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The implementation, maintenance and development of IT systems: selected problems of designing contracts

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ABSTRACT

Preparation of IT systems implementation projects is connected with many issues of design, technical, and technological nature. Many IT projects encounter difficulties in their implementation, which often results in problems with achieving the assumed functionality, exceeding the project execution time, and additional costs, if not in the investment phase, then surely in system operation phase. A number of difficulties are due – among other things – to imperfections of the contract between employer and contractor, which in case the employer is a public party, has substantial limitations concerning changes in its content, thus it may later cause difficulties in its execution. The paper, among the many issues related to implementation of IT systems, focuses mainly upon the subject of the contract, its scope, period of validity, and remuneration for implementation and maintenance of IT project.

KEYWORDS: contracts, implementation of IT systems, IT projects, public funds, public procurement, option contracts

1. Introduction

Preparation of implementation of IT systems is connected with numerous problems concerning design, technical, and technological issues. Those issues are topics of various documents, such as functional-technical assessment studies, general designs of systems, or technical designs. The issues are difficult and complicated, yet in times of open markets and availability of various advanced IT technologies, most often they are not decisive for the success of an IT project. Ever more often the key factors for implementation of an IT system are the issues concerning organization, law, and finances. Generally speaking, those issues should be properly recognized and prepared before proceeding with the project, as part of the feasibility study. The latter, however, particularly when prepared for public entities, in many cases assess IT projects feasibility quite optimistically and fairly superficially, they focus on demonstrating the financial feasibility of a given undertaking, assessment of costs and opportunities for the implementing entity, external benefits, as well as general legal conditions for the undertaking, overlooking or treating very generally the risk analysis and possible obstacles in execution of the undertaking. As a result, many IT projects encounter difficulties in their implementation, which often results in problems with achieving the assumed functionality, exceeding the project execution time, and additional costs, if not in the investment phase then surely in system operation phase. A number of difficulties are due – among other things – to imperfections of the contract between employer and contractor, which - in case the employer is a public party - has substantial limitations concerning changes in its content, thus it may later cause difficulties in its execution. The paper, among the many issues related to implementation of IT systems, focuses mainly upon the subject of the contract, its scope, period of validity, and remuneration for execution of IT project.

2. Implementation and development of IT system – key issues discussed in the literature

When regulations and procedures preceding the conclusion of contract for delivery and implementation of IT system are described, one can distinguish in particular the public sector entities listed in art. 9 of the Act of Law of August 29, 2009 on public finance, obliged in accordance to art. 3 of the Act of Law of January 29 2004, public procurement law, to follow that act of law in the course of procedure to select the contractor, as well as subsequent due performance of the agreement/contract. This is due to the fact that those entities spend public funds. The second group consists of entities that do not belong to the public sector, general with private equity – in such cases civil code regulations apply. Those entities are free to a large extent to select contractors in due procedures, they can independently lay down the principles of proceeding, have the liberty to change conditions, cancel the procedure, change the time for which contract is concluded, and possibly also introduce further changes to the contract at a later date. In case of those entities, the formal and legal aspects of the undertaking are made easier.

