they would like to have a greater impact on the functioning of the company. It turns out that among this minority of employees who perceive such an impact as desirable for themselves, prevail the areas directly related to the performance of their employee duties. These are statements relating to the reorganization of work centres, distribution of duties, or even the equipment of the workplace, as well as issues directly related to the organization of working time (here an example of such statement: *employees should be able to go dressed up during their working hours, not after quitting time*). Individual statements referred to fundamental issues, such as the impact on the bonus system.

One of the CMS's theses is that employees are treated like objects, and in the efficiency--oriented conditions that waste their potential, are not aware of it. In the context of this statement, the surveyed employees were asked whether they sometimes feel that they are involved in achieving those objectives of the company which affect only the assessment of their superiors, and have no impact on the assessment of their own performance of the tasks, that is employees themselves (Figure 3.8).

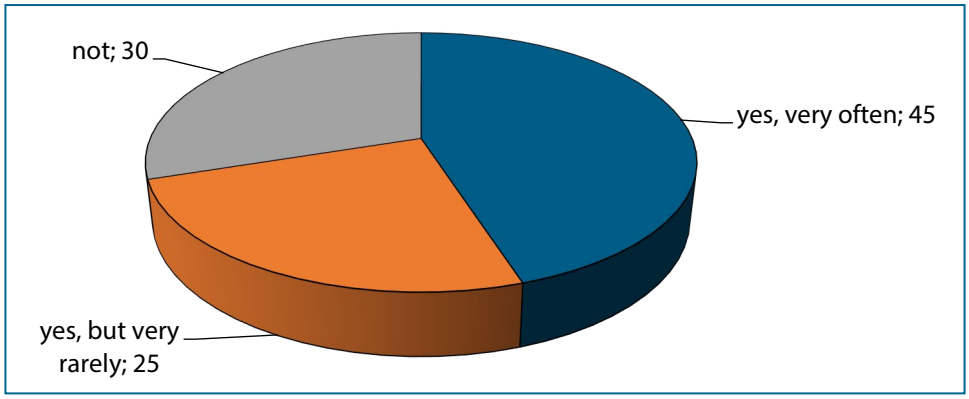

Figure 3.8. Structure of answers to the question: *Do you sometimes feel that you are involved in achieving the objectives of the company, which only affect the assessment of your superiors and do not have any influence on the assessment of the implementation of your tasks*? (in %, *N* = 100)

Source: own elaboration.

The results obtained in the research are in contradiction with the CMS thesis, because as many as 70% of respondents said that they had such a feeling, only 30% of respondents did not notice such a problem. However, these data show the exploitation of employees in question, the process that causes them to be alienated. Moreover, the process of subjecting and alienating employees may also be a consequence of the procedure of using socio-techniques by superiors in order to obtain particular benefits. The results of the research also shed light on this issue, because the respondents were asked to express their opinion on the question: *Have you ever had the impression that your superiors are influencing you in order to force you to tasks that do not lie in your area of activity as your superiors are responsible for them* (Figure 3.9)?

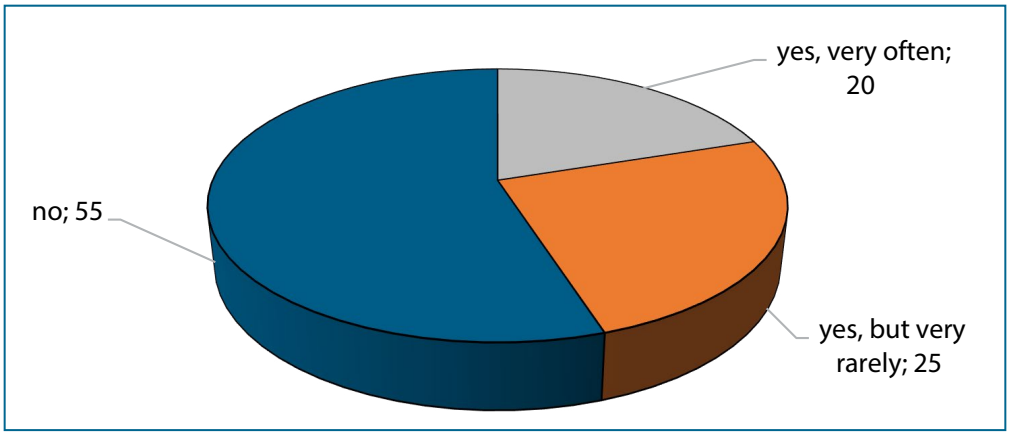

Figure 3.9. Structure of answers to the question: *Have you ever had the impression that your superiors are influencing you in order to force you to perform tasks that are not in your area of activity and are the responsibility of your superiors*? (in %, *N* = 100)

Source: own elaboration.

The majority of respondents, as much as 55%, had a negative opinion on this, but the rest, not a small part – 45%, commented positively in this matter.

The question of "ethical competence" of employees can also be verified on the basis of opinions relating to the question whether the respondents would accept a situation in which, without the knowledge of their supervisor and contrary to the procedures adopted in the enterprise, they could achieve an objective that gives them additional benefits, e.g., a bonus (Figure 3.10). Statements accepting such a situation would indicate a complete alienation of the respondents as being the part of the employee team, and would indicate

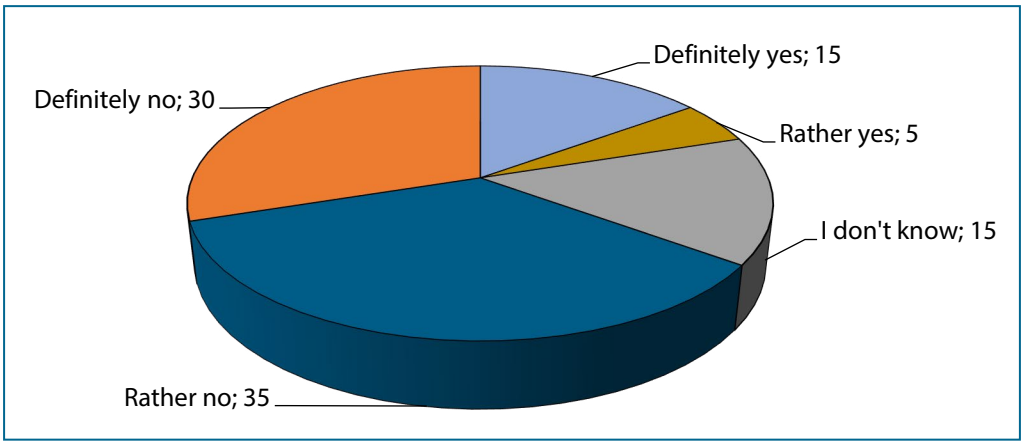

Figure 3.10. Structure of answers to the question: *Would you accept a situation in which, without your manager's knowledge and contrary to the procedures adopted in your company, you could achieve some goal giving you additional benefits, e.g., bonus* (in %, *N* = 100)

Source: own elaboration.

maximum instrumentalism in the treatment of their professional duties. It turns out that most of the respondents responded negatively to this question, but as many as 20% of them answered that it could be acceptable, and in addition, 15% showed an attitude of hesitancy, and lack of firmness.

So, what affects such employees' attitudes? Perhaps the reason lies in the perception of the company as a place where employees experience discrimination, mobbing, and treat their workplace as one that does not bring anything useful to the environment. For this reason, there is such a clear split between identification with the enterprise and pragmatism with instrumentalism. Therefore, the research also attempted to answer the question of how the company is perceived by employees, whether employees see in this economic entity a place where there are numerous dysfunctionalities and its social significance is marginal, and that is why there is such a strong attitude of alienation, lack of identification with the company and lack of deeper personal ties with the goals of the management board? The indicators of this were answers to questions about the experienced criticism – both toward employees and their co-workers – from the part of the board, i.e., discrimination on grounds of sex, age, cultural diversity, or lack of care for the natural environment and lack of involvement in various kinds of charity projects.

The results of the research on the individual issues mentioned above indicate that the feeling of alienation, of lacking sense of subjectivity of employees, may result from the management attitude, which according to the respondents applies criticism more often than praise for the work performed (Figure 3.11).

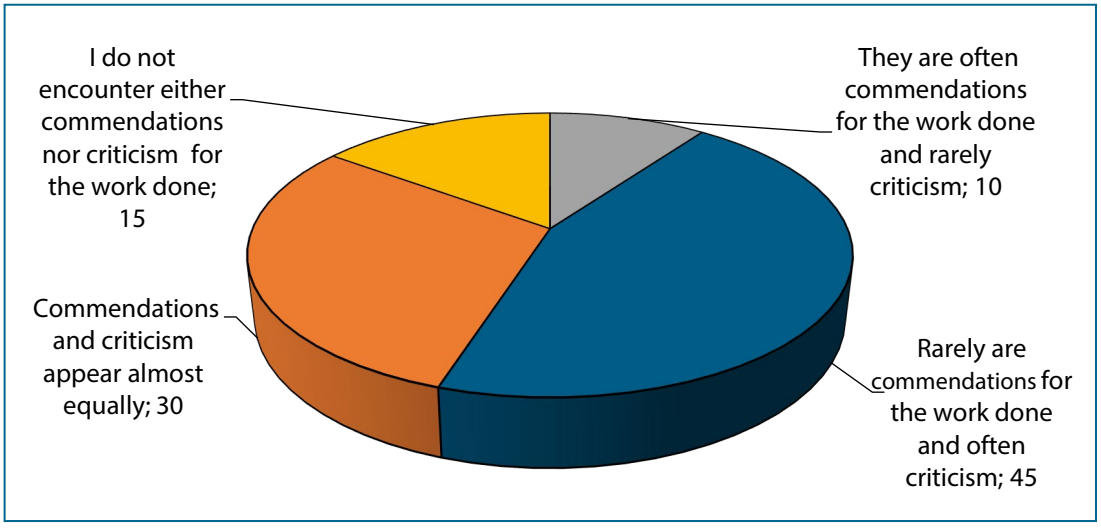

Figure 3.11. The structure of the answer to the question: *What situations do you encounter more often in the workplace where you work, with praise or criticism*? (in %, *N* = 100)

Source: own elaboration.

The criticism that the respondents (65%) had possibly met, was most often experienced not in the presence of other people, however more than 30% respondents said that it was in the presence of other employees, what certainly negatively affects both the perception of the managerial staff and the feeling of community with other workers, weakens therefore the bonds with the company and its management. This view is enhanced by the answer to the question: *Have the respondents ever observed a situation in which a worker from an enterprise in which respondents work was criticized by the supervisor in the presence of other people*? Most of the respondents (60%) answered positively. This is an indicator explaining the lack of stronger relations with the company and its management board, justifying the attitude of employees to their duties in a pragmatic way.

It is indeed this criticism that constitutes a kind of dehumanization and the objective or instrumental treatment of employees. In the light of the results of the study this is an administrative problem of the investigated company, disturbing the sense of community between lower-level employees, occupying the positions of workers, and the management. Answers to questions concerning such negative phenomena as discrimination based on the sex of the employees, their age or religious or cultural affiliation, indicated that they did not occur in the investigated enterprise, and therefore did not constitute a problem. Certainly they were not factors triggering the sense of alienation of employees. Moreover, the respondents referred positively to the issue of ecological awareness of the company board and its involvement in charity actions. Therefore, in this context, the perception of employees of their workplace and its image, were positive.

3.4. Conclusions

The critical management theory proposes effective management concepts that differ from the traditional ones, an insight into the functioning of the company, and in particular the relationship between employees and management. The experienced exclusion, criticism, the instrumental treatment of employees by management, is emphasized here as the main problem indicating the deep crisis of relations between employees and the managerial staff in the company under examination. This crisis even points out the dehumanization of the employee, as well as of the environment in which he/she functions. The results of the research presented here indicate the reality of this crisis, showing that employees do not feel a special relationship with the company (only about money – pragmatism), and the management does not want to integrate them too much and use their potential. An instrumental treatment of employees is even seen. Pragmatic instrumentalism is revealed as an expression of dehumanization of employees by management staff, while voluntary alienation of employees as members of the team also takes place. Of course, the question arises here, what is the main functioning purpose of the organization (the company): is it economic efficiency, or rather creating conditions in which employees feeling their value become some real capital,

and are not treated solely instrumentally. In this first situation, their reaction is pragmatism, guided solely by their own interests. This is reflected in the desire to achieve greater (sometimes unjustified) income from work done, and when such expectations fail, an increasing sense of frustration and alienation from the community of workers appears. However, the authors believe that the current "ethical competences" of serial employees are a significant reason for this state of affairs, expressing the lack of willingness to engage in management processes, help team colleagues, or involve into the so-called civic activities in the enterprise. In such a situation, will any subjective, non-instrumental treatment of employees strengthen their sense of community with employees and the management of the company, and thus increase their effectiveness? Perhaps the goal of building engagement, being in the hierarchy of goals most probably below the efficiency goals, should be pursued regardless of the current ethical competences of the employees – so as to shape future generations, but with no illusions about the impact of these actions on the current situation? This seems particularly important in the era of processes observed on the labour market related to the transformation of demographic characteristics, but this is already the subject of research going beyond the subject area of this work. It should also be noted that in large, stronger controlled production companies, there are no flagrant manifestations of unethical activities toward employees. They may be treated instrumentally, but at the same time are strongly protected by regulations and due caution, giving no reasons for criticism that may destroy the reputation of a large employer, avoiding the risks associated with non-compliance with labour law.

We believe that in this respect large companies are far more secure than small employers. Similarly, in terms of environmental issues, it is easier to control large entities than a number of small ones. However, this is another issue, requiring a separate study. Additional aim of this work was to refer to the thesis on inculcation as a tool of modern post-bureaucratic control. The results indicate that no such action takes place. Employees are not too intensively indoctrinated, as the lower-rank management is too weakly associated with senior staff, too poorly paid, and too much similar to the regular employees to act in this way. Their approach to all these hardly "readable" and depersonalised, completely strange and distant to them corporate ideologies is simply keeping a distance. This leads to maintained pragmatism. The general conclusion could be, in our opinion, that the pragmatism of both sides prevails in a situation where the potential source of corporate ideology (owner, senior staff) is distant from a serial employee, who currently exhibits a low level of "ethical competences" and a low need for functioning in a humanized organizational environment. Rather, there is an ideology free and dehumanized context, alienation and instrumentality, the reason for which is the absolute domination of material needs over the higher order ones, in particular such as affiliation, recognition, or self-realization.

