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Targeting sustainable competitiveness in Croatia by implementation of "20 Keys" methodology

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Abstract

Throughout the current wave of regulatory reforms, several theoretical models have been proposed that call for the emergence of instruments of self-regulation under some form of state supervision as part of the demand to improve product development performances aligned with awareness of environmental needs, to help with meeting regulation and to reduce the risk of production nonconformance. "20 Keys" is one example of a mass application of a methodology for raising sustainable development and holistic approach to competitiveness in new EU member the Republic of Croatia, and therefore, the aim of this study is to observe the results of the methodology application in Croatian companies. 20 Keys is a methodology that brings an integrated set of tools aimed at increasing overall productive efficiency and quality level with simultaneous reduction of costs. As it was shown in this paper, implementation success is coincident with senior management's active role in setting the main goals for implementation, assuring that suitable methods and tools are used, allocating resources appropriately and enabling communication within the company.

Keywords: 20 Keys methodology, Managerial tool, Sustainable production, Lean management, Manufacturing companies

Background

The concept of sustainable production emerged at the United Nations Conference on Environment and Development in 1992 and is closely related to the concept of sustainable development. In 1996 "The International Organization for Standardization" introduced a series of certifications and standards in the realm of ISO 14000, which has become the reference model in Environmental Management System (EMS) (Boiral 2007). ISO 14000 certification (ISO 14001:2004 and ISO 14004:2004 focus on environmental management systems) is intended to provide a framework for a holistic strategic approach to the organization's environmental policy, plans, and actions. The total number of certificates awarded at the end of 2000 was 22,897, compared to 14,106 at the end of December 1999, showing a very significant rise of 8791. The rate by which companies are getting ISO 14000 certified has increased from 128,211 at the end of 2006 to 188,815 in 155 countries in December (Wiengarten et al. 2013, International Organization for Standardization 2008) highlighted that many governments and jurisdictions are introducing legislations to address sustainability in terms of climate change in general and

product- and process-derived pollution in particular. The ISO 14000 standard is the most popular of a growing family of corporate self-regulatory instruments that typify an era of intense regulatory reform. Levi-Faur (2005) called it "regulatory capitalism," a new paradigm in regulatory theory characterized by the emergence of decentralized forms of regulation, an increase in delegation to autonomous agencies, and the proliferation of internal structures of governance used by corporations to ensure social responsibility. Several authors (Cockrean 2000, Clapp 2004) have also questioned the importance of ISO 14001 as an effective policy instrument, emphasizing several of its limitations. For example, it fails to take in consideration environmental performance as it does not prescribe specific targets; continuous improvement is associated with management practices and not environmental performance; it does not ensure regulatory compliance neither does it promote disclosure of information; it does not distinguish good from poor performers; and it lacks reporting requirements (Loureiro et al. 2011). From a manufacturing enterprise perspective, awareness of the global activity is essential to ensure long-term business success. In order to strategically work towards sustainability, it is imperative that companies define, implement, and agree on what sustainability means for them (Broman et al. 2000) and to ensure that a complete sustainability perspective, including both ecological sustainability and social sustainability, is used to guide innovation processes rather than single aspects of sustainability (Hallstedt et al. 2013).

The methodology of 20 Keys has been fully implemented in 48 companies in Croatia during the period between 2004 and 2010 and was co-financed by the Ministry of Economy, Labour, and Entrepreneurship (Ministarstvo gospodarstva, rada i poduzetništva 2004). Study results show that companies that have participated long enough in the program achieved better financial results and growth rates in comparison with the average of Croatian companies from same industries. Paper examined changes of performance and results achieved by implementation of 20 Keys methodology, growth in revenue after implementation 20 Keys methodology with an average of Croatian companies has been compared, and increase in employee's motivation as the area in which 20 Keys has been implemented has been highlighted.

Literature review

Other researches show that key factors affecting implementation effectiveness include focus on internal improvement, top management support, design of the system around existing processes, use of information technology, positive employees' attitude, and employees' use of the system (Ivanova et al. 2014). It is also shown that voluntary environmental initiatives, often in the form of ISO 14000 certification, have been highly associated with the performance of that companies (Kuei et al. 2013).

