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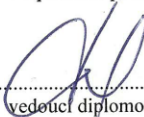
Rámcový obsah diplomové práce: Describe the ECI principle and tools in the construction industry. Analyse the possible benefits of its application, as it can enhance the currently low efficiency of Czech as well as Russian public funded projects. Provide recommendations regarding its implementation.

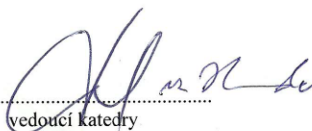
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Tomáš Buchal

Poděkování

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Early Contractor Involvement (ECI) and its Implementation

Časné zahrnutí dodavatele a implementační proces

Abstrakt

Cílem výzkumu bylo nalézt způsob pro budoucí zefektivnění produkce českého veřejného stavebnictví pomocí ECI implementatce. Motivací pro provedení výzkumu byl výrazný úspěch zahraničních států při použití ECI principů ve státem dotovaném stavebním sektoru. Především používané modely ve Velké Británii a Austrálii společně s konkrétními příklady jejich projektů zahrnujících ECI principy byly prozkoumány v rámci výzkumu. Největší potenciál časného zahrnutí hlavního dodavatele do zakázky pomocí smlouvy založené na větší míře spolupráce tkví pro české veřejné stavebnictví ve zlepšeném návrhu a inženýringu projektu v ohledu nabízené hodnoty za peníze. Toho je dosaženo přes poskytování speciálních oborových znalostí, zkušeností a expertíz potřebných pro rozhodování v době s efektivním vlivem na projekt v rané fázi jeho životního cyklu.

Důkladná analýza současné praxe ve státem dotovaném stavebním sektoru byla na začátek absolutně nezbytná, aby bylo možné později vytvořit reálné návrhy pro budoucí rozvoj. Základna znalostí a zkušeností ohledně ECI principů byla následně zřízena za účelem možného vytvoření přizpůsobeného modelu pro jejich aplikaci v České republice. V třetím kroku byly vyhodnoceny přínosy v rámci jistých druhů projektů a odůvodněno uplatnění ECI v domácích podmínkách na základě poskytnutých případových studií. V neposlední řadě byla poskytnuta doporučení pro realizaci implementace založené na předešlém a zdokumentovaném výzkumu za účelem zabezpečení procesu a požadovaného výsledku.

Jako výsledek provedeného výzkumu bylo jednoznačně doporučeno použít ECI principy v rámci českého veřejného stavebnictví vzhledem k významnému a prokázanému přínosu směrem k budoucímu zdokonalení. Nicméně to je možné pouze v rámci koherentní a důsledné strategie pro celý sektor, která vyžaduje velké úsilí pro vývoj. Z tohoto důvodu je zapotřebí důkladná spolupráce zástupců České republiky společně s předními odborníky z oboru na vytvoření dlouhodobého plánu, aby se úspěšně a také bezpečně podařilo překonat průlom v současné době převládajícího statutu quo ve státem dotovaném stavebnictví.

Klíčová slova

Časné zahrnutí dodavatele

Dodavatelské systémy

Veřejné zakázky

Spolupráce

Výměna a zachycení znalostí

Strategie pro stavebnictví

Výběrová kritéria

Abstract

The research aimed to discover the possibility for future performance improvement of the CZ public funded construction through ECI implementation. The motivation for such a research had been the great success of ECI principles employment within the public sector construction in foreign countries. Especially the examples of the UK and AU models, as well as their specific projects involving the ECI application, were reviewed within the research. The greatest contribution for the CZ public funded construction sector, through the earlier involvement of the general contractor to the process under a more collaborative contract, lies in the project design and engineering enhancement in terms of the offered value for money. This is reached through providence of the special field knowledge, experience, and expertise needed for decision making in the time of effective project influence up front its lifecycle.

Firstly, thorough analysis of the current practices in the construction sector was absolutely essential in order to create any later suggestions for their future development. The knowledge and experience base, in terms of ECI principles, was afterwards established in order to enable customized implementation of the model for CZ conditions. Thirdly, the benefits of ECI within certain construction projects, together with the justification for its application in CZ, were provided and supported with findings from numerous case studies. Last but not least, the specific implementation recommendations were provided based on previously documented findings in order to secure the process and its desired result.

As a result from the undertaken research, it was strongly recommended to implement the ECI principles within the CZ public funded construction due to its proven contribution capacity towards its future improvement. However, such a process is possible only along with a coherent and consistent strategy for the whole sector which requires a great effort to develop. Therefore, the profound collaboration of CZ officials, together with recognized professionals, on its future long-term plan is required in order to safely and successfully overcome the breakthrough in the currently prevailing status quo.

Key Words

Early Contractor Involvement

Procurement methods

Tender process

Collaboration and knowledge exchange

Construction sector strategy

Evaluation criteria

Seznam zkratek

Early Contractor Involvement (ECI)

Czech Republic (CZ)

European Union (EU)

United Kingdom of Great Britain and Northern Ireland (UK)

Australia (AU)

Design-Bid-Build (D-B-B)

Design-Build (D-B)

Construction Management (CM)

Public Private Partnership (PPP)

Building Information Modeling (BIM)

Risk Adjusted Maximum Price (RAMP)

Risk Adjusted Price (RAP)

Most Economically Advantageous Tender (MEAT)

Strengths Weaknesses Opportunities Threats (SWOT)

Social Cultural Legal Economical Environmental Political Technological
(SCLEEPT)

Fédération Internationale Des Ingénieurs-Conseils (FIDIC)

Work and Pensions (DWP)

Land Securities Trillium (LST)

Effectiveness Economics Efficiency (3E)

Národní ekonomická rada vlády (NERV)

Národní rada ministerstva pro oblast stavebnictví (NRMPOS)

Portál o veřejných zakázkách a koncesích (POVZAK)

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1. Introduction

One of the most important economic branches in the CZ is its construction industry which contributes approximately 6.5% to the overall GDP and employs approximately 9% of the national population. More than 50% of revenue in construction industry comes from the public sector spending and thus the CZ government itself is the biggest contributor. Because of this exclusive position, it can effectively influence the whole industry. The CZ public sector procurement in construction is characterized by low variety of standardized options for the project procurement systems in use and by high level of bureaucracy and corruption. Moreover, the current CZ public funded construction generally suffers from certain level of inefficiency and strongly adversarial environment. All above mentioned factors along with other, more specific ones described further later in this work that are characteristic for mostly complex projects, lead to delays and over-budgeting in the public funded construction of CZ.

ECI is a procurement and delivery method that is suitable for use in the construction industry with potential for improvement of its current performance. The main intension is to engage the general contractor, preferably even the key supply chain members and collaboratively involve them with architects, engineers and investors in the early stages of project life. The cooperation is based on conditional appointment under the contractual conditions of two-stage tender process for the single project delivery; or under the contractual conditions of framework agreement process for the multiple projects delivery. In the traditional system of procurement the main decisions about design and engineering are made before accurate information has been obtained. Moreover, during the actual project execution, team members' roles are only reactive, as they are involved to the process afterwards. Those team members generally have higher level of specialized expertise compared to the others due to their comprehensive experience and knowledge of the construction field. Therefore, in order to improve the decision making and planning process, the ECI brings their additional contribution in time. Additionally, the project execution team members' roles change to a pro-active one, as they are brought early into the process under

cooperative contract conditions. Resulting from the above mentioned, the successful ECI implementation into the project has mainly the capability to:

- Enhance design and bring knowledge;
- Reduce cost and time necessary for construction;
- Strengthen risk management and planning process; and
- Improve performance efficiency and add value.

It has been investigated that in the CZ conditions, each € of the realized construction production leads to the increase of approximately 2.2 € in production of the national economy (Svaz podnikatelů ve stavebnictví v ČR, 2012). Unfortunately, the CZ currently does not have any ambitious and clearly defined long-term public spending policy for the construction industry in terms of its procurement and performance. Generally, the public funded construction suffers especially from the limited expertise, narrow variation of procurement options and adversarial conditions with lack of trust and collaboration involved. As the ECI method offers a great capacity for the performance improvement, it is recommended to closer analyse and consider its implementation. In recent years, countries such as UK or AU have employed customized ECI methods for their public funded construction with great results. Thus, their cases are closer reviewed and analysed with the ambition that the findings can assist the CZ in optimal design of the method and smoother implementation of relevant processes. However, it is necessary to mention that ECI method is still considerably new and not yet a fully explored construction process and thus requires great attention. Moreover, ECI use is not even the best choice for every project. For instance, in case of a simple, repetitive as well as small scale projects, ECI implementation tends to be pointless or maybe even disadvantageous. These types of projects, where data is fully available, which are executed the exact way, and where the assessment is not complex, do not require extensive and special planning provided by ECI.

1.1. Research Methodology

“Research in simple terms, refers to a search for knowledge. It is also known as scientific and systematic search for information on particular topic or issue. It is also known as the art of scientific investigation. Several social scientists have defined research in different ways” (Mills, Durepos and Wiebe, 2010). For instance according to Redman and Mory (1923) as one for all, the research is defined as a systematized effort to gain knowledge. “On the other hand, research methodology is the way of systematically solving the research problem. It is a science of how research is conducted scientifically. Under it, the researcher acquaints himself/herself with the various steps generally adopted to study a research problem, along with the underlying logic behind them. Hence, it is not only important for the researcher to know the research techniques/methods, but also the scientific approach called methodology” (Mills, Durepos and Wiebe, 2010).

1.1.1. Introduction

Undoubtedly, the decision about the basic methodology of the research has to be clearly defined first. Thus the possible options are going to be explained and afterwards the choice will be made, corresponding to the prevailing characteristics of the planned research. The research is qualified as quantitative when the main purpose of it is to test the stated hypotheses in order to clarify its refutation or confirmation. Therefore, it is based on statistical results of undertaken data collection. Another type of the research is called qualitative, which requires deeper understanding of the issue, as its main purpose is to describe it in detail. Moreover, the studied problematic are applied to the certain conditions and its internal and external processes, relations and results are precisely described and generalized. The decision does not have to be made with pick of the more suitable method. Creation of personalized method with combination of both attitudes according to the researchers’ needs is possible. Furthermore, the certain combinations are even more advantageous, as they can eliminate weak aspects of both methods.

Secondly different attitudes exist and its clarity is required in this aspect as well. Therefore the possible options are going to be explained and afterwards the choice will be made, according to the prevailing needs of the planned research. The attitude is qualified as positivistic when its goal is solely objectivity of the result in order to avoid biases of the researcher. Hence, it is preferably based on statistical logic, as it is the best manner to gain accurate knowledge from experiments. Another type of the attitude is called phenomenological, which requires recognition of phenomenon occurrence as well as clear understanding of its background, as the main purpose is creation of assumption for empirical knowledge. Furthermore, the recognized consensus allows involvement of the researchers' input in terms of specific understanding of problematic, as the goal is the rich, complex and innovative description of phenomenon.

Finally, the most suitable approach towards the research as a whole or its sequential parts has to be applied. Thence, the possible options are going to be explained and afterwards the choice will be made, corresponding to the prevailing demands of the planned research. The approach is qualified as deductive when research starts with clearly stated hypothesis and its aim is to test and verify its implication. Therefore, the process and its progress go from the broad knowledge into its more specific application. Another type of the approach is called inductive and is the contrary to the previous one, as its goal is to identify new matrix and to deduce the hypothesis from it. Moreover, that means the opposite process and its progress is used, as it leads from a specific example to the generalized knowledge creation.

1.1.2. Case Studies

The practical analysis and case study research is one of the comprehensive methods that distinguishes itself by bringing us to an understanding of an intricate issue and reinforces and enhances the knowledge received through previous research. The aforementioned study dwells on the detailed contextual analysis of a restricted number of events or conditions and their interconnections. Moreover, it represents an essential research methodology

for applied disciplines and sciences. Regardless of its use and implementation in terms of either theory building or theory testing, it reveals the process of academic inquiry and exploration the underlying purpose of which is to create new knowledge. Every research is represented with tenable theoretical issues which further consider the study's framework, conception, and course of implementation. According to Yin (2009), all and sundry case studies are considered to display five key-components which comprise the core structure of the research: the statement of a question, the proposition, the analysis, the logical connection of the data accessed and the propositions considered, and the criteria for rendering and expounding the data received. The suitable method for the case study process undertaking is shown in Figure 1 and contains different key-components division and their inner relational links. The principal conception of case studies is devised and developed for the mere purpose of correspondence of the research questions and their reasoning and averment. The relevant plan for the case study result gaining is shown in Figure 2 and contains different steps description and their goals.

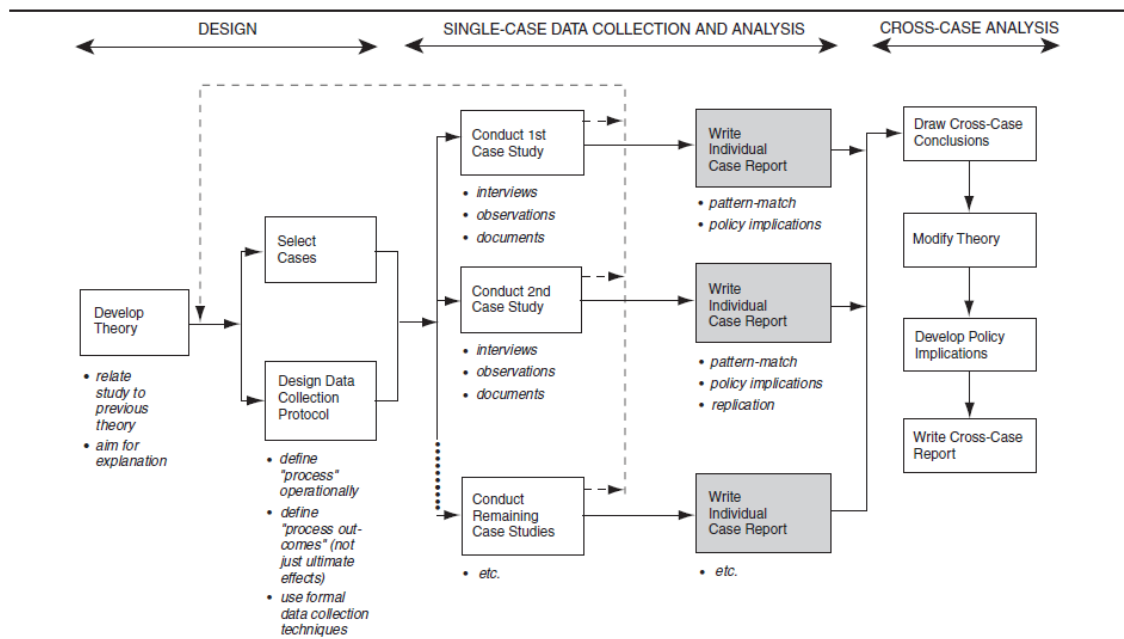


Figure 1: Case study method for the process undertaking (Dooley, 2002)

Step	Activity	Reason
Getting started	Definition of research question Possibly a priori constructs Neither theory nor hypotheses	Focuses efforts Provides better grounding of construct measures Retains theoretical flexibility
Selecting cases	Specified population Theoretical, not random, sampling	Constrains extraneous variation and sharpens external validity Focuses efforts on theoretically useful cases, that is, those that replicate or extend theory by filling conceptual categories
Crafting instruments and protocols	Multiple data collection methods Qualitative and quantitative data combined Multiple investigators	Strengthens grounding of theory by triangulation of evidence Synergistic view of evidence Fosters divergent perspectives and strengthens grounding
Entering the field	Overlap data collection and analysis, including field notes Flexible and opportunistic data collection methods	Speeds analyses and reveals helpful adjustments to data collection Allows investigators to take advantage of emergent themes and unique case features
Analyzing data	Within-case analysis Cross-case pattern search using divergent techniques	Gains familiarity with data and preliminary theory generation Forces investigators to look beyond initial impressions and see evidence through multiple lenses
Shaping hypotheses	Iterative tabulation of evidence for each construct Replication, not sampling, logic across cases Search evidence for "why" behind relationships	Sharpens construct definition, validity, and measurability Confirms, extends, and sharpens theory Builds internal validity
Enfolding literature	Comparison with conflicting literature Comparison with similar literature	Builds internal validity, raises theoretical level, and sharpens construct definitions Sharpens generalizability, improves construct definition, and raises theoretical level
Reaching closure	Theoretical saturation when possible	Ends process when marginal improvement becomes small

Figure 2: Case study plan for the results gaining (Dooley, 2002)

Reflective and structural analyses are cardinal investigative methods used in case study research. Structural analysis is described as a process of data examination in the perspective of identifying paradigms intrinsic to scientific phenomena. Reflective analysis develops techniques for facilitating reflective critical analysis as a means of eliciting in-depth reflections on practice. It is fundamentally based on author's personal judgment of the analysed data rather than on appointed technical requirements and doctrines.