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4 The Role of Higher Education in Shaping Human Capital for the Growing and Evolving Needs of the Modern Economy

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4.1. Introduction

Crisis situations in the economy can be an outcome of many events. The consequences of such situations may be various types of disturbances, imbalances and destabilization of the economy. Numerous natural disasters, as well as social, military or political conflicts can often be identified as causes. Social, economic, technological or the most actual challenges related to health and military threats play an important role. Crises may also result from the dynamic economic development, they may be a consequence of risk and uncertainty appearing in the economy. Economic crises are inevitable, they can often lead to a collapse of the economic situation of even highly developed countries, economic regions or a group of countries.

We can also ask why the business environment has become so dynamic, uncertain and ambiguous and often leads to crisis situations. A combination of different factors has created the current VUCA business environment. Changes in the economic environment force the speed of adoption of technologies. The advanced technology and the need to create and implement innovations took over the world of business. This means a massive reorganizational and upskilling effort. In this context, the knowledge-based economy and the role of universities, which are largely responsible for creating the right skills in the context of the needs of the economy, are becoming increasingly important.

To prevent crisis situations, a variety of actions can be undertaken, to respond appropriately to emerging crises.

It is necessary to adapt the form and content of high schools teaching in order to achieve educational effects being the proper response to the needs of the environment. In this paper, attention will be paid to higher education and methods of responding to environmental challenges and potential crises. Another interesting issue will be to study how universities in various countries react to such situation. The purpose of the considerations is also to answer the question whether selected countries and the universities representing them react to a similar extent or whether there are differences.

4.2. The Importance of Knowledge in the Education Process

The concepts of a modern university and the current economy often underline the dominant role of knowledge-based economies. Many authors point to the great and increasing importance of knowledge for both the economy as a whole and for universities as a knowledge-providing institutions.

Market criterion, from primary education, through the secondary one, up to higher education, started to play a key role in determining discourses, scientific research and pedagogical practices. We can now see free market ideology, largely influenced by the needs of managerial staff and, consequently, new thinking about knowledge. Learning is expected to perform adaptation functions. In the current system, organized around global capital, access to scientific and technological know-how may constitute a competitive advantage and positively stimulate appropriate decisions (Biały, 2011, pp. 32–36).

It is also believed that investments in human capital, inventions and innovations, are largely responsible for contemporary concepts of economic growth. Such activities have an impact on the dissemination of knowledge, technical progress and innovation. The choice of such a direction of investment increases the research and development potential of economies, having an impact on building human capital, and consequently leading to sustainable and competitive economic growth. We will find such assumptions and approach in the so-called knowledge-based economy. Its most important features include (Niklewicz-Pijaczyńska, 2011, p. 443):

- establishing new companies and employment growth in knowledge-based sectors,
- high share of the service sector in employment and GDP,
- increasing investment in research and development,
- increased importance of exports and international links,
- growing importance of formal and informal networks.

It has been pointed out that in recent years in the global economy some directions of change could have been observed, starting from an industrial economy (based on economies of scale) to a free market economy in which technological potential and a high level of

human capital play a key role. Countries that make better use of these factors gain a competitive advantage due to the key role of knowledge and innovation in the economic growth rate. Such dependence causes that in some countries, especially highly developed ones, the search for sources of new knowledge and ways of developing an innovative economy becomes a priority and leads to building a knowledge-based economy (Dworak, 2014, pp. 13, 14). This author also quotes a Japanese economist Kodama, who indicates the need to comply with a principle that allows a company to qualify as a knowledge-generating company, which in the next step transforms into innovation. This is the moment when investments in R&D are greater than investments in fixed capital.

The question can be asked how the above regularity can be applied to the functioning of enterprises. According to Łobos and Puciato, important are intangible determinants of enterprise competitiveness. These authors believe that competitiveness issues are determined by the enterprise management process, which should take into account both activities aimed at shaping the company's internal potential, and constant analysis of the environment and quick response to changes occurring in it. This means that an increasingly important group of factors of competitiveness understood in this way are intangible resources related to broadly understood intellectual capital. (Łobos & Puciato, 2013, p. 89).

With regard to knowledge itself as a resource, the authors point to its important features such as dominance over other resources, hence given priority over them. An important feature of knowledge is also its inexhaustibility, which means that knowledge resources do not run out as they are used (Łobos & Puciato, 2013, pp. 97, 104). With such a great importance of knowledge as a valuable resource for enterprises, its value and use can be associated with the development of knowledge-based economies and societies.

The authors of the report *Democratizing Knowledge for Global Development* even discern some addiction of economic development on knowledge. The relationship between knowledge and development has become very close, and the next steps in development seem driven by knowledge. The authors also base on reports from the World Bank, according to which the current knowledge driven society will depend on knowledge in most areas of its operation. They note that currently the concept of a knowledge-based economy, mainly taking place in developed economies, in the area of so-called Global North, does not exhaust the area where this concept can be observed. The knowledge-based economy model and its development are increasingly visible in some developing countries in Asia and Latin America (Aarts, 2011, p. 12).

From this statement it can be concluded that also in other developing economies certain models and values that have been introduced and do work well in developed countries, may have a wider application. In turn, benchmarking can answer whether individual countries similarly use education as a response to the environment, including the economic situation.

4.3. Higher Schools in Shaping Human Capital for the Modern Economy

In the context of the growing importance of knowledge, one can look for the answer to the question what role universities should play in this respect, in what direction to evolve, to what extent they should take into account changes in organization and approach to their mission, bearing in mind a number of contemporary challenges, such as globalization, and the need to build a competitive advantage based on intangible assets.

The question can also be asked what should be the role of the university as a knowledge broker, how should the role and activity of universities be defined in the modern market, whether the current model of knowledge transfer is adequate to the socio-economic challenges. It has been pointed out that there is no other, more predisposed institution to play the role of a knowledge broker than a university, but to achieve success and improve knowledge management, the university should know how to effectively implement three key processes involving knowledge: its creation, codification, and transfer (Mierzejewska & Płoszajski, 2005, pp. 105, 106).

Creating the right knowledge and its subsequent transfer can be a big challenge for universities, especially at a time when the labour market, the dynamics of business development, and economic transformations are characterized by constant changes to overcome crisis situations. The expectations for an appropriate resource of knowledge change adequately.

The reason for the failure may be the mismatch of the educational offer to the current needs of the labour market. The problem can be multiplied if changes in employers' needs are not coordinated with the education system. Forward-looking activities and forecasting the development of the labour market are therefore important. Failure to do so may result in structural mismatches and discrepancies between employee qualifications and employers' needs and expectations. Poland and other European countries, in parallel with integration and globalization processes in Europe and in the world, should adapt education systems to the knowledge-based economy (Trych, 2011, pp. 45–54).

The role attributed to higher schools is particular from the point of view of creating a knowledge-based economy, because it gives opportunities for countries and economies wanting to enter the path of long-term growth. The knowledge-based economy concept introduces a new development paradigm to economic theory and economic realities, a new quality in which knowledge and innovation play a key role. Adequate human capital is the provider of knowledge-based values for the whole economy and single enterprises. In this context, the role of universities is particularly important, because universities have an impact on the process of creating human capital and investing in it (Jakubowska & Rosa, 2011, pp. 64, 65).

The authors of the report *Analysis of strategies, models of operation and evolution paths of leading universities in the world* are of a similar opinion. They believe that the creation

of knowledge by universities is closely related to the creation of human capital. This is the result of a correlation between research activities and educational ones, understood as improving the quality of education, which is based on research and obtained results (Olechnicka et al., 2010, pp. 21, 22).

The contemporary stage of socio-economic development, with the priorities given to knowledge resources and development of human capital, results in the need to determine the role of higher education in this process, the role of universities in shaping human capital and competences.

4.4. The Specificity of Expected Competences and the Direction of University Development

Being aware of the role of knowledge in the society and in the economy, the specificity of competences expected in the labour market, now and in the future, should be taken into account. This area can show the dynamics of changes in the area of education – a key function of higher schools to which universities should adapt.

Parallel with technological changes, social changes occur, leading to different understanding of human work and its importance. This means that society must face an unpredictable future. Increasing importance gain not only the skills closely related to a particular profession, but universal, transferable competences, applicable to various situations and changes (Woźnicki, 2019, p. 7). Attention is also drawn to key fields of education that will answer the question „how to educate for the future?" They can be described as follows (Chmielecka, 2019, pp. 17, 18):

- skills and knowledge made as durable as possible, maintaining their relevance in the face of change.
- building awareness among graduates, having to face change and adapt to cope with change.
- paying more attention to social competences.

The ability to accurately predict the specifics and needs of the economy in the future can help in shaping specific competences to meet these needs. According to Piotrowska and Saryusz-Wolski the slogan "competence of the 21st century" has become an important topic of discussion of contemporary universities and the model of their functioning under the influence of the environment. The authors point out that according to analyses in this area there is a gap between holistic and generic competences. They also note that the most innovative universities pay great attention to shaping students' ability to perform complex tasks, solve problems, communicate and cooperate. An appropriate attitude of response to change, based on such features as cognitive initiative, perseverance, flexibility and leadership, becomes a key competence (Piotrowska & Saryusz-Wolski, 2019, p. 55).

In turn, attention is drawn to the possibility to forecast the directions of civilization changes, based on the analysis of the dynamics of development of selected technical and technology changes from the last decade. However, this task can be planned for a period of several years, longer time perspective is not very realistic due to the dynamics of changes. On this basis, the opportunity appears to make research on the competences that will be needed in the future. Successful forecasts and lower risk of errors will be possible when assuming linear socio-economic development, while failures may occur with abrupt development jumps (Kwiatkowski, 2018, pp. 23–25).

Table 4.1. Key skills in 2015 and 2020

No.	2015	No.	2020
1	Solve complex problems	1	Solve complex problems
2	Coordination of tasks in the team	2	Critical thinking
3	Managing people	3	Creativity
4	Critical thinking	4	Managing people
5	Conducting negotiations	5	Coordination of tasks in the team
6	Quality control	6	Emotional intelligence
7	Service orientation	7	Assessment and decision making
8	Assessment and decision making	8	Service orientation
9	Active listening	9	Conducting negotiations
10	Creativity	10	Cognitive flexibility

Source: (Pater, 2019, p. 96).

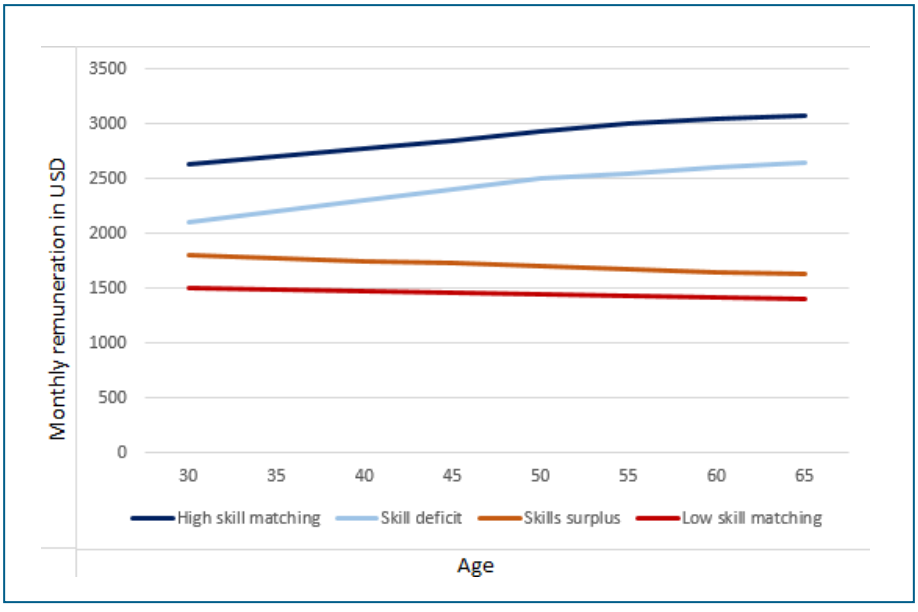

Figure 4.1. Relationship between skills mismatches and earnings

Source: (OECD, 2012, p. 20).

Pater, referring to the data of the World Economic Forum, shows the dynamics of changes in the relatively short period of five years (Table 4.1). The change in the nature of skills is mainly caused by modern technologies and related implications for the labour market. The pace of change in relation to expected competences may lead to a situation that they do not fully respond to the needs of the labour market. Mismatch may vary in nature, and differences may arise at various stages of professional development.

The dependencies presented in Figure 4.1 can bring important information for universities – how to properly build *curricula* from the point of view of achieving appropriate learning outcomes. The analysis of competences in relation to the specifics of the labour market may be one of the dimensions of the education process, showing the need for continuous changes and adaptation work.

Contemporary universities, struggling with the dynamics of changes that are taking place in their surroundings, should set in their missions and visions the goals such as the ability to anticipate and meet current trends, ability to redefine one's own role in modern society, ability to transform and go beyond the position currently 'designated' for higher schools, ability to create value for the client, innovation, ability to compete, and even setting trends on the educational services market (Maliszewski, 2019, p. 29).

4.5. Globalization as a Determinant of the Development of Higher Education

Higher education and its specificity are determined by particular needs of the environment, including the economic environment. Given the fact that the number of international interdependencies in the economy increases, it is worth considering education in connection with the specificity of globalization. The nature of education systems in the world is largely the consequence of globalization processes, while changes in the socio-economic sphere determine the needs of changes in education.

The emergence of modern technologies supporting communication processes is recognized as the most important stage of globalization. This in turn has a positive impact on increasing the scale and form of global exchange, travels and other types of interaction. It is believed that the nature of education systems is a derivative of globalization processes, and civilization changes set the direction for thinking about the needs of changes in education (Kojs, 2014, pp. 15–19). The author notes that education has always been determined by the specific needs and interests of individuals, playing a supportive role in relation to social interests expressed through specific ideas, ideologies and strategies. The question is raised: what goals for education are formulated by globalization processes? He further argues that the premises of education are within the framework of specific globalization strategies, they are an expression of globalizing economies, and to a lesser extent an expression of national and cultural values.

Another view refers to the globalization process in the context of the challenges for education. The author claims that the pressure associated with progressive globalization processes creates the need to analyse the functioning of educational institutions. It is important to link the specificity of higher education with transformations in the entire public sector. An important element is the fact that the global context will require not only understanding that some change is needed. The need for a thorough understanding of the needs and aspirations of citizens, and the role that universities can play in this process, will become increasingly important. It is further emphasized that the main driving forces behind changes in education are of global character (Furmanek, 2014, pp. 137–144).

