Leading, lagging and perceptive performance measures in the construction industry

Mladen Vukomanović
University of Zagreb, Faculty of Civil Engineering, Croatia
mvukoman@grad.hr

Mladen Radujković
University of Zagreb, Faculty of Civil Engineering, Croatia
mladenr@grad.hr

Maja Marija Nahod
University of Zagreb, Faculty of Civil Engineering, Croatia
majan@grad.hr

POOR PERFORMANCE MANAGEMENT is one of the main reasons for such low image that the construction industry has in the society. It is percieved as the worst, ineffective, inefficient… Even though Key Performance Indicators (KPI) should be at the heart of every performance system, many organizations do not acknowledge their importance and thus are measuring the right things wrong and vice versa. This paper elaborates distinction among three types of KPIs: leading, lagging and perceptive, and explains their role in the performance measuring process within the construction industry. Even though many authors emphasised the importance of implementing KPIs, literature review showed that world's practice still does not recognize the distinction. Furthermore, survey taken across Croatian construction industry, showed that: 90% of proffesionals understand KPIs' importance, 71% used some kind of performance indicators, 63% used KPIs for internal benchmarking, 43% showed high interest in such systems, but only 28% understood above-mentioned distinction. The survey also showed that even though the managers percive all three types of KPIs important, they are still not implementing them in the practice. The paper concludes that the use of all three types of indicators is the prerequisite for benchamarking, strategy alignment and realistic goal setting.

INTRODUCTION

Even though there has been a huge amount of research done in the area of project management, construction industry has issues with poor performance (Latham, 2004; Eagan, 1998; Beatham et al., 2005…). The industry suffers from many problems, e.g.: high level of fragmentation, dispersed structure…, and is falling behind other industries. In 1999, construction engineers spent more than 1 billion £ on rework (Nicholson, 1999). In 2003, private companies have spent a 1,5 billion £ on tools for performance measurement (Edwards and Thomas, 2005).

Concept of performance management is still young and has emerged in last two decades (Sharif, 2002) as a logical response to questions such as: "How are we doing business?", "How are our projects (firms) performing?", and "Are we investing in the right project and what benefits are we gain-

ing through them?"... Neely (1999) stressed out seven reasons for managing performance: growth of competition, specific initiatives of improvement, national and international quality awards, change in organization roles, change in external demands and power of information technologies. Latham (1994) and later on Egan (1998) concluded that construction industry must replace the standard market competition with long-term relations based on transparent measurement of quality and efficiency. Through the last decade, there has been a lot of research activity in this area, but a small number of articles covered critical (key) performance indicators and even smaller studies concentrated on construction. Literature review showed that traditional systems, based on financial measures, cannot integrate all factors that are affecting performance of projects and organizations (Freeman and Beale, 1992; Kaplan, 1983.; Kaplan, 1984)

Performance indicators are compilations of information that are used to: measure and assess performance (Edwards and Thomas, 2005) and to give the final mark of company's efficiency and effectiveness. Construction managers deal with a large amount of performance indicators. Often they are measuring the right ones wrong, and vice versa, and so form a distorted image of performance. The fact that only 34% of projects meet their time objectives and 51% have issues with cost (Standish Group, 2003) shows the importance of improving the performance.

This paper brings the importance of KPIs closer to the reader and examines their definition, structure, purpose and role in construction processes. It sumarizes efforts gained in the area of KPIs untill today and compares them with results gained trough a structured survey taken across Croatian construction industry.

Key performance indicators (KPI) or Key performance results (KPR)?

Performance management is just part of larger system of business improvement. For an effective system, managers need a balanced set of performance indicators (Beatham et al., 2005; Kaplan and Norton, 2001; Neely, 1998, …). The results should be: benchmarked, incorporated into strategic priorities and then transferred, and cascaded in to activities and processes. Still, the majority approach to performance management in intuitive and "ad hoc" fashion.