1.1.3. Verification and Validity

This is an important part of the research methodology because in this part the researcher finally obtains the data from the research to start with the final part Verification and Validity. The qualitative research is focused on finding relations between two or more variable. Its main aim is to verify the validity of theories given by the hypothesis assumed at the beginning. At the beginning the researcher settled up some hypothesis based on assumptions which were given by some basic knowledge about the topic. The hypothesis must be validated by the qualitative data collection. This gives the researcher the findings which must be

analysed. These findings can confirm or reject the hypothesis and that is the desired effect of verification/validity.

1.1.4. Generalization

The data in qualitative research generalize claims are less declaratory. The generalisation theory is that case happened at specific place on specific time can happened anywhere else or in different time. According to data obtained by the research and also based on the confirmed or declined hypothesis there will be some generalization about the approaches to the public procurement system. The main aim is to get some relevant data from both countries and compare what is the ideal way for public procurement in infrastructure (Vodička, 2014).

1.1.5. Conclusion

The methodology is a complex matter and its design clarity is required in order to conduct the research process successfully. Moreover, the overall result strongly depends on each part of planned research, as their future undertaking otherwise will not meet the required outcome because of designed methodology's systematic fail. Based on the previously stated requirements for punctuality in research clarity, the research plan in terms of the its methodology, attitude, and last but not least, approach is clearly needed up front the research itself starts. Therefore, the deep thinking and planning in terms of methodology have been done. According to the procedure itself as well as partial and even overall results expectations from the analysis for the possible implementation of ECI procurement system into the CZ public funded construction, the preferably phenomenological attitude with solely deductive approach toward purely qualitative research methodology will be used.

Great importance within the work will dedicated to the results and research contribution of involved case studies, as their value for the research mostly lays in the practical aspects. Moreover, to gain precise and complete knowledge from the case studies research and results the factual and formal sides of the case study analysis and reporting have to be clear. Therefore, the proper understanding of

the desired information had to be clarified. Corresponding to the structure itself as well as the purpose of the case studies of the successful real life projects with implementation of the customized ECI procurement systems within the foreign countries public funded construction, the type of descriptive case studies with purely structural analysis is most suitable.

1.1.6. Justification

The construction procurement is generally a really complicated and complex system. Moreover, every single construction project is unique and most of the times the variance is significant or even absolutely different. The modulation of the construction project process or results in terms of all internal and external influential forces is almost impossible. Therefore, such a major change as the ECI principles implementation into the public funded construction cannot be researched with use of modulation in order to gain its understanding and plan its undertaking based on the statistical results. Undoubtedly, the qualitative research methodology then is the only possible choice. Additionally, it offers the opportunity to study broader continuity of the influence as well as to describe immeasurable occurrences within the process.

As the basics of ECI principles in the public funded construction procurement are known and already described within several other previous researches, the phenomenological attitude is the most suitable for the needs of research for those principals possible implementation in the CZ conditions. Furthermore, the successful implementation of those principles requires a long term effort and its current success in the foreign countries has not been proven over time. Therefore, the lack of comprehensive data to base the theory on is obvious and underlines the phenomenological attitude choice.

The implication of any process, system or just a single event which has been already used in different situation or under different conditions is principally based on the same theory with customization of the model according to the new circumstances. Furthermore, the ECI principles offer more comprehensive variants for their application and even tools for the process of implementation for

the CZ conditions. Thus, the solely deductive approach toward the research is suitable, as the research is based on the basic and widespread knowledge presented together with previous usage experience in order to suggest its application to a specific case of the CZ conditions.

Lastly, the type of descriptive case study with purely structural analysis is going to be used for foreign projects with ECI procurement system implementation in order to understand its contribution, as it suits the most to their principle and desired output. Descriptive case studies are recommended when the objective is to provide the most comprehensive description of the phenomenon. It is necessary to determine in advance the list of core topics and aspects covered by the research focus.

1.2. CZ Construction Industry Overview

The CZ is a small country with rich history in terms of economic successes as well as failures. National public funded construction industry is characterized by conservative demand for its new construction with considerably low exceptionality and innovations. Moreover, the traditional system of one-off project delivery is used almost exclusively because it is viewed as a time-tested method. Overall, the CZ public funded construction industry suffers from high inefficiency, low quality and corruption. Oživení (2012) stated that “analysis of the public procurement system in the CZ on the basis of a defined desirable model of public purchasing and a brief comparison with foreign systems shows that in the CZ there is practically no comprehensive policy for public procurement.” Further improvement in such area deemed necessary in order to provide healthy and sustainable recovery from the current depression as the main frame of infrastructure is already in place. On the other side private construction industry exhibits preferably good level of performance and is able to compete on the foreign markets, as can be seen on the examples of companies like PSJ a.s., Skanska a.s. or Metrostav a.s. for all. Therefore, the CZ public funded construction industry could employ their skills and knowledge earlier in the process to overcome its current struggles.

1.2.1. Critical Evaluation

Generally speaking when any system is getting complex, the right understanding of its principles is becoming significantly difficult. As the national construction industry is with no doubts truly complex system with a high level of possible external influence, it is recommended to break it down into smaller and simpler subsystems to gain a better and deeper understanding of each section and thus even of the total, while still considering surrounding conditions of the system. According to the specific needs of this study for CZ construction industry critical evaluation, the specialized SCLEEPT tool has been chosen for its division (Eaton, 2014).

1.2.1.1. Social

The level of tertiary education in the field of construction is of considerable quality which leads to well-prepared graduates entering the workforce every year. On the other hand the supply of qualified craftsmen has been on a steady decrease for a long time and is expected to worsen as there is a lack of new apprentices.

Another well-documented issue is the rising proportion of unqualified workers entering the construction labour market. This is mainly caused by the above mentioned shortage of qualified craftsmen as well as the contractors' preference for cost savings over quality work. With the more relaxed European labour market, even the CZ has experienced an influx of workers from abroad. In construction this can for instance lead to potential health and safety hazards because of communication problems and cultural misfit. Nevertheless, in comparison with more developed countries within the EU, the salaries and wages in the CZ construction sector are still significantly lower.

From the social point of view the CZ construction industry can be considered average among the EU countries and there is a relatively small risk of any significant change of this status. There is no significant threat to the construction industry that would arise possibly from the social matters 'overnight'.

However, if the need to deal with current problems is neglected, such problems could potentially escalate. One of the possible ways how to tackle problems on the other hand are the alteration of bidding process, as the local benefits promotion within tenders could help. Consequently only those contractors who can prove that their workers meet certain qualification criteria would be allowed to participate in the bidding process. This would in turn drive the demand for qualified apprentices as well as such educational path (Buchal, 2014).

1.2.1.2. Cultural

The adversarial attitude in the construction industry around the whole world is well documented and the CZ is no exception. As such it suffers from lack of trust among stakeholders, low cooperation and high rate of legal disputes. This is further exacerbated by the sharp competition. Moreover, the current situation in CZ public funded construction is based on one-off system of procurement where lack of trust dominates. For this reason team created for project delivery has very short term and mellow relation between members and it can degrade its collaborative work, as the teams break apart after each project completion to create a new one on the following one.

Another big problem is according Matyáš (2012) the bad reputation of construction industry and it leads to the low motivation of people as their job serves them to secure them the bottom levels of Maslow's hierarchy of need instead of all of those levels (Reid-Cunningham, 2008). Lack of future vision can be seen in the CZ construction, as the public sector clients do not have to follow any coherent and comprehensive policies in order promote and improve the sector (Oživení, 2012). Moreover according to Deloitte (2012) the private companies operating within construction sector usually do not make a lot of effort to develop quality long terms plan for their sustainable growth and focus more on shorter planning based on profits instead.

Continuous development of both public and private stakeholders' attitudes in the construction industry as well as a change of mind-set is needed in order to overcome present obstacles. This can be achieved by alterations in educating the

new generation of construction employees and training of the current ones. This is a long term goal and therefore it requires willingness to change of all participants. On the other hand, once the construction industry image finally starts to improve, its process acceleration is expected.

1.2.1.3. Legal

The biggest problem of the legal system within the CZ is high level of bureaucracy. It considerably slows down every construction project. Even though the general frame of construction legislation is stable there are frequent changes of smaller range. As the construction procurement legislation is already aligned with the EU Legal System and Regulations it should lead to better transparency. In terms of public construction procurement, alternative legal option for traditional highly competitive one-off project procurement with evaluation system based on 3E method is missing. Additionally because the construction industry projects are usually large in terms of their financial dimension, the problem of corruption is present.

There can be seen the progression in the legal frame to reduce the level of bureaucracy (shorten and simplify the process of issuance of building permits in 2006 new edition of the Building Law) and corruption (duty to publicly disclose every public procurement project's details on the government server). On the other hand it is important to mention that any major legal change consumes a big amount of time and effort to be successfully prepared and implemented.

1.2.1.4. Economical

From the economic point of view the construction industry is the only CZ sector that has been facing recession 4 years in row after the 2008 crash of global markets which heavily influenced almost every segment world-wide. In almost every country the construction industry heavily depends on the domestic market as its contribution in the CZ conditions is approximately 98%. Considerable part of those expenses is funded by the EU as the opportunities for further development support. Because of the current economic depression, reduction of national

budget and missing investment strategy in the CZ, the public investments had to be reduced which in turn significantly affected the construction industry (Deloitte, 2012). Moreover, the CZ economy and therefore construction industry as well, are strongly dependent on the economic health of the surrounding EU markets (EC Harris, 2010).

Ordinarily, the performance of companies operating as general contractors in the CZ is evaluated only according to financial criteria such as profitability or return on capital. Moreover, balanced and positive cash flow is one of the most important aspects for successful running of company operating in the construction sector (McDermott, 2013). On the CZ construction market is usual payment period of 90 days (Tomek, 2013). Unfortunately the payment flow from the client throughout the general contractor and even whole supply chain suffers with common delays and even unfair shorter payments. Preferably in order to create additional pressure on inferiors in case of some legal disputes or additional increase of the project profit. Also the current CZ public construction procurement bidding culture is based only on lowest price criteria (Ochrana, 2008). It leads to the low profit within the public funded construction projects usually between 2-5% (Tomek, 2013). The above mentioned conditions and commonly exhibited unfair practises lead to current struggles of all stakeholders with positive cash flow maintenance. Thus it seriously affects the project delivery smoothness and quality.

1.2.1.5. *Environmental*

The significant climate changes currently taking place all around the world are influencing the construction industry. On the other hand the construction activities and above all their results in form of buildings are one of the main contributors in terms of energy consumption, waste production and material use (U.S. Green Building Council, 2012). That is a significant environmental burden leading back to the climate changes. The CZ has the mild climate known for its classical four seasons with almost extreme conditions. However, because of the increasing climate changes the global weather is no more so easily predictable and extreme conditions occur more often. The trend is that winter season is

getting shorter and milder, which should be good for construction as it allows more construction activity, on the other hand the extreme conditions are getting stronger which can be documented e.g. by an increasing intensity of flooding in the CZ (Hanák, Vítková and Hromádka, 2009). As the CZ is a part of EU, its legal framework is aligned with its regulations and legislation for the environment protection (Ministerstvo Životního prostředí, 2012). This has a positive impact on the environmental protection. However, a continuous effort for environmental protection is needed as this fight will never have its finish line.

1.2.1.6. Political

According to Deloitte (2012) there is obviously a considerably higher political instability in the CZ in comparison with most of other countries within EU. On the other hand, according to the CZECHINVEST (2008), its policy is one of most consistent and predictable from the counties which have joined since 2004. The CZ Government proves that is relatively skilled in coping with the more short-term and technical policies, but as can be seen for example complications with the Lisbon Treaty, it still struggles in coping with long-term and plain policies (Šlosarčík, 2011). Because previous two and the current CZ Government have not had stable position the delays in government decision are another problem. Lastly, the political environment is considered to be largely corrupted as municipal authority lack of capacity to comply with the rules or just fail (Transparecny Intenational, 2012). From its stability point of view, the political situation in the CZ does not change significantly, but its relative instability reduces the possibility of quality planning and leading. However, the CZ needs a quality and strong leader on its political scene who can possible development and carry out ambitious and comprehensive long-term vision. According to Šlosarčík (2011) as regards the EU, the CZ has to learn how to define and defend its national interests within the EU structures.

1.2.1.7. Technological







As regards technology in construction production as well as material production, the CZ construction industry uses good quality equipment and its processes are aligned with modern standards. It is the result of effort to maintain the production competitiveness and continuous development programmes within the private construction companies. Moreover, the great contribution to it can be noticed even in the fact, that the significant portion of large construction companies are subsidiaries of multinational construction companies (CzechTrade, 2009).

On the other hand, the energy demands are still proportionally higher in comparison with the western EU countries in terms of waste recycling and material insufficiency. The CZ construction industry relies mainly on traditional materials such as cement products, concrete or plaster. From the technological point of view, the CZ construction industry lags in applying the modern technologies in the pre-construction phase, such are BIM or ECI as example for all, that are based on cooperation and quality information sharing. It is because of the prevailing traditional attitude towards the production delivery and aforementioned adversarial conditions.

The scientific progress in terms of construction stagnates since there is no demand for innovative construction solutions. Therefore the production delivery maintains merely incremental innovation rate. Benchmarked against the whole EU market, the CZ construction industry would score as average. Therefore innovation is crucial in order to improve its competitive position within the EU construction marketplace. For instance according to Kalinichuk (2013) the improvement of information connected within the project sharing is needed to successfully implement modern, trendy and beneficial approaches in construction management as lean construction or relational contracting.

1.2.2. Public Funded Procurement

The CZ has been part of the EU since May 2004 and therefore its legislation for procurement in construction funded directly or indirectly by public funds is already aligned with the EU Legal System and Regulations. Any such construction project has to be procured by use of procedures set out in the Regulations based on EU Procurement Directives and its failure to adhere may result in penalties. As Knébl and Němec (2010) stated, there exist various types of CZ procurement procedures as follows:

- Open procedure -  ;
- Restricted procedure -  ;
- Negotiated procedure with publication -  ;
- Negotiated procedure without publication -  ;
- Competitive dialogue -  ; and
- Simplified below-the-threshold procedure -  .

According to the Ministerstvo pro místní rozvoj ČR (2012) the total value of all public sector procurement in the CZ was 19.3 billion Euros in 2011 and 8.3 billion Euros from it was spent in construction sector. Different procurement procedures proportion change in the previous time is shown in Figure 3 and Figure 4. The choice of appropriate procedure depends on specific project and each of those listed procedures consists of different requirements and schedules. However, all of them have to respect EU public expenditures manners that the Sweet Group (2012) stated as follows:

- Equal treatment (fairness);
- Transparency (openness);
- Proportionality (equal requirements to size);

- Mutual recognition (internationality in the frame of EU); and
- Confidentiality (of information from tenders).

