

A MODEL FOR OVERCOMING CERTAIN PROBLEMS OF COOPERATION AS A COMPONENT FOR THE SUCCESSFUL FUNCTIONING OF THE JUST-IN-TIME PRODUCTION AND SUPPLY CHAINS

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Abstract In this paper, the importance of cooperation on an external and internal level has been considered, which is an important condition for the proper functioning of the Just-in-time (JIT) way of production and supply chains, which participate in the implementation of the JIT business strategy. Cooperation as a condition for the successful implementation of the Just-in-time business strategy has not been previously considered in detail in the literature. In this paper, certain factors that influence the success of the cooperation have been identified. Problems and consequences that may arise as a result of the effect of these factors on the functioning of the JIT production and supply chains have been identified. A proposal of a new model has been given that allows problems of cooperation that arise as a consequence of the identified factors to be overcome, in order to reduce or eliminate delays in production and distribution, that is in order to achieve the continuity of the JIT business strategy. This model is based on new forms of cooperation between companies on the one hand and the labor market and universities on the other.

Keywords: Just-in-time production; supply chains; JIT model of cooperation.

1. INTRODUCTION

Based on the results of the conducted research, in [1] it has been confirmed that there are multiple connections between the Just-in-time method of production and the management of supply chains. However, the Just-in-time management and the Kanban as a means of implementing such production philosophy can not be successfully implemented, unless certain internal and external conditions have not previously been fulfilled [2]. The fulfillment of these conditions also reflects on the functioning of the supply chain.

As it is known, the Kanban represents a method, or rather a production management technique, which can have many positive effects on supply chains. The Kanban improves material flow and has an impact on the synchronization of the supply chain with the actual production [3]. Although the Kanban is often viewed as an integral part of the Just-in-time production, it can be applied independently, although in this case the same final effects on supply chains can not be expected. For that reason, prior to the implementation of the Kanban system, it is common to ensure an improvement in the production process beforehand.

In [3], the possibilities and ways of applying the Kanban system in supply chains are considered. A realistic production plan can not be made without information which is supplied by the supply chain.

For that reason, companies, that want to introduce the Just-in-time method of production and the Kanban as a means of its realization, need to harmonize the functioning of the supply chain with the production. The whole system should then be regarded as a single entity that functions according to the Just-in-time principle. For that reason, some factors which have an impact on the Just-in-time production and the Kanban also have an impact on supply chains and vice versa. One of such factors is cooperation.

If the Kanban is viewed as an integral part of the Just-in-time production, then all the conditions for applying the Kanban system are the same for the Just-in-time production. According to [2], the external conditions for the application of the Kanban system refer to those components that are out of the firms reach, or to those which the company can only influence indirectly. Internal conditions are those conditions which the company provides itself and can therefore directly achieve the corresponding effect. However, the successful implementations of these systems depend on some key factors, such as cooperation, which can be classified into both internal and external conditions. Bearing this in mind, both forms of cooperation (external and internal) will be the subject of consideration in this paper. Cooperation represents a factor that should not be considered separately when it comes to the Kanban and supply chains if the company wants to achieve the Just-in-time method of management.

2. COOPERATION IN THE JUST-IN-TIME PRODUCTION AND SUPPLY CHAINS

The problem of cooperation in the Just-in-time production wasn't previously discussed in detail. In the literature that in detail and multi-dimensionally considers the Just-in-time method of production [4, 5, 6, 7] it is often the case that the cooperation as a factor for the realization of such a way of production is not mentioned at all. On the other hand, there is a literature where the importance of cooperation for the realization of the Just-in-time method of business is recognized [8, 9, 10, 11, 12, 13, 14, 15], but this problem has not been taken into consideration in the mentioned literature in more details. In connection to this, the aforementioned literature does not consider the possible problems that can be a result of inadequate cooperation, and which solutions can be offered to overcome problems of this type. As mentioned above, it is also important for supply chains to have an appropriate level of co-operation, so that the Just-in-time production can function. In this regard, in [3] is stated that "a good supplier relationship is characterized by cooperation".