Review of literature concerning implementation of IT systems indicates that a large number of publications focus on the functionalities of module and IT systems, principles of designing and methodology of IT systems implementation [2, 7, 8, 11, 13, 16]. Far fewer publications refer to the efficiency of IT systems [3], or the risk connected with their implementation, although such issues are also taken up [5], oftentimes the publications refer to various applications of information science [4, 6, 9, 10, 12, 17]. On the other hand, the issues concerning wording of contracts on supply and implementation of IT systems are subject of several publications only, in Poland there are only several such publications. In general, no hand-books or documents exist, which could indicate good practice in ordering and concluding supply and implementation contracts for IT systems. Against that background, one can assess very positively the documents prepared by The Public Procurement Office [15] as well as the documents of the system *Project for supporting actions concerning building of electronic administration* [14]. Many things in that scope are just in the phase of development. This is due to several reasons. In contracts, numerous detailed regulations are used, which have been introduced to Polish legal order fairly recently. Besides the civil code, contracts for implementation of IT systems make use of regulations related to public procurement, law on copyright, personal data protection, and many others, related to a given sector or the type of services, to which the given undertaking applies. For example, the implementation of electronic payments for public services is related to acts of law concerning electronic payment instruments and banking law. With the exception of civil code, the regulations listed do not have a long history in Poland, which results in fairly general knowledge of them, scarcity of comments, or decisions in civil code proceedings. Also, the implementation of big, extensive, and extremely costly IT systems in the conditions of open IT markets is a very young discipline, for several reasons incomparable with other fields of business activities. On top of that, there is the complexity of the undertaking of such kind, often its innovative character, as well as the occurrence of problems mentioned earlier, which had not been anticipated during designing.

To finish off the reference made to studies already undertaken, one should add that the problem stipulations made in contracts may be considered in the context of game theory achievements, as the very conclusion of the contract and its subsequent execution is a process which has to do with the balance between parties to it. This is of importance, as in the situation where a contract is concluded with certain infringement of the balance between parties, its execution becomes difficult, and problems dealt with by one party, most often will be transferred to the other party, in one way or another.

3. Description of the subject of contract

When preparing the draft contract, one should aim at giving an explicit, precise, and exhaustive description of the ordered product, as this is of key importance both at the stage of the procedure of selecting the contractor, and later on, during the execution phase. At the stage of ordering and submission of offers, the description of subject of contract allows the potential contractors to assess the possibilities of performing, as well as to prepare the offer price. It is thus important for fulfilling the condition of competitive tendering procedure, as potential contractors understand the subject of contract equally well. At the stage of contract execution, an accurate description of the subject of the order enables to avoid, or significantly reduce the divergences connected with different interpretation of contractual provisions, and complications related to that. It also reduces the possibilities that the contractor may have to possibly refuse to perform certain activities which, in the opinion of the employer are included in contract concluded, whereas the contractor may claim otherwise, taking advantage of the too general stipulations made in the contract. Disputes resulting from different interpretations of the scope of work to be executed in connection with the contract concluded, are difficult to resolve, as narrowing down the scope translates into additional expenditures for the employer, while widening it would incur specific additional costs for the contractor. Binding settlements are possible as a result of court verdicts (concerning the content of the contract), yet time factor comes into play here. Long time that may elapse before a court decision is made, this may postpone the execution of the project, as well as cause losses due to it, much more substantial that the value of the object of dispute. On the other hand, appendices, agreements, or settlements concerning the subject of the contract may be interpreted as, or de facto are changes of the scope accepted earlier, which in turn – in case of contracts made under public procurement law procedures – is subject to considerable limitations.

Detailed description of the scope of deliveries, services, or activities being subject of the contract does not exclude, at the same time, the possibilities of modifying it. However, one should stipulate

the possible scope of changes at the beginning, and describe in the contract the principles governing changes/replacements and variants. Changes themselves should not be anything extraordinary, in case of IT systems they are first of all the result of progress taking place and the availability of solutions better than were available when the contract was formulated. Other factors of change include changing legal regulations or market conditions, changing expectations of the employer – concerning the IT system being implemented. It is also advised to introduce stipulations which allow increased deliveries of selected devices and/or relinquishing deliveries of others, within the framework of a given contract. This, of course, is connected with creation of a certain system of payment for activities executed under the contract, in which selected elements of hardware, software, or some activities will have unit costs, as this will enable – within certain limits of course – adjusting deliveries to demand, not causing problems with invoicing and settlement, though. This takes the form of options, then.