An interesting view regarding globalization is presented by Czaplińska, who believes that together with the increasing complexity of the world, interpenetrating different worldviews, differences in culture and the level of socio-economic development, global education and the development of appropriate competences become important. Raising awareness of global changes and obtaining appropriate knowledge increases development opportunities (Czaplińska, 2010, p. 487).

It can therefore be stated that we are dealing with growing awareness in the understanding of the key values of the modern world, its problems and relationships. This attitude can, as a consequence, provide a good basis for building ever stronger relationships between the economy and education. So, there is a need to look for the optimal form of education. However, there are difficulties in finding and applying an ideal model to shape social capital being adequate in relation to the direction of economic development.

4.6. Economy Evolution and the Role and Adaptation of Education

In the practice of social-economic life solutions should be used to maximize social benefits and minimize costs. Managing the relationship between the economy and education should not be included only into the ideologies of the free market. It is important to conduct diagnostic and planning activities at the level of state institutions that would allow to correlate priority areas of the economy with educational activities (Lewowicki, 2014, pp. 48, 49).

It is worth asking a question what should be the nowadays the strategic goal. Will it be to optimize educational activity in relation to economic specificity, not only on a national scale, but also with regard to international solutions? In the study on global economic space, the impact of globalization processes on education and the economy, the economic potential and diversified development of individual regions of the world has been taken into account (Zioło, 2014, pp. 208–210). The author assumes that civilization development generates changes that have their expression in the area of socio-economic evolution in each individual stage of evolution. It involves the transition from an industrial society, with the dominant role of industry in the economy, through the post-industrial phase, with the predominant role of services, up to the phase of the information society, where the economic

base is science, and the economy is based on knowledge. The role of the state and its strategy in creating intellectual resources is important in this process, which has an impact on accelerating or delaying economic, social and cultural development.

The diagram of the relationship between globalization and education as well as the place and nature of education in the context of economic development, is presented in Figure 4.2. It seems important to search for factors that determine the optimization of education, in the context of a given specificity of the economy, and on this basis to maximize the interrelation indicated in Figure 4.2. From the analysis of similar situations in history, and on the basis of available data, it seems reasonable to state that it would be very difficult to achieve 100% effectiveness when striving to maximize the indicated relationship.

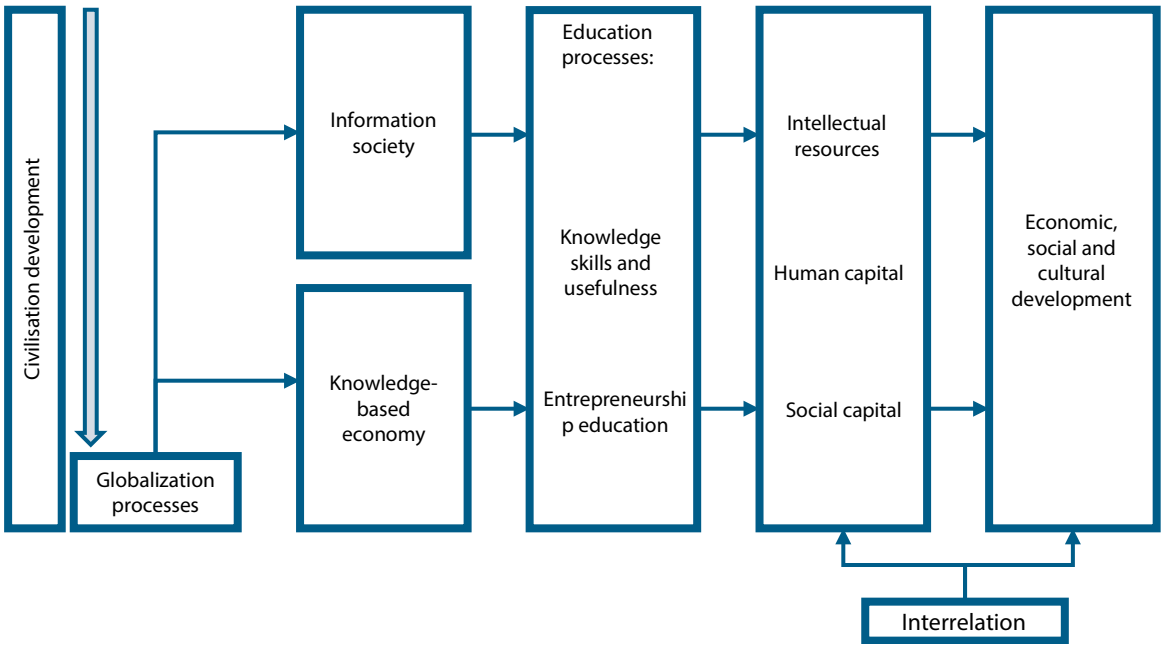

Figure 4.2. The relationship of globalization with education and civilization development

Source: own study based on (Zioło, 2014, pp. 208–210).

One can look for an answer to the question: why it is so difficult to keep appropriate pace when acquiring knowledge in the conditions of ongoing globalization processes, including those emerging in crisis situations. Based on the literature on the subject and the author's own experience, it may be reasonable to state that finding an optimal, effective and sustainable education model, especially in relation to the international perspective, unpredictable turbulences in the economy, can become difficult. Considerable importance can be attributed in such circumstances to high-quality educational offer, its continuous evolution and responding to emerging needs of labour market.

4.7. Quality and Efficiency in the Functioning of the University

With regard to the fact that in the process of modernizing higher education quality becomes an important element of change, it is worth referring to the point of view of the authors of the study on the directions of pro-quality and pro-efficiency activities of higher education in Europe (Wiśniewska, Grudowski, Plura, & Nenadal, 2016). The authors believe that quality issues in the higher education sector have become particularly important over the past two decades, and individual countries are working on improving quality in accordance with the guidelines developed by ENQA (European Association for Quality Assurance in Higher Education), but at the same time promote their own solutions for assessing and improving quality in higher education. The effectiveness of education is always important throughout the process, and is measured by the degree of adaptation to socio-economic life.

Introducing quality priorities into higher education development policies in the long run is important. On the example of Poland, it is worth paying attention to which areas are covered by a pro-qualitative approach in the field of modernization of higher education in the period up to 2030. The program for the development of higher education and science is a response to the social, economic and civilization challenges facing Poland. It is setting goals and indicates appropriate actions to improve the condition of science and the higher education system, as well as proposals for changes. The program has four goals (Ministerstwo Nauki i Szkolnictwa Wyższego, 2015, pp. 4–32):

- increasing the quality of education while adapting it to social and economic needs,
- increasing the quality of research,
- improving the functioning of the system by implementing changes in the area of organization, management and financing,
- strengthening the impact on the social, economic and international environment – the undertaken activities should lead to greater interest of enterprises in cooperation with universities, popularizing knowledge, building environmental trust, which will allow higher education to have a greater impact on the economy.

The above example of Poland shows a multitude of areas in which the promotion and application of pro-quality solutions plays an important role in the development of universities. In each of these four goals proposed changes are based on increased quality.

In the transformation of universities, from the Humboldt model to the entrepreneurial one, their relationship with the environment is emphasized. They are increasingly becoming participants of the market game, and they must respond to the situation in their surroundings. This results in the need to improve both quality and efficiency of university functioning. In the context of the market oriented higher education, the university's offer relates to some defined target market. This requires careful analysis and understanding of customer expectations and then meeting these needs (Pabian, 2016, pp. 87, 88). It has also been emphasised that market competition forces pro-client thinking, which results in the focus on quality and thinking in terms of effectiveness of activities (Goranczewski, 2011, p. 339).

It seems reasonable to claim that the implemented solutions of high quality and efficiency are inventive and innovative activities that can help, by offering appropriate competences to students, in responding to the demanding specific economy situations, including unpredictable emerging crises.

Promoting high-quality activities at the university, including the methods and tools applied, may determine the competitive position of the university on the market. It can be assumed that the university's task is to create and implement educational services in an innovative form, and this can be done by defining a key distinguishing feature that will bring new, competitive quality to the market. Therefore, such a goal should be included in the university's development strategy that will favour the creation of a new quality of educational service, while also responding to the market demand. This orientation of university development will contribute to being socially responsible to external stakeholders (Geryk, 2012, p. 291). A socially responsible university should be a stimulus for pro-innovative activities in the environment. The pursuit of creating and implementing innovation is the driving force of the economy – that is, it responds to the needs of the environment. The implementation of innovative solutions requires a specific goal to be formulated by the university, that will make adequate response to the diagnosed needs of the organization and the environment.

In relation to innovative activities in universities and the way of thinking about the strategy of the educational service, Wójcik-Augustyniak indicates the need to develop an innovation strategy for the value of the educational service. According to the author, in the face of increased competitive pressure, the strategy should be understood as choosing priority projects for the future, at the expense of other, less significant university activities. A detailed analysis of individual areas of the university activities may allow for hierarchy, where in the foreground there will be activities that have the greatest impact on shaping the future of the organization. An important stage in the selection process is the creation of so-called value curves, and identifying factors that are important for stakeholders. Examples of factors considered key ones may be: (1) prestige, (2) innovation, (3) scientific strength/effectiveness, (4) conditions of studying, (5) internationalization (Wójcik-Augustyniak, 2017, pp. 222–224).

In the context of the above, one can look for a way to distinguish specific factors that the university may consider valuable in relation to individual areas of functioning. They should be possible to implement, and adequately fit to the expectations of the environment and university stakeholders. Different approaches can be found in the literature concerning the methods of selecting activities being relevant to the development of the university.

Bearing in mind the variability of the environment, the use of management concept that focuses on the most important priority areas is recommended. Such a concept includes Priorities Management, according to which organizations should focus on selected activities that are important due to the possibility of taking advantage of emerging opportunities in the environment and avoiding strategic threats. This concept is particularly applicable in the

shorter period, usually one year (Łobos & Puciato, 2013, pp. 190, 191). It can therefore be concluded that the focus on the relevance of the university's assets refers to the continuity of the modernization processes in higher education, their improvement, while the pursuit of market convergence refers to the dynamics of changes in the university's environment, emerging crisis situations and the need to cope with them. It is worth paying attention to the concept of creating key success factors when building a strong competitive position of the university and choosing crucial areas of its activity.

Attention is also drawn to the very essence of using the method of defining key success factors as a basis for creating a competitive advantage. Such information can help in determining the strategic potential of the enterprise, including also any university, and thus building a competitive advantage.

Key success factors are the result of transforming resources, processes and skills into tools that allow you to study competitive advantage. Not all resources at the organization's disposal are a source of advantage; some may be in this aspect completely useless, because their role is only to ensure the duration of the organization (Maliszewski, 2015, p. 148).

It is important to assess them from the point of view of suitability in supporting the development and success of a given organization.

The method of key success factors allows to analyse the trends in the development of higher education systems in relation to changes in the environment and in relation to the future, as they are included into the strategy, which refers to activities over the next years. Researches in the area of universities competitiveness show that it is difficult to find universal success factors, they can also change over time and varying specificity of the environment.

The justification for the pro-qualitative and pro-efficiency orientation of higher education development can also be found in the report *The Avalanche Is Coming*. The authors point to a large increase in the number of universities in the 20th century and their standardized nature, where in the face of hard competition in student acquisition, and consequently funds, a strong competitive position will be maintained by the most prestigious, elite universities. Other universities must work out an offer that will make them differentiate from competitors. The way to develop a unique offer can be to find and ensure high quality in a selected area of university operation. Standard course content does not have to be a decisive factor for the success of the university. The distinction of some given area may obviously relate to the quality of the education offer, a given module, but also to the quality of mentoring, the relationship of the university with its city or region, the nature of the dialogue between students (this may be even global), paths from universities to the labour market, or global partnership with study opportunities abroad. Innovation fields appear in these areas, and universities can undertake them (Barber et al., 2013, pp. 49–51).

The above considerations may lead to a broader analysis of the selected area of university operation. Considering the success factors selected for a given organization as a priority and including them into the strategy may be limited to the need to check the real value of some selected areas of university operation, e.g., internationalization.

4.8. Internationalization as One of the Areas of University Functioning

When considering key success factors for any university, some selected area of its functioning can be subjected to a broader analysis. Bearing in mind the need to provide graduates with appropriate qualifications, what is the most important goal for universities, the educational one, one can focus on the role of internationalization. Universities that want to educate and prepare students for life in the world of globalization, pay attention to the quality of the internationalization process, support them in social and academic integration, create a multicultural campus, thus helping to develop the skills of global graduates who are sought after by employers (I-graduate, n.d.).

Globalization is widely recognized as the main driving force of higher education internationalization, and is also a key element of the environment in which higher education institutions operate and to which they must adapt. As it results from previous considerations, globalization is both a series of development opportunities for the economy, but includes also periods of stagnation and crisis moments. The scope of globalization had a great impact on higher education, and internationalization has become the main response to this phenomenon. It seems that the international dimension in higher education will remain and probably continue to gain importance in the programs of individual institutions and national/regional higher education systems around the world.

The university internationalization aspect appears in many rankings, which may indicate its importance for universities, acknowledging this area as one of the key factors of the university's success. Individual rankings often give weights to any given indicator, and the most frequently assigned value for the internationalization is between 5 and 15%.

It is also worth paying attention to the achievements of selected universities, which took the highest position in Times Higher Education World University Ranking (in 2015, as an example). The results of study (Figure 4.3) presented for selected group of universities, i.e., two top-ranked universities in the world, in Europe, and in Central and Eastern Europe, can be helpful. A visible difference can be seen between the achievements of the best universities in the world, those from Europe, and from Central-Eastern Europe. These differences concern also international achievements.

With regard to the above-presented analysis of justifications for the need for internationalization of universities, one cannot omit the important fact that the reasons for internationalization can vary for different countries. The reasons for internationalization may vary for different countries. For example, the authors of the *The EAIE Barometer* report have noted significant differences between countries and regions such as Great Britain, the United States, Western Europe, Central and Eastern Europe, in which various reasons for internationalization appear. Different value can be assigned to selected features and international ventures, they can be treated commercially, or as a means of diplomacy and building prestige, there may also be other premises for implementing mobility or internationalizing curricula (Engel et al., 2015, p. 3).