The Royal Society of Arts, Manufactures and Commerce (RSA), for more than 15 years ago, gave a vision of a modern business system: "*To achieve sustainable business success, on a demanding World's market, company must…, use the relevant set of performance indicators*" (www.thersa.org). KPIs represents basis for measuring business and project success. The purpose is to enable the measurement of performance within companies and the industry, and to initiate benchmarking. Besides direct advantages, KPIs are used as means of communication within stakeholders to inform them about constant improvement endeavors. The largest performance association in UK, The construction excellenceworking group, defined KPIs as: "*A Key Performance Indicator*

(KPI) is the measure of performance of an activity that is critical to the success of an organization" (www.constructingexcellence.org.uk).

The majority, including EFQM, named the whole set "KPI", even though the lagging measures all called the same. We will name the whole set as Key Performance Results (KPR) to avoid the confusion (see figure 1).

KPR structure

If one observes the list of company's reports and tries to find out who gets the information and is that person able to affect it, he/she will often find a small number of such correspondences. Thus, the information is slowing system's efficiency and effective decision-making. Managers must primarily focus only the information on which they have direct influence. To help managers in the maze of chaotic reports, during our last research (Vukomanovic, 2006), we derived a list of elements that every KPR should include. These are: 1 Name, 2 Purpose, 3 Goal, 4 Formula, 5 Frequency of measurement, 6 Source of data, 7 Who is responsible for KPR, 8 What is their role, 9 Alignment with the strategy and other processes, 10 Impact on other KPRs. It is crucial to involve strategy alignment (ad 9) for effective performance management systems. Often this link is conducted trough Critical Success
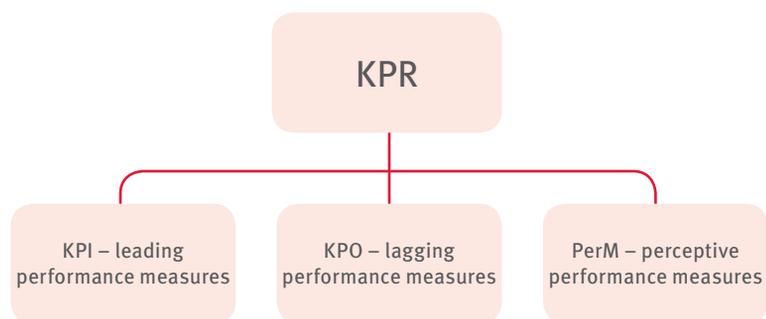

Figure 1. **KPR classification**

Factors (CFS) as the representation of higher business objectives.

KPR classification

We have devided indicators on leading (KPI), lagging (KPO) and perceptive (PerM) measures. Only few models made such a distinction (e.g. EFQM excellence model). We found quite confusion among authors with defining and classifying KPRs. In most cases they are confuse KPIs for KPOs and only few acknowledged importance of PerM (Vukomanovic, 2007).

Construction industry, nowadays, mainly criticizes KPRs because of their incapability to change the processes, but only to signalize the performance of already finished activities (Beatham et al., 2004 and 2005). In addition, we have found places where goverments forced down KPRs on to companies, (e.g. in UK) which afterwards produced resistance and antagonism. Managers mainly use KPRs as "lagging" (KPO) or measures that fall behind. "Leading" measures (KPI), unlike "lagging", give a possibility to influence the result and should be used to provoke future decisions and to change result.

KPI – leading measures

KPIs are *indicative* performance measures that assess unfinished processes. KPIs are not in a direct correlation with project outcomes (like time, cost, defects), but are indirect factors (like absence from work, motivation, communication...) that *lead* to the result. Let us use the following example. High level of absence from work can be associated with lack of moral, which can be than connected with week leadership, absence of work, poor work conditions, and lack of motivation... Encouraged with these kinds of indi-

cators managers can introduce corrective measures in order to reduce absence from work and improve the performance.