The institution of options consists of determining the minimum level of orders, which will be executed for sure, as well as defining a certain additional scope, that may be executed if certain circumstances defined in the contract occur. The employer may use the option right, but does not have to. Making use of the option thus does not constitute change of the contract, nor conclusion of additional contract with new conditions, yet is the execution of the contract already concluded. Introduction of the right of options may thus be advantageous for the employer, as it allows to make the order more flexible, excluding at the same time the risk connected with the application of art. 144 item 1 of the public procurement law [1].

In case option right is included in the contract, both the scope of the contract covered by the option, and the circumstances, in which the right of option may be utilized should be described accurately. The description must stipulate accurately the scope of the contract, its duration, as well as the manner performance, in order to enable the contractors a correct and comparable preparation of offers/bids. It is indispensable to distinguish clearly, both in the material contract terms, and in the description of the subject of contract, between the basic scope of work and the scope covered with the right of option. At the same time, both the basic and optional part are included in the same subject of contract, with established total estimated value. What is important, the prediction and execution of the right of option may not lead to evade to stipulations of the public procurement law. The employer may not include, within the right of option, in the content of terms of reference or in the contract provisions a principles which would enable execution of possible future orders in the range that exceeds the subject and value of contract awarded in a specific procedure [1].

A good solution is to select, within the framework of one contract, and thus one tender procedure, a contractor whose task will be both the delivery and implementation of the system, and its subsequent operation, that is provision of service, maintenance, and – to some extent – also the development of the system. First of all, this concerns introduction of alterations and modifications in the system, related to extension of functionalities, and adjustment to changing requirements, e.g. legal ones. There are several prerequisites that support the selection of a contractor, who will provide the servicing and maintenance, at this stage or together with selection of the contractor who will implement the system First of all, in case of big, extensive, and complex IT systems, it is difficult to determine clearly a breaking point between implementation of the system and starting its operation. Of course, the moment of completing implementation is indicated, due to formal reasons that are related to financial settlements, yet it is often the case that one goes smoothly from testing phase to the so-called production start up. Gradually, specific functionalities are launched, on top of that come also the obligations of the employer, often connected with transformation of organization structure and linking the processes taking place in the institution with new IT system.

The moment, which can be considered the end of implementation is often a subject of disputes between parties, the contractor aims at conducting the full set of tests and obtaining confirmation of execution, or himself states that the system has been delivered in compliance with contract. This often takes place in conditions of delays, which are connected with penalties fixed by contract. It turns out, though, that in normal operation conditions of the system, faults and defects occur, which make the functioning of the system virtually impossible. Frequently occurring situations are those in which IT systems are implemented in stages, and reaching the stage of operations may take place even in situations in which the implementation of the entire system has not been completed yet. Consequently, it may turn out inconvenient for the success of the entire undertaking, at the most crucial moment, namely the production start up of the system, to replace the implementing entity with the one responsibility for its maintenance and service. Another prerequisite supporting the connection of execution and operation under one entity is related to the location of risk concerning delivery of an unreliable system and related costs among contractor risks. If the contractor knows he is also responsible for the maintenance and service of the system, then at the stage of implementation he will be motivated to create a reliable and open system, to minimize the later costs of services and implementation of changes. Thus, executing the contract, he should also take into account – when selecting components of the system – the subsequent consequences of their possible failures, as he will be charged with the excessive costs of servicing.

A vital problem encountered during implementation of IT systems is system openness as well as the employer's acquiring of rights and technical capacity to meddle in the systems delivered. It is not only about their interoperability, which allows to expand the activity and use components of suppliers, but also about the technical capacity and feasibility, at acceptable costs, the servicing and updating of the system, which the given entity has not implemented. Attention is paid to the time and cost connected with getting acquainted with the system, often designed and developed to meet the specific needs of the employer. One can come across various specific impediments, such as completeness and correctness of the system documentations, for example. That is why conducting the procedure of selecting the contractor for maintenance, servicing, and updating of an existing system is fairly difficult; even if competitive mode is prepared, the very fact that one entity implements the system makes that entity privileged as concerns knowledge of the system, in comparison

with other entities. A much better solution is to select the entity at the very beginning, when potential bidders may – having equal opportunities – offer to undertake the entire project consisting of supply, implementation, and further maintenance of the implemented IT system.