As various lean methodologies have been present in manufacturing companies during the course of last 30 years, with the increased awareness for environmental topics, a new term was coined—lean and green. Among the available strategies lean, green and resilient are considered as new management strategies for the supply chain management to achieve competitiveness. According to recent research (Govindan et al. 2015), the practices with the main driving power are just-in-time (lean practice), flexible transportation (resilient practice), and environmentally friendly packaging (green practice). Dhingra et al. (2014)) proposed new frameworks and methodologies that will facilitate further studies and assessments in the swiftly developing field of lean and green with a

goal that potential applications of lean and green will help society make the transition to more sustainable societal pattern.

Toyota Production System (TPS) and the derived lean methodologies have begun a new era in production efficiency frameworks (Ohno 1988). Just like 20 Keys, there are other methodologies that run in parallel but rest on same basic principles and theories. World class manufacturing (WCM) is one of similar methodologies, and it was recently revived by the Fiat Group (Chiarini and Vagnoni 2015). Fiat's WCM seems to have a "grand strategy" focused on quality and cost savings where quality must be reached with no trade-off with other strategies. Safety is pursued above all else and Fiat's WCM cannot be implemented without this first achievement. A particular system called "cost deployment" measures wastes and losses on processes. The performance measurement system is structured and fosters day-by-day management as well as computer-based management. Furthermore, the performance measurement system is based on a complex and formal auditing and benchmarking process.

Toyota Production System (TPS), in particular, is in varying degrees contingent upon the socio-cultural, historical, and environmental context of the host nations into which such transfer occurs (James and Jones 2014). Lean manufacturing is not simply a set of concepts, techniques, and methods that can simply be implemented by command and control. In the course of transferring lean practices from Japan to overseas affiliates, either an absence of due consideration or disregard for a host nation's unique socio-cultural and environmental factors could lead to unproductive organizational outcomes for the parent company.

Common approach to assessment of implementation and its success rate is through benchmarking. There are many devised benchmarking standards—including the tools in the 20 Keys methodology. An appropriate measurement tool is needed to assess the effectiveness and efficiency of the lean implementation throughout the entire organization. Based on lean research, Pakdil and Leonard (2014) developed a comprehensive tool called the leanness assessment tool (LAT), using both quantitative (directly measurable and objective) and qualitative (perceptions of individuals) approaches to assess lean implementation. The LAT measures leanness using eight quantitative performance dimensions: time effectiveness, quality, process, cost, human resources, delivery, customer, and inventory. The LAT also uses five qualitative performance dimensions: quality, process, customer, human resources, and delivery, with 51 evaluation items. Verrier et al. (2014) proposed a framework for the lean and green management, which includes lean indicators, green performance indicators, and green intentions indicators. His framework enables a consortium of companies to benchmark their lean and green practices in order to target the best in class and the associated best practices. Building on existing efforts to develop sustainability indicators and the LCSP indicator framework (Lowell Center for Sustainable Production. Sustainable Production,1998), Verrier et al. (2014) proposed a set of 22 core indicators (applicable to any organization) and guidance for selecting additional, production-specific indicators. Innovative approach has been constructed by Susilawati et al. (2014). He developed a multi-dimensional concept involving a variety of components of lean practices that is measured in order to arrive at a measure for the lean activity of a given organization. It is constructed from primary and secondary data involving a comprehensive literature review and validated with interviews with a set of sample organizations representing

the entire spectrum of the industry. The vagueness of subjective human judgment on degree of application of lean practices is modeled by fuzzy number in conjunction with an additional consideration related to the length of lean practice implementation and the use of multi-evaluators.

Recent studies show that many methodologies share common ground in solving operational and organizational problems. Pacheco (2014) analyzed points of convergence and divergence between the theory of constraints, lean manufacturing, and six sigma, when used in an integrated manner for the continuous improvement of existing productive systems. Results have shown that the theory of constraints, lean manufacturing, and six sigma have many complementary elements that overlap their divergent points and that a vast field of research exists on this issue for future exploration. Another hybrid that delved from "lean" is "leagile," which is a combination between lean and agile. This approach is popular in supply chain management and often reflects on supplier sourcing and management. Purvis et al. (2014) introduced an extension of the "leagility" concept beyond the simple material flow decoupling point concept. Two new types of leagility are put forward: (1) leagile with vendor flexibility systems, which combine the use of agile vendors with lean sourcing practices and (2) leagile with sourcing flexibility systems, which combine the use of lean vendors with agile sourcing practices. Recent integration of lean and six sigma methodologies brings certain unique concepts over the main body of common principles. Thus, the most desirable results can be attained when lean management and six sigma techniques are used together and in a manner that both support each other (Atmaca and Girenes 2009).