To implement KPIs properly and set realistic goal, the system must rely on benchmarking (1st, 2nd and 3rd level). Following question explains this prerequisite: "What level of absence is acceptable on our construction site". If managers do not have the information from other sites – and the best practice – they will only assume the threshold and hold on to our intuition and "ad-hoc" management.

KPO – leading measures

KPOs are measures that report accomplished performance and final outcomes and as such do not enable ability to change the future outcome. In most cases, managers use KPOs as KPIs, even though they are not aware

outcomes. Following example explains previous prerequisite. For assessing projects success, managers often use: time, cost and quality – the iron triangle". 10% time breach can easily lead to conclusion that the project's level of efficiency is not satisfactory. However, this KPO does not explain why the delay happened, what caused delay and, especially, on which areas managers must concentrate in order to mend the deviation.

KPOs can be also assigned to a sub-process to affect the outcome of it successor (Beatham et al., 2005). Example of building a concrete framework of a 10-storey building can clarify such conclusion. If time of embedded concrete is measured after each storey, the whole picture becomes more and more visible as project continues. In that way KPOs becomes KPIs or a sub-process KPO (figure 2).
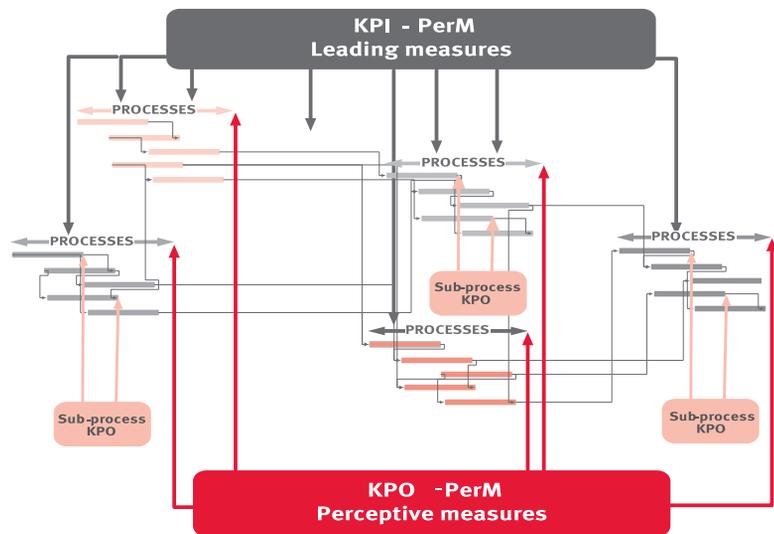
Figure 2. Distribution of KPIs throughout the project

of it (Beatham et al., 2004, Beatham et al., 2005). Companies traditionally observe business performance from financial perspective (e.g. profit, yearly income, share value...). Financial perspective cannot point the key problems and opportunities, but only the

PerM – perceptive measures

PerMs are measures that report stakeholders' perception in projects and can be lagging or leading. (e.g. Construction Best Programme Practice – CBPP, uses PerM as lagging indicators). E.g.

Client satisfaction measured during the execution becomes leading measure. PerMs are usually generated trough interviews and questionnaires.

Still managers should carefully implement them since they can cause repulsivness within project stakeholders (Beatham et al. 2004, Kaplan and Norton, 2000,..). Construction still has not accepted PerMs, probably because of traditional and qualitative approach on solving problems.

Figure 2 shows the applicability of each indicator on the project. KPIs are applied during business processes, because of their ability to anticipate future performance. Even though they do not define the causal connection, they show corrective measures and focuses management on problem areas. KPOs and sub-KPOs are applied on the end of each process or sub-process, respectively.