4. Contract execution period

Another important thing is the period of contract execution by the contractor, most often understood by the employer as the period, which elapses from signing the contract or the date stipulated in the contract, on which its execution should start, and commissioning of the implemented system. That period is most often defined by the employer, contractors have limited influence here, also it is possible to assume a solution in which the execution time declared by the bidders is used as a criterion for assessment of bids. The contract execution time, defined in the contract, should result from realistic time schedules, prepared on the basis of real time consumption related to specific stages of implementation, hardware and software delivery times, time required for testing, introduction of corrections and acceptance/commissioning, taking into account the sequences and consequences of related actions, as well as the fact that not all actions may be execute in parallel. Also, some extra time should be reserved, for unexpected situations.

Unfortunately, fairly often one can encounter situations, in which the system is to be delivered and implemented to a certain deadline indicated, while that deadline does not result from the assessment of labour intensity and execution capacity; it depends upon - e.g. – changes in law, necessity to settle the funds at the end of the year, or that period gets reduced, in order to shorten the investment execution period. There are also cases and situations, where the project-related procedures or selection of contractors are prolonged, which later results in the employer reducing the time for execution proper. Projects executed in accordance with the time schedule developed in that way are often delayed at the very start. Oftentimes, also the labour intensity of the project is underestimated, or certain actions which turn out to be necessary have been omitted. Mistakes in assessing the project execution period thus consist of:

- ignoring the fact, that project execution time does not get reduced in proportion to the increase of resources, in most general terms: increasing resources twice does not necessarily lead to reduction of project execution time in the same degree,
- assessment of execution time in separation from time required for delivery, assembling, and testing of equipment supplied by subcontractors,
- assuming the availability of resources at the past level, although it is not so in practice,
- assuming optimistic attitude during preparation of time schedule, based on the Assumption that risks characteristic for the given project will remain hypothetical and will not turn into problems to be solved.

Too short contract execution periods in practice result in delays in relation to time limits fixed in contracts, or submission for commissioning of such systems, which have not been property tested, are not complete or not finished. In such situation the employer, after application of suitable procedure, should refuse their acceptance, demanding required corrections from the contractor. However, one can encounter situations, in which the employer does not want to prolong work on system implementation, accepts its commissioning or conditionally accepts it, requiring the contractor to pledge to correct the errors or other drawbacks in the time stipulated.

The executed project may be divided into stages, that are subject of intermediate acceptance. This is recommended particularly in case of implementing large and complex IT systems. This has several advantages, it allows the employer to arrange work properly, and to assess the project progress realistically. Additionally, it is possible to use the hardware supplied and solutions implemented, even when the entire project has not yet been completed. Moreover, acceptance procedures are not condensed – they are not carried out at the same time for the entire system, they are conducted when work in other stages of the project is still under way. Division into stages is advantageous for the contractor, as it allows to receive funds in the form of advance payments for executed stages of the project.

The contract should stipulate the course of acceptance and commissioning procedures, in order to determine in general terms the consecutive actions, in the form of procedure algorithms, as well as the duration of commissioning activities performed by the employer, from the moment of acceptance request. In case of stages in which the contractor supplied hardware and provided its installation, the acceptance procedure is mainly carried out to check each shipment for conformity with the quantity ordered. The hardware is checked for completeness, compliance of sub-assemblies serial numbers with the documentation provided (warranty issues), as well as completeness of documentation concerning installation/assembling – in case of hardware installed in the field – permits, agreements with owners of the land, on which the devices have been installed, as well as agreements and documentation connected with power supply. Acceptance procedures, whose subjects comprise system software, start up, and correct functioning of the system – in compliance with the parameters stipulated in the contract – as well as provision, over a certain time or at a certain time or in the scope determined, of specific system functions and actions. This requires labour intensive acceptance procedures, namely testing the functionalities and correct functioning of individual modules, and subsequently – also the system as a whole. Such testing should be performed by the contractor before making the acceptance request, it can be stipulated in the contract that the contractor is obliged to deliver reports from tests made by companies that are external for the contractor. However, imposing upon the contractor the obligation to perform tests, even in case of positive reports of external testers, should not exempt the employer from performing the tests on his own, as it is the employer who bears the main consequences of performing and confirming the acceptance of system, which has not gained definite efficiency and functionality. The very testing of software, its integrality and the entire system should follow the accepted principles/rules, which may be described in the so-called test scenarios. In general, the issue is to perform the tests as efficiently as possible, using statistical methods in selection