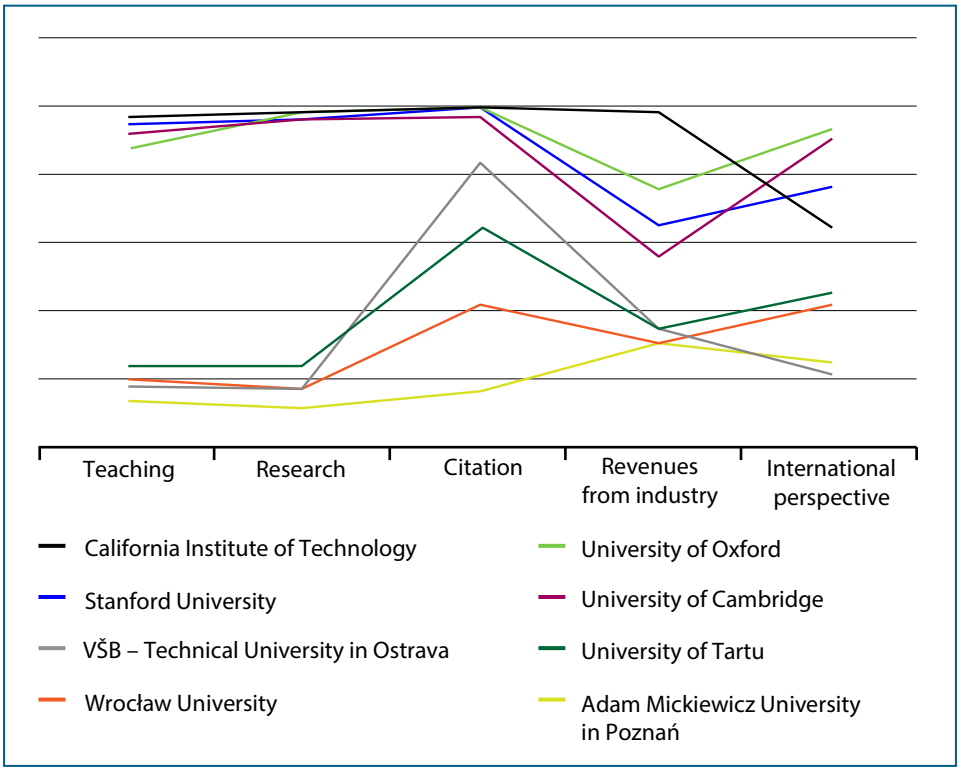

Figure 4.3. Basics of higher education strategies, according to Times Higher Education World University Rankings 2015–2016

Source: (Wójcik-Augustyniak, 2017, p. 195).

To sum up – the importance and legitimacy of internationalization in the higher education development is visible all over the world. This phenomenon affects individual institutions and higher education systems. The impact of internationalization on higher education can be seen in the way in which the basic activity of the university has changed in recent years, it concerns in particular teaching and research. The requirements of a global knowledge-based society have put pressure on higher education. World business trends emphasize the education of young professionals with specific skills (Sandström & Hudson, 2018, p. 11).

4.9. Goals and Activities in the Internationalization of Higher Education

Given the importance of internationalization as an area of university functioning, the importance of this concept should be brought closer and attention should be paid to achieving what goals internationalization of the university should lead. It is widely accepted that internationalization leads to many potential benefits for students, institutions and

society as a whole. To achieve them, universities should understand their surroundings and then develop a strategic approach, define goals and optimize the implementation of internationalization, as well as monitor and evaluate this process.

An interesting approach analyses the university motivations to implement and develop internationalization. They may vary depending on the region, country and institutions, and result from various reasons. Most often universities have a number of goals, which include (Green, 2012):

- preparing students for „global citizenship" and for work around the world,
- improving the quality of teaching and research,
- increasing prestige and visibility,
- generating revenues,
- contributing to local or regional economic development,
- creating knowledge about global issues and solving global problems,
- increasing international understanding and promoting peace.

The question arises whether it is possible to find a common trend – motives and goals for all universities. The results of the research carried out in 2018, in which universities were asked about the most important goals of internationalization, are presented in Figure 4.4.

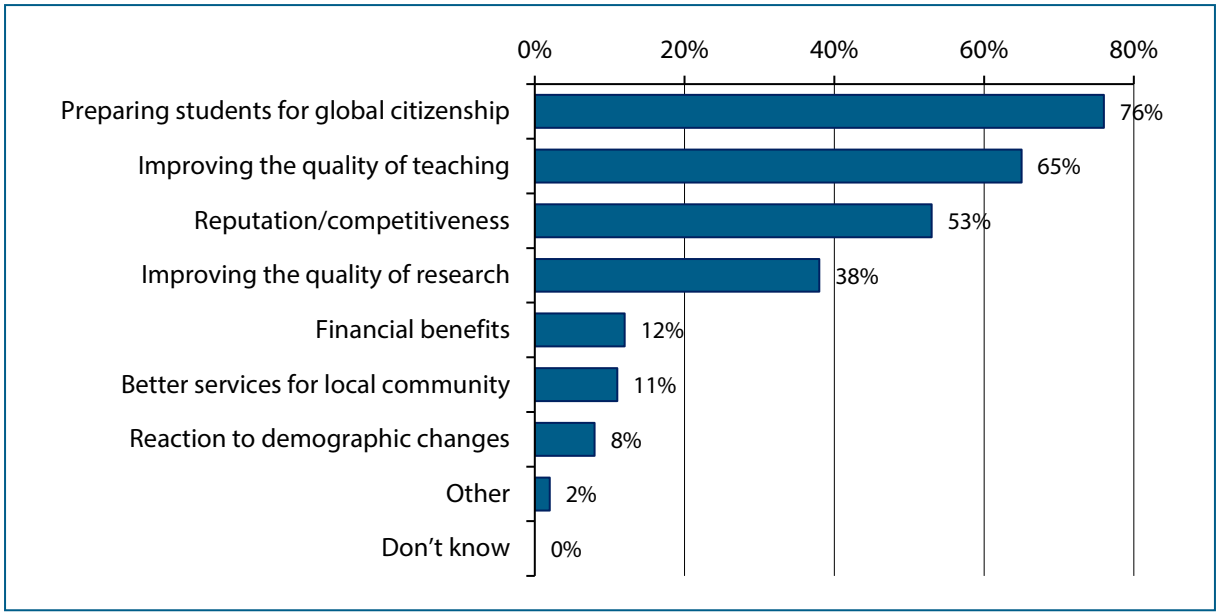

Figure 4.4. Main goals of internationalization, 2018 (*n* = 2317)

Source: (Sandström & Hudson, 2018, p. 12).

These results show that there are some trends in defining goals, but there are also differences that may result from the specificity of a given country and its strategy towards higher education, type of university, their location. When analysing the results of the

EAIE Barometer, it is clear that, for example, preparing students for life in the global world is becoming one of the most important goals of internationalization. In turn, when the adopted goals are achieved, the measurable impact of higher education on the environment, including also the economic one, is proved.

4.10. Efficiency and Quality as Variables in the Internationalization Process

Given that internationalization can contribute to achieving goals in terms of improving the global labour market, including the impact on the level of economic development, it is important to show how internationalization is measured. Referring to the previous argument about the essence of applying qualitative and quantitative measures to the entire university, it is also justified to use them to measure internationalization.

In the opinion of the authors of The EAIE Barometer, internationalization is an increasingly complex phenomenon, and higher education institutions are multi-faceted organizations that are constantly evolving. Analysis of both quantitative and qualitative indicators can be an ideal tool to assessing the full range of dynamics and internationalization effects (Sandström & Hudson, 2019, p. 4).

When seeking justification for the use of efficiency and quality measures discussed above, one can refer to the role of the environment, external factors, which determine the functioning of universities, and the goals formulated on this basis for internationalization. Success in their implementation may result for universities in responding more effectively to changes in the environment and the economy, both during its periods of growth and decline, including also crisis situations.

Important environmental factors are the growing requirements of university stakeholders, students, parents, employers, which in turn forces the university to meet emerging needs. In the face of strong competition, including international competition, universities must achieve their goals, i.e., look for the best way to achieve high efficiency. It is important to analyse the degree of implementation of the internationalization objectives and their outcomes (Hudzik & Stohl, 2009, pp. 11–17). It should also be noted that rankings and accreditation agencies of higher education institutions, in relation to their responsibility towards the environment, encourage universities to assess the effectiveness of their internationalization. Methods for implementing the appropriate internationalization model and methods of how to accurately measure results in this area are sought (LeBeau, 2018, p. 1).

When analysing the relationship between quality and efficiency, it is worth considering the interpretation of efficiency, primarily as the high quality of educational services. In general, efficiency related to the university sector should be considered in conjunction with the quality of all implemented activities (Piasecka, 2013, p. 266). It has been stated that the activities of universities are usually based on quantitative analyses of selected parameters, however, in assessments intended to affect the shape of the university's functioning,

qualitative methods should also be used, based on 'soft' data, so that you can take into account the full situational context (Jabłecka, 1995, p. 34).

Another view is that the use of efficiency measures should be carried out taking into account qualitative and substantive assessments (Julkowski, 2014, p. 34).

Higher education, subject to increasing internationalization, operates according to universally recognized standards, which in turn forces competition within this sector. In consequence, by adopting a global perspective of action and development and thus strengthening the role of internationalization, the need appears to strengthen in university development the excellence and quality of education (Hryniewicka-Filipkowska, 2017, pp. 64, 65).

When considering both the efficiency and quality of internationalization, it is important to note what the relationship between them is, and whether we can achieve more valuable results by including these two aspects into research. It is believed that quality-oriented strategy is becoming a necessity for the university. In turn, quality of international activities is regarded as support in achieving the intended goals and results of internationalization. Quality testing in international cooperation projects can assess the level of given activity. Quality control includes monitoring progress, maintaining focus on the satisfaction and motivation of all partners, documenting conclusions drawn, and identifying potential threats before they become problems (Bischof & Punco, 2015, p. 69).

The need for quality is combined with global challenges and trends, such as privatization, reduction of government funding, new technologies of teaching, learning and research, globalization, knowledge-based economy, and increased competition. To respond appropriately to such challenges, evaluation and quality assurance is considered as a means of improving the adequacy, efficiency and effectiveness of the institution or program. Another reason is the growing emphasis on a results-based approach to education. This trend is related to the consumer movement, in which the student is perceived as a customer, as a buyer who wants to obtain the best value for the money invested. This relationship applies to higher education in general, but is also important for internationalization. As the importance, commitment and investment in internationalization increase, expectations for the quality of ventures and value added to higher education are growing (Knight, 2008, p. 42).

4.11. Conclusions

It is worth referring to the concepts and results of research carried out by Tomaszewski. The author refers to the definition of internationalization, in which internationalization is most often defined as the process of integrating the international, intercultural and global dimension into the goals, functions and method of providing an educational service. Internationalization defined by Knight is a process and reflects a set of activities that universities formulate in response to the environment, including the specifics of the

economy, especially in the era of globalization. Universities can carry out these activities at a different level of quality, both within a given country and abroad, hence there is a need to measure quality and the possibility of conducting comparative tests (Tomaszewski, 2022).

This approach to internationalization allows international activities to be considered in terms of value, changes, purposeful and planned results. "As a consequence, this has implications for controlling the achievement of the objectives adopted in the field of activities with an international dimension, of which an important element should be a measurement enabling the assessment of effectiveness" (Dymyt, 2018, p. 196).

In some part of the Tomaszewski's doctoral dissertation the research was targeted to the three countries studied, i.e., Poland, Great Britain, and Ukraine. The economic aspect that differentiated them was the level of economic development. To this end, the university's results were analysed in terms of efficiency and quality of internationalization and correlated with the GDP *per capita* indicator. The ranking of this indicator for the last three years was: Great Britain, Poland, Ukraine. In those countries, where the average GDP *per capita* ratio was higher, the university's share in terms of both efficiency and quality among the highest--classified universities is higher. Among the top ten in terms of efficiency there were as many as 60% of universities from Great Britain, 17.6% of universities from Poland and only 6.3% of universities from Ukraine. In turn, in terms of quality, 30% of universities from Great Britain, 23.5% of universities from Poland and 18.8% of universities from Ukraine. The obtained results confirm that the level of economic development translates into the achieved results (Tomaszewski, 2022).

Consequently, it can be concluded that through appropriately designed education and its selected tools, we can prevent and mitigate potential crisis situations in the economy and the enterprises operating in it.

Additionally, the history shows that companies that are able to implement innovations through a crisis outperform peers during recovery in their operations and businesses can gain long-term advantages. The implementation of innovations in turn may be a consequence of the knowledge capital built which is the responsibility of the education.

To sum up these considerations it can be concluded that internationalization is one of the key areas of university operation. Activities based on appropriately shaped international strategy and its development can contribute to the success of the university in reaching the adopted goals, and thus have also an impact on the situation in the national economy, it is the way to respond to emerging crisis periods. The issue of higher education functioning is of particular importance under pressure from the environment. Universities try to meet the requirements, addressing numerous challenges that arise in particular from the international nature of the economy.

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5 Cryptojacking: Definition, Implementation, Effects and Protection Against That Form of Cyberattack. Is Malicious Cryptomining a Manifestation of the Crisis Behaviour of Individual Miners During Cryptocurrency Rush?

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5.1. Cryptojacking: A New Form of Cybercrime

The dynamic progress of information technology observed in recent years and the unlimited possibilities offered by the Internet may also have negative effects in certain situations. New and more sophisticated methods of preying by hackers on ordinary users of the global network are emerging. Generally, it is about making profits illegally, at the expense of unaware owners of computers and other digital devices operating under the supervision of operating systems. One such cybercrime, closely related to cryptocurrency mining, is the so-called cryptojacking, which is also called malicious mining (Gaździcki, 2021). In the opinion of many economists, resorting to cryptojacking by some miners generating virtual currencies may be considered a manifestation of crisis behaviour on their part. It results mainly from economic reasons, focused on "optimizing" costs related to cryptocurrency mining. High prices of equipment used for mining and still rising electricity prices "incline" some cryptocurrency miners to take criminal action, to take advantage of the scale effect and significantly increase their chances of finding another block and attaching it to Blockchain, while "collecting" due remuneration, i.e., block reward expressed in units of a given cryptocurrency.

The economic profitability of mining is largely dependent on the costs of electricity consumed in this high energy-consuming process. Cryptocurrency mining rigs generate huge electricity demand, because they constantly perform billions of complicated calculations per second to find the right string of characters, i.e., hash. The power consumption of such a virtual coin digger, and therefore the cost of electricity, is so high that it can exceed the revenue from mining cryptocurrencies. Hence the constant search, by persons conducting mining activities of virtual currencies, for cheap electricity or "free computing power" from the illegal takeover of other users' hardware resources connected to the Internet. In addition, the crisis behaviour of individual cryptocurrency miners is partly due to the high degree of monopolization of cryptocurrency mining. In this situation, the possibilities to cope with hard competition in the so-called race to find the next block are disproportionately small for individual miners, compared to large installations operated by agreements and associations of cryptocurrency miners.