Insight from practice

The evidence from present researches in area of KPIs – UK

During literature review, we analyzed papers from science databases (e.g. Science direct, Springer…), case studies and publications form performance clubs and tried to find best practice. The review showed low level of awareness of performance management tools, especially KPRs (less than 30% – Robinson, 2002; Cox, 2003). That fact is alarming because of construction's low image (Xiao-Hua and Ling, 2004) and low performance. Furthermore, authors and professionals mainly did not recognize the difference between factors and criteria that Lim and Mohamed (Lim and Mohamed, 1999) so comprehensively explained. The review produced following conclusions:

▶ In most cases, KPOs were used as leading as well as lagging indicators. Performance clubs in UK (e.g. Respect for people, Satisfaction of service, The MGC, CPI…) mainly used KPIs. "Environment issues" and "Safety at work" were only two KPI that were present in most of the cases, but because of legislative obligations, we did not consider them as innovative and novel. "Respect for people" has mainly developed leading indicators such as: absence from the work, migration, loss of staff qualifications, training, etc… and had most of leading indicators.

▶ KPRs were not designed to fulfil specific organization needs but specific association's aspirations. We have also found more than 25 various KPR sets, where each one was proclaimed as the best practice. That kind of chaos can act destructive in terms of benchmarking and strategy alignment.

▶ Many authors (Latham, 1994, Ng et al., 2002, Ugwu, et al., 2005…) observed importance of procurement routes in construction projects and various contracting models. CBPP had an opening role in introducing such indicators throughout different project phases, e.g.; completion of design documentation in design & build contracts is obviously not suitable KPR.

The insights from Croatia

The aim of the research was to assess weather Croatian project managers understood the difference among KPRs. The data was collected trough surveys and interviews, on representative pattern of construction firms in Croatia (Vukomanovic, 2006). We divided companies on Investors, Contractors and Consultants. Since the industry is relatively small, there was not a large amount specific category to analyze it separately. The distribution of respondents (all executives) is shown on figure 3.

After initial pilot questionare (sent to three professors and three CEOs of Croatian construction companies), the final survey (see Appendix 1) was issued. The survey was consitent of two sections. In the first, respondents needed to give general information, like: Name of company, annual income, Construction category, Name of respondent, Function in the company, etc… In the second, respondents had to answer on questions that related to use of KPRs. Likert scale was used, from 1 to 6, to assess the importance of a given term. Felows and Liu (1997) observed the benefits of using a set of even numbers in scale, with removing the subjectivity by choosing the neutral value. The third part of the survey listed commonly used KPRs in the construction practice. The respondents had to rate their importance in respect to their relevance in measuring overall level of performance. The survey questions were genrated from hypothesis H1, H2 and H3:

H1. Croatian construction industry, regardless to company's category, does not recognize the set of KPRs, as vital part of performance management system.

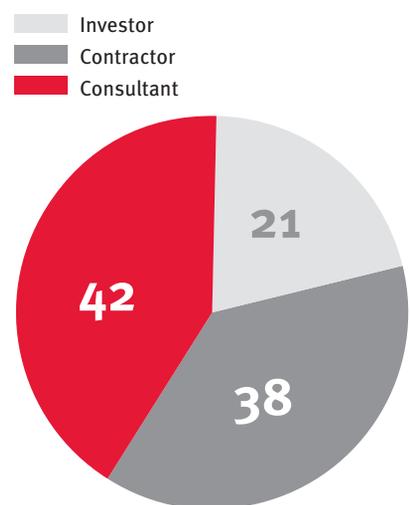Participation of respondents in %, according to respective

- Investor
- Contractor
- Consultant

21

42

38

Figure 3. Distribution of respondents

Questi.:	Respondents (construction firms)																								AVG
q1	5	5	4	5	5	3	3	6	4	4	3	3	4	4	4	5	5	4	5	6	5	5	5	6	4,50
q2	1	1	0	1	1	0	0	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1	1	1	0,71
q3	0	0	0	1	1	0	0	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1	1	1	0,63
q4	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	1	1	1	1	0,33
q5	5	5	4	5	5	3	6	5	4	4	3	3	4	6	6	5	5	2	5	6	6	4	6	5	4,67

Table 1. The responses on questions generated form hypothesis H1:

H2. Managers classify KPRs on leading (KPI), lagging (KPO) and perceptive (PerM).

H3. Managers percieve KPRs even though they are not implementing them in practice.