of samples for testing, and procedures indicating the scope of testing and ways of proceeding in case of detecting various types of errors in software functioning.

The employer should also be prepared for the consequences of a situation, when a phase/stage for which acceptance request has been made a few times (e.g. after getting remarks/reservations from the employer twice) and that phase/stage still fails to comply with requirements. In extreme cases the employer should, in such a case, have the right to notice the termination of the contract (or, possibly, withdraw from the unfulfilled part of the contract). Limiting the risk related to potential delay in implementation, the employer may agree for the production start up of the system, on condition that in the system stabilization period all faults will be corrected and final acceptance of the system shall be carried out. The employer should also regulate the issue of the so-called silent acceptance, that is a situation in which the employer does not carry out the final acceptance on time, neither has remarks nor refuses to accept a specific phase/stage or the entire system. The parties thus should determine the consequences of such abstaining from action by the employer, and determine the procedure to be applied in such a case [1].

Delivery and implementation of the system takes varying amounts of time – between a few months and a few years. After that, the system maintenance and servicing commences, as well as the implementation of minor or major modifications due to development. It is natural that selected elements will be replaced or supplemented – extension of memory, increased line-rate and data processing speed, devices and functionalities will be added. Thus, the period for which the contract for system maintenance and development should be concluded is an open question. On the one hand, the stipulations of the public procurement law generally limit – in case of public entities – the period for which contracts are concluded to 4 years. The task of it is to look after openness of markets, and market verification of prices of services provided. However, exceptions are possible: due to the subject of the contract and particular interest of the employer; in such cases contracts can be concluded for a longer time. It seems that in case of systems with high complexity, sophistication, as well as high costs and long time of implementation, it will be natural to make use of that exception. Complex and expensive IT systems' life cycles are ever longer. The system life cycle, often of several years' duration, is significantly longer than the depreciation period, or the durability defined as the duration of recorded depreciation. Oftentimes, the first year or two years are devoted to reaching the full efficiency of the system. This means that in case of complex systems the contract for maintenance and development should be for minimum 5 years. The maximum length, on the other hand, is determined by the time after which so significant changes are expected, that the provision of maintenance and development services concerning the system in its present shape may be useless. It seems, that although it should result from more detailed analyses of the development of the entire IT sector, as well as the given IT system, that 8 – 10 years may entail the need for far reaching changes. In fact, the question boils down to how much the sector in which the system is implemented undergoes intense changes, which force substantial changes in IT systems.

5. Remuneration of the contractor for execution of the project

In most general terms, the amount of remuneration for deliveries and actions described in the contract in the result of competitive proceedings and acceptance of the bid offering suitable proportion of the price and other parameters important for the employer. One should strive to have the pricing of the entire order in the competitive procedure – both the implementation part and system maintenance/support – of course broken down into basic types of hardware, software modules, and selected functions. Extending the scope of the order later on, by adding items not included in the contract, generally ends in single-source procurement procedures. Even if competitive procedure could be theoretically possible, it proves to be difficult to obtain the required documentation amidst the implementation process, to define standards clearly, and to organize co-operation of another entity with the contractor for the entire project. Knowing about it, contractors generally – during the execution of the order or after its completion – execute additional orders, using remuneration for them to compensate for the lower commission assumed in the bids under competitive procedures.