For obvious reasons, the greatest interest in mining Bitcoin and other cryptocurrencies occurs during periods of speculative bubbles on the market of these virtual assets. Then, attacks in the form of cryptojacking on computers belonging to unaware users are intensified, because the rapidly growing valuation of a given cryptocurrency in fiat money creates space to achieve much higher profits from mining. In such situations, "taking advantage" of cryptojacking, which is *de facto* "free" virtual digging at the expense of others, brings tangible benefits from this criminal practice. The profit and loss account for the miner-hacker does not include then the variable cost item, in the form of electricity consumed, and fixed costs related to the purchase of additional mining equipment, its operation, service and depreciation. To put it simply, if a miner takes the liberty to undertake cryptojacking, the obtained revenues are equal to cryptocurrency mining income.

5.2. The Essence of Cryptojacking

Cryptojacking is an IT term describing the practice of taking over resources and computing power of a computer illegally to mine cryptocurrencies at the expense of the unconscious owner of the equipment. This is done without the consent and knowledge of the user, because the device has been tricked into malicious code, enabling the miner to derive financial benefits from working on the computer network of the victim of cryptojacking. In other words, cryptojacking is a criminal version of mining.

According to the US Cybernetic Security & Infrastructure Agency (CISA) "cryptojacking occurs when cybercriminals use malicious code and effectively take over the computing power of victims' devices and systems, using vulnerabilities in websites, software and operating systems to illegally install cryptocurrency mining software on victims' devices and systems (Cybersecurity and Infrastructure Security Agency [CISA], 2021). This definition by CISA clearly and comprehensively addresses the issue of cryptojacking. It indicates directly who practices cryptojacking, how such a cyberattack is carried out, and what purpose

it serves. On a legal basis, there can be only one interpretation of cryptojacking: it is a form of theft of the computing capacity of devices and their users' systems by illegally installing malware to dig cryptocurrencies. It is worth mentioning that some other definitions of cryptojacking also use this term to determine the form of cryptocurrency theft by cyber criminals that consists in the use of malicious scripts and codes for the illegal takeover of the content of the cryptographic wallet of computer owner.

All criminal activity based on cryptojacking and thief practices of miners-hackers are subordinated to single goal – acquiring "free computing power" to be used for "cost-free" mining of the so-called fossil cryptocurrencies (mineable cryptocurrencies), by creating a special type of mining rig based on the summarized ability to process data from foreign devices, without the legal right to use them.

To this type of robbing, being in fact the illegal takeover of the electronic ability of a digital machine to perform ultra-quick arithmetic operations in a specific unit of time, are exposed desktop computers, laptops, tablets smartphones and servers, as well as other network devices. It does not matter under the supervision of what operating system they work (is it Windows, Linux, MacOS, Android or iOS), the only condition is Internet connection.

In addition, also at risk are devices operating in a system that enables automatic communication and data exchange via networks without human intervention, i.e., the Internet of Things (IoT)[1]. This can be explained as a network of physical objects that are equipped with sensors, special software and other technological solutions enabling connection, data exchange with other devices and systems via the Internet. It is estimated that in 2020 in the world there were over 10 billion devices connected to the IoT infrastructure, covering both ordinary household items (e.g., TV, cameras, refrigerators, washing machines, dryers, etc.), as well as advanced industrial tools (e.g., intelligent digital supply chains, intelligent production, intelligent power networks and smart cities), and by 2025 their number may increase to as much as 31 billion (Lueth, 2020). It is worth noting that in 2017 Symantec, an antivirus software manufacturer, recorded a huge increase in the total number of attacks on devices operating in the IoT system, by as much as 600%. This means that cybercriminals have used and will probably continue to use the network nature of these devices for mass mining of cryptocurrencies.

The most frequently attacked are private user computers and servers in data centres of companies and enterprises operating in various areas of the economy, as well as public organizations and institutions. The dominant motivation for resorting to such immoral and pirate methods by some cryptocurrency miners is the desire to achieve maximum profits from the mining process, with the peculiar method to "optimize" own costs by taking over a specific percentage of computing power of individual devices equipped with processors in combination with the scale effect achieved by mass infection. This mechanism (based on maximizing the number of infected digital devices in the network) is used to compensate in

[1] At present, more and more frequently the term "Intelligence of Things" is used.

some way for the relatively small "output" from the computing power of individual computers belonging to individual Internet users.

Sneaky infection of the potential victim's computer occurs *via* such e-mail that appears to be a reliable message from an allegedly verified sender, but contains the fabricated file (usually in the compressed archive form) or a link to some malicious program. Cybercriminals deliberately use the so-called phishing, i.e., the phenomenon of impersonating other people or institutions that are widely recognized and usually enjoy great social trust (Pieleszek, 2019, pp. 35–48). These include, for example: police, border guards, and other uniformed services, banks, post office, courier companies, prosecutors, courts, notary offices, law firms, brokerage houses, social insurance institutions, insurance companies, tax offices, mobile operators or electricity suppliers. Opening such an attachment by the user is equivalent to installing a virus that constantly "steals" a certain percentage of the computing power of the owner's device. From this moment the threat is already permanent, and cryptocurrency mining activity is resumed after each time the computer is started and the Internet is connected. The whole process takes place in the background of the data processing process by the user's computer, so it is not easy to uncover.

It should be noted that malicious cryptocurrency mining scripts can also be hidden inside advertisements, browser plugins and content management system plugins. In such cases, no other user action is required to infect the computer. All you have to do is visit specific websites or install and enable the plugin, and cryptojacking will be done at its best. Cybercriminals can also use the user's (victim's) cloud computing infrastructure by taking over access rights, i.e., API/SSH keys.

5.3. The Course of Cryptojacking Attack

By using a specially written and fabricated script, hackers gain unauthorized access to the hardware resources of users connected to the Internet. The processor power (CPU) and/or graphics card (GPU) of the victim's computer for such a sneaky attack is "included" into the cryptocurrency mining process. This happens in a camouflaged manner and is difficult to detect by an ordinary computer or smartphone owner. Attackers cynically use the multiplied computing power of virus-infected computers to unaware users. The more victims are "caught" in this hidden net, the faster the efficiency of mining, and competitive advantage over other miners increase.

In fact, the cybercriminal "creates" a special infrastructure infected with malware devices called botnet which it manages in connection with mining at the expense of other users. The theft of "only" a small part of the computing resources of a single digital machine user is a "thoughtful" strategy of cybercriminals from the group of cryptocurrency miners, aimed at making it difficult for computer owners to detect their mining practices and limit the effective elimination of these types of threats.

Cryptojacking itself is constantly evolving. Initially, malware absorbed 100% of the computing power of the affected victim's computer processor. It was a very "effective" method only in the short run, because the user could easily realize that his computer was working incorrectly (huge slowdown in system operation, loud operation of the cooling system, which is accompanied by too frequent switching of fans at higher or maximum speeds). In the case of laptops and smartphones, there was also the effect of excessive heating of the device and "battery drainage". Sooner or later, it must have caused the user's concern and attempts to look for the reasons for this. As a result, cryptojacker was detected relatively quickly and at this point all criminal practices were successfully terminated.

Cryptojacking, which took over almost 100% of computing resources, could cause serious damage to the victim's equipment, speeding up processor wear and tear, and even its damage (smartphones and tablets) together with shortening battery life (laptops and other mobile devices). The rapid deterioration of the parameters of a computer or other device could cause concern to the user and take a number of actions to determine the sources of this incorrect work, which resulted from an effective cryptojacking attack. The second, more sophisticated method of mining using cryptojacking is to modify the malicious code so that the script "provides" cybercriminals with only the planned fraction of the computing power of the victim's computer, with long and unnoticeable operation. The longer such a harmful script remains undetected by the user or antivirus software, the greater the benefits for the hacker and the higher damage to the cryptojacking victim.

Figure 5.1 illustrates the processor's operation on the user's computer on which malware for cryptojacking has been running in the background. The processor idle load is on average 10% of its total performance. At the time of the attack, switching on a script that illegally mines cryptocurrencies, there is a sharp jump in CPU usage (even above 90%). After a short time, it stabilizes at 80–90% of the CPU computing power. The harmful script has been designed so as not to engage 100% processor power, because the user could quickly realize that some process running in the background is excessively consuming its resources. There are also modifications to malware that engage only 30–60% of CPU computing power. In this way, they are more difficult to identify and remain undetectable for a long time. You can defend yourself against such an attack by installing the appropriate browser plugins or using AdBlock – the software blocking ads and java scripts on websites (the vast majority of infections occur when browsing Internet resources). However, this is associated with limiting the comfort of browsing websites (not all options are available and not all information is displayed correctly). Whereas, if you open the attachment attached to e-mail message or run a program downloaded from an illegal source, the only barrier that computer can detect and block such malicious scripts are various anti-virus soft wares. Unfortunately, they are not able to identify correctly all threats related to cryptojacking.

The strategy of cybercriminals using cryptojacking in the process of mining cryptocurrencies is to "hack" to the largest number of devices, not oriented and unaware users, to take profits from the so-called scale effect. This is especially important when the miner-hacker "collects" only a small percentage of computing resources from each device.

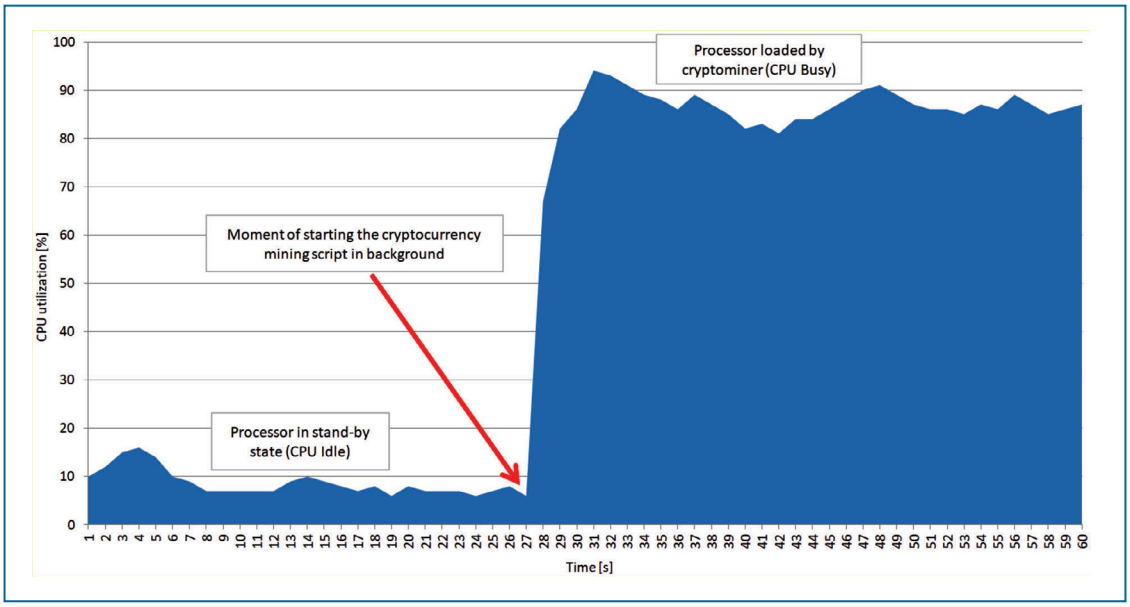


Figure 5.1. Load of the (CPU) processor during its inactivity and at the time of the attack using a malicious cryptocurrency mining script

Source: own study using MS Excel.

Due to this approach, the number of infected computers must go into hundreds, thousands or even millions. Everything is subordinated to the fact that such a cybercriminal can conduct low-cost or often cost-free mining activities.

The first generation of malicious codes used in cryptojacking was based on the so-called thief's call to action (Pieleszek, 2020). This means that the potential victim had to "take the initiative" by opening the attachment in an e-mail, by clicking on the fabricated link, or by downloading and running the file sent from an unknown source. At this point, the operating system was infected by malware, being added as a service and continuously operating in the background. In this simple but insidious way, the hidden cryptominer installed on the victim's computer. It was, in fact, one of the forms of long-used by the cybercriminals phishing[2].

[2] Phishing is a special method of cheating an unconscious and reckless user. It serves, among others, to infect a computer with harmful software, persuade the victim to perform specific actions or extort confidential information. For example, by means of a fabricated website or e-mail, cybercriminals acquire proprietary data that the victim himself voluntarily provides. She is convinced that she logs in to a bank or other website. It is also common practice for hackers to send false e-mails whose content prompts the user to open an attachment in which a harmful code is placed. The essence of phishing is not related to software or the equipment itself, but is based on social engineering and manipulation, where the weakest link is the human factor. Security specialists distinguish 12 basic forms of phishing (for example Clone phishing, Spear phishing, Pharming, Whaling, Email Spoofing, Website Redirect, Typosquatting, Watering Hole and Giveaways) (*Co to jest phishing...*, 2023; *What Is Phishing?*, 2022).

Increasing users' awareness of online security threats, including phishing, "forced" hackers to increase the level of advancement of such an attack. It had to be more sophisticated and reaching more people. This is how the second generation of cryptojacking was initiated, in which the Internet user no longer had been left with the "initiative" (e.g., opening the attachment or downloading and running the file), but all that was needed was to visit an infected website that contained implemented JavaScript malicious code (web-based cryptojacking). Currently, most of the harmful cryptocurrency mining software on third-party devices is launched through scripts embedded in the source code of the website. This process is presented in Figure 5.2. The cryptojacking miner-hacker attack begins by placing a malicious code or script on a website through its "injection", i.e., placing a fabricated ad or using a security vulnerability. When an unconscious user visits such an infected website, the malicious code is executed in his web browser and the computer's operating system is infected. From that moment, the equipment of the victim of such a cyberattack becomes a cryptocurrency mining rig that creates virtual currencies for the benefit of a cybercriminal, and all this is done without the knowledge and consent of the device owner. The block mining reward, i.e., the funds of a given cryptocurrency, goes to the cryptocurrency wallet of a miner-hacker. In this way he used the victim's computing power and did not incur any costs related to mining.