The methodology of 20 Keys had been designed in Japan during the 1980s as a result of the longstanding work of Iwao Kobayashi, who harmonized certain of the existing methodologies aimed at advancing and introducing the so-called lean manufacturing. Kobayashi had also devised concrete tools in implementing these in a number of areas—raising motivation, enhancing quality, speeding up the process and delivery, cost reduction, and technology use. While optimizing the system in Mitsubishi, Kobayashi had been employing experience gained by the very advanced, at the time, production system used by the neighboring Japanese corporation—Toyota. The experience relates to TPS, whose founder Taiichi Ohno had been working for years both on perfecting various tools and techniques and on a philosophy of management aimed at enhancing productivity and quality of production facilities owned and operated by Toyota.

While there is a wealth of information about the methods, there is almost no research exploring the impacts in different regions of the world. Therefore, the objective of this paper is to examine if this approach has improved the competitiveness of Croatian companies.

About the 20 Keys

The term 20 Keys refers to 20 different tools and methodologies used in different areas and situations in conducting business. In fact, the keys are agglomerates of different tools and techniques which are already well known in the world, but they are incorporated into a common system of evaluation, visual reporting, monitoring of results, and work organization. Each of the keys contains a detailed manual for installation and training and a range of practical tools that enable the achievement of desired goals in defined business areas.

Most companies have been participating in the program during the period between the 2004 and 2008. However, 2 years after the end of the Ministry's subsidy scheme, the number of the program's participants was greatly reduced, which can be partially explained by unfavorable developments in markets around the world caused by the global economic crisis. Deloitte CE was the only authorized company to implement this methodology in Croatia, and therefore, during the period observed in the study (2004 to 2008), it was possible to monitor the spread of this methodology in Croatia.

In our research, attention will be paid to the structure of enterprises that have entered into the program subsidized by the Ministry of Economy, Labour, and Entrepreneurship. Companies will be analyzed according to several indicators—ownership structure, company size, and classification of activities according to the National Classification of Business Activities 2007. The aim of the analysis is to determine trends among enterprises that entered into the 20 Keys program by the survey conducted among participants in the Republic of Croatia (Table 1).

The focus of research will also center on the results these companies gained after they were familiarized with the methodology. The goal is to compare the performance of companies that have participated in the program against the Croatian average and to account for any specifics of individual industrial sectors in terms of actual results of business operations.

Although the 20 Keys methodology is being propagated as universal and applicable in any kind of organizations—not just in production—the results and successfulness of

Table 1 Listing and dividing keys by five main categories (Deloitte 2004a, 2004b)

Category	Aim	20 Keys	
M	Energizing workplace	1	Cleaning and organizing to facilitate work
		2	System rationalization/goal alignment
		3	Small group activities
		10	Workplace discipline
Q	Improving quality	7	Zero monitor manufacturing/production
		9	Machinery and equipment maintenance
		11	Quality assurance
		12	Suppliers' development
		15	Skill versatility and cross training
C	Cost reduction	13	Eliminating waste
		14	Empowering employees to make improvements
		6	Kaizen of operations
		17	Efficiency control
		19	Conserving energy and materials
D	Enhancing the flow of the process/stock reduction/ faster delivery	5	Quick changeover technology
		4	Reducing work-in-process (WIP)
		16	Production scheduling
		8	Coupled manufacturing/production
T	Technology development	18	Using information systems
		20	Leading technology/site technology

enterprises, as well as the number of keys implemented by specific branches of activity, should draw attention to the degree to which employees and managers have accepted the methodology. An analysis employing these indicators should indicate how the results and time spent in the program are linked. Certainly, the mere acceptance of the methodology in Croatian companies will be amenable to comprehension by reference to the results of a survey conducted on a sample of 26 Croatian companies which took part in the 20 Keys.