A good solution, however, is to break down the total remuneration not only into specific stages, but also basic types of hardware, software module, and significant actions/activities carried out under the contract. Of course, valuation of parts of the order does not entail that the employer or the contractor will have the possibility to define the scope of the order freely. First of all, however, for the employer it simplifies the proceeding in situations, in which the subject or scope of the order changes in comparison with the original provisions of the contract. These may be situations of additional orders, as options which are assumed in the contract, they may also concern the uselessness of involve performing certain tasks from the point of view of employer's needs, they may also involve non-performance or improper performance of certain parts of the order, and the employer has been forced to make settlements with the contractor, considering those previously not predicted situations.

One should also consider the dependence of the remuneration amount on selected technical parameters achieved by the system, or indicators of products, results, and/or effects to be achieved by the contractor. This will motivate the contractor to such implementation of the system, that it will perform the functions and employ processes in line with the expectations of the employer. This may happen by means of increasing the remuneration amount, depending on the moment (in time) when certain effects are achieved. One should take into account that - in order to avoid possible conflicts – any remuneration increase has to depend solely on the activities and work of the contractor.

When drawing up the contract, one should consider whether the stipulated penalty is to be calculated for retardation or for delay. Penalty for retardation is imposed in the situation of retarding the project, regardless the fact that the retardation is due to the contractor, or due to other reasons that do not depend on the contractor. Thus, in such situation it is the contractor who bears the risk that there

will be circumstances that do not depend on the contractor, which will retard the project. More often, stipulated penalties in contracts depend on the delay, that is a situation, in which the delay is caused only by the contractor. Such a formulation of stipulated penalty may lead to a situation, in which the project has a considerable delay, yet the contractor does not agree with imposing any stipulated penalty, claiming that the delay is a result of various external events, on which the contractor had no influence. This is not difficult, taking into account that supplied of hardware and software come from various parts of the world, that it is necessary to locate various devices in different places, obtain various documents or approvals from third parties, unexpected difficulties or obstacles in construction works may occur or appear, etc. Another issue is the amount of stipulated penalty. Unfortunately, substantial delays occur in execution of IT projects, which are not counted in days, but in months or years. In such a case the penalty amount calculated in accordance with the contract may be significant indeed, even equal to or exceeding the remuneration, which may lead to absurd situations. A solution here may be the mechanism that limits the maximum amount of penalty, or restraining the penalty.

6. Conclusion

The implementation of an IT system, in particularly systems with quite complicated processes, innovative ones, and used by big entities, whose activities require location of system components in many different places, is a complex undertaking for various reasons. Definitely, it requires knowledge, experience, and selection of suitable information technologies. Such an undertaking also has its organizational, legal, and financial nature. It has many risks involved, as well.

The success of implementation depends to a large extent upon its preparation, including the preparation and conclusion of a suitable contract with the contractor. The contract contains numerous provisions, among them it should accurately define and address the obligations of parties. However, the implementation of IT system entails the possible occurrence of many risks, thus the occurrence of various problems will be very probable. A well-constructed contract should foresee the procedures which are most prone for problems to occur, as well as those whose negative consequences may be substantial.

The employer has extensive influence upon the form of contractual provisions, thus it can attribute risk areas to the contractor, as well as determine the principles of procedure so that they can be convenient for the employer. After signing the contract, the advantage and decision possibilities of the employer become more illusory, because practically speaking the employer becomes ever more dependent upon the contractor as time goes by (not necessarily in line with the progress of work). Of course, the contract can be dissolved due to the fault of the contractor, should circumstances stipulated in the contract occur. For the employer this entails discontinuation of work by the contractor, complications with termination of the existing contract, with probable court proceedings, and commencing the procedure of selecting a new contractor. Of course, without guarantees that is will turn out to be better than the previous one.

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