Interpretation of results

In total, 26 out of 100 targeted Croatian construction firms responded. We found the 26% response rate acceptable, which was compliant with world practice (Fellows and Liu,1997; Zelenika, 2000).

Note:
q1, q5 — Likert scale [1-6]
q2, q3, q4 — yes=1, no=0

Responses on questions, based on H1 (table 1), showed the following:

▶ Construction firms recognized relatively high (4,50) level of KPR's influence on overall business success.

▶ 71% of respondents showed that they were using some kind of performance indicators.

▶ 63% of companies compared internal performance results as improvement initiatives.

▶ 33% of respondents answered that they use performance or quality management system.

▶ 43% of respondents showed relatively high interest in such systems even though did not implement such systems.

These results showed that Croatian construction companies did not recognize a set of KPRs. Thus, **hypothesis H1 was rejected.**

Note:
q6 – yes=1, no=0

Responses showed that the majority (72%) of construction firms still did not understand the distinction among leading (KPI), lagging (KPO) and perceptive indicators (PerM). Low level of understanding, among practitioners (28%), **rejected the hypothesis H2.**

Table 3 shows how Time, Cost and Quality ("the Iron triangle") are still dominant peroformance measures in the construction sector. Thus, top ten indicators (see table 3) included leading indicators, lagging indicators and perceptive measures. This showed how managers percieve KPRs even though they are not implementing them in practice. These results therefore accepted hypothesis H3.

Disscusion

This paper clarified the distinction between three types of performance measures: KPI – leading indicators, KPO – lagging indicators and PerM – perceptive indicators; and stressed-out their importance in construction processes. Unfortunately, we have found that world practice, as well as

Croatian construction industry, still suffers from lack of knowledge from performance management, especially in the area of Key Performance Results and benchmarking.

1	Quality[2]
2	Cost [2]
3	Number of owner interferences[1]
4	Changes in Owner's Project Support[1]
5	Time/schedule increase[2]
6	Client satisfaction[3]
7	Employees' satisfaction[3]
8	Innovation and learning[1]
9	Time/schedule [2]
10	Identification of client's interest[2]
	KPI – [1], KPO – [2], PerM – [3]

Table 3. The overview of responses on question generated from hypothesis H2

High amount of different KPRs, promoted by different performance clubs, resulted with a vague picture of the indicators and repulsiveness within the industry. The worst scenario would be to force down indicators on to companies (e.g. UK case, which resulted with high level of rejection of KPRs) and expect them to comply. Terms like: KPI, KPO and PerM are still not harmonized in literature, which causes communication problems. Furthermore, KPRs are mainly not designed for different procurement routes and specific markets.

Questi.:	Respondents (construction firms)																								AVG
q6	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	1	0	1	1	0,28

Note: q6 – yes=1, no=0

Table 2. Table 2: The overview of responses on question generated from hypothesis H2

This kind of situation makes it very difficult for construction companies to implement benchmarking, try to initiate strategic control and start managing performance; as many authors so harshly stress out (Latham, 2004; Egan, 1998; Beatham, 2005…). Many companies also developed their own sets of KPRs. Main weakness in this kind of approach is the inability to conduct benchmarking and initiate performance management (French, 2009).

We have found that Croatian construction industry uses some kind of lagging indicators, but far from a methodologically and scientifically based KPR set. High level of interest among professionals showed a good foundation for further improvement. On other hand, even though many companies implemented some kind of quality systems (i.e. ISO), they were not aware of its dependence to performance management system and KPRs.

It was interesting to note that even though the construction has still not begun to ackowledge KPRs in practice, the top ten KPRs consited of all three types of indicators. This showed that the perfomance management initiatieves are beginning to emerg in the construction. Therefore, KPRs in construction are still evolving and there are still quite of areas to be covered, e.g.: perceptive measures, leading measures, different procurement routes, target setting, measures selection… In the period to come, the greatest benefit for construction companies would be to acknowledge one common set of KPRs, use them in order to encourage benchmarking (internal as well as external), and thus improve construction's week performance.