Research design

Research goals

Based on theoretical model and building on existing efforts to develop sustainability indicators and the 20 Keys indicator framework, the authors pursued the following four distinct lines of inquiry:

Proposition no. 1. 20 Keys methodology is the most appropriate for and provides best results in manufacturing companies.
Proposition no. 2. Manufacturing companies which have opted for the implementation of 20 Keys generate above-average growth in revenue compared with an average of Croatian companies in the manufacturing sector (manufacturing industry).
Proposition no. 3. Enterprises which participated in the program for a longer period of time and introduced a greater number of keys generate higher revenue and profit growth than the companies which participated for a shorter period of time.
Proposition no. 4. Application of the methodology in Croatia from 2004 to 2008 did not fully utilize all the resources of the methodology, because an insufficient number of companies took advantage of all the knowledge and tools offered in 20 Keys and participated in the program long enough to realize the necessary improvements.

Methods

Research methodology

To substantiate the propositions with relevant data, the data required for the study were collected from several different sources. The first piece of data tied to financial performance indicators of enterprises was collected from the international database Bureau van Dijk (Bureau van Dijk 2010). For each company in the program, we use the following indicators:

1. Total revenues
2. Earnings before interest and taxes (EBIT)
3. Number of employees

In selecting the time period for data analysis, we took into account the period of the company's entry into the program, with the exception of that companies which have started to implement the program in the months of January or February when we took the previous year and results from 2008. The choice fell to 2008 because it was the last year when, for most companies, there were no clearly noticeable effects of the global economic crisis. Also, 2008 was the last year when the Ministry of Economy, Labour,

and Entrepreneurship subsidized program participants. After 2008, the number of active participants began to decrease drastically.

The second part of the data, associated with the classification of activities and size of companies participating in the program, was collected at the site of the Register of Business Entities (Hrvatska gospodarska komora 2010). Classification is consistent with the decision of the National Classification of Activities (Narodne novine d.d. 2007a) while the size of a company incorporated is in accordance with Article 3 of the Law on Accountancy (Narodne novine d.d. 2007a).

The third part of the data, regarding the participating companies and keys they implemented, comes from the internal records of Deloitte CE.

The fourth part of the data, or more accurately the results of surveys conducted among participants of the 20 Keys in Croatia, was obtained from the survey that was conducted in 2007 by Deloitte employees on a sample of 26 participating companies.

Much of the conclusions and comments on the survey results were produced as results of the experience of one of the author of this paper in the introduction of the methodology 20 Keys in 39 Croatian companies. The data presented in tables are calculated as follows:

1. Average annual growth of business incomes of the enterprise (compound annual growth rate of revenues (CAGR))

$$\mathrm{CAGR} = \left(\frac{\mathrm{PP}}{\mathrm{ZP}}\right)^{1/(\mathrm{ZG}-\mathrm{PG})}$$

Equation 1: CAGR, where
CAGR Compound annual growth rate of revenues
PP Revenues in the year of entry into the 20 Keys program
ZP Revenues in 2008 (last year recorded)
ZG Last year on record (2008)
PG Year of entry into the program

2. Growth rate of profit margin (ΔEBIT)

$$\Delta\ \mathrm{EBIT} = \frac{\mathrm{ZP}}{\mathrm{EBIT2}} - \frac{\mathrm{PP}}{\mathrm{EBIT1}}$$

Equation 2: ΔEBIT, where
ΔEBIT Growth rate of profit margin (in percentage)
PP Income in the year of entry into the 20 Keys program
ZP Income in 2008 (last year recorded)
EBIT1 Earnings before taxes and interests in the year of entry into the program
EBIT2 Earnings before taxes and interests in 2008 (last year recorded)

3. Change in the number of employees (ΔFTE)

$$\Delta\ \mathrm{FTE} = \frac{\mathrm{FTE2}-\mathrm{FTE1}}{\mathrm{FTE1}}$$

Equation 3: Change in the number of employees, where
ΔEBIT Change in the number of employees during the observed period
FTE2 Number of employees in 2008 (last year recorded)

FTE1 Number of employees in the year of entry into the program

4. Average annual productivity growth per employee (PCAGR)

$$\mathrm{PCAGR} = \left(\frac{\mathrm{PP}/\mathrm{FTE1}}{\mathrm{ZP}/\mathrm{FTE2}}\right)^{1/(\mathrm{ZG}-\mathrm{PG})}$$

Equation 4: Average annual productivity growth per employee (PCAGR), where

PCAGR Average annual productivity growth per employee

PP Revenues in the year of entry into the 20 Keys program

ZP Revenues in 2008 (last year recorded)