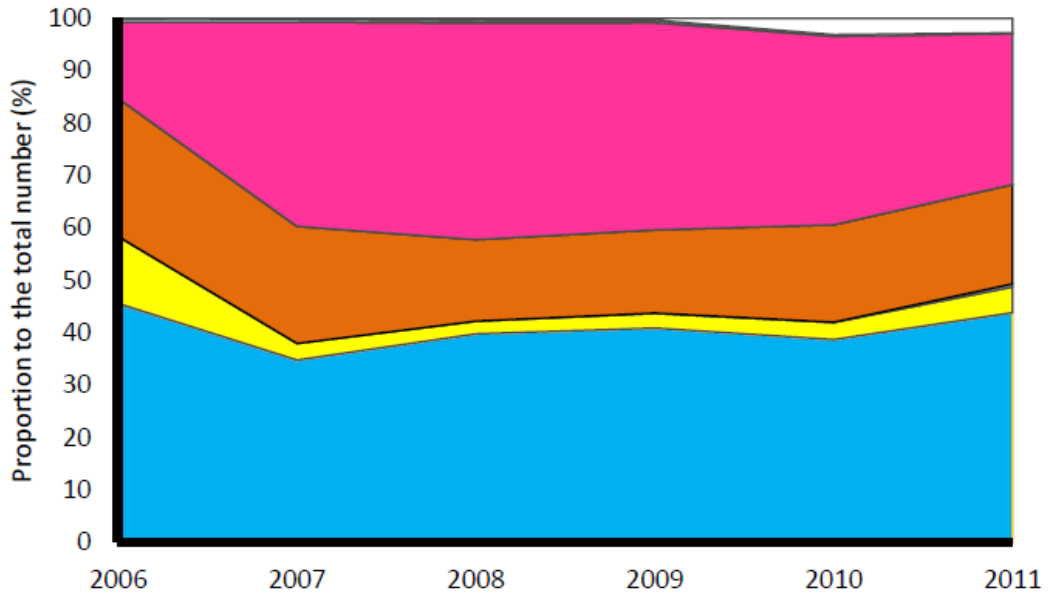


Figure 3: Proportion of the CZ procurement procedures to the total number in time (Ministerstvo pro místní rozvoj ČR, 2012)

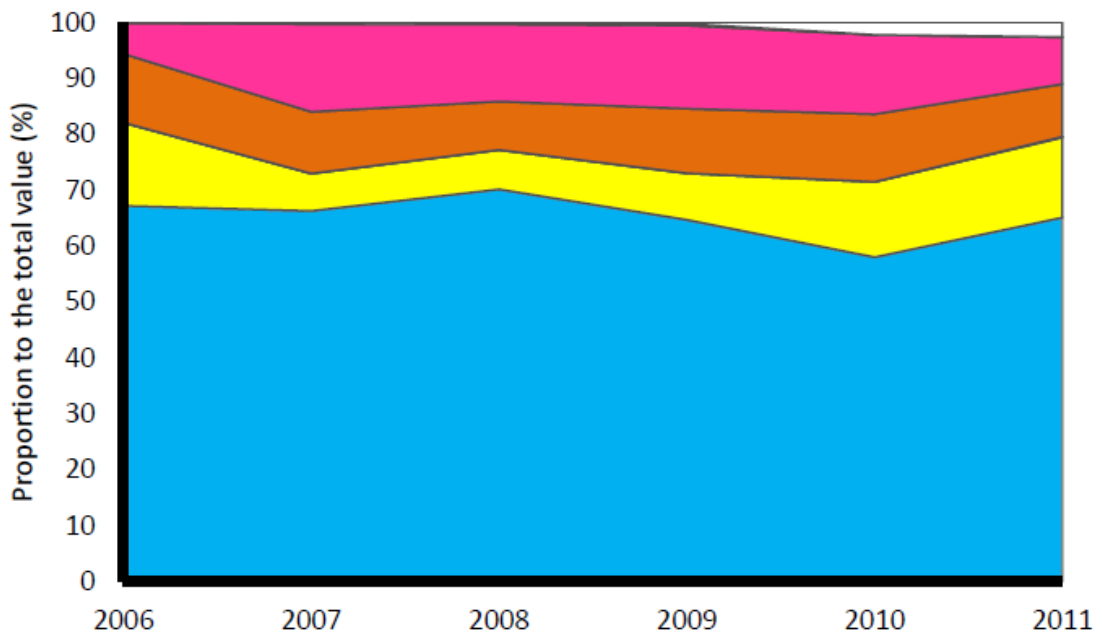


Figure 4: Proportion of the CZ procurement procedures to the total value in time (Ministerstvo pro místní rozvoj ČR, 2012)

1.2.2.1. Practises

Continuous effort of CZ officials has been conducted in past years or even decades in order to improve process of public procurement for its public funded construction. Namely The Public Procurement Act No. 137 / 2006 and The Building Act No. 183 / 2006 came into effect as the biggest contribution. Moreover, both acts have been amended several times since. Unfortunately that still has not brought the expected significant enhancements in terms of its efficiency and cooperation involved. Even the conditions still remain strongly adversarial with high level of involved bureaucracy and corruption. The low improvement acquired with high effort needed is due to missing long term vision and innovation in conducted changes. Additionally, the politically instable situation and high politicisation involved throughout the system in CZ authorities led to creation of uncovered loopholes in legislation.

The legislation in the CZ enables more types of procurement systems for its public funded construction. However, D-B-B procurement system is the only one in use due to several influential forces, as for instance lack of knowledge, low desire for innovation, fear of unknown as well as political pressure, specific mind-set of people involved and missing motivation. Furthermore, the so called traditional system is almost exclusively promoted, as its legislation the most developed from all possible systems. "The client appoints independent consultants, on a fee basis, who fully design project and prepare tender documents upon which competitive bids, often a lump sum basis, are obtained from main contractors" (Masterman, 2002). Once the bidding process is completed, the general contractor is chosen to meet qualification requirements based only on the lowest price. According to Masterman (2002), D-B-B procurement system is not the most efficient procurement method for project delivery on time and on budget for every project or even for most of the projects. Unfortunately the consensus among the CZ officials is to prefer use of traditional procurement system for public funded project's delivery still remains. Also in the CZ public funded construction procurement is used only method of sealed envelope for tender offers submission with general contractor choice based on

lowest bidding price under fulfilling legally required conditions. The above mentioned practises most certainly cause insufficient cooperation as well as late general contractor involvement, possibly resulting in production with delays and over budget. Additionally, the other serious problems arise as the CZ legislation does not allow any changes of the project during its construction phase against its design phase result, which has been tendered. Therefore have to be solved by annexes to the main contract which require additional effort and can possibly lead to legal disputes. These changes are inevitable in almost every construction project due to complexness of construction projects and certain level of information incompleteness present in each project lifecycle.

The breakthrough in current status quo that is prevailing in the CZ public funded construction procurement is seriously needed. The hint of it can result from successful implementation of some previously issued strategies. For instance the Superstrategie prepared by the CZ Ministry of Transport, which promotes new forms of financing and procuring of transportation construction projects in order to cheapen and accelerate the project delivery. Nevertheless, the adversarial conditions and traditional mind-set of people that dominate in the public funded part of CZ construction industry have to change to finally allow reaching the sustainable improvement of the whole industry.

1.3. ECI Overview

The employment of ECI principles into the public funded construction has become more common in recent years, as the public authorities seek how to improve their procurement systems and performance. Although the ECI has clear principles, every country that has already implemented it within its public funded construction procurement had customized its form and implementation process. Moreover, any country which considers implementing ECI principles in future is recommended to do such a customization in order to ensure its positive result, since the conditions are everywhere different. For instance the UK adopted the ECI principles based on collaborative approach continuity throughout the whole project delivery procurement lifecycle. On the other hand, AU implemented

customized model with collaboration moved upfront the project execution process and a more conventional one later on. According to the prevailing condition and readiness level of the current situation in the CZ, the AU approach is more suitable to employ, as it is less radical with less risk involved (Rahmani, Khalfan and Maqsood, 2013). However, the UK system involves the ECI principles in their purer form which allows for greater enhancements and therefore the CZ should pursue their example further in future. The profound analysis and planning preceding the creation of a precise and coherent long-term vision have to take place to allow reach real improvement in the procurement performance of the CZ public funded construction. Moreover, the presence of the long-term vision will ensure greater alignment and coherence in implementing it. Still, the traditional procurement systems remain and will remain the prevailing method in use worldwide, even in the CZ, as it still suits the majority of demanded construction projects and offers its simplicity and familiarity. Generally speaking, the ECI implementation is not suitable for every construction project and can even cause certain harms in case of inappropriate use. It is recommended and mostly successful within large scale, complex projects with considerably high risk profile.

Mosey (2009) identified general and undesirable common mistakes of design and construction separation and stated that “without a clear preconstruction contractual model there is a greater likelihood of decisions being delayed or sidestepped, thereby deferring main contractor and specialist appointments and perpetuating the problems of separating the design of a project from its construction. It has long been recognised that design contributions should be made not only by consultants but also by contractors and specialist suppliers and fabricators to achieve a complete and functional design.” The ECI method belongs to the procurement methods, where the core improvement lies in the premise that traditional models form the complete delivery team late in the project delivery procurement lifecycle with very limited scope of collaboration and lack the desire for innovation. Therefore, the key idea of the ECI is to include preferably a general contractor and even key members of the supply chain already into the early stages of project design and planning in order to obtain the greatest possible contribution of all stakeholders involved to secure successful project results.

Moreover, the support of collaborative work through the alignment of different stakeholders' project interests successfully inhibits greater portion of innovation in the project development.

The currently desired and feasible method for the CZ is the two-stage tender with similar features that have been issued in the case of AU and with the influence of the UK system. The investor involves the general contractor early in the project development on the basis of price and non-price related criteria. The CZ does not offer to comprehensively imply non-price related criteria within its public funded procurement. However, the EU Commission issued the MEAT strategy which implication in the CZ legislation over currently used 3E method could effectively enable to do so. The professionals of the general contractor in cooperation with recalled professionals of the key supply chain members assist in conjunction with client on the fee basis during the project design, development and planning processes. Generally, the contractors have a higher level of expertise compared to designers. Moreover, in the case of the CZ they have even more efficient practises than authorities due to their field experience, competitive impact and preferably comprehensive knowledge. Therefore, their contribution in terms of price estimation, design development, material and equipment use, processes planning and operation management is greatly beneficial to the project. As a result, the CZ has to consider the ECI principles implementation in its public funded construction procurement and develop it most suitable customized method. The negotiated D-B procurement system, legally based on a two-stage tender, which is a variation of the AU and UK models on a lower scale, proves itself to be the best first step to break the currently prevailing status quo, as is shown in more detail in the following work.

2. Theoretical basis

2.1. Time Scale

ECI, by its main principle and even simply by its name, involves the contractor early in the process of the project lifecycle. Moreover, the matter of

involvement should not be 'just' a general contractor but even the key supply chain members and specialists, as their contribution to the project development success can be crucial. The specific phase or even its partial step of the diverse and successive construction project lifecycle for their involvement into the cooperation varies. There exist more methods that enable to employ the ECI principles into the project. Yet, the ECI implementation within the options of the two-stage tender and framework agreement is later described in more detail. The comparison of those suggested methods within the CZ public funded construction commonly or even exclusively used D-B-B procurement method within the project lifecycle progress is shown in Figure 5. The summary of main steps common for both discussed methods of the ECI principles application is described in the Figure 6 with depicted continuity.

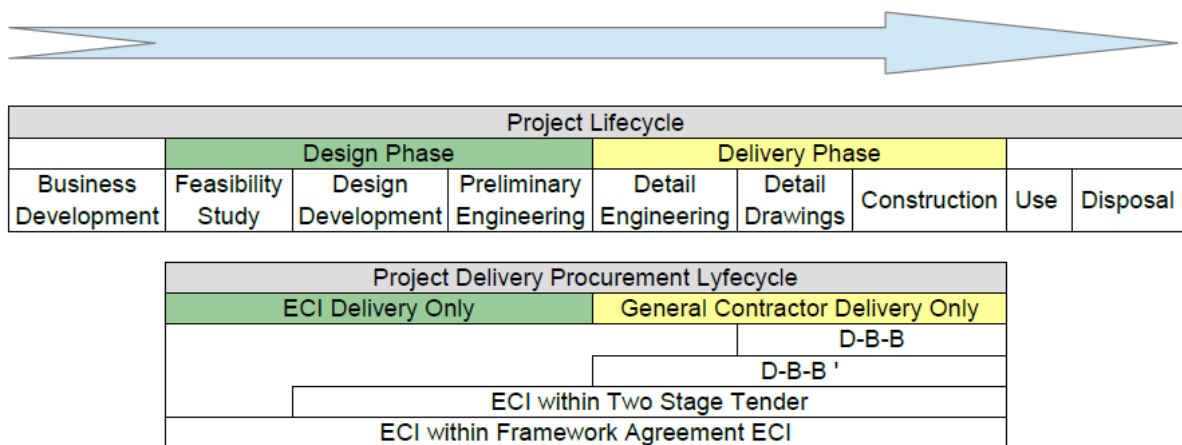


Figure 5: The ECI demarcation throughout the project lifecycle (Walker and Lloyd-Walker, 2012)

The D-B-B procurement system lacks any interaction between the general contractor and design and project development teams. Therefore, any changes have to be negotiated and carried with increased cost and time contingency later in project lifecycle. As the construction industry is characteristic by the complexity of its production, the presence of changes is inevitable and causes disruptions. Moreover, the system uses classical fixed price and time contract agreements which do not support cooperation among stakeholders. The duration of the general contractor involvement into a project can be within the method marginally

extended. However, the knowledge exchange, experience input and joint decision making involved is still not sufficient, as it takes place late in the project lifecycle.

Two-stage tender legally allows apply the ECI principles through the negotiated D-B or even D-B-B procurement system, as the process is described lower in more detail. Undoubtedly, the general contractor has experience, knowledge and expertise that is useful in early stage of the project. Moreover, the capability to contribute in design development and engineering in terms of advising, testing and decision making is significant. Therefore, the general contractor collaborative involvement is advantageous and should be considered and promoted among the considerably complex public funded construction projects.

The framework agreement legally allows apply ECI principles though any known procurement system as well as their customized or combined variations. However, to maintain the collaboration continuity, the CM method serves the purpose the most, as the process is described lower in more detail. To explore the feasibility of its idea and its possible scale, the technical input similar to the previously mentioned but on the general level, becomes truly beneficial. Thus, such cooperation with the general contractor is extended on the time scale. Therefore, the alternations of partnering agreements or even joint ventures creations arise, as with their use, the major project goals of investor and general contractor align.

Consultants procurement and appointment	Contractors procurement	Conditional contractors appointment	General contractor offer review	Contractors appointment
Consultant procurement process to select design consultants and cost consultant for framework or individual project. Appointed design consultants create early designs options and their quantification and cost consultants validates client budget.	Main contractor procurement process to select main contractor for framework agreement or individual project based on price and non price criteria. Main contractor bidders review early designs, visit site, assess budget, and submit bid prices and proposals.	Conditional main contractor appointment subject to contractual timetable and processes to satisfy agreed conditions. These conditions include contractor and supply chain expertise input to the project design, planning, engineering and costing.	Satisfaction of conditions examination undertaken preferably at the same time as design finalisation by joint review of submitted offer, which have to achieve best value for money, enhance quality, reduce risk load and promote local benefits.	Main contractor and key supply chain members appointments to commence work on/off site.

Figure 6: The ECI main steps summary throughout the project lifecycle (Mosey, 2010)

2.2. Workload Distribution

As the involvement of the general contractor early in the project offers input into the project development in terms of design, engineering and planning, the increased workload in those stages is expected. The increase of workload of course brings with itself increase of the cost in comparison to the traditional execution of the project. However, the justification of such a factor is simple, as the positive influence of the project can be reached with lower effort. In other words, there is an increased team focus in the front end workload project upon the generation of added value, as the greater level of possible project result contribution is allowed through effective project variation with lower change cost. Therefore, the project strategy has to be clearly stated upfront to clarify the investor's purpose and ensure the additional front end cost justification. In conclusion, it resulted in desire to creation and further development of other variations to existing procurement systems and them supporting procedural methods to introduce the expertise and engineering earlier in project delivery procurement lifecycle. For instance negotiated D-B or CM procurement systems with involvement of ECI or even BIM can contribute with greater capacity of the knowledge and experience from the field. The distribution of the ECI workflow in

comparison with the traditional workflow over time of the project lifecycle including is shown in the Figure 7.