The lack of cooperation on an internal and external level can condition the inadequate efficiency of the Just-in-time and Kanban system. First of all, it should be pointed out that the Kanban (in its full form) can not be applied in a factory where assembling is not performed, given that the implementation of this system implies that the executive "production plan" begins from the final assembly. This does not mean, however, that a company that does not perform assembly as an internal activity can not implement and operate according to the Kanban's principles, thus achieving partial or integral (if viewed as part of a larger, that is, the whole system in which it is involved) the Just-in-time production. For example, it is often the case that a particular company produces certain parts for another company, which incorporates the cooperating firms' parts into its final product. If the company in which the montage is being carried out accepts the Just-in-time method of production, then the cooperator can and should accept the principle of management in accordance to Kanban, so that the whole system could function according to the Just-in-time production. In this way, it is

included in the supply chain and becomes part of a comprehensive system that operates based on the principles of Kanban and the Just-in-time production, which includes the "parent" factory and cooperators. As already mentioned, it's necessary to achieve cooperation on an external and internal level, which will be separately considered.

3. COOPERATION ON AN EXTERNAL LEVEL

According to [16], "cooperation is organized between two or more enterprises with different specializations, but their specializations are complementary, or they even may have similar specializations and then complement one another only in certain areas." Considering the above, it can be said that cooperation on an external level implies cooperation between the parent company in which the final product is assembled and its cooperators, which supply it with the necessary parts. In essence, it represents the cooperation between two or more companies. The importance of selecting an appropriate cooperator for the supply chain is great because it supplies the parent company with parts or material in the right amount at the right time. This is in any case necessary, so that the final products can also be delivered in the right amount and at the right time. In addition, as it is emphasized in [17], the quality of the supplier's products must also be satisfactory, i.e. based on delivering without faulty parts.

According to [17], there is a general trend of decreasing the number of suppliers (cooperators) to the lowest possible extent. The idea is that each supplier provides a number of different parts. The cooperation strategy is to retain one principal cooperator for each item. A smaller amount of cooperators allows for a more solid and more frequent cooperation. In this way, among other things, through the reduction of the scope of business, the work of the purchasing department is significantly reduced.

Although the monopoly of one of the cooperates can lead to difficulties [2], it should be kept in mind that the whole relationship is regulated by the contract of cooperation which obliges both parties to a certain type of cooperation, which reduces the risk of loss. Namely, such a contract may, in addition to compensation due to unsettled current obligations, also provide a certain type of compensation in the case of a complete termination of cooperation (which is not initiated by discontinuity caused by unfulfilled obligations, but is the consequence of other internal reasons). In addition to the monetary compensation, it is also possible to anticipate the obligation that the cooperator supplies the purchaser with the necessary parts in a certain period of time, in order to avoid the complete termination of production. On the other hand, everything mentioned above also implies to the purchaser. These are all prerequisites for a long-term and quality cooperation.

Deviating from the aforementioned leads to different situations in which the co-operant and the purchaser accuse each other for unfulfilled obligations. Excuses are sought to avoid contract clauses (which are sometimes not completely precisely defined), or even forms of cooperation that are unacceptable are insisted upon. Some of these failures are present in certain segments of the industry (especially in the case of developing countries) and they are one of the reasons why the Just-in-time method of production is inadequately applied, or not applied at all.

However, sometimes in theoretical considerations related to the application of JIT production, it is insisted on insufficiently precise forms of cooperation in the supply chain. As an illustration of the above, the following example can be used. In a paper that deals with the Just-in-time concept of production planning in the business conditions of companies in Serbia [18], it is pointed out that business relations between companies in the reproductive supply chain are insufficiently cooperative. In the mentioned paper, it is stated that "they are mostly reduced to sales relations, which often have fixed, rather than flexible obligations. Autonomous insistence on the realization of contractual obligations (quantity, deadlines, payments, etc.) without the obligation of monitoring other participants in the reproductive chain, certainly leads to discontinuity of planned tasks, production stalling, stockpiling, loss of sales, etc. ".