CONCLUSION

We can conclude that Croatian practice still falls behind results gained trough researches in the last two decades. Many construction companies are still using only lagging (mostly financial) indicators, developed at the beginning of the last century (Eccles, 1991). We have found that Croatian construction does not acknowledge KPRs as the means improving performance or as the means for benchmarking. Furthermore, few companies showed awareness of distinction among three types of indicators (KPIs, KPOs and PerMs).

Causal connection within causes and consequences is highly complex in business environment (Beatham et al., 2004, Beatham et al., 2005, Kaplan and Norton, 2000,…), especially in construction. Companies should generate every performance indicator from strategic objectives and should try to align them with current business environment. Only thus, companies can control strategy implementation, according to their aspirations, i.e. mission and vision. Since strategy should change, companies need external benchmark of performance, i.e. an external set of KPRs. This issue raises the question of how will internal KPRs reflect onto external ones.

Models like European Foundation for Quality Management, Malcom Baldridge National Quality Award, and such initiatives, represent examples of non-biased external KPR sets. In following years, researchers should try to integrate performance measurement systems (e.g. The Balanced Scorecard, The Performance Prism…) with external KPRs and thus form a holistic model for performance management.

If construction industry wants to improve performance and be an example for the others, it ought to implement KPRs more systematically.

REFERENCES

Beatham, S. et al (2004) KPIs: a critical appraisal of their use in construction Benchmarking: An International Journal, 11(1), pp. n/a

Beatham, S. et al. (2005) Insights from practice: An integrated business improvement system (IBIS) for construction Measuring business exellence, 9(2), pp. n/a

Cox, R. F, Issa, R. A., Ahrens, D, (2003) Management's perception of key performance indicators for construction, Journal of construction management and engineering, 142-151

Eccles, R. G., (1991) Performance measurement manifesto, Harvard Business Review, Vol.69, January-February, 131-7.

Edwards, D. and Thomas, J. C. (2005): Developing a municipal performance measurement system: reflection on the Atlanta dashboard, Public Administration Review, 65(3), 369-76.

Egan, J., (1998) Rethinking Construction, Department of Enviroment, Transports and the Regions, UK., pp. n/a

Fellows, R. and Liu, A., (1997) Research Methods for Construction, Blackwell Science, Oxford.

Freeman, M. and Beale,P. (1992) Measuring project success, Project Management Journal, 23(1), 8-17.

Frencf, S. (2009) Re-thinking the foundations of the strategic business process. Journal of Management Development, 28, 51-76.

Kaplan, R. S., (1983) Measuring manufacturing performance: a new challenge for managerial accounting research, The Accounting Review, 58(4), 686-705.

Kaplan, R. S., (1984) Yesterday's accounting undermines production", Harvard Business

Review, 62, July-August, 95-101.

Kaplan, R.S., (1994): The evolution of management accounting, The Accounting Review, Vol. LIX No. 3, pp. 390-418.

Kaplan, R.S. and Norton, D.P. (2000) Having trouble with your strategy? – Then map it, Harvard Business Review, September – October, 167-76.

Kaplan, R.S., Norton, D (2001) The Strategy-Focused Organization. Harvard Business School Press, Harvard, pp. n/a

Latham, M., (1994) Constructing the Team: Final Report of the Government/Industry Review of Procurement and Contractual Arrangements in the UK Construction Industry, HMSO, London, UK, pp. n/a

Lim, C. S. and Mohamed, M. Z., (1999) Criteriaof project success: an exploratory re-examination, International Journal of Project Management, 17(4), 243-8.

Ng, S.T. et al. (2002): A dynamic e-Reporting system for contractor's performance appraisal, Advances in Engineering Software, (33), 339–349.

Neely, A., (1998): Three models of measurement: theory and practice, International Journal of Business Performance Management, 1(1), 47-64.