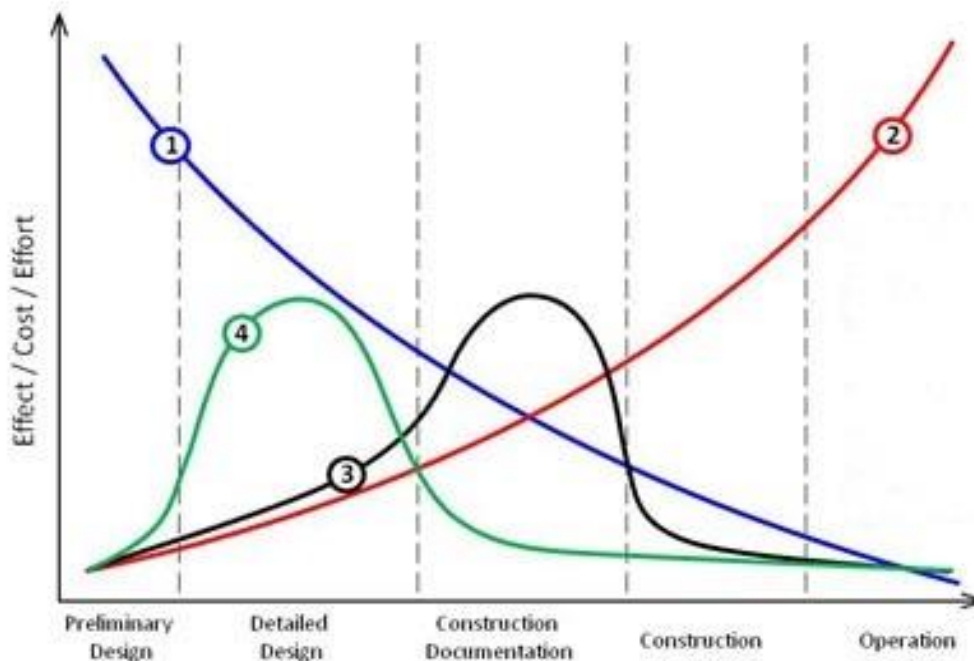


Figure 7: Workflow for different methods with the ability to impact performance and cost of changes over typical project lifecycle (Strafaci, 2008)

1 - Ability to impact performance

2 - Cost of change

3 - Traditional workflow

4 - ECI workflow

2.3. Process

The process of project delivery generally consists of two different phases and for its success the profound and efficient cooperation throughout each of them and mostly in between then is demanded. The design phase is first and the production phase follows. Both of the phases separately or combined in terms the cooperation continuity have straight and strong influence on the construction project resulting in its price, duration and quality. If the process fail in any of those factors it will definitely negatively influence any public funded construction

project's overall result. Therefore, the importance of the suitable procurement system choice as well as its correct execution is significant or even crucial.

The ECI system for public funded construction procurement commonly consists of two phases as well. Moreover, legally the process is most commonly secured with the two-stage tender, which based on its main idea is considerably similar to the traditional procurement with extended and deeper level of coordination involved. On the other hand, there exists another frequent legal variant of system for public funded construction procurement with use of ECI principles. It is by the EU promoted and thus increasingly more widespread framework agreement, which based on its main idea, merges to a certain extent the two phases into a single one.

In comparison of the possible legal and even practical implementation readiness as well as complexity, the two-stage tender is more feasible in the case of current conditions prevailing in the CZ. This is based on the two-stage tender lower requirements towards the CZ public sector as well as the comprehensive construction market level of development in terms of the legal matters and mind-set of people involved. Undoubtedly, the framework agreement implementation has higher requirements for the overall system readiness and even desires more effort. Therefore, its implementation is recommended as another step of the way towards the ECI principles implementation into the CZ public funded construction procurement system at their full scale. Based on this, the bigger emphasis is thus given to the two-stage tender detailed process description within the following part of this work. As for the framework agreement, the basic idea and system description is also provided.

2.3.1. Two-Stage Tender

The legal two-stage tender format utilises the ECI principles in the procurement in order to secure the process of the most suitable contractor selection for a specific public funded project. Fundamentally, the two-stage tender legal format allows for negotiated D-B and even D-B-B procurement systems.

However, the goal is to avoid the D-B-B procurement system, as it reduces the recognized contribution of the ECI principles involved in the public funded project.

Magnus (2004) stated that, from the legal point of view, two-stage tender “combine two elements: the flexibility afforded to the procuring entity in the first stage by the ability to negotiate with suppliers or contractors in order to arrive at a final set of specifications for what is to be procured, and, in the second stage, the high degree of objectivity and competition provided by tendering proceedings”. The D-B-B is basically used only when the original negotiated D-B procurement system fails, as the cooperation in the first stage did not bring the desired result. The original cooperation is then cancelled and the project delivery in the second stage is amended. The aim is a continuous and collaborative workflow based on a single contract with the general contractor for the whole duration of the public funded project, resulting in its overall project improvements in terms of quality, duration and cost. Therefore, the contract has to cover both stages, where its validity in the following stage is conditional based on the investor acceptance of the offer submitted by the general contractor, as an outcome of the first stage. A detailed overview of each sequential step in the process, including provision of the decision flowcharts developed by the AU based on the principles of the UK system, as well as the suggested payment system is given bellow.

Other possibly beneficial enhancements in the system can be reached with increased competitiveness of the whole process with use of 2 different tenderers engaged during the first stage. Both of them undertake parallel and complete project development work without any influence from each other and the better one is awarded by the contract for the project realization. Unfortunately, the increased urge for funds upfront of the actual construction work with uncertain rate of their return leads to its possible provisional implementation denial in the current conditions of the CZ, even though the system is successfully implemented for instance in the very case of AU (Department of Treasury and Finance, 2014).

2.3.1.1. *Sequentially*

Firstly, the need for tender activities in terms of its planning and designing arises, resulting in the awarding of the best general contractor with the contract, who afterwards enters the first stage of cooperation. The most suitable tender participant is chosen based on the MEAT principles stated by the EU legislation among the eligible respondents usually with predominance of non-price related criteria but even on the general cost related criteria in accordance to the prevailing project characteristic. An assessment of tender rates for the activities within the first phase is made, as the preferred contractor is finally chosen. The relevant flowchart developed by the AU, as mention above, is shown in Figure 8.

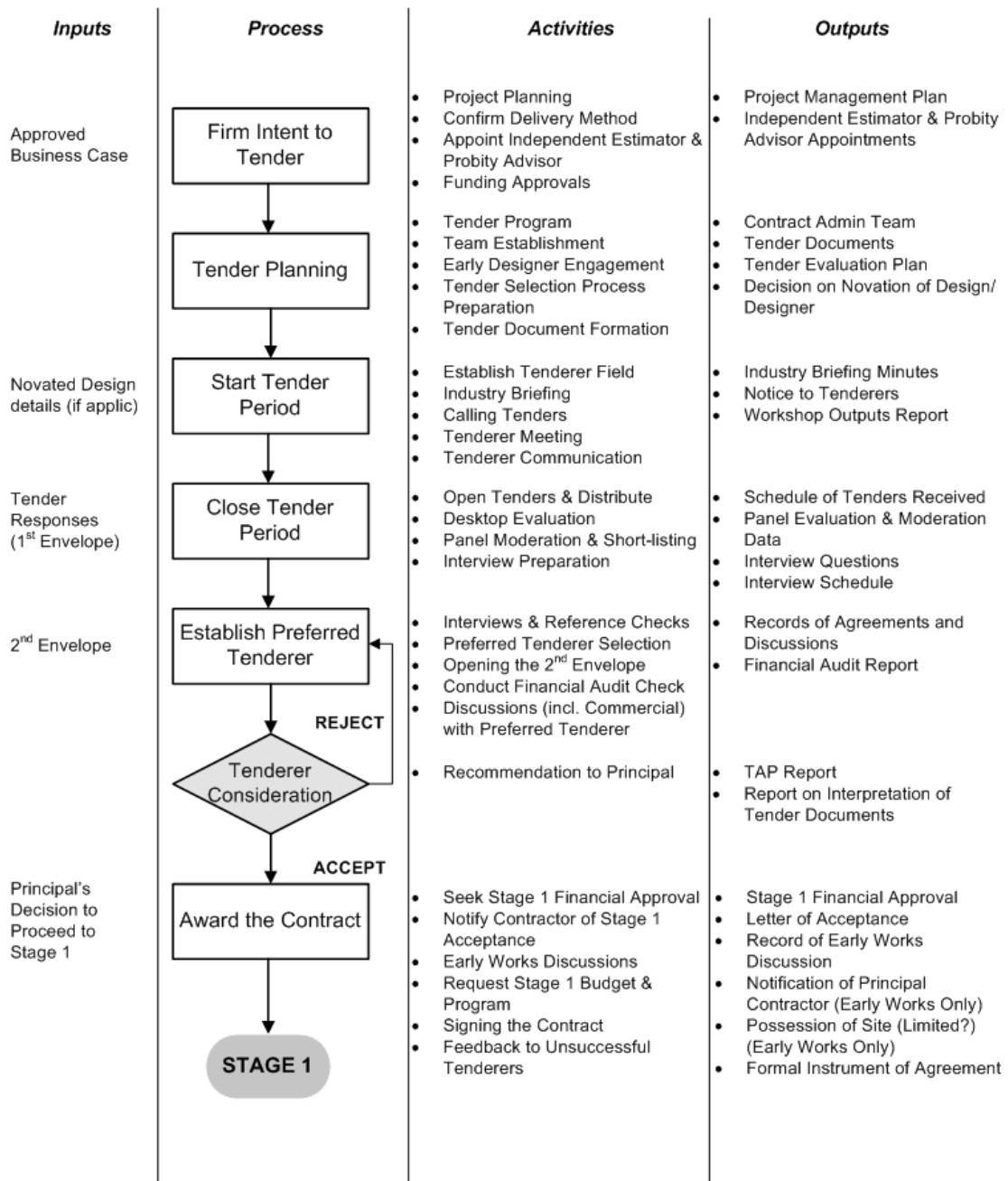


Figure 8: AU tender 1 flowchart (Queensland Government, 2009)

Then the stage 1 commonly referred as Development of the stage 2 offer follows. The strong relationships between all stakeholders involved and their close collaboration during the process are the key elements for its success. Both those factors directly depend on the significant interaction of the tenderer with the appointed design team and close supervision of the investors' appointed

representatives. Each of the involved stakeholders has a different task within the required work which is planned as partnership cooperation. All those works are undertaken based on previously stated service agreements in order to develop detailed design to be accurately planned and priced. Undoubtedly, the stage 1 is an interactive process between all parties, which is opened to the opinions and variants explorations and justifications. Therefore, it results in quality decisions making and risks allocating. The stage may also involve an early work proposal and execution, if needed, and ends with the tenderers' stage 2 offer submissions. The relevant flowchart developed by the AU, as mentioned above, is shown in Figure 9.

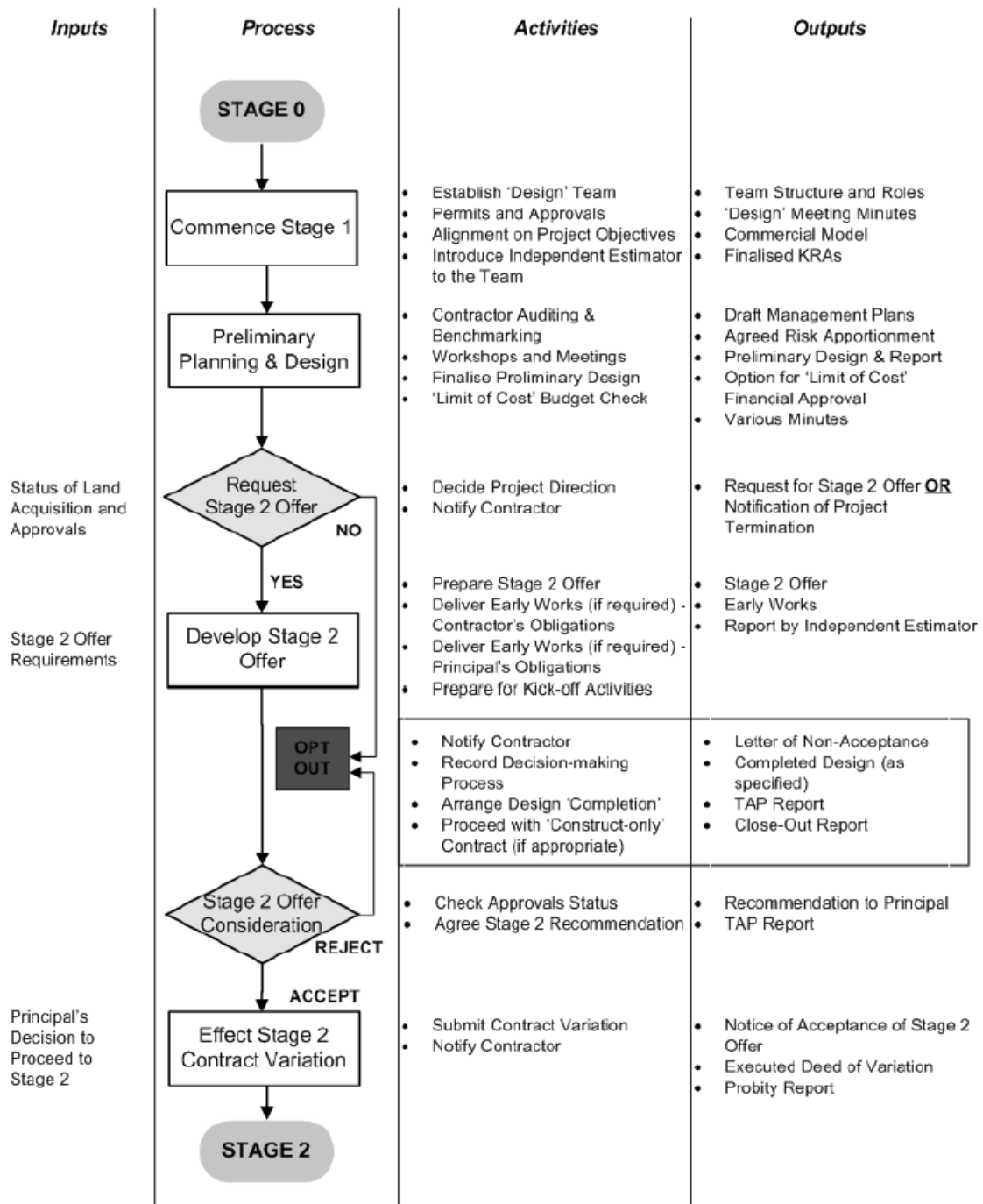


Figure 9: AU stage 1 and tender 2 flowchart (Queensland Government, 2009)

Thirdly before the following stage can start, the client again has to confirm previous or select the new most suitable general contractor. The preferred, and for the project more beneficial option, is to confirm the general contractor from the stage 1 based on the previously submitted offer to preserve continuity of

cooperation. The evaluation criteria and the format of the tenderers' offer are revealed and specified sufficiently in advance. Moreover, it can commonly be either RAMP in the case with already agreed design and risk allocation or RAP in the case without already agreed design and risk allocation. Therefore, the agreement of the general contractor for the stage 2 is basically considerably close to the conditions used in the extended D-B-B contracts. The client has the right to refuse the offer based on any unsuccessful cooperation in previous stage or a failure to reach clearly stated project results and mile stones within the submitted offer. In such a case, the need to finalize the design development and complete the tender documents and permissions in order to undertake traditional open bidding process arises, as the desire is to find the general contractor with available capacity and sufficient skills to realize the advertised and planned construction works on time with the lowest price. Naturally, the general contractor previously appointed, who failed in the stage 1 cooperation, is not invited to tender. Thus, the project, from that point on, turns legally again into the traditional procurement system because the following cooperation is known as 'construct only'.