The consequences of the aforementioned approach described in the previous example are not controversial. However, their cause is questionable. In other words, in [18] it is insisted on a flexible relationship between cooperators, at the expense of better "cooperation". This type of flexibility can be manifested through imprecise obligations and responsibilities between the parent company and its cooperators. In this way, the quantity and price of the materials or parts which are to be delivered by the cooperator, the payment period etc. can be imprecisely determined, which may affect the establishment of the Just-in-time production. On the other hand, there may be a situation where precise obligations of the cooperators are insisted on, whereby the obligations of the parent company towards the cooperator are not precisely determined in the contract. In other words, the cooperator is required to produce the exact amount of a product and to deliver it within a certain timeframe (Just-in-time), while the payment is uncertain in terms of amount and time (Just late). It is not difficult to conclude that such an approach can also cause the absence of JIT production between its cooperators, which certainly reflects on the business of the entire system.

The cooperator's decision to join a large system and to subordinate his obligations to a complex system is in itself a sufficient reason for the parent company to respect the cooperator. It is not acceptable that the cooperator be involved in problems of realizing (or even production) the final product of the mother's company, because it can not make any executive decisions in a company it does not belong to. In addition, the parent company in most cases has a number of cooperators who can fulfill the contractual obligations, but also who don't fulfill them. In relation to this, the question may arise, should the cooperator also be involved in other cooperators problems of realizing, producing and delivering? Familiarizing a cooperator with the problems of the parent company does not significantly contribute to their resolving, because the cooperator himself also has obligations towards the suppliers of raw materials (in order to properly fulfill his obligations). This approach only conceals the problem, while the real cause of such a situation is suppressed. All of this is contrary to the business based on Kanban system, whose circulation provides the possibility of visual control and detects the causes of a problem and places of their appearance.

Management based on the principle of the Just-in-time strategy is neither simple nor easy. Although the whole concept is presented in a seemingly accessible and understandable way, the application of this strategy requires a lot of additional consideration, calculation and corrections in accordance with the specific conditions of application. All of this can not be solved by "convincing instead of demanding" the participants in the reproductive chain and "informing instead ordering", as suggested in [18]. In essence, in order for the supply chain to function smoothly and without any problems, each

participant in a system that functions according to the Just-in-principle is obliged to fulfill its contractual obligations and to be held accountable for them. Certainly, the parent company in which the final montage is carried out, in comparison to the other cooperators has a greater responsibility, because it has to provide a timely production, but also to harmonize and realize plans relating to claims and the fulfillment of obligations, especially in relation to other cooperators. However, if the company does not work in this way or the realization of the Just-in-time method of management is not fully developed, it risks becoming a cooperator of another company that is capable of achieving the mentioned production method.

4. COOPERATION ON AN INTERNAL LEVEL

According to [19], cooperation in a strategic sense implies an agreement between two or more independent companies that pool their capacities and resources to carry out joint activities in order to maintain and enhance the competitive advantage over time. This understanding of cooperation as a cooperation between different firms corresponds to the previously exposed type of cooperation at the external level, that is, the form of cooperation that is often quoted in different literature and often is only understood by the term cooperation. However, such a concept does not include all the forms of cooperation that exist between the participants in the production. In addition, in [20], it is stated that within complex cooperations (when participants with different specialization cooperate within one company), it is necessary to differentiate the cooperation in which there is no internal division of labor (where each participant performs all the operations on the subject of work from the beginning to the end) and the type of cooperation in which the internal division of labor exists, so that the participants perform only one of the successive operations, where the object of production is passed from one participant to another during the production process, until the product is finally completed. In view of this, cooperation on an internal level can be defined as the cooperation between individual organizational units or participants in the production process (that is, the reproduction process) of one and the same company. This form of co-operation is often omitted from consideration, assuming that this is something that itself is implied to exist. However, when it comes to production that is carried out according to the Just-in-time principals, the comprehensive realization of cooperation on an internal level is a necessary precondition for the achievement of JIT production. It should be mentioned that the specialization of jobs, as one of the causes for the emergence of cooperation, exists on an external level (cooperation of the observed company with two or more other companies), as well as on an internal level, within the company itself.

5. PROBLEMS IN THE REALIZATION OF COOPERATION IN THE JIT WAY OF BUSINESS

There are a number of factors that influence the level of cooperation on an internal level. Disturbances of work discipline, motivation, poor interpersonal relations, relations within the group and between groups, conflicts of power and competence, distribution of salaries and the commitment to the company are some of them. In addition to these factors, when it comes to the Just-in-time method of production, there are other factors that can affect the level of cooperation within the company. These are the factors that influence the breakdown of the production rhythm, that is, when the worker does not receive the subject of work at a certain time in the next phase of the technological process (or from another work unit), because the employee from the previous phase has not completed his part yet.