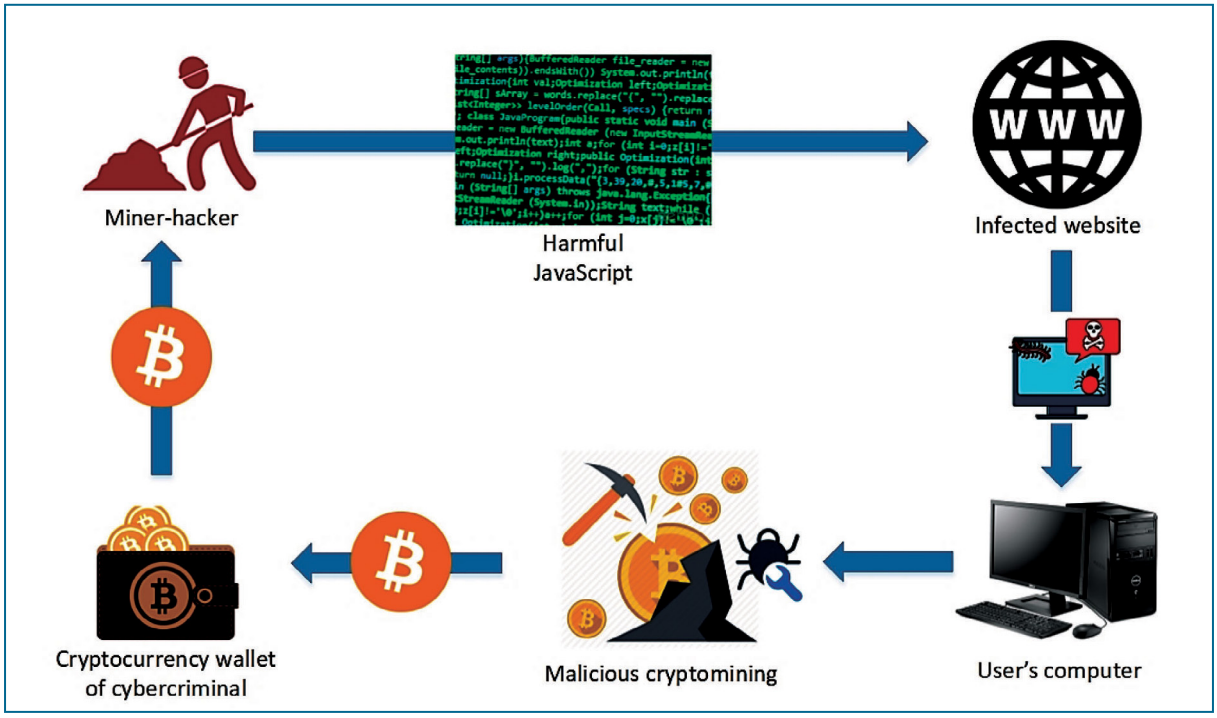


Figure 5.2. A mechanism of cryptojacking action involving placing a malicious script in the source code of a website

Source: own study using MS Visio.

It is worth recalling that Bitcoin mining (or other mineable cryptocurrencies) is the process of creating new BTC units by solving extremely complicated math problems that verify transactions in that virtual currency. When a block is successfully mined, the miner receives a predetermined amount of Bitcoins as a reward.

To sum up, the actions of cybercriminals "practicing" cryptojacking have evolved over time, because they quickly realized that attempts to take over 100% of the computing power of attacked computers can be easily detected, even by an inexperienced user. And then after clearing the browser cache memory or restarting the computer, they lost the cryptojacking victim's computing ability. New versions of this tricky software are more "intelligent" and quite effectively mask their presence. They are primarily focused on the longest possible operation of the infected computer. Therefore, malicious scripts often use only about 1/5 of the processor's computing power so as not to arouse suspicion of the workstation owner. They are constructed in such a way that they make the most of the idle mode (maintenance mode) of the device and then perform the calculations most aggravating the processor. When the user returns to normal operation, they go into "economical" (20–30% CPU load), not to reveal their presence in the operating system and be able to "rob" a victim of its resources and electricity for a very long time, remaining undetected.

5.4. Scale and Examples of Cryptojacking

It is difficult to estimate the scale of cryptocurrency mining using cryptojacking, because official data and statistics are lacking, and the phenomenon itself is still under-explored. It can only be said with certainty that such attacks around the world can be counted in millions. For example, according to the report of November 21, 2017 by Adguard (a company that launches web browser plugins that block unwanted ads and harmful scripts – e.g., AdGuard AdBlocker and Adguard Web Filter), about 33,000 websites were identified that contained a malicious script for mining cryptocurrencies. The analysed sites generated more than a billion entries per month. Adguard was able to determine that within one month there was an increase of as much as 31% in the number of websites that cybercriminals tricked into mining cryptocurrencies (run in-browser mining)[3]. It is estimated that such an increase was caused by one of the largest speculative bubbles on the Bitcoin market that was formed at that time. In turn, the Bad Packets report in February 2018 (Mursch, 2019) already showed over 34,000 pages (34,474), on which hackers secretly launched the most popular cryptocurrency mining script called "CoinHive".

It is worth knowing that cryptojacking does not require any special IT skills (programming, knowledge of the basics of computer networks, or web design). For example, in

[3] "We found cryptojacking scripts on over 33,000 sites with a total traffic of 1 billion monthly visits. The number of sites from Alexa's top 100K list which run in-browser mining grew by 31% over the past month. The overwhelming majority of sites don't bother to warn users or get their consent to mining" (Meshkov, 2022).

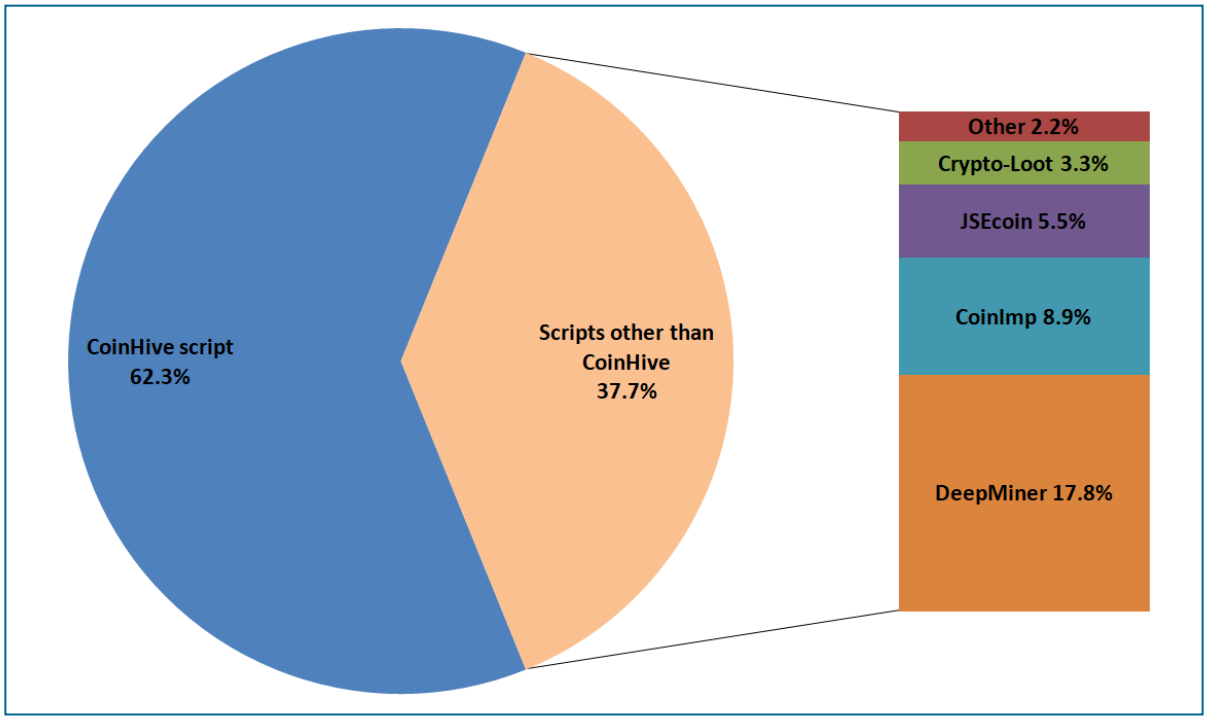
the so-called underground and illegal Internet (Darknet) criminals offer ready-made cryptojacking toolkits for only USD 30. This cost, combined with the prospect of mine a large number of cryptocurrency units, without incurring the cost of purchasing equipment and charges for electricity consumed, makes cryptojacking a very profitable practice. Often, thanks to cryptojacking, hundreds, thousands and even millions of devices dig up non-stop cryptocurrencies. The risk of detecting this malware is relatively small, as such a script can work for a long time imperceptibly (stealth mode). In addition, cybercriminals do not run the risk of prosecution by the relevant services because they do not steal any user data and do not encrypt his hard drive, as is the case with cryptolockers (ransomware). The most famous example in the world of blackmail software was the worm attack "WannaCry", which in May 2017 infected over 300,000 computers in 99 countries. Cybercriminals are increasingly less interested in using ransomware that encrypts users' hard drives to raise funds for "unlocking" access to data carriers. To avoid being targeted and identified by law enforcement, criminals forced a ransom in Bitcoins or other cryptocurrencies. The decline in popularity of malware encryption resulted, among others for two reasons.

First, only a small percentage of users (around 3%) whose hard drives have been encrypted, were willing to pay the ransom. Quite often this was one-time earning for hackers. However, cryptojacking brings income in the long run. In addition, many companies (banks, institutions, corporations, offices and enterprises) regularly back up their data and can easily restore data resources that have been blocked. This means that cyber blackmailers will never receive ransom money from these entities. In addition, companies that create antivirus programs enrich them with additional scanning modules that are able to detect and block such malware. The mechanism for isolating running programs, open attachments and websites in an environment specially separated from the operating system is also very useful. It is called sandbox.

Secondly, people who demand ransom for unlocking user data commit an obvious crime and expose themselves to criminal liability. A hacker intending to use blackmail software must somehow "reveal", by sending a crafted account number, specially prepared mail to contact the victim, etc. This can help law enforcement authorities identify such a criminal operating on the TOR (Darknet) network. In the case of cryptojacking, the miner-hacker basically becomes anonymous all the time and it is difficult to "track down". Unlike most malware software, cryptominer scripts do not cause damage to seized hardware and operating system, but only use the processor and/or graphics card computing power. Cybercriminals stealing computing power of computers of Internet users, to mine Bitcoin or other cryptocurrencies, are primarily guided by fast and high profit ("cost-free" mining). When it comes to the possibility of maintaining almost 100% anonymity, cryptojacking works well for altcoins such as Monero (XMR) and Zcash (ZEC). In the opinion of experts, in the case of Bitcoin one cannot speak of full anonymity, but only pseudo-anonymity.

Figure 5.3 presents the most commonly used scripts that illegally mine cryptocurrencies. The most popular among cybercriminals was the CoinHive script, based on the JavaScript programming language. This was due to its large configuration capabilities and easy imple-

mentation on the website. It did not require particularly deep knowledge of programming and hacking techniques. It was enough for an amateur of illegal mining cryptocurrencies to paste the two-lines code into the source of the page. Such a short script enabled the automatic execution of malicious code in the victim's web browser. The CoinHive script is also compatible with all the most popular web browsers and is relatively easy to implement.



Other (2.2%): Minr, ProjectPoi, CoinNebula, MinerAlt and CoinRail.

Figure 5.3. Structure of Java malicious scripts used by cybercriminals divided into CoinHive and scripts other than CoinHive

Source: own study using MS Excel based on https://badpackets.net.

For the reasons indicated above, CoinHive came first among all malicious codes used for cryptojacking. CoinHive is used by cybercriminals for attacks *web-based cryptojacking* on hacked websites. In other words, it is implemented without the knowledge and consent of website owners. This was done by using vulnerabilities in server or web application configurations. The most frequently attacked in our country were websites of national or local newspapers. This was mainly due to two reasons. First of all, the administrators of these websites did not carefully verify the ads placed on their pages, and indeed such ads written in Java were "carriers" for cryptominers. Secondly, cybercriminals were interested in sites with poor security and at the same time generating heavy traffic (a large number of visitors), as is the case with newspapers and online periodicals. As already mentioned, the

most "popular" among cybercriminals using cryptojacking is JavaScript called CoinHive. It has been identified on over 62% of affected sites that have been dragged into a hidden mining process. Among the group of other scripts, DeepMiner (17.8%) and CoinImp (8.9%) were most commonly used. In June 2018, Check Point Software Technologies revealed that 4 out of 10 detected malicious codes (malware) were so-called cryptominers, i.e., scripts used by hackers for cryptojacking. CoinHive dominated here. In summary, it can be stated that the CoinHive script was the undisputed leader among malware for cryptojacking. Almost every fifth malicious code is DeepMiner, and every tenth is CoinImp, while every twentieth is JSEcoin.

It is worth knowing that cryptojacking has undergone a kind of evolution. Initially, scripts for capturing computing power of unaware users were placed only on pages with unchecked reputation and widely recognized as harmful (e.g., pages with illegal software, illegal music and movies, such as The Pirate Bay and adult content sites). Over time, however, cybercriminals began to infect sites that generated very high network traffic and were widely recognized as safe. Hackers in Poland even went so far as to install malicious scripts (mainly CoinHive) on pages enjoying high attention and widespread prestige (e.g., YouTube, *Rzeczpospolita*, *Gazeta Wyborcza*, *Gazeta Wrocławska* and other local dailies as well as naszemiasto.pl, parkiet.com, motofakty.pl, muratordom.pl or telemagazyn.pl).

In February 2018, a malicious script used for cryptomining was detected on the *Los Angeles Times* website (O'Donnell, 2019). According to cybersecurity specialists, CoinHive software dedicated to illegal cryptocurrency mining, which was embedded on the *LA Times* (cryptojacking code, was hidden on the interactive page of the kill report – *Homicide Report*), was also implemented on the government websites of Great Britain and the USA. RedLock (RedLock Security Blog. Cloud Threat Defense) reported that the manufacturer of Tesla electric vehicles also fell victim to cryptojacking. Cybercriminals have placed in the corporate cloud environment malicious scripts mining cryptocurrencies.

Currently, the most common form of cryptojacking is the so-called web-based cryptojacking (drive-by cryptomining). Malicious scripts are embedded on the website and when it is opened by the user, it is automatically initiated to mine cryptocurrencies by the browser. The success of such criminal practice depends to a large extent on how cryptominers will be hidden in the source code of the website or in displayed ads on the site.