Finally the process results in stage 2, commonly referred to as Construction of the Works. If the previously submitted offer has been accepted, the project procurement moves into last stage dedicated to required detailed development and planning, which is followed lastly by the construction itself. The general contractor is responsible for the detail engineering, detail drawings and construction. The investor takes the role of contract and cooperation administrator and is responsible for surveillance of the progress and process. The construction itself can start with certain interval of delay alongside detailed planning and engineering, as they both simultaneously continue under collaborative contract conditions reducing the risk of production disruption. Moreover, the collaborative cooperation between all stakeholders involved prevents the delays caused by late issue of needed documentation. Such a situation is the desired state for all concerned in the public funded construction project with the use of ECI principles in its procurements system. The relevant flowchart developed by the AU, as mention above, is shown in Figure 10.

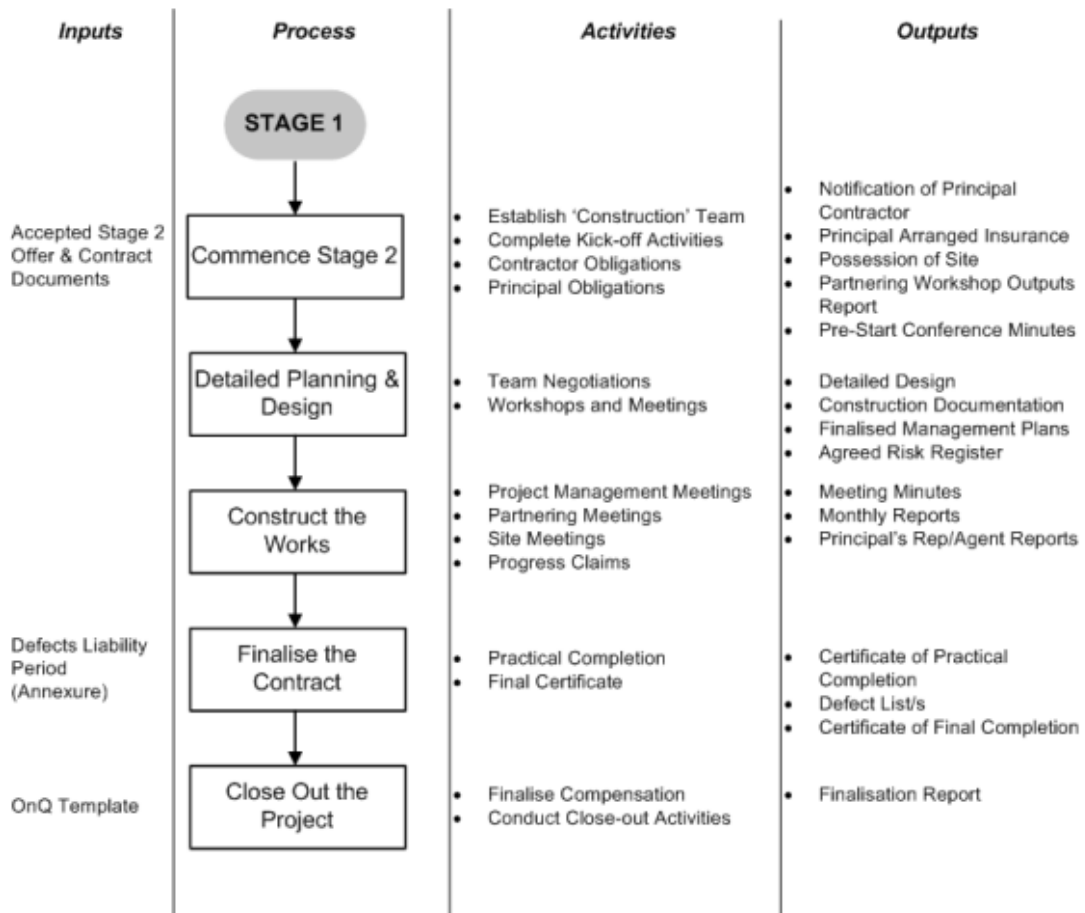


Figure 10: AU stage 2 flowchart (Queensland Government, 2009)

2.3.1.2. Payment System

In the phase 1, when the tender is developed in cooperation with the general contractor, the payments are typically on an open-book basis with use of fixed rates negotiated as a part of the ECI agreement. Moreover, they are usually based on the rates from independent experts. On the other hand, the overall fee should not, generally speaking, exceed the average and realistic estimate of cost for the general contractor to participate in the collaborative design phase. The issued ECI agreement for the phase 1 is basically arranged only on fee-for-service conditions. Therefore, the clear description of deliveries and services provided by the general contractor is issued together with method of their remuneration. Moreover, a condition of possibility and preference for the contractual extension in phase 2, based on the criteria for the exhibited cooperation result and submitted

offer, is included. Due to the above mentioned, the desire of the general contractor to achieve the best reachable level of collaboration in order to get appropriate outcome arises, as its interests are aligned with investor's interests.

In the following phase 2, when the detailed planning and drawing work, together with the actual construction, are undertaken, the payments can be based on guaranteed maximum price, lump sum or schedule of rates. In the case of previously submitted and accepted offer based on a RAMP, only the option of guaranteed maximum price is suitable. On the other hand, in the case of previously submitted and accepted offer based on a RAP the options of lump sum, schedule of rates with provisional sums or any previously negotiated combination of both is possible. Thus, the ECI agreement for the phase 2 is complex so it requires careful negotiation and preparation which even partially takes place in the first tender in terms of general conditions. Moreover, the agreement part of the paid bonus or in other words shared savings in case of the delivery of the contracts' subject under the budget submitted with the offer from the stage 1 is recommended in order to motivate the general contractor to improve performance.

Unfortunately, the possible, inconvenient and mostly exceptional circumstances of poor performance of the general contractor throughout the phase 1, or unfilled project goals within the submitted offer result in disruption of the ECI cooperation. The investor has the right to terminate the ECI agreement for insufficient cooperation or the threat of failing to reach the project's clearly stated goals under previously negotiated conditions; and is recommended to do so. Then continuity of the work breaks, as the need for the new general contractor arises. According to the already completed level of design, the investor determines the approach how to appropriately conduct following process. In a really early stage of the design another general contractor can enter the ECI agreement or more likely the process continues with use of a D-B-B project execution. Thus, the payment system then becomes traditional and well known following current Public Procurement Act No. 137 / 2006 which is aligned with the EU Procurement Directives.

2.3.2. Framework Agreement

Basically, the legal format of the framework agreement allows a creation of collaborative and simultaneous workflow system of all participants in the public funded construction projects. The desired potential lies in its capability in terms of cooperation improvements and long-term partnerships creation. As the possibilities are various, deep analysis for the investor specific demands is needed. Moreover, the framework agreement's basic conditions have to be designed to follow previously undertaken analysis results and be clearly and sufficiently described to secure its overall success. As the framework system enables to integrate the ECI principles on the highest possible level and even involves all the main stakeholders from the procurement and delivery process early in the project, its implementation results in project engineering performance enhancements as well as overall results improvement in terms of cost, time and quality.

The Office of British Government (2008) described the framework as “an agreement or other arrangement between one or more contracting authorities and one or more economic operators which establishes the terms (in particular the terms as to price and, where appropriate, quantity) under which the economic operator will enter into one or more contracts with a contracting authority in the period during which the framework agreement applies”. According to Constructing Excellence in the Built Environment (2007) usage of framework agreement in procurement enables to deliver public funded construction more efficiently. Moreover, the capability for promotion and enforcement of the, lately still more often discussed, local benefits as well as sustainability is significant within the use of framework agreement for public funded construction procurement

From the construction classification point of view, the framework agreement legal format allows alongside the typical and well described D-B-B, D-B and CM systems even their customized combinations and variations. It depends only on the basic conditions of each framework agreement created and formulated in accordance to its specific and investigated needs. However, the main reason to mention the legal possibility of framework agreement is its great capability of ECI

principles integration in into the public funded construction process. Thus, the more detailed process description of CM procurement system used within the framework agreement is given below, as it enables the purest ECI principles involvement in the process.

2.3.2.1. *Sequentially*

As the authorities have to ensure that all their spending follows an economic, efficient, and even appropriate methods, the creation of framework has to precede scoping of investors and stakeholders expectations and its agreements should respect the results. The use of the framework agreement may not suit every single purpose and project. Moreover, it is the most beneficial when the investors are aware of upcoming workload of public funded construction projects in a certain period of time and desire to develop a strong and partnering based relationships with smaller number of contractors and consultants. The single tender process following the EU Directives is carried out to create cooperative group of involved stakeholders.

The creation of framework agreement with only one contractor is possible but eliminates the beneficial factor of competition presence. Therefore, the multi contractor framework agreement is recommended, where the statutory minimum number of stakeholders involved is three with no limitation for the maximum number. The potential contractors have to submit sufficient tender offers in terms of legal requirements. The evaluation criteria are stated upfront according to the MEAT principles stated by EU legislation and have to secure the choice of the most suitable contractors for framework agreement specific needs in terms of their production quality, qualification, capacity and price. The authorities can appoint the contractor for the their individual projects within created framework agreement without full procedure of EU Directives, as the process has been already undertaken during the framework agreement setting up. However, the appropriate EU Treaty based principles still apply and have to be followed especially in terms of discrimination and healthy competition.

The contractor appointment process for the specific project within framework agreement can be either with or without the use of a mini competition. Direct awarding of a project to the contractor, as well as the use of mini competition, still have to follow the appropriate above mentioned EU Directives principles. For instance the created ranking system, pre-agreed percentage of the total value or simply the rotation system can be used in the case of direct assignment for project. On the other hand the mini competition does not have any statutory limitation for its tender process. Basically it has to be developed or customized in order to serve to purpose of the specific project as much as possible but still follow general law principles.

Resulting from the above mentioned, a great possibility to choose the right general contractor within the previously created framework agreement arises. The general contractor afterwards enters the CM procurement system, which is offering great or even the greatest deal of capability for ECI principles involvement, or any other designed way of cooperation and delivery. The CM method basically assigns the general contractor to manage the process of design development, documentation management and construction production on behalf of investor and under his control. Investor has straight input in the project definition and scope, collaborate with the general contractor throughout the whole process and have the opportunity to influence the decisions. The open book cooperation with shared risks and profits has the ability of significantly improving transparency and efficiency in the described method, as it brings the main stakeholders closer together and aligns their project goals. Therefore it should be at least considered if the circumstances enable it.

2.4. BIM tool

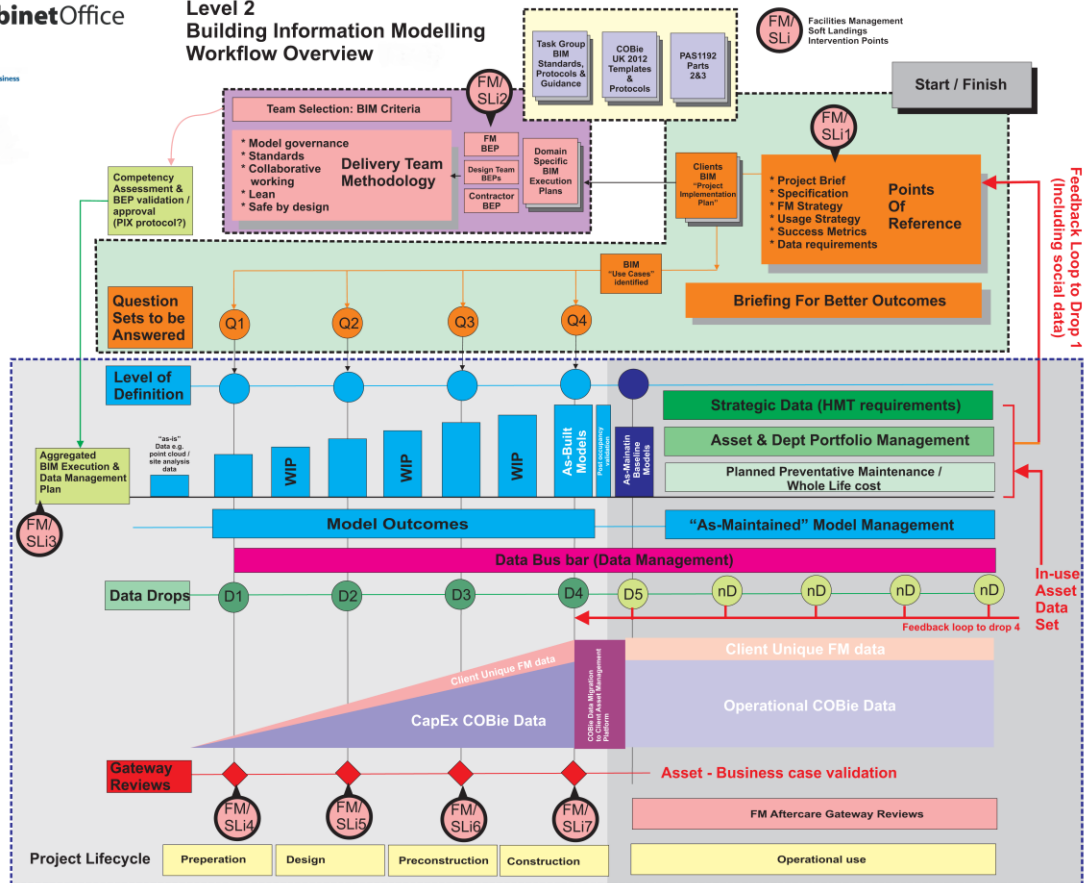
Construction industry as well as the real estate market has dramatically changed during the last few years. Expectations for buildings have raised and this consequently leads to considerably higher complexity in construction. Customers require sustainable and high quality performance from construction as well as in facility management which leads to demand for more detailed information carried

in project. In its principle the BIM is a specific attitude to the processes taking place in the construction project delivery with the usage of specialized software. The biggest contribution to the project delivery and following building usage lies in its ability to carry reliable and complete information about the building that can be easily accessed during the whole duration of project lifecycle (Epstein, 2012). There is no universal generally accepted definition of BIM. For instance British Government (2011) described BIM as “a collaborative way of working, underpinned by the digital technologies which unlock more efficient methods of designing, creating and maintaining our assets. BIM embeds key product and asset data and a 3 dimensional computer model that can be used for effective management of information throughout a project lifecycle”. BIM can be seen as a specific way how to reach the ambitious but realistic goal of cooperative sharing, creating and using of information during building’s lifecycle. Processes among all stakeholders are interoperable with clear responsibilities and duties defined in the contract. This leads to collaborative and coordinated teamwork with exchange of knowledge among all stakeholders. BIM is in principal formally established interoperable processes between each stakeholder with free flow of information via data capture and with technological support of the BIM software tool.

As the workload within use of ECI principles in the public funded construction moves in the earlier stages of the process in comparison with the use of traditional project execution method, the need for information clarity, reliability and security arises. BIM by its potential enables the solving of such a problem and securing the process from work duplication. Moreover, the modern software tools for BIM offer great possibilities in terms of specialized expertise tools for the design and engineering improvements, which are the main goal of ECI as well. From all previously mentioned about the ECI and BIM principles, it is clearly and undoubtedly possible to state that both methods support each other and are based on a collaborative and interoperable teamwork of involved stakeholders. Respective stakeholders move towards the shared goals with functional exchange of knowledge along the project’s lifecycle. On the other hand, each stakeholder has to be aligned with the BIM process otherwise it is impossible to be involved. Moreover, the BIM application is a really complex matter which requires additional

effort and cost on the long term basis for alignment of the market with its practises on sufficient level. For instance the workflow description on the level 2, which is currently promoted, and by the year 2016 mandatory, for the UK's public funded construction, is shown in Figure 11. Even though its compatibility with ECI is significant and its implementation alongside would contribute greatly to the CZ public funded construction, it requires another complex study in order to gain deeper analysis of its capabilities and application possibilities. Moreover, the BIM use within any construction project is categorized as is shown in Figure 12, where its 3rd and currently highest recognized level offers the biggest capacity for possible enhancements. The BIM implementation is continuous effort with sequential progress, where the current level depends on the weakest stakeholder within the project. Resulting from the above mentioned, the vision for the BIM implementation within the CZ public funded construction is required to secure return on required effort. Moreover, such a plan is too complex to suggest any quality plan without deep research and planning within this work. However, its application is recommended together with ECI principles due to their complementarity.