Some of these factors cause temporary reductions in working ability, accumulated fatigue, worsening of working conditions and safety in certain units, injuries, the absence of more workers within one unit, strikes, as well as all other unforeseen cases leading to the failure of the production plan.

It is understandable that deviations in the realization of cooperation on an internal level most often lead to deviations in the realization of cooperation on an external level. The aforementioned factors directly influence the realization of production, although they are not included in a long-term, annual or daily production plan. A cooperation plan on an external level as part of an annual plan usually involves specifying each cooperators task and deadline, in order to ensure the continuity of the production process. During the formation of these plans, almost without exception, most of the aforementioned factors be omitted, which can affect the disruptions in JIT production and supply chain.

It should be kept in mind that it is difficult and sometimes impossible to plan the time and place of the appearance of the aforementioned factors, of which cooperation depends. However, measures for their prevention can be planned, as well as measures to eliminate the consequences of their manifestation. Such measures should become an integral part of the cooperation plan on an internal or external level. Therefore, in addition to the cooperation plan with other companies, it is necessary to have an elaborate cooperation plan (internal plan of cooperation), which would enable to avoid and overcome those forms of mutual cooperation between employees that threaten the realization of the planned goal of production. All this will contribute to the realization of the JIT production.

6. MODEL FOR OVERCOMING THE PROBLEM OF COOPERATION IN JIT PRODUCTION AND DISTRIBUTION

The common characteristic of all the above mentioned factors is that their effect causes standstills in the supply chain and production, which, as a consequence, may lead to a deviation from the JIT business strategy. In addition, all these factors have in common that an employee (a worker) appears as their carrier, that is, as a medium of manifestation. A new model will be proposed here, which will enable to eliminate the consequences of standstills resulting from the effects of the aforementioned factors.

As stated above, if the machine is not the cause of a standstill in the supply chain or the production, then it is a worker. So, here we are considering a situation where the worker is not able to meet the requirements of production or distribution as a result of the effect of some of the factors mentioned above. If the worker is unable to meet the planned production or distribution requirements, the lack can be solved in several ways. The usual way companies solve this problem is by working overtime, and/or rotating the workers, as well as increasing the level of automation.

If more machines are involved in the production of one part, and a worker at one of the machines is unable to meet the norm, the problem can be solved by making the workers on the other machines work overtime. A greater problem is represented when only one worker is controlling a machine that produces a specific part. Then the problem can not be solved only by making the workers work overtime. It is then necessary to rotate a worker from another machine or from another part of the firm, to the workplace where the mentioned employee is working.

The company can also solve above-mentioned problem by increasing the level of automatization of the production and the supply chain. Substituting workers with a fully automated machine will in some cases contribute to solving the described problem. However, if the problem is solved this way, it is necessary to pay attention to the superiority in execution when a specific task is done by a machine or by a human. The introduction of automation should not be a priority if the capabilities of a man for a given operation are above the abilities of the machine.

The application of the solutions described above is tied to certain disadvantages and problems. In the case of working overtime, the problem may be the resistance of workers to work overtime. Overtime work compensation can also be a source of problems. Certainly, an additional limiting factor can also be the employees' fatigue. In the case of employee rotation, the problem is that a worker who rotates to the workplace of the worker who is not able to work must leave his/her workplace, which can cause delays and certain problems in the workplace of the worker who goes to another workplace. Another problem may also be regulation of the financial compensation for such work. In addition, a substitute worker must be pre-trained to work in that workplace, which is not his primary workplace. Furthermore, both of these solutions are temporary, because one worker can not perform work tasks in two workplaces simultaneously during a longer period of time. When it comes to applying automation as a possible solution, the main disadvantage is that the introduction of automation is not instant, but it is a process that requires time. Therefore, the introduction of automation into the production process and/or the supply chain is not a solution to the acute standstill problem in the Just-in-time production. Automation can be a long-term solution, especially in production and distribution areas where the problems of slowdown or stoppage occur. An additional problem in the introduction of automation, which should certainly be taken into account, is the cost of implementing such a system.