It is worth recalling that in September 2017 the official CoinHive script appeared (based on the Java programming language), which allowed website owners to earn legally, without having to display intrusive and annoying ads for users. A person visiting such a site was informed about it and had to agree to it. In this way, the user knowingly "provided" a certain percentage of the computing power of his processor and/or graphics card to support the creator who provided the content he created for free. The website owner officially earned by mining cryptocurrencies on the equipment of users visiting his website, and not on ubiquitous advertisements that generated much less revenue and discouraged Internet users from entering such a website. The web administrator had double benefits: his site was higher positioned in search results and earned legal mining income. Over time, the above-

-mentioned script began to be used to illegally take over the computing power of Internet users' equipment. After loading the selected website, the user was no longer asked for permission for use computing power of his computer. He was completely unaware that such a process had already been initiated, and he himself was insidiously manipulated. This was done in two ways. In the first case, the website owner/administrator himself intentionally and thoughtfully placed the mining script on his own website without informing users. Cryptocurrencies mined by this method were pure profit for him. The second option is related to the activities of cybercriminals who illegally placed cryptominers (without the consent and knowledge of the website administrator) in the source code of the page. The site owner did not benefit from it, and hackers took over all the income from cryptojacking. According to Internet cybersecurity experts, the CoinHive script became the biggest threat among malware in the first half of 2018. He even overtook ransomware attacks and Trojans stealing login details for electronic banking. According to the Symantec Internet Security Threat Report, in 2018 the number of ransomware attacks dropped significantly, in contrast, there was a real plague of cryptojacking attacks (Symantec, 2019).

There are really many examples of cryptojacking. Here are some of them related to the use of CoinHive.

December 2017 – malicious CoinHive script was secretly implemented by the owner of the Starbucks chain in Buenos Aires. Customers using the free WiFi network at the company's premises were tricked into mining Monero cryptocurrency on their laptops and smartphones.

January 2018 – on the largest platform offering video streaming, i.e., YouTube, CoinHive was hidden in ads displayed while watching movies.

The turn of July and August 2018 – an attack was carried out on over 200,000 MikroTik routers in Brazil. Each user using wireless networks provided by these routers unknowingly participated in mining cryptocurrencies. The attack using the CoinHive code was intended on a large scale.

The increase in the scale of cryptominers' attacks was associated, among others, with the emerging speculative bubble on the Bitcoin and Ethereum markets. It was the strong economic stimulus that encouraged to intensively mine cryptocurrencies, also using illegal cryptojacking.

Figure 5.4 shows how the use of malware for cryptojacking has changed. In the period from first to third quarter of 2017, the number of uses of this type of software increased moderately. In the fourth quarter of 2017, compared to the previous quarter, attempts to use the malicious code for illegal cryptocurrency mining doubled (100% increase). This was strongly correlated with the speculative bubble formed on Bitcoin (at that time, other mineable cryptocurrencies also followed its trend).

Starting from the first quarter of 2018, there has been a rapid increase in the use of this type of software in taking over the computing power of Internet users. On average, there were 2.5 to 3.8 million new threats related to cryptojacking every quarter. In just two years (2017–2019) almost 16 million different versions of malware software willingly used by cybercriminals to mine cryptocurrencies without the knowledge and consent of computer

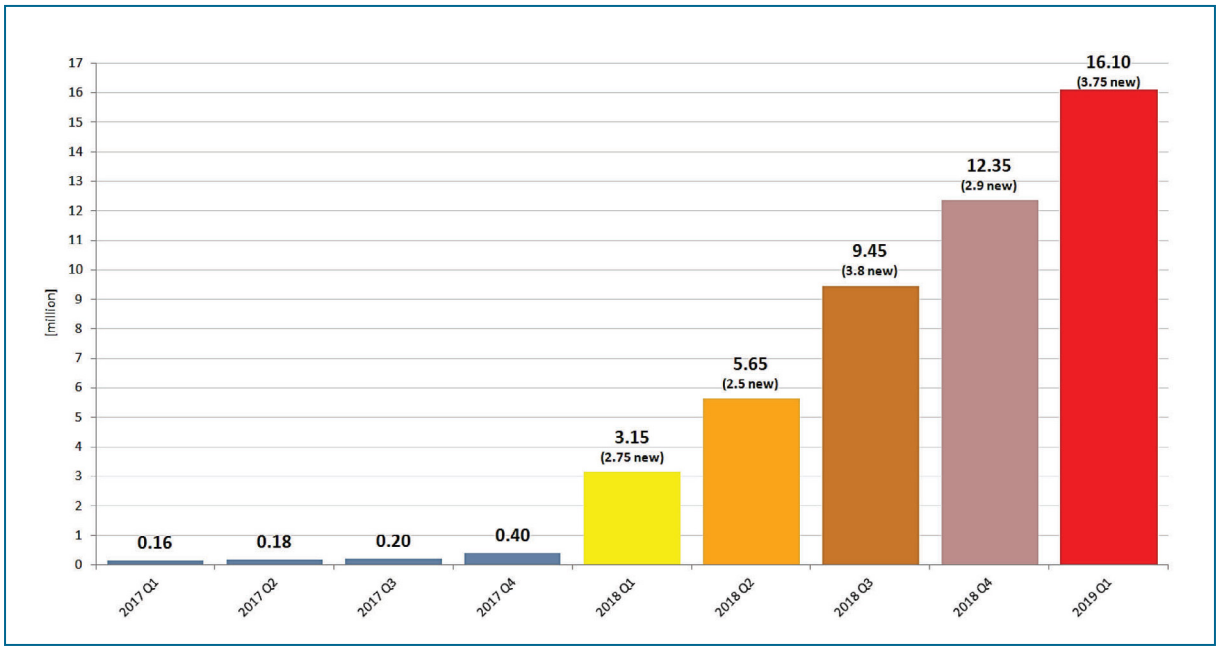


Figure 5.4. Harmful malware used for cryptojacking including new threats/scripts in the period from the first quarter of 2017 to the first quarter of 2019

Source: own calculations using MS Excel based on McAfee Labs Threats Report.

hardware owners or mobile devices. In other words, new threats related to the illegal use of other users' equipment for mining cryptocurrencies increased over hundred times (precisely by 10,062.50%, increase from 0.16 million to 16.10 million).

In 2018, cryptojacking dethroned ransomware (data encryption and ransom demand) as the most popular form of cyberattack. Based on the above analysis, it can be concluded that the huge "popularity" of such solutions in illegal cryptocurrency mining resulted primarily from two factors. First, cybercriminals made profits without incurring any costs associated with the purchase of cryptocurrency mining equipment and charges for electricity consumed. Secondly, the so-called scale effect: taking over the computing power of one or several computers was not important for cryptojacking, but when these numbers went into tens or hundreds of thousands or even millions of Internet users, the profits must have been fabulous, without any own contribution. In other words, cybercriminals mined for free, without taking any risk there. Their calculation was simple: income = profit (because there were no costs associated with mining cryptocurrencies). It can be assumed that if there will be no changes in technology and security in the near future, this dangerous trend will have great progress. At this point, one can put forward the thesis that the existence of cryptojacking is related to the used Proof of Work consensus algorithm, which requires miners to offer some specific amount of work on behalf of the entire network, e.g., Bitcoin. The mining devices used are very energy-consuming. Therefore, the costs of energy consumed may often exceed the revenues from the mining. Until there is a change in the Bitcoin mining

algorithm and other mineable cryptocurrencies to more energy-saving ones such as Proof of Stake and putting them into circulation, the problem of cryptojacking and "free" mining at the expense of other Internet users will remain.

According to estimates contained in the McAfee Labs Threats report, in the first quarter of 2018 there was a rapid, gigantic increase in new malicious scripts mining cryptocurrencies compared to the last quarter of the previous year. This number increased from around 400,000 to 2.9 million (increase by 2.5 million), which means more than 6-fold increase (625%)[4]. It is worth noting that comparing the fourth quarter of 2017 to the third quarter of the same year, the increase in cryptominers was estimated as only 50%. In turn, in the second quarter of 2018, compared to the first quarter, there was a further huge increase in the number of scripts like CoinHive, again by 2.5 million new threats regarding cryptojacking. This meant an increase of 86.21%. In cumulative terms, taking as a basis the fourth quarter of 2017, as many as 5 million completely new and harmful scripts mining cryptocurrencies without the knowledge and consent of users arrived.

Great progression in the growth of new malware dedicated exclusively to illegal cryptocurrency mining, used as part of cryptojacking, is well illustrated by the data for two periods. During one year (from the third quarter of 2017 to the third quarter of 2018) there was over 47-fold increase (4,725%) of the total number of cryptocurrency mining scripts at the expense of unaware Internet users. In the two-year period (first quarter 2017 – first quarter 2019) this increase was gigantic, since it has been estimated to be 10,063%. These numbers can be frightening, but they can also indicate that cryptojacking has become the most "popular" way among cyber criminals for illegal income obtained virtually cost-free. These statistics can also confirm the thesis that ransomware and theft of login data for electronic banking have been overtaken by cryptojacking. The fragment from the original report cited below leaves no doubt that malicious scripts like CoinHive have become "favourite" form of cryptojacking by cybercriminals.

Coin miner malware grew a stunning 629% to more than 2.9 million known samples in Q1 [2018] from almost 400,000 [395 000] samples in Q4 [2017]. This suggests that cybercriminals are warming to the prospect of monetizing infections of user systems without prompting victims to make payments, as is the case with popular ransomware schemes. Compared with well-established cybercrime activities such as data theft and ransomware, cryptojacking is simpler, more straightforward, and less risky. All criminals must do is infect millions of systems and start monetizing the attack by mining for cryptocurrencies on victims' systems. There are no middlemen, there are no fraud schemes, and there are no victims who need to be prompted to pay and who, potentially, may back up their systems in advance and refuse to pay (McAfee, 2018).

It should be recalled that malicious scripts for mining initially appeared on pages with a very dubious reputation offering illegal content (e.g., the most famous page with torrents,

[4] Another producer of antivirus software and cyber security, TrendMicro, published a report in which it informs that according to the analyses, there was a 956% increase in the number of cryptojacking attacks. The study concerned a period of one year, from the first half of 2017 to the first half of 2018 (Trend Micro, 2018, 2019).

i.e., The Pirate Bay). Over time, they were secretly placed on websites of online stores, blogs of famous people and celebrities, and even on the websites of state offices and agencies. It was possible, among others, because the content management software for such pages has not been regularly updated. It is thanks to the gaps in the CMS (Content Management System), that cybercriminals obtained easy and often full access to the source code of the page, on which they placed harmful scripts or hid them into official advertisements presented on these websites. Some hackers even went so far as to create false software updates with implemented malicious code to take control of the computer and its computing power.

Cloud services offered by the global giant Amazon have also been used by cybercriminals to practice cryptomining. Miners-hackers broke into the AWS (Amazon Web Services) of several companies and took advantage of the fact that the administrative console was not protected by any password or the default password was not changed, e.g., "admin". As a result, they obtained the highest level of permissions (this resulted from the reckless approach of the system administrators themselves), which in turn allowed them to take over the gigantic computing power of the Amazon cloud and the offered resources of virtual machines for mining cryptocurrencies, such as Bitcoin, Litecoin or Ethereum (Peterson, 2017).

One of the most famous companies in the world that used Amazon's cloud services and fell victim to cryptojacking was Tesla, founded by Elon Musk, a leading manufacturer of electric and autonomous cars. The hacker attack also led to the disclosure of some proprietary data, including maps, telemetry and vehicle servicing (Browne, 2018). At this point, one should agree with a statement by Kumara, the technical director of RedLock which specializes in monitoring the security and threats of providers of the largest cloud services, such as Microsoft Azure, Google Cloud Platform and Amazon Web Services. "Given the immaturity of cloud security programs today, we anticipate this type of cybercrime [cryptojacking] to increase in scale and velocity" (Liberto, 2019).

In 2018, cybercriminals even used audio description software on official government sites of countries such as Canada, the US and the United Kingdom to bypass security and implement a malicious script that digs cryptocurrencies, called CoinHive. All persons who visited the government websites of these countries were unknowingly used to mine cryptocurrency on their computer equipment. The situation becomes very dangerous when such an attack and the acquisition of computing power of computer systems concerns the management of critical infrastructure of the city, region or even country. An example is the hacking of the European water supply control system (European Water Utility) for cryptomining. This was the first example of cybercriminals' action against the industrial control system, causing perturbations in network management (Largue, 2018). It is worth mentioning that the system worked under the control of Windows XP, whose extended support ended on April 8, 2014. Such an important industrial control system was based on an outdated operating system with many gaps, which is not a very professional approach on the part of administrators.

Virtually anyone can become a victim of cryptojacking. In July 2018, it turned out that on the Steam platform, which is ranked as the largest digital distribution of computer games,

a game with hidden malicious code was available. We are talking here about the game "Abstractism" which without the knowledge and consent of people playing it secretly mined cryptocurrencies. That PC game has been prepared and issued only to unauthorized use of the computing power of computers users (processors and graphics cards). The game has been designed in such a way as to encourage users to use it as long as possible. The more time the player spent on this game, the more virtual items he received (like weapons, points or experience) for use in other games. In other words, the longer the player was connected to the Internet and logged into the game, the rarer and more valuable items he could receive. For example, the first of them was available to him after 15 minutes, the second one after 30 minutes, and the third only after an hour of continuous gameplay (Gurwin, 2018). It was rightly assumed that it could be a camouflaged cryptocurrency mining rig. The excuse of the producer, Okalo Union, was quite naive. The company claimed that the high consumption of the processor and graphics card is the result of starting the game at the highest graphic settings. These were ridiculous arguments, because the game was very simple and only two--dimensional, and in addition in the black-white version. Therefore, it could not absorb such computer resources in any way. Suspicions have been confirmed; the game mined the cryptocurrency in the background, previously installing the so-called Trojan horse, which transformed player's computer into an efficient cryptomining machine. The owner of the Steam platform, Valve, has removed "Abstractism" from its gaming catalogue. This is an example that even on such a well-known and valued service as Steam, you could fall victim to cryptojacking (Radulovic, 2018; Tomczyk, 2018a).

Experts on cybersecurity have shown that it is possible to illegally mine cryptocurrencies through the hidden use of JavaScript even in an Excel spreadsheet. Of course, with no permission to perform the relevant calculations and without obtaining the consent of the user who started such a fabricated file (Tomczyk, 2018b). In this way, virtually anyone can fall victim to cryptojacking, because the Office programs package is very popular, and a large number of users download data from various sources in CSV or XLS/XLSX format.