Level 2 Building Information Modelling Workflow Overview



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Figure 11: BIM level 2 workflow plan (Innovation and research FOCUS, 2011)

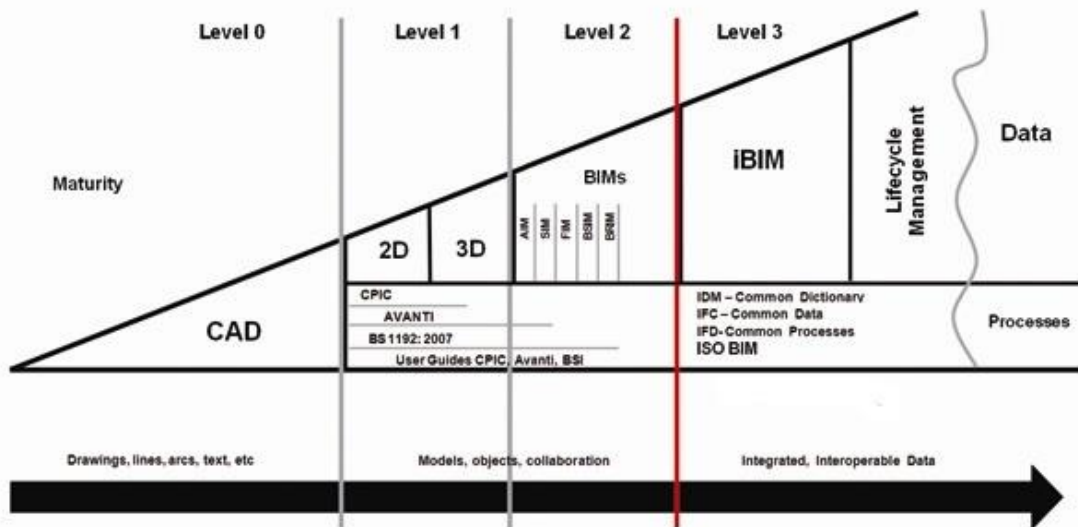


Figure 12: BIM maturity levels (Metal Cladding and Roofing Manufacturers Association, 2012)

3. Practical usage

3.1. Case studies

The following part is dedicated to the insight to the practical use of the previously reviewed and analyzed ECI principles within the public funded construction projects abroad, particularly in the UK and AU. As the currently more desired and feasible way of employment of those principles in the CZ conditions is through the negotiated D-B procurement system enabled with two-stage tender, the bigger emphasis is given to its exploration. On the other hand, the CM procurement system enabled within the framework agreement, which offers greater possible improvement and is another matter of this work, deserves closer attention as well. Thus, one of the provided case studies uses the framework agreement method (UK) and the other two use the two-stage tender method. However, both of those projects differ in their customized process and approach, as one is from the UK and the second is from AU. It enables the better possibility to compare, which eventually provides more stable knowledge base for decision making process in development of the unique CZ implementation plan. The case studies the D-B procurement systems.

3.1.1. 1st Study

The abovementioned study introduces the newly built Bermondsey Academy in UK, which was established on a restricted site including incorporated academic and sports facilities worth £22 m shown in Figure 13. The investor of the project was represented by the City of London Academy and the tendered general contractor was Willmott Dixon Construction Ltd.

The project itself revealed the early involvement of the general contractor and all of the design consultants, as well as the simultaneous establishment of roles and responsibilities in preconstruction phase agreement and programme. The project also comprised the joint management of cost and time correlation of the requirement for major amendments in the temporary site, as well as the risk

managerial activities. The agreement of incentives to motivate cost savings and added value was also supported (Mosey, 2009).



Figure 13: Main academic building of the Bermondsey Academy (Studio E Architects, 2014)

The investor was financed by the Department for Education and Skills and the City of London Corporation and used the establishment of the preconstruction phase agreement to state the responsibilities of all project members to implement design ideas and risk management and to ensure the availability of the project within the given budget. The investor was interested in preserving its bonds with the design team which had been assembled through multi-party contractual obligations, including the preconstruction phase agreement.

The general contractor of the aforementioned project, as well as its design consultants were appointed simultaneously. They were employed under certain conditions which included the stated timetable of preconstruction activities to develop innovative designs (establishing the majority of the lighting and ventilation) that were affordable and efficient (Gupta and Chandiwala, 2007). The team has also implemented pivotal risks management such as the monitoring of the removal of on-site contamination and most significantly the last minute need to amend the site of the required temporary school.

The most significant conclusion made by the City of London Corporation was introduced by the fact that any ambiguity and uncertainty can easily lead to the reluctance of the other parties to sign the preconstruction phase agreement. It was also necessary to monitor and manage the development of the preconstruction phase risk register for the mere possibility to provide risk contingencies allocated to particular items that were subject to scrutiny and agree on actions carried out by project team members, as well as to reduce or eliminate such contingencies wherever possible prior to finalisation of the agreed price for the project.

The project was highly assessed and given the status of the exemplar project by the Department for Education and Skills. Moreover, it was named the Medium-Sized Project of the Year in 2006 by the Department for Trade and Industry and Constructing Excellence.

3.1.1.1. Preconstruction Phase Agreement Contribution

The use of the preconstruction phase agreement was beneficial for reaching the clear comprehension of the roles and responsibilities of the project members, particularly the relations between the design consultants and the general contractor. It also made the integration of preconstruction phase design development with finalisation of open-book prices feasible, as well as stabilized the fixed price for the start of the project where any change resulting in such a price had to be supported by detailed information and proper risk monitoring. The effective risk management of the on-site contamination and the monitoring of the switching sites for the required temporary school during the preconstruction phase were reached with no cumbersome issues arising. The project team had also successfully implemented the agreement of performance measures to focus all the major activities on the investor's priorities. Moreover, the early agreement of commercial incentives by way of shared savings was performed to encourage the search for risk solutions.

The use of preconstruction phase agreements in the procurement of two additional academy projects in Hackney and Islington have been also brought

about by the City of London Corporation, as well as the procurement of a significant the West End of London office development, due to its previous success in the case study project.

It is worth mentioning that in its subsequent academies and the commercial project the City of London Corporation, the investor stepped into the preconstruction phase agreements at an earlier stage for the assurance in design consultants and general contractor undertaking joint feasibility studies and obtaining the required planning consents before being authorised to proceed with detailed design and finalisation of prices.

3.1.2. 2nd Study

The study introduces the enlarged and rebuilt hospital Albany Health Campus in AU, which resulted to be a \$170 m rapid redevelopment of the hospital campus within western AU health system with the effective incorporation of the reconstructed site of health care facilities while providing hospital services in operation (Figure 14). The investor of the project was represented by the AU State Government, Royalties for Regions programme and Commonwealth Government and the general contractor was established as John Holland Pty Ltd.

The project itself reveals the early appointment of the general contractor, as well as the simultaneous estimation of the intermission of the current activity due to medical needs and vice versa with its sufficient management. The team of the project aimed at successful risk management policy which included reviewing sessions with managers and stakeholders, as well as the implementation of the independent process of the system control and monitoring with the subsequent reporting to the governmental representatives. The performance of the D-B based agreement with the general contractor was implemented build on the estimated fees. The team has also planned the rapid procurement in order to fulfil commitments in time (Parliament in Western Australia, 2011).



Figure 14: The Albany Health Campus (Government of Western Australia, 2014)

The general overview of the existing facilities had shown significant limitations within the framework of the original engineering services and had represented the necessity of the replacement. Hence, the procurement analysis was performed by Ernst & Young Company and stated the unsuitability of the current project for PPP delivery route and its program and to note that the development of the design has shown the ECI delivery method as the most appropriate one.

The general contractor had been selected and involved in the development of the project designs and ideas. This resulted in submission of a successful lump sum proposal for the establishment of the reconstruction activities with the use of D-C contract which provided the risk management system and cost certainty. The pivotal point of the project was the system of continuous reports which was done in accordance with the reporting template developed for the project. The open approach to problem solving during the early project phase assisted both parties in developing the design that met the requirements and standards and was easy to implement on the aforementioned site. The D-C contract was established in order to provide the investor with effective risk management and to secure the

delivery with the greater certainty of final price. The D-C contract was established to operate clearly apart from the previous ECI performance. This resulted in dividing of the project development and at the same time the delivery risks as well as provided the certainty of the guaranteed price for the construction phase. As the major part of the design development was performed in the process of the ECI phase which, however, did result in the user groups involvement in the process led to requirement for their following training to get the constraints under which they were working (Department of Treasury and Finance, 2014).

The project has been awarded with the Best Regional Project by MBA Excellence in Construction Awards in 2014.

3.1.2.1. Preconstruction Phase Agreement Contribution

The use of the preconstruction phase agreement was beneficial for the realization of a complex construction programme which ensured the integration in the clinical programme. The chief aims of the investor had been implemented through the agreement between the involved stakeholders in terms of clinical priorities, the necessity of the time and risk management, and the agreement of a cooperative approach. The early development of the communication system enabled the team to react collectively to unforeseeable events. Moreover, the project delivery team benefited from the previously and clearly established communication strategy even in following construction phase in order to smoothly overcome the cumbersome issues in the process which inevitably arise in any construction project.

The final designs had to be compatible with the legal requirements which had to be achieved by the supplier within the appointed schedule. The hourly rate for variations was paid during the abovementioned ECI period which enabled the state assess to the cost implications of changes, as well as to the assessment of the progress.

3.1.3. 3rd Study

The study introduces the national office refurbishment programme Job Centre Plus in UK, which was fast-track programme for the Department of Work and Pensions and Land Securities Trillium refurbishment and establishment of 969 integrated Job Centres and Benefits Offices worth £737 m. The investor was represented by the Department of DWP and LST and the tendered contractors were Interserve Project Services Limited, Mowlem plc, B&K Building Services Limited, Rok Build Limited, Wilmott Dixon Limited, Shepherd Construction Limited, Midas Property Services Limited, Mansell Construction Services Limited, Overbury plc, Curzon Interiors Limited, Longcross Limited, Banner Holdings and David Maclean Contractors Limited.

The project itself reveals the early appointment of 14 general contractors by two investor bodies under multiparty framework agreement and successive project-specific building contracts as well as the appointment of subcontractors and suppliers under the additional framework agreements and subcontracts. Swift preconstruction phase procedure and programme for each project was revealed together with the establishment and the development of the design introduced by design consultants and general contractor. The project team had also implemented the system of joint risk management through the shared information to ameliorate the processes within the given task (Mosey, 2009).

The investors of the project had chosen a total of 14 main contractors and a number of subcontractors to carry out the nationwide programme for conversion of Job Centres and Benefits Offices to provide combined Job Centre Plus offices. This programme aimed at implementing standard approaches, materials and designs in various construction sites. The common aim of DWP and LST was represented in the plans for finding an effective and working agreement structure to manage a rapid start of the process of construction with the realization of the applied standards. England, Wales and Scotland were further subdivided into districts, and one of the chief contractors was appointed to perform construction activities in each of the aforementioned areas. The clients' volition was to guarantee the performance of the multi-party Framework Agreement between all

14 general contractors and the subcontractors. The planning implied the establishment of an integrated supply chain in order to organize a full support of the programme coordinated with the subcontractors and suppliers. Both the preconstruction and construction phases were bound by the fixed schedules of the project (British Government, 2008).

The Job Centre Plus programme successfully realized the initial aim of transforming the Job Centre and Social Security Network and managed to save the budget (final cost in 2006 - £737m, expectation of 2003 - £981 m) by 24.8%. The programme has been awarded with the Building Magazine Integrating the Supply Chain prize in 2004, the OGC Government Opportunities Award for Public Procurement Excellence in 2003 and the LABC Services Award for Integrated Site Safety in 2004.

3.1.3.1. Preconstruction Phase Agreement Contribution

The use of the Framework Agreement was beneficial for the establishment of a 16 party framework covering the £737m Job Centre Plus programme, considered and appointed on the equal conditions with all 14 general contractors. It also made the development of the standard preconstruction phase agreement feasible for the real utilisation within the framework of 969 projects, as well as the integration of the comprehensive roles and responsibilities of the project managers. Support of the adjusted workloads among contractors was implemented in a strict accordance with the assessed achievement of all current targets (cost, time, health, safety and environmental impact).

The mere implementation of the preconstruction phase agreement also positively influenced the formerly considered steps of design development, as well as assisted in reaching the advance agreement on the schedule for the construction phase of each project. The identification, management and minimisation of risks have been successfully performed, which resulted in the accomplished integration of the Office of Government Commerce Gateway Process in the framework of the timetable and risk management structure.

3.1.4. Contracting

This part discuss the relevant structures and provisions of the construction contract for the D-B procurement system, rising from the practices used in the previously reviewed case studies. The construction contract significantly influences the exhibited processes and performance during the construction. In case of the ECI cooperation it extends its influence even into the project design and development. Thus, great emphasis for its quality development is needed. Naturally, it is possible to create new and unique contract for every project, however, it is even feasible to use recognized and over time proven templates in order to save time, reduce cost and avoid errors or omissions, as the contracts are usually really complex, complicated and mostly highly important. The investor from the Case study 1 (UK) used for its preconstruction and construction phase single contract according to the PPC 2000 standard form. On the other hand, the investor from the Case study 2 (AU) used by state utilized contracts for separate phases of preconstruction and construction. However, both contract variations are possible to summarize as conditional appointment of a general contractor for the participation in project development and design. The following cooperation turns into the unconditional, when prices and risks are sufficiently analyzed and agreed in order to commence first works on the actual construction site.

3.1.4.1. Design Development

Naturally, the contract form has to clearly set out roles of each stakeholder in order to specify all their responsibilities. Moreover, it is absolutely essential to clarify that any stakeholder involved in the design process is responsible for all omissions and errors of issued documentation which has been prepared by it or to which preparation it has contributed to. Time schedule of the project design reviews and evaluations during needs to be a part of the contract conditions, as the milestones of cooperation has to be met in order to continue in effective and successful collaboration. The biggest contribution of ECI for the design is its value engineering. The general contractor proactive seeking of design alternations is

secured in contract with requirement of periodic submissions of engineering proposals.

3.1.4.2. Pricing

The appointment of the general contractor in the early stages of the project is based on price and even non-price based criteria in order to effectively collaborate on project design and development. After this initial phase the general contractor has to submit the offer based on RAMP or RAP in accordance to previous agreement. Such a price is created with cost rates and key work prices agreed from the initial tender, if such a criteria were proceeded, extended with other rates and prices within the pricing list developed during the first-stage cooperation or just on those. If the offer satisfies the investor and the contract is prolonged for the following stage, the construction can start. It is possible and even recommended to apply the shared pain and gain strategy in order to motivate the general contractor to effectively seek any cost saving during the construction works. In such a case any positive or negative difference from the lump sum contract price will be divided between stakeholders involved in the contract according to a specified ratio.

3.1.4.3. Risk Management

The extension of the conditional appointment of the general contractor for the project delivery phase is based on the overall project price submission, which is adjusted with the risk load integrated in the project. Thus, the investor effectively moves the risk responsibility to the general contractor. In order to reduce negative influences, the general contractor has to profoundly identify the possible project risks and develop their effective management in the initial phase. The ownership and suggested action plan in case of any risk occurrence for all identified risks from previously created risk register has to be specified in unconditional contract version.