Neely, A., (1999) The performance measurement revolution: why now and what next?, International Journal of Operations & Production Management, 19(2), pp. 205-228.

Nicholson, R. (1999) Egan – rethinking construction, paper presented at the Construction Productivity Network Seminar, Royal Institution of British Architects, Birmingham, 1999.

Robinson, H. S., Carrillo, P. M., Anumba, C. J. and Al-Ghassani, A. M. (2002) Business performance measurement and improvement strategies in construction organizations. Loughborough Univ., Loughborough, U.K., pp. n/a

Sharif, Amir M. (2002): Benchmarking performance management systems, Benchmarking: An International journal, vol 9. No. 1, 628-642.

Standish Group (2003) Chaos Report, www.standishgroup.com

Xiao-Hua Jin, FYY Ling, (2004): Engines for change in Singapore's construction industry: an industry view of Singapore's Construction 21 report; Building and Enviroment, 39, 699-711.

Ugwu, O. O., Kumaraswamy, M. M., Wong A., Ng, T. N., (2005): Sustainability appraisal in infrastructure projects (SUSAIP): Part1 Development of indicators and computational methods, Automation in Construction pp. n/a

Zelenika, R., (2000): Metodologija i tehnologija izrade znanstvenog i stručnog djela, Ekonomski fakultet u Rijeci, Rijeka.

Vukomanovic, M., (2006): Key performance indicators in project oriented construction system (M.Sc.), Faculty of civil engineering, University of Zagreb.

Vukomanovic, M.; Ceric, A. and Radujković, M. (2007) BSC-EFQM Based Approach for Performance Benchmarking in Construction Industry, ARCOM 23rd Annual Conference 2007 Proceedings, Reading, ARCOM 2007., 631-641

http://www.constructingexcellence.org.uk

http://www.thersa.org/

APPENDIX 1 – THE SURVEY

Faculty of civil engineering, University of Zagreb, Department of construction management and economics, made this survey. All data contained, will be classified and used only in purpose of academic research.

If You have any question regarding the survey, please contact Mladen Vukomanović, M.Sc., M.Eng., C.Eng., on 01/4639-270 or mvukoman@grad.hr .

Thank you in advance on your consideration to research.

THE FIRST PART: GENERAL INFORMATION ON RESPONDENTS

Please fill in:

Name of the company:	
Phone, fax, e-mail:	
Construction category (civil, infrastructure,...):	
Investor, Consultant, Contractor	
Annual income (€):	
Name, Surname:	
Function (site engineer, project manager, project director, executive board):	
Years of experience:	

THE SECOND PART: INFORMARTION ABOUT KPRS AND PERFORMANCE MGMT.

1. What is the level of KPR influence on overall success of a construction company?

   LOW   HIGH
   1   2   3   4   5   6

2. Does Your company implement a set of KPR as indicators of business assessment?

   Yes _____ No _____

3. Does Your company use a set of KPI in order to compare and assess the performance of various business section within?

   Yes _____ No _____

4. Does Your company implement a model of performance management and/or quality management?

   Yes _____ No _____

5. Please, select the level of KPR importance in performance or quality management system.

   LOW   HIGH
   1   2   3   4   5   6

6. Do You recognize the difference between leading (KPI), lagging (KPO) and perceptive measures (PerM)

   Yes _____ No _____

NOTES:

A Key Performance Result (KPR) is the measure of performance of an activity that is critical to the success of an organization

A Key Performance Indicator (KPI) is indicative measure of performance of an unfinished processes or activity

A Key Performance Outcome (KPO) is the measure of performance of an activity or process that report accomplished performance and final outcome and as such do not enable ability to change the future outcome.

A Perceptive measures (PerM) is the subjective measure of performance of an activity or process, wich generated trough surveys and interviews.

THE THIRD PART

Please rate the following measures with respect to their relevance in measuring overall level of performance.