5.5. Effects of Cryptojacking

The effect of hidden cryptojacking resulting from taking over computing power is – from the exploitation and technical side – deterioration of computer's operation. Among others this includes increased processor load, increasing fan switching frequency and multiplied operation at higher speeds than usual, repeated system suspension, heating the case of the entire device and its loud operation, which does not occur under normal conditions of use. A device that has been infected with malware for cryptojacking can also switch off without reason, automatically restart repeatedly, or often display so-called Blue Screen of Death (BSoD). This is a symptom of a serious error of the system or running application, due to the consumption of excessive computing power and preventing other system operations. The

increasing number of episodes with the emerging BSoD is caused by excessive overloading of computer resources, which may result from its inclusion in the mining process, when cryptominer is active in the background.

In the case of infected smartphones and tablets, malware used for cryptojacking occurs with strong overheating of batteries in these devices during their network operation. As a result of miners/hackers cryptojacking – the equipment's life is significantly reduced. This entails financial consequences for users who are forced to purchase new devices much earlier than would appear from their normal life cycle.

In other words, the destructive effect of cryptojacking on the user's computer on which cryptocurrency malware has been insidiously installed, will manifest itself in the best case with a decrease in its performance and interference in smooth operation and technical perturbations, and in the worst one – total and irreversible damage/destruction of the device.

Seemingly, this criminal practice (cryptojacking) may seem harmless to the user or the attacked institution. Taking over the computing power of a computer, server or mobile device using a malicious script, however, has many negative effects. On the one hand, cryptojacking reduces the performance of the equipment in use, and on the other – generates higher expenses for its owner. It is about spending on electricity consumed and maintenance services, or the purchase of new computer components that have been worn out prematurely as a result of cryptomining.

5.6. Cryptojacking as a Criminal Act

Among all cybercrimes cryptojacking (also known as cryptomining) has been gaining importance since 2017, and its intensity is strongly correlated with fluctuations in cryptocurrency rates expressed in fiat money, and connected with the creation and bursting of price bubbles. It was at the end of 2017 that one of the largest speculative bubbles on the Bitcoin market was growing rapidly, counting from his debut on the web in 2009, and thus mass of miners grew, including miners-hackers using cryptojacking to mine new BTC units. The effect of cryptojacking is the perfidious and hidden theft of some computing resources of network users, leading to slowing down the operation of the devices they use and contributing to a significant reduction in their actual service life, which, as a consequence, is reflected in higher electricity bills and undesirable shortening of the equipment replacement period due to excessive exploitation and increasing failure due to continuous overload and overheating of computer components.

Cryptojacking still does not pose a high risk to the hacker performing such an attack, while it is relatively easy to implement on the victim's computer, and at the same time not easy to identify by a user robbed of part of the computing capacity of his central unit. It should be emphasized that detecting the operation of a cryptominer is not easy for the average owner of a computer connected to the Internet, because malware has the possibility of so-called mimicry, consisting in similarity to other installed programs. A kind of chameleon

effect works here. In addition, the tracking and detection of the perpetrator by the relevant services and law enforcement bodies is relatively difficult.

It is worth noting that in Poland cryptojacking exhausts the features of computer fraud, so it is a criminal act, in accordance with the wording of art. 287 § 1 of the Polish Criminal Code.

Who, in order to achieve a financial gain or cause damage to another person, without authorization, influences the automatic processing, collection or transfer of IT data or changes, removes or introduces a new record of IT data, is punishable by imprisonment from 3 to 5 months (Ustawa z dnia 6 czerwca 1997, Art. 287 § 1).

Unfortunately, in practice the detectability of this type of crime is extremely low, and the criminalization of such a criminal act is so far unique. By January 2021, courts in Poland had only imposed a prison sentence against one cryptojacker. It can be assumed, without a high probability of making a mistake, that there were quite numerous cases of cryptojacking in our country's territory, because constant and massive attempts to steal computing power from foreign computers are a common phenomenon on the network. It is estimated, however, that most such attacks affect individual computer users in countries such as India, Japan, Taiwan, the United States of America and Australia.

The law attorneys Friedman Nemecek & Long L.L.C.[5] from Cleveland, the state of Ohio, present the following interpretation of cryptojacking with an indication that this is a federal crime in the US: "Cryptojacking involves using part of someone's computing power without their knowledge or consent to gain monetary benefits. Under federal law, this act is a fraud and suspects in cryptojacking may be brought to justice" (Friedman & Nemecek, 2022). According to the information of this lawyer's office referring to the prosecutor, at the end of 2021 two people were accused of financial fraud related to cryptojacking. The US Attorney's Office for the Eastern District of Missouri in the collected evidence showed that two accused Iranian citizens were acting to the detriment of the interests of a technology company from the city of Saint Charles, Missouri. They were accused of deliberately misleading the cloud service provider to launch five additional servers working for and at the expense of the entity. Two cybercriminals, by obtaining unauthorized access to the official account of this company, which is used to manage access to the Microsoft Azure cloud, placed an order on its behalf to extend the existing cloud service capabilities. According to prosecutors, "Jeloudar and Safaei 'fraudulently' gained access to a cloud services account used by a tech company in St Charles, Missouri" (*Two Iranian*…, 2021). The contracted increased cloud computing power was to be used to mine Monero cryptocurrency for cyber criminals. The crime was only revealed when the cloud service provider issued an invoice for a dizzying USD 760,000.

By misrepresenting themselves through the victim company's account, the defendants fraudulently authorized the cloud service provider to build and install at least five new

[5] "A Limited Liability Company [LLC] is a hybrid between corporation and partnership structures in the United States whereby business owners are given liability protection and pass-through taxation. This means that owners of an LLC are not personally liable for the company's debts and obtain certain tax advantages. Furthermore, owners of an LLC are called 'members' rather than partners or shareholders" (*Limited Liability*…, n.d.).

computer servers in the cloud. The purpose of the new servers was to run and operate software programs to generate cryptocurrency (Kovacs, 2021).

It is worth mentioning that in the US financial fraudsters are punishable by up to 20 years imprisonment and/or a fine.

It should also be mentioned that the European Union Agency for Cybersecurity (ENISA) is of the opinion that cryptojacking is an illegal activity, but such attacks are not of great interest to law enforcement authorities, and their cases are rarely reported by injured users, mainly due to the relatively small negative direct consequences (European Union Agency for Cybersecurity [ENISA], 2020a). The ENISA report confirmed that in 2019 the most commonly used malware by cybercriminals was cryptojacking (over 64 million cases in 2019) (ENISA, 2020b). Infection of the internal network of companies and organizations of this type with malware causes financial losses of these entities or increases the costs of operating IT systems (increased electricity consumption and IT costs, as well as a decrease in the efficiency of the attacked equipment, and thus a reduction in employee productivity).

In summary, cryptojacking is an illegal method of mining cryptocurrencies. This crime is not about directly stealing other people's virtual funds. In practice, the Internet user who is the target of the attack does not need to have cryptocurrencies at all for crypto-jacking to occur. A cryptojacking attack describes the unauthorized use of a person's computing power to mine virtual currencies. This is done by insidiously infecting a computer or other devices connected to the Internet with malware.

5.7. Possibilities of defence against cryptojacking

It is worth emphasizing that Internet users are not completely defenceless against cryptojacking. To protect from it relatively easily. Some basic rules must be observed. First, under no circumstances open suspicious links to unknown pages (i.e., redirecting) and open files (especially with the EXE, ZIP or RAR extension) sent *via* e-mail or downloaded from unknown and uncertain sources. A good habit is to regularly and systematically update your operating system and software to "fix" security vulnerabilities. In addition, it is recommended to install a web reputation rating plugin in your browser that suggests which pages are secure and which may contain malicious scripts (Pieleszek, 2019, pp. 49–56). One should not forget about having commercial antivirus software. Free antivirus programs are not effective enough to detect and block malicious code that is a cryptojacking medium. Cybersecurity specialists also suggest adding an extension to your browser that blocks ads (AdBlock) and Java scripts on websites and thus prevents the launch of illegal cryptomining (e.g., No Coin, NoMiner or minerBlock).

It should also be pointed out that human aspect is always the weakest security link and this is also confirmed in the case of cryptojacking. It is the user who usually performs the action, e.g., opening an attachment or clicking on a link or advertisement that runs the

mining script. Therefore, the system should be regularly scanned for the presence of cryptocurrency mining code and backed up data.

Protection against cryptojacking is really possible, but you need user involvement. There are plugins (addons) for web browsers like Firefox or Chrome, that are blocking the display of ads on the page (with hidden cryptominers) and the execution of Java scripts (like Ad Blocker Plus). However, such an add-on had to be installed on the user's own initiative, and configured accordingly. Many of them either disregarded the problem or did not have adequate knowledge of this threat and could not be properly secured. The first browser that had a built-in and integrated mechanism for detecting and blocking cryptocurrency mining scripts on websites was Opera. It was enough to select only the "No Coin" function in the settings. It should be added that later there was an automatic regular update of the cryptojacking script list.

It is worth emphasizing once again that in the face of cryptojacking attacks, users are not completely helpless and powerless. They should use common sense, not perform unthinkingly certain operations and activities. In a word, you must follow the elementary rules of using the Internet. In the case of malware hidden in files, do not open attachments sent *via* e-mail from unverified senders, in particular executable files with EXE extension and packed files with ZIP or RAR extensions. When browsing the Internet resources, you should examine the reputation of the pages you visit using special plugins that are added to your web browser. Downloading illegal content from unknown sources, including pirate software, may expose you to infecting your operating system with a malicious code. In addition, do not mindlessly click on the links redirecting to a given website, in particular in the so-called shortened links. The last element of defence against cryptominers is installing a dedicated plug-in blocking ads and Java scripts. This plugin should be added to every web browser used. Unfortunately, this involves incorrect display of some websites and forms. In other words, the comfort of browsing websites is reduced, but this is at the expense of security.

Confirmation of the importance of security is the systematic and regular update of the operating system and installed programs is the Trend Micro report published on June 10, 2019. The security bulletin highlights the new threat of insidious installation of illegal cryptocurrency mining software. Cybercriminals are increasingly using vulnerabilities in operating systems, programs and services to gain unauthorized access to a computer or server to implement malicious code. It should be emphasized that each software provider periodically issues patches that remove detected vulnerabilities. Unfortunately, not all users decide to update their software, especially the Windows operating system, which may seem logical and rational. It has often happened that the official update issued by Microsoft worsened the functioning of the system instead of increasing its performance and functionality. Paradoxically, the official patch to remove vulnerabilities in Oracle WebLogic has made it easier for hackers to penetrate systems and install cryptojacking software. They used security certificates, behind which scripts that illegally mine cryptocurrencies were

hidden. In this way, they outsmarted antivirus and malware detection programs because they do not scan certificates for encrypted connections (https).

The idea of using certificate files to hide malware is not a new one [...]. By using certificate files for obfuscation purposes, a piece of malware can possibly evade detection since the downloaded file is in a certificate file format which is seen as normal – especially when establishing HTTPS connections (Vicente, Triunfante & Gelera, 2019).

In addition, other issue of broadly understood security should not be underestimated. Cryptojacking can contribute to increased infiltration of operating systems, ranging from home computers (PCs) to servers of large corporations and government agencies. This is a very dangerous trend that will promote the intensification of data leaking, including business data, as well as sensitive data and strategic data important for the functioning of countries.

5.8. Conclusions

With the development of cryptocurrency mining carried out in the online environment, and significantly driven by the mechanism of creating speculative bubbles on the market of these virtual assets in combination with the highly rooted FOMO syndrome (Fear of Missing Out) among investors eager for quick and huge profits, a completely new form of cybercrime has appeared on the web. On the IT level, it consists in planned, intentional and insidious infection by miners/hackers with a malicious code of devices equipped with processors and connected to the network, and then on taking over their computing power for their own purposes – so mining cryptocurrencies for free. Such criminal activity is referred to as cryptojacking, also called malicious mining (malicious cryptomining) (Behan, 2022, pp. 649–656). This is a relatively new type of computer attacks launched by cybercriminals on the equipment of ordinary users, including not only personal computers, but also servers, smartphones and tablets.

Miners/hackers can for a long time operate other people's devices connected to the Internet in order to achieve their own financial benefits, without the knowledge and consent of users. Cryptojacking can affect both individuals, companies or public institutions, and be used for unconscious work of entire groups of computers or related devices cooperating via the network. Infected computers and servers lose their performance by slowing down the work of a company or organization or institution. Systems and programs may not work as smoothly as the user needs, and which is directly due to the technical specification of the equipment and its configuration. In addition, as a result of infection, devices consume much more energy, which due to a large number of them can be a serious financial problem for the entity conducting business activity.

It should be emphasized once again that cryptojacking is a type of cybercrime, where the miner/hacker secretly uses the victim's computing power to generate cryptocurrencies. This usually happens when the victim unknowingly installs a program containing malicious scripts that allow the cybercriminal to access the computer or other device connected to the

Internet. Cryptojacking may seem like a harmless crime, because the only thing "stolen" is just some fraction of the power from the data processing potential of the attacked user's computer. However, the use of someone else's computing capacity for this criminal purpose takes place without the victim's knowledge or consent, only for the benefit of a cybercriminal who illegally mines cryptocurrencies and earns money on it. In these circumstances, revenue means pure income for the miner/hacker, as he does not bear the costs associated with the creation of mineable cryptocurrencies (purchase of equipment and operating costs, including electricity costs). Considering the large number of infected devices and the possibility of obtaining a total gigantic computing power, creating conditions for generating cost-free huge amounts of virtual currencies based on the so-called Proof of Work consensus algorithm, miners/hackers see cryptojacking as a lucrative crime that is easy to commit, while being difficult to detect.

It is also worth answering the question contained in the title of the article. Cryptojacking can in a sense be seen and considered as a manifestation of the crisis behaviour of individual miners, which is particularly intensified during periods of the rise of speculative bubbles on the market of specific virtual currencies. This may be due to two economic reasons. Mining grown by individual miners is generally unprofitable, because their mining capacity as represented by their equipment is relatively small and in no way can compete with the so-called mines, which bring together large groups of users, creating gigantic computing power. In relation to the total computing power of typical mining farms, mining rigs of individual miners are only a part per thousand of their efficiency. Hence the resort of individual miners to not always legal attempts to make a profit, even at the expense of other Internet users. The second reason why an individual miner decides to use cryptojacking is that the variable costs of such an undertaking as cryptocurrency mining are very high and often prevent profitability. In addition, the complementary factor in cryptojacking are fixed costs – cybercriminal is not forced to buy their own equipment and operate it.

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