3.1.4.4. Communication

Communication is the key element supporting successful collaboration in the project as well as the considerably new conditions in contract in comparison with contracts in use within traditional construction delivery method. The basic feature in such a section requires creation of alert system among the stakeholders. Each involved stakeholder is naturally aware of any error, discrepancy, omission or legal claim formation throughout the project lifecycle, however, the conditional and immediate warning of any other involved stakeholder has to be required. Additionally, the clear communication channels have to be stated in the contract to support the daily cooperation and avoid any need for work duplication or even rework.

3.1.4.5. Team Integration

The contract creation has to naturally precede the future cooperation analysis and part of it is the development of common information system within the project. The level of information sharing has to be proposed in order to support the collaboration and team integration, however, only as far as reasonable from the point of view of different contract sides with slightly different project expectations. The system has to be specified in contract together with dispute solving unified procedure and decision making hierarchy to avoid major process disruptions. The partnering agreement between involved stakeholders is greatly beneficial expansion of contract agreements in terms of collaboration as well as in other spheres. It supports the awareness of any possible project threats. Moreover, the problem solving process is more natural and cooperative based on maybe limited but shared economical result performances of each stakeholder.

3.2. SWOT Analysis

According to its principle and features, the SWOT analysis is an appropriate tool for the strategy overlook in the time of low information availability. Such a method sufficiently combines general examination of the system as well as of its surrounding environment, as the aim is to correctly consider the external and

internal factors coming into account. Therefore, the SWOT analysis tool perfectly suits to the strategy development process due to its ability to identify and interpret the available approaches toward the plan in order to reach real improvement. The ECI principles implication into the CZ public funded construction sector is in this point of time challenging strategy possibly resulting in great deal of improvement; however, the plan is currently preferably general and shallow. Moreover, the profound strategy development process requires clear and coherent foundation in terms of CZ public spending long-term vision which is still missing and it makes any more specific and deeper strategy build-up effort inefficient and maybe even counterproductive. Thus, the ECI principles implementation is still in the conceptual phase and SWOT analysis tool is the most suitable to review its characteristics in order to demonstrate its desirable future performance and practises enhancements as well as point out the possible problems. In addition, appropriate focus of the SWOT analysis is on the general idea of ECI principles use within for it feasible public funded projects in the CZ construction sector whenever its enabled with any customized tender procurement system or legal method. As the participant's judgement has straight influence on the analysis' results, and even the purely qualitative approach is used, certain level of subjectivity is inevitable.

3.2.1. Strengths

In other word, identified internal factors of the strategy to employ the ECI principles into the system of CZ public funded construction sector with determined contribution input in the current state and arising from the system's characteristic features. Undoubtedly, those factors should motivate the CZ officials to demand ECI application and thus invest effort in its strategy development.

3.2.1.1. Workload Distribution

As has been stated and shown above, the workload distribution within the use of ECI principles in the project delivery moves the main workload up front in comparison with the traditional project delivery methods, which are currently solely

used in the CZ public funded construction sector. Such a major change offers better possibilities in project improvement through moving of the decision making process in the earlier stages of development, where the variation is greater and any change is cheaper.

3.2.1.2. Final Result

The main purpose of the ECI implementation within the CZ public funded construction sector is to improve its current considerably poor performance and to enhance the overall project results. It is widely recognised that the private operators are generally more sufficient in terms of their processes than the public sphere and ECI basically deposes certain responsibilities and operations from the investor to the general contractor. Moreover, the early involvement of the stakeholders with possession of field knowledge, experience and expertise on the highest possible level, ensured by the sharp competition prevailing in the CZ construction sector, results in quality decision making and improved design development leading to rework reduction. Thus, the positive contribution to the project delivery and even lifecycle performance is expected in terms of cost, time and quality.

3.2.1.3. Risks Management

The negotiated D-B procurement system within the legal frame of the two-stage tender process in comparison with the D-B-B procurement system through traditional tender process resolve in risk adjusted price agreement at the time, when thorough risk analysis has been undertaken. With the increased level of the general contractor involvement into the project delivery in terms of both cooperation and even time scale, the allocation of certain risk load moves away from the investor. Moreover, in-time identification and profound understanding of project risk exposure by the general contractor enabled through the early involvement result in appropriate risk management plan development, as the private sector bodies operating in the conditions of CZ construction usually feature with good practises in use.

3.2.2. Weaknesses

Additional internal factors of the strategy to employ the ECI principles into the system of CZ public funded construction sector are identified while some negative elements are illuminated. Furthermore, those factors deserve greater further attention in order to eliminate or at least minimize their probable effect.

3.2.2.1. Complexity

Any major construction project is, by its nature, a complicated process which with the use of ECI principles becomes genuinely even more complex by involving a high number of stakeholders for a longer period of time. Moreover, economic or interpersonal problems among stakeholders can have a negative influence on the cooperative workflow. Thus, the importance of the contract arises, as the ECI process can turn back to non-collaborative and adversarial process with increasing number of litigation between stakeholders caused by poor quality of laid out relations and conditions. Additionally, it is crucial to mention that the negotiated D-B method is a complex process based on a complicated contract which basically has to cover the phases of service agreement and construction delivery, which are of a substantially different basis.

3.2.2.2. Cost Distribution

Even though the great contribution to the overall project result reached with the redistribution of workload up front the project delivery lifecycle along with the justification for such a change has been previously proven, the increased need for effort and resources in the earlier stages in the project arises. Since the general contractors, as well as the key members of the supply chain, are involved from the early stage, the increase in funding is significant. Even the involvement of the investor senior staff is needed for longer periods of time, which leads to additional cost. Moreover, such an increase means higher possible loss in case of project cancellation.

3.2.2.3. Bureaucracy

As the complexity of any construction production is significant and its result has serious impact on its surroundings as well as users, the legislative load on the process is massive. It is undisputable need for regulation of construction production in terms of its safety, quality and environmental effect in the interest of all the citizens. Moreover, the public sector has to secure its production in terms of corruption and performance. However, the CZ suffers with high bureaucracy involved in the legal processes. Additional load of legislation arising from its membership in EU make the situation more complicated. Therefore, any new strategy to implement new and improved practises, have to undertake long journey before they come into use. Furthermore, the use of the ECI principles in a project increase its complexity and additionally requires, for its success, a great portion of collaboration which is problematic to perform in system with big load of bureaucracy involved.

3.2.3. Opportunities

Such factors are external to the system, as they arise solely from its surrounding conditions, with identified positive influence which can support the overall and desired performance improvements. As those factors arise from the outer area of the system, the potential influence is limited. However, the beneficial contribution can play major role in the desire for ECI implementation.

3.2.3.1. Collaboration

The alternative contract solution used within the ECI based construction delivery offer greater possibilities to involve collaboration among the major stakeholders. It is even possible to state that the collaboration is one of the crucial conditions for success of the implemented change in project delivery process. The collaboration presence, especially from early stages of the project, promotes the clearer understanding of involved parties in terms of any technical matters as well as greater awareness of any possible risks. Thus, the project development and delivery can be properly managed resulting in mutual benefits for all involved

parties. Additionally, it is widely known that collaboration enables to use full team potential and improve long-term relationships among the involved members from which can both investor and contractors gain enhanced overall outcomes of single or even multiple following projects.

3.2.3.2. Knowledge Exchange

The greater involvement of private bodies into the CZ public funded construction in terms of the time scale and depth of collaboration is meant to preferably improve the result of the specific project. However, the contribution to the CZ public funded construction sector performance should reach the maximum possible level especially through knowledge exchange from the long-term point of view. It has been previously mentioned that private construction sector operators on the CZ market possess high standard field knowledge, experience and expertise which can enrich the considerably out-of-date and low performing practises within the public sector. The improved development of a specific project, as well as knowledge exchange, can be reached through effective collaboration and information exchange. Thus, the process should operate only with unified information at the high level of clarity and information should be stored in protected data capture accessible for each stakeholder in time.

3.2.4. Threats

On the contrary, other identified factors arising from outside of the system but with unfavourable outcomes belong in this section. Those factors bring difficulties for the CZ officials in the ECI principles implementation justification within the long-term public spending vision. Moreover, such factors deserve closer attention in following and deeper study, as their negative influence has to be brought to a minimum affordable level to avoid the strategy failure.

3.2.4.1. Corruption

The challenge in any public sector of any country is to reduce the presence of corruption to a minimum possible or at least affordable level. The construction

sector in addition, is generally one of the most affected sectors with corruption, as the projects operate with large amounts of money and involves high number of people. Such a factor can negatively influence the successful implementation of new practises within the CZ public funded construction sector based on deeper and longer collaboration and with employment of ECI practises in order to enhance its current performance, as the CZ is recognized for its considerably high portion of corruption load throughout the public sector within the member countries of EU. The alternative non price based criteria awarding, the initial authorities' inexperience with the system and the contractual alternation can possibly cause the biggest danger in terms of corruption increase. Thus, the need for profound and coherent strategy arises as well as involvement of independent cost estimators and professionals into the process of tendering and contract milestones reviewing.

3.2.4.2. *Adversarial Conditions*

Not two project are the same and the need for different approaches in terms of methods for their procurement is recognized. The CZ public funded construction sector currently still use solely traditional methods for the construction project delivery which has led to the system becoming obsolete with limited or even no desire for further education and improvement. Technology involved in the construction works itself is up-to-date; however, mind-sets of people involved from the public sector tie to the traditional procurement system. Thus, the system is shackled with status quo and fear of change or job loss, which has to be broken with properly managed change through issued strategy involving the education and training of public operators. Moreover, with economic crisis hit, construction market of the CZ suffers with highly adversarial conditions, which can seriously and negatively affect the new strategy implementation, as any construction project cannot result in overall great success without support and will of involved stakeholders in relation of their contract or even outside of its borders and it is crucial and desired even for the new way of cooperation.

3.3. Implementation

Implementation of any new principal into the working system and preferably on the public level is a challenging and complex process including people, culture, structure, legislation and technology. Therefore, such an action requires a significant amount of time, energy, and recourses. ECI implementation into the CZ public funded construction sector would require a general change in its practises, which could bring the breakthrough in the current status quo. Thus, upcoming major change undoubtedly brings certain level of risk that must be by the CZ representatives reduced to a minimum possible and affordable level. The high importance of well-prepared long term vision and sufficiently executed realistic change strategy is illustrated in the Figure 15, which shows the J-curve visually clarifying the process of expected change in the CZ public funded construction performance in time.

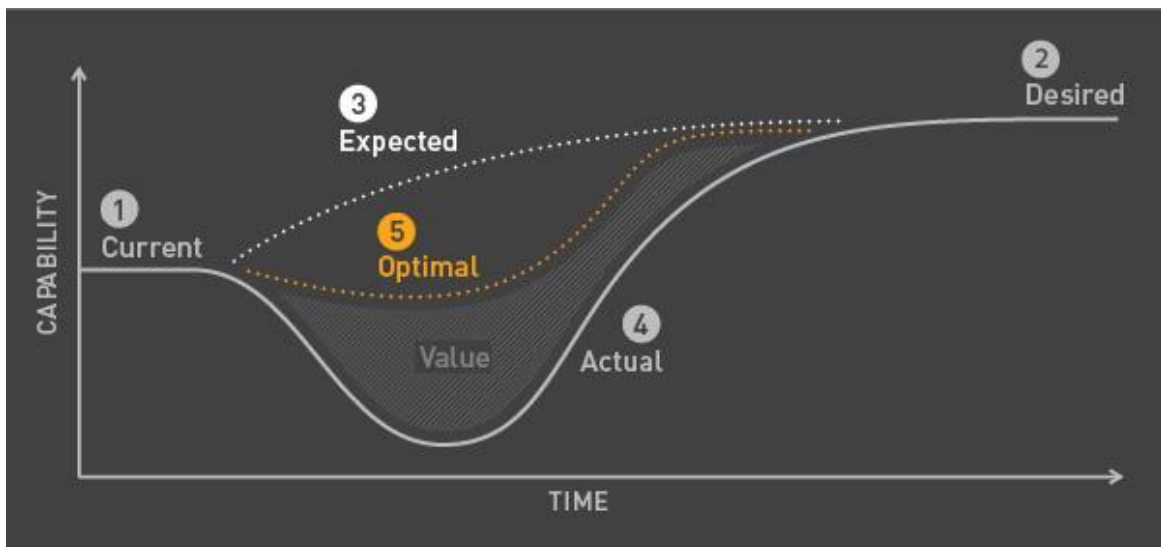


Figure 15: capability J-curve for ECI implementation in time (ANGL, 2013)

1. Current situation is level of capability before ECI implementation.
2. Desired situation is ideal and planned level capability in future after successful ECI implementation that fostered decision for undertaking the change.
3. Expected curve show the mistakenly expected unreal capability progress.

4. **Actual curve show the actual capability progress of unprepared change. The unexpected fall of the performance exhibited can cause stress in the system and certainly increase costs.**
5. **Optimal curve show the optimal capability progress of well-prepared change. The CZ representatives have to precisely describe functional strategy to reach this curve.**

3.3.1. Vision

The CZ has been always struggling with creation of any coherent policy for its public spending throughout most of its sectors. Moreover, its policies usually lack the long term vision and preferably focus on short term goals, as there can be seen a high populism in its system. For instance the CZ had previously issued a document called Superstrategie - Green Paper, describing the core of its strategy for the future public spending in transportation in order to improve its performance and announcing the creation of the document called Superstrategie – White Paper (Ministerstvo Dopravy, 2011). The following document should have provided the involved authorities with the detailed toolkit for the implementation of the strategy and appointed some of the needed legislation change; however, it has never been issued. Despite the strategy has never been implemented, its suggestions for alternative financing for the projects with use of the PPP form is worth mentioning. Unfortunately, any further plan for the alternative procurement systems promotion was not discussed either. Therefore, the only emphasis within the public funded construction procurement is for careful preparation of a tender and project documentation to minimize possible claims and extra works compared to the contract. This is mainly caused by the rise of claim or any contracts change in the D-B-B procurement system, which is solely used within the condition of the CZ public funded construction, causing significant disruption and possibly additional cost because of the non-collaborative way of work in the project.

Currently there does not exist any coherent or even partially valid strategy defining the behaviour of the CZ authorities during the public funded construction procurement in order to secure its efficiency and performance. Moreover, in the CZ does not exist any legal option of procurement and delivery system alternation

to solely used D-B-B. Traditional system is maybe proven by time, familiar to people involved and most suitable for some type of project, however, the large and complex projects as well as modern projects with demand for innovation require different solutions in terms of their procurement system to successfully reach expectations of the public client from their delivery. Thus, the CZ has to develop complex and long term vision to follow, which is promoting clearly stated ideas of focus on the final result enabled with efficient process of its delivery secured by thorough planning in the initial phase in order to save public resources. Even though the CZ public procurement legislation is aligned with EU directives, the practise within the authorities lacks use of alternative procurement systems to the D-B-B. Thorough planning in the initial phase has to analyse expectation of the project as well as the project characteristics in order to choose for it most suitable procurement and delivery method and properly plan the process execution. Efficient process of the delivery is possible to secure with the competition involvement and education and training of authorities. The focus on the final result can be promoted with collaboration of stakeholders involved in the project, as their goals are aligned through sharing of possible savings. Thus, the above mentioned ECI principles or even BIM workload are important part in such a vision, as they can notably contribute to the desired public funded procurement performance enhancement. The support material for the creation of the customized and challenging vision for the CZ public funded construction sector dealing with its specific problems in frame of the currently prevailing conditions certainly is previously issued and in its purpose similar vision of the UK. According to the British Government (2011) its vision “calls for a profound change in the relationship between public authorities and the construction industry to ensure the Government consistently gets a good deal and the country gets the social and economic infrastructure it needs for the long-term“ and even demand to challenge previously used industry business models and practices, as it plans ”that the public sector will become a better client - more informed and better co-ordinated when its requirements are specified, designed and procured.“

3.3.2. Strategy

To reach any future improvement in currently considerably poor practises, any CZ authorities' actions have to be aligned with its long term vision and avoid stepping out of the suggested path of improvement. To enforce the stated vision based on collaborative workflow and precise planning up front the project execution, the CZ has to issue its implementation strategy. It involves legislation update offering different procurement systems, authority executives' education and training for the new way of cooperation and requirement for analysis-based approach to the project execution design. Undoubtedly, the application of the ECI principles offers great possible performance improvement, as it is widespread known that contractors and key supply chain members possess a great deal of experience, knowledge and expertise. All of which are potentially significantly valuable for the project front end development. Moreover, the private sphere of construction market in the CZ conditions is markedly efficient and modern in terms of its production practises in comparison with the public. Thus, its deeper and longer employment could greatly contribute in future improvement and even from the long term point of view lead to creation of stable cooperation with knowledge exchange.