Below are given two new solutions that can be used as an alternative, or a replacement for the previously described solutions to the mentioned issues. The first approach is based on the replacement of a worker who is unable to meet the obligations at a particular workplace with a pre-trained worker for that job. The essence of this approach is the following.

Every company that wants to operate in accordance with the JIT system sends to the job market a job list and describes the work tasks of a potential worker who is expected for that workplace. The job market then offers unemployed workers, who meet the vocational qualifications to work in a particular company at certain workplaces, the opportunity to be trained for that specific workplace at the firm, or a certain number of workplaces in that company, free of charge. After considering the applicants for certain jobs, the company then offers the interested unemployed persons a training course in one or more workplaces in the company. After the completion of the training course, the trained workers enter into a contract with the company, according to which, they can be engaged as a substitute if needed, for a certain financial compensation. This way, in the event of a sudden inability or absence of a worker in the company, the trained worker, according to the principle of "change on the fly in hockey" can replace the worker from a particular workplace in the firm. This way, the waiting loss is reduced to a minimum (which can be compensated by a short period of overtime work). Furthermore, the workers in addition to obtaining qualifications and work-related training gain the possibility of additional earnings. In the event of a prolonged absence of the worker from that company (due to a severe illness or injury), they have the ability to obtain an additional source of

income for an extended period. In the event that a worker is trained for greater number of specific jobs in the same or more firms, his chances of earning and employment increase even more.

Another approach, that is, another possible solution for the described problem is based on the cooperation of companies with faculties. In most faculties, students have an obligation to do practical work in the industry (in addition to the education that they acquire in classrooms). In this regard, according to this model, companies send faculties an offer to train students in specific workplaces, especially in those workplaces where specific equipment is used, or the work is done according to a specific or original methodology. After training a student at one or more workplaces (depending on the students' choice), the student can sign a contract with the company, according to which, through the job market, the student can be hired as a replacement at specific workplaces. This way, the student also acquires the possibility of additional earnings, as well as an application reference for a job in that, or some other company. The disadvantage of this solution in relation to the previously described solution is that this solution can primarily be applied when the worker is absent for a short period of time from the company, given the students need to follow the current study program. However, depending on the amount of financial compensation, the student is left with the ability to decide which option to choose at that moment (to study or work). In addition, if a company has more trained students, which can work at a particular workplace, it can, in agreement with the students (the faculty and job market), schedule their successive engagement, in order to decrease the students' absence from classes. The described solutions are contained in the model shown in Figure 1.

Companies also previously had the opportunity to hire unemployed workers from the job market. However, such workers rarely had previous work experience in a particular firm where they were working as a replacement. It rarely occurred that workers from the job market were trained for specific jobs and for a particular type or model of machine (equipment), and that they had undergone the necessary training to manage specific machines and tools used at that workplace. Training unprepared workers for the job requires time, which reflects on the JIT method of management and the losses that are caused by deviations from the foreseen deadlines.