KPIs	LOW					HIGH
1. **Cost (Eur/m²):** The value needed to embed 1 m² (for similar projects)	1	2	3	4	5	6
2. **Cost increase (%):** The difference between estimated cost at Start-up and Close-out phase	1	2	3	4	5	6
3. **Cost predictability:** Percent of the cost increase to respective value in feasibility study.	1	2	3	4	5	6
4. **Cost of work:** The cost of effective work	1	2	3	4	5	6
5. **Change of cost(%):** The percent of change of cost regarding contracted value.	1	2	3	4	5	6
6. **Time (day/m2):** Total time needed for construction – from the phase of execution until delivery	1	2	3	4	5	6
7. **Time increase (%):** The difference between estimated time at Start-up and Close-out phase	1	2	3	4	5	6
8. **Time predictability:** Percent of the time increase to respective value in feasibility study.	1	2	3	4	5	6
9. **Continuity of work:** The total time of delays from the phase of execution until the delivery	1	2	3	4	5	6
10. **Quality:** Assessment of requested level of quality at the delivery.	1	2	3	4	5	6
11. **Defects:** Total amount of defects at the time of delivery.	1	2	3	4	5	6
12. **Rework(%):** Amount of rework caused by differentiation from project specifications	1	2	3	4	5	6
13. **Productivity:** The sum of working time against delivered units	1	2	3	4	5	6
14. **Deviations from standards:** Total number of standard deviations during construction	1	2	3	4	5	6
15. **Motivation (%):** The level of workers motivation.	1	2	3	4	5	6
16. **Units (%):** Total amount of embedded material against planned value.	1	2	3	4	5	6
17. **Change of scope:** Total number of approved changes of scope during construction.	1	2	3	4	5	6
18. **Ready to build:** The assessment of contractor readiness to build.	1	2	3	4	5	6
19. **Contract & legal disputes:** Total number of claims and disputes, caused by the nature of the contract	1	2	3	4	5	6
20. **Attitude to claims and debts:** How much contractor uses unnecessary correspondence and avoids contract commitments.	1	2	3	4	5	6
21. **Communication (project):** The number of dissidences within the project organization	1	2	3	4	5	6
22. **Satisfaction of the team:** How much are the team members satisfied with present and motivated for further work	1	2	3	4	5	6
23. **Cooperation with subcontractors:** How much are subcontractors satisfied with contractor relationship	1	2	3	4	5	6
24. **Market conditions(%):** The number of unavailable material or services, and the change of its cost.	1	2	3	4	5	6
25. **Legal problems with Land:** Number of unpredictable problems regarding land.	1	2	3	4	5	6
26. **Investor's engagement (%):** Number of changes caused by the investor	1	2	3	4	5	6
27. **Project support:** Number of delays and difficulties caused by the investor.	1	2	3	4	5	6
28. **Client satisfaction:** Client's satisfaction at the delivery.	1	2	3	4	5	6
29. **Profitability (%):** Company's profit stated as % of year's income.	1	2	3	4	5	6
30. **Avoidance of unprofitable processes:** The number of avoided projects because of unfeasibility.	1	2	3	4	5	6
31. **Employees' satisfaction:** Employee satisfaction in the company	1	2	3	4	5	6
32. **Improvement in organizational capabilities(%):** The growth of competent employees, technologies and innovations in business processes	1	2	3	4	5	6
33. **Productivity (organizational):** Company value against number of employees	1	2	3	4	5	6
34. **Organizational growth(%):** The growth of number and diversities of projects, and partnership with other companies.	1	2	3	4	5	6
35. **Innovation and learning:** Decrease of time and cost for similar projects.	1	2	3	4	5	6
36. **Communication (organizational):** Numbers of delays caused by the administration burden.	1	2	3	4	5	6
37. **Clients interests:** Fulfillment of client satisfaction during bidding and at the delivery.	1	2	3	4	5	6

Please be free to make any comment regarding this survey or key performance indicators. If You feel that we have forgotten something, send us your remarks.

Thank You in advance.
Mladen Vukomanović, MSc, MEng, CEng