The implication process requires time and continuous effort within clearly stated execution plan and its contribution will only be visible over time. Moreover, the use of such a method at its highest possible level is not feasible straight away and should require different and increasing steps of application. That should avoid the risk of unrealistic expectations of involved stakeholders from such cooperation (Walker D.H.T and Lloyd-Walker B, 2012). To properly educate and train the involved authorities as well as private bodies, expectation material has to be provided. Last but not least, the ECI principles implementation within the CZ public funded construction should thus consist of gradual process with continuous effort. The first stage desires to establish the system which is able to smoothly perform public funded projects delivery with use of negotiated D-B procurement system within the legal frame of a two-stage tender, where the ECI principles employments as well as its overall result benefits are still limited. The second

stage seeks the full-scale ECI principles application in order to reach maximized performance improvement with use of the CM procurement system in the public funded projects legally through framework agreement. Moreover, the comprehensive and coherent toolkits for the project planning in different spheres have to be developed, issued and promoted as part of the strategy to easier proceeding of the strategy by the end users or in other word procuring authorities. The UK successfully implied the ECI principles in its public funded construction and to enable do so their officials had to issue the action plan. Thus, the CZ can find in the UK model valuable information for development of its own unique future strategy. The British Government (2014) within its strategy stated that “the presumption for all the new models of procurement is that high levels of supply chain integration, innovation, and good working relationships between client and industry will lead to a significant change in the costs and risks of construction projects“ and issued tools in order “to assist clients, consultants, Tier 1 contractors and Tier 2/3 subcontractors and suppliers to understand and adopt a consistent approach to the procurement and delivery of the Cost Led Procurement, Integrated Project Insurance and Two Stage Open Book models.“

3.3.3. Influential forces

Every change is influenced by internal or external forces. Proven tool of force field diagram efficiently enables to effectively identify, organize and operate driving or restraining forces for the ECI implementation process. “Starting from the premise that any given present situation represents equilibrium between forces driving change and forces resisting change, which are in tension (i.e., a force field) the point is to identify the forces, their direction, nature and strength, and how they can be modified” is the basic principal of force field diagram by Green (2007) that is graphically shown in Figure 16. Driving or restraining forces should be identified in by the change challenged areas of people, structure and culture of the public sector. ECI implementation offers the CZ public funded construction procurement wide range of technological and other benefits as well as possible risks as mentioned above. They can also be considered as the possible forces. Based on proactive effort to implement new technology and new way of workflow it is

obvious that the CZ desires to move forward from the current state and increase its capability in spite of certain level of natural resistance. The force field diagram results extended by driving forces benefits for the ECI application within the CZ public construction sector are shown in Figure 17.

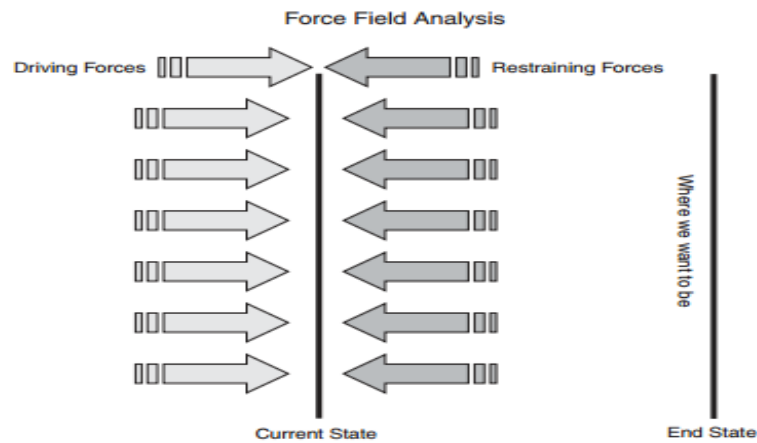


Figure 16: force field analysis principal (Green, 2007)

Driving forces	Driving forces benefits	Restraining forces
Bureaucracy reduction Process and production improvement	ECI reduces work duplication and increases efficiency of work. Moreover, it unifies the knowledge and experience exchange.	Natural fear of change Lack of knowledge and skills
Enhance team cooperation and interoperability	Each stakeholder unit as well as each team member should work together and share information and their ideas. It leads to productivity enhancement.	Unit complacency with current situation
Reach expectation of procuring authorities Achieve highest value for money	ECI offers great contribution for project development. It enables design improvements, cooperation support and expectations alignment.	Fear of failure and negative promotion Corrupted and mistrusting climate

Governmental decision and pressure	The CZ proactively wants to implement ECI as the reaction on market pressure in order to reach future production improvement through involvement of efficient and proven operators from private sector.	Fear of unknown and culture disruption
Possibility of current conditions and job satisfaction enhancement	ECI implementation into the system is requires destructuralization and creates new positions, which enables participants to show up and succeed.	Fear of current status or job loss

Figure 17: extended force field diagram results for the ECI application within the CZ public construction sector

3.3.4. Contracting

Coherent, precise and complete contract conditions are the basis for any cooperation among stakeholders in any sector. Especially the construction sector in the CZ and even in most other countries worldwide is characterized with adversarial conditions with a high number of disputes, as has been previously stated and is widely recognized. Therefore, the desire for customized and well developed contracts between all involved stakeholders in any construction project is essential for success. The presence of corruption in conditions of CZ public funded construction sector has been previously recognized. That together with other factors underlines the need for independent judges' invitation into the process of contract milestones review. The bottle neck of the ECI process application throughout the CZ public funded construction sector, from the contractual point of view in terms of possible corruption, is the time when the conditional contract changes into the unconditional. The awarding criterion is based on the submitted offer, as result of conditional cooperation, including the price in previously agreed form of RAP or RAMP. To reduce risk of the corruption leak into the process in order to secure improved overall result of the ECI employment in a project, the review of the offer has to be undertaken with recognized and independent professionals. The quantity survey including the

average market pricing has to be created to analyze the offer for its beneficial contribution to its price, as result of previous cooperation. If those conditions are not met, the prolongation of contract is cancelled. The report of the analysis has to be prepared carefully in a unified form and be accessible for public in order to ensure the process transparency.

As the D-B-B procurement system is solely applied throughout the CZ public funded construction sector, the traditional building agreements for one-off projects with mostly construction works and limitedly engineering provision are in use for the general contractor contracting. Therefore, currently used contract templates lack the adjusted specifications for alternative way of contracting, especially in terms of conditions for previously described fields of Design development, Pricing, Risk management, Communication and Team integration. The elegant, time-tested and complex solution is to accept the foreign system of contracting which is generally recognized, as for instance the FIDIC where especially the Silver Book fits the purpose the most. "The FIDIC includes a note that a two-stage tender procedure may be adopted for some tenders which include contractor design. The first stage would comprise technical proposals, on which the investor may comment before he invites one or more of them to submit final priced offers. Investor makes the payment to tenderers for the additional work in preparing a second stage tender. It may be necessary to discuss and modify the particular conditions in order to satisfy both sides" (Totterdill, 2006). As the negotiated D-B procurement system enabled through two-stage procurement method is of a complex matter, and especially due to its application recommendation for preferably large in scale projects, only the basic legal frame can be taken from FIDIC and significant additional effort is needed for complete and final contract development with desired emphasis on its quality.

3.3.5. Sector Professionals Assignment

In the 2008 the massive economic crisis hit the EU economy and in response to then current situation the CZ government established the NERV in order to overcome the significant drop of the national economic performance and

minimize its long-term effect. The core idea was to gather the professionals and representatives from major economical spheres as well as from the academic field in order to advise the best course of CZ government future actions to seek the maintenance of economic growth. As a result, the NERV submitted at the end of its operation report about economic conditions within the CZ market as well as about the global economic situation throughout the EU and worldwide together with the most important part including suggestions for future plans (Vláda České Republiky, 2010). The effect of its contribution is questionable due its arguable member cast and discussion regarding it is not within the scope of this work. However, the core idea behind NERV is undoubtedly beneficial and has even been already applied in many foreign countries with great success. Therefore, the creation of NRMPOS modeled after NERV example appears understandable in order to support and secure the future CZ public funded construction performance improvement.

The NRMPOS should consist of independent construction field professionals, academic field members, financial sector professionals and legislation experts to cover all the major influential forces of the construction sector overall performance. The NRMPOS sphere of activity could be even extended in comparison with NERV, as the CZ public funded sector requires breakthrough in its practices and any major change brings with itself a great danger of unknown. Thus, the main task of the NRMPOS should be to continuously assess the situation and advise the CZ executives as well as to develop a specific and challenging long-term plan and issue supporting materials for authorities. The performance and effort of such a board has to be coherent and complex in terms of its output, as can be seen for example in the case of the UK with their regular reporting, long-term planning and toolkits issuing (for instance Egan Report, Government Construction Strategy, Infrastructure procurement routemap for all). Moreover, the significant emphasis of NRMPOS has to be given to secure the CZ public funded construction sector against one of its most dangerous factors which is corruption. Once the major change in the CZ public funded construction sector practices comes into practice, the end authorities which are actually procuring projects with the public funding will need

considerable support in order to secure process against corruption and legislative mistake. Thus, the toolkits for choice of project's most suitable procurement system according to its characteristics and size as well as following process instructions are needed and NRMPOS should be assigned and responsible for their development.

3.3.6. *Knowledge and experience capturing*

The ECI use within the CZ public funded construction should, based on its principles and successful implementation, transfer knowledge and experience from the skilled general constructors, which are collaboratively involved in the project for an extended period of time in comparison with traditional methods, to public representatives of project delivery team. The initial task is to improve specific project results, however, from the long-term point of view, it is necessary to effectively capture gained knowledge and experience and enable it to spread among the whole CZ public funded construction sector. The CZ previously created POVZAK to satisfy the need for more effective competition as well as transparency of its tender processes. The service of such a portal could and definitely should be extended in order to serve the need for project procurement and delivery data capturing, as the sufficient knowledge of past is the basis for any efficient future enhancement.

The knowledge and experience capture is possible through requirement for a report creation after the project completion. The information clarity is possible to reach through unification of the reporting system and division of information according to project's type and size. Any information loses its purpose if it is not delivered to the right hands in-time and thus the POVZAK can enable to do so, as its database is easily accessible through internet. According to currently valid Public Procurement Act No. 137 / 2006, any new tender has to be published on the POVZAK. Therefore, the report upload can be made a mandatory condition for successful disclosure of the tender on the portal. Moreover, it would even enable the information seekers to obtain a contact for the previous project performing

authority in order to make a future appointment to discuss some of more specific queries.

4. Conclusion

The undertaken research carefully followed its deliberately designed research methodology in order to provide a, within the project's limitations, neutral and thorough overview of the CZ public funded construction sector, including the analysis of its possible future performance improvement through alternative tendering as suggested ECI.

Thorough critical evaluation of the current practises in use throughout the CZ construction sector with a particular emphasis on the public funded sphere provided an insight to the system. Moreover, it enabled the illumination of its most significant bottle necks and areas for possible future enhancements. Overall, the CZ public funded construction lacks procurement system alternatives to the traditional method in use in order to provide fit-for-purpose delivery process according to the specific project's characteristics.

Moreover, the CZ misses its long-term public spending vision leading to low demand for innovation within projects, and bureaucracy increase, mostly within its newly issued legislation, instead of its contribution toward continuous improvement. However, the CZ government is the construction sector's biggest customer. Owing to this exclusive position, it has the ultimate capability to effectively improve the prevailing sector-wide practises, and as such should properly utilize this capability.

Many alternative procurement systems have been developed and applied worldwide; however, their level of achieved success and their suitability for the CZ are questionable. Furthermore, the procurement of construction projects, and especially those which are funded with public resources, is a complex matter. Therefore, the possible use of ECI principles within the CZ conditions was solely studied and analyzed in the undertaken research, as it offers a great capability for its future performance improvement. The case studies within the research

provided the confirmation of the positive influence of the earlier and more collaborative cooperation with the general contractor on the project results. Moreover, they proved the possibility of ECI application throughout the public sector, as evidenced in particular cases of UK and AU. Yet, it is important to realize that ECI use fits only certain projects, as mainly complex and large-in-scale ones are suggested.

However, due to the current state of CZ system readiness, the ECI implementation was recommended to be divided into phases with different level of core principles employment. Moreover, the CZ public funded construction sector should seek continuous and sustainable improvement of its practices instead of a single major change, as it undoubtedly appears less dangerous and more effective from the long-term point of view. Resulting from all above mentioned, the negotiated D-B procurement system, legally empowered through the two-stage tender method, should be enabled and promoted for use at the first stage. It offers the desired and significant improvements, while still granting the investor a great portion of control throughout the whole process in order to prevent corruption and failure.

After the ECI collaboration from the first stage is firmly established among the CZ authorities, further research for possible extension of the ECI cooperation should take place to suggest following actions in seeking future performance improvement in this field. Nevertheless, the undertaken research suggest, based on the current CZ situation, as well as on example from UK, to further extend the ECI principles employment through the CM procurement system legally empowered with the framework agreement method due to its openness and promise of significant reduction of procurement cost. The process review of both methods, together with the general ECI risks and benefits, were provided as part of the research and later confirmed with analyzed case studies. Yet, the depth of both analyses differed in accordance with the previously stated amount of interest in each method based on the current CZ situation.

The development of suggestions for a successful and smooth implementation process of the ECI principles within the CZ public funded construction sector as well as its supportive actions were part of the research, which was conducted last. Any future improvement in system requires planning and executing actions. Thus, the development of coherent and challenging vision for any spending is needed in order to secure a sustainable performance growth of CZ public funded construction sector. Moreover, any future actions of CZ officials have to be aligned with such a strategy to avoid increase of unnecessary bureaucracy in the system. Specifically, the long-term CZ construction strategy, with demand for alternation of procurement systems including the first stage ECI principles implementation, has to be developed and supported with corresponding legislation release, as was discussed in more detail throughout the research. Establishment of the NRMPOS was recommended in order to secure the strategy development and enforcement among the CZ public funded construction sector. Its assignment to release of the fit-for-purpose procurement system choice toolkit should promote the right use of ECI principles among the CZ authorities. Furthermore, the successful ECI implementation should be supported with education and training of CZ authorities for its use within their projects. Therefore, the NRMPOS should issue the process instruction and internet accessible data capture on POVZAK. The gathering of information from reports of previously performed projects should be established. Last but not least, replacement of the lowest price criterion in the tender awarding process, with MEAT strategy or its customized option, is absolutely crucial for the success of the ECI implementation in the CZ conditions.

The research was designed to provide information basis about the current practises within the CZ public funded construction procurement and describe the general idea and process features of ECI principles, as it aimed to suggest customization of such a method for CZ conditions together with its implementation support. That has been achieved through the review of foreign models and based on a critical analysis of domestic conditions. The motivation for such a research had been the undoubtedly beneficial contribution of early general contractor assignment to construction project. That is a common practise within private

sector, as its significant contribution in terms of field knowledge, exercise and expertise to project is expected. Moreover, the private sector operators, in comparison with public bodies, ordinarily reach a higher level of efficiency within their processes due to the competitive conditions. The CZ authorities are able to transfer above mentioned benefits and promote the value for money approach throughout their performance via employment of ECI principles in suitable projects, as has been proven in case studies within the undertaken research.

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