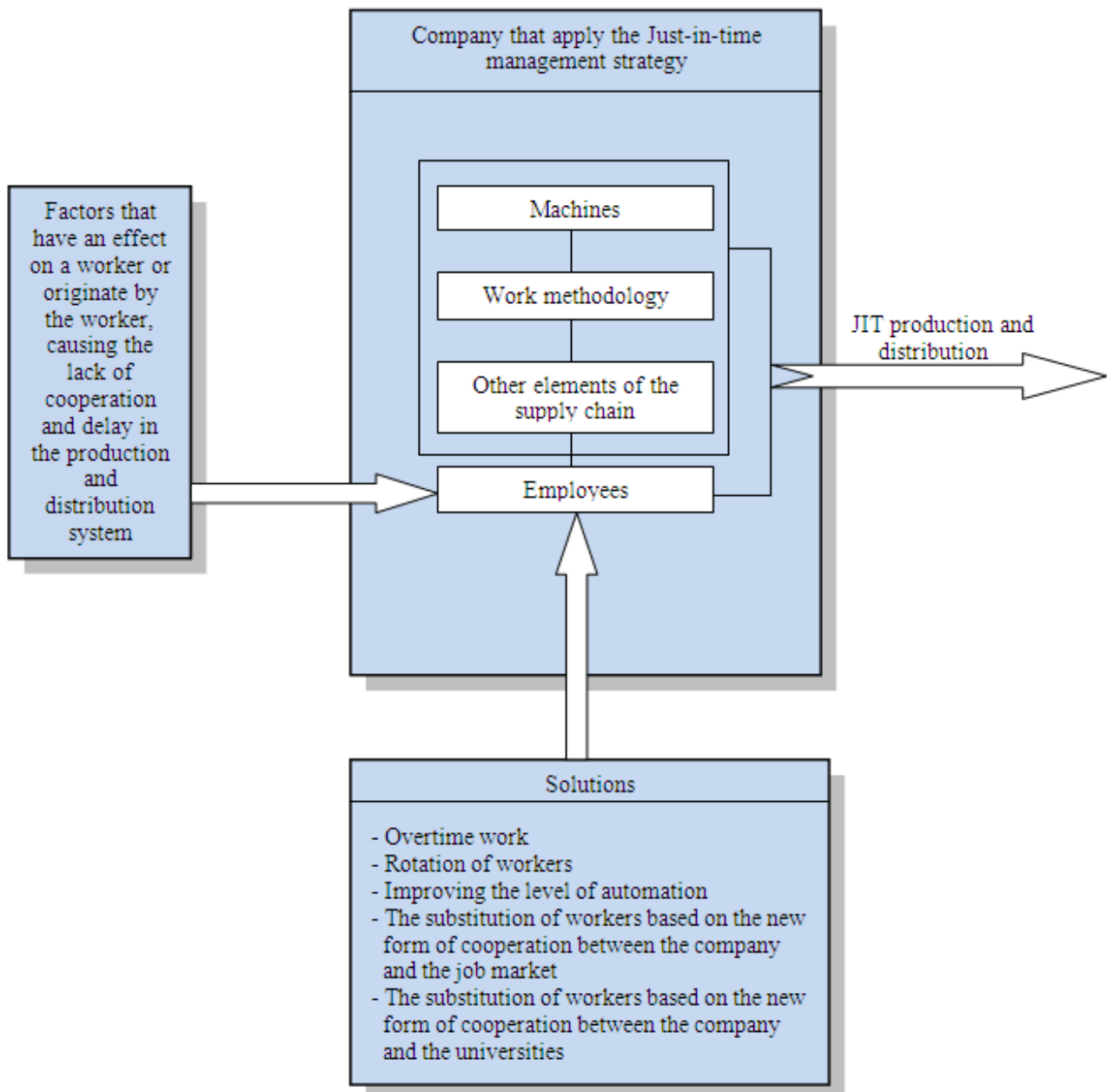


Figure 1. A model for solving standstills in the JIT way of production and distribution, which were caused by a lack of cooperation on an internal level, while the new solution consists of two new, specially arranged forms of cooperation on an external level, between the company and the job market, as well as companies and universities.

7. CONCLUSION

Based on the above, the importance of cooperation on an external and internal level for the functioning of the Just-in-time and Kanban systems, as well as supply chains can be noticed. Cooperation plays an important role in achieving timely production. The lack of quality cooperation can significantly impede the functioning of complex systems, primarily systems that have accepted the Just-in-time management strategy. On the other hand, consistent efforts toward meeting this requirement lead to a business without standstills and losses.

In this paper, some of the factors that can be the cause of a slowdown or a standstill in the Just-in-time management strategy have been identified. In addition, two new solutions have been provided to overcome the problem of the unsuccessful JIT way of business, which is a consequence of the influence of identified factors that act to or originate from the worker. Both of these solutions require establishing and defining the new forms of cooperation between companies on one side and the job market and universities on the other. In connection with this, there is a need regarding these forms of cooperation to be regulated legally. However, the application of these solutions is not difficult or demanding. From the implementation of the presented solution, the benefits can expect the companies which in this way increase the potential for the Just-in-time business, as well as the unemployed population, which gains the opportunity for additional sources of income and that increase the probability of permanent employment.

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