FTE2 Number of employees in 2008 (last year recorded)

FTE1 Number of employees in the year of entry into the program

Results and discussion

Analysis of participant companies of 20 Keys in Croatia

Analysis by type of activity

If we observe the emergence of the methodology developed over the years by Mr. Kobayashi in Mitsubishi machinery, it can be concluded that 20 Keys methodology is primarily intended for manufacturing companies. Kobayashi himself places emphasis in his book, when explaining the approach to introducing specific keys, on the application of keys in manufacturing. It is only at the end of his book (Kobayashi 1995, p. 221), in one chapter, that he deals with applying the methodology in supporting services. There is no mention of service sector companies in the book.

However, the South African company ODI has, in material adjustments to Western markets, among other things, introduced checklists and graphic representation of the level of the individual keys for support services (ODI 2006a, 2006b) and thus opened the possibility for companies that do not engage in productive activities to participate in the program.

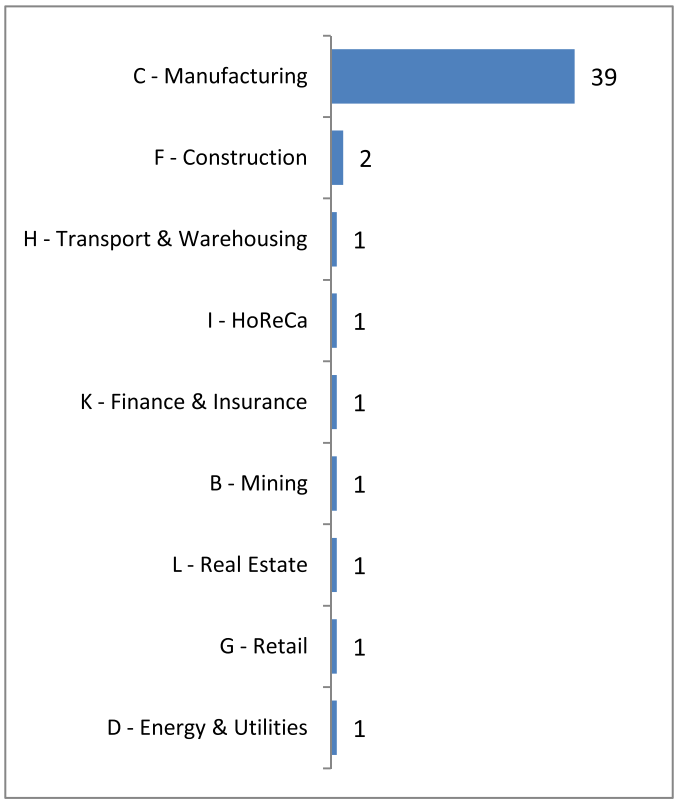
In Slovenia, during the implementation with the support of the Slovenian Ministry of Economy, 89 % of the companies came from the manufacturing sector and the remaining 11 % from other activities (Jug 2004, p. 47). In Croatia, however, the picture is even more pronounced on the side of non-productive enterprises because as much as 18.75 % of companies came from other activities, which is, if one takes account of the fact that the methodology was originally designed for manufacturing operations in manufacturing companies, a very high percentage. The exact distribution of companies by sector can be seen in Table 2.

This analysis clearly shows that Croatia is joining a growing trend of non-productive enterprises in the program 20 Keys, more so than was the case with Slovenia from 2000 to 2004. However, companies in the processing sector were the most represented with 81.25 % in the program, and their number is large enough in order that the cross section of their common data provides further analyses with statistically reliable results.

Analysis regarding of profit/loss accumulation

According to data collected in the year of entry into the program, it is clear that 26 % of the companies operated with negative financial results—losses (Fig. 1). If we observe the section of manufacturing industry in Croatia, similar results will appear—28 and 72 % loss-making enterprises and 72 % that operated with profits (Fig. 2).

Table 2 Profile of the companies studied



The ratio consistent with the average Croatian industry shows that there are no significant variations in the composition of companies that decide to enter into this or similar programs—that is, neither the loss-prone companies choose these tools to overcome negative financial results nor do successful companies choose such programs for improvement because of its success.

Analysis according to companies' size

The size of the companies that enter into the program, and the deviation from the cross section in the case of the Republic of Croatia, can indicate several things regarding the application of the methodology. Since in the Republic of Croatia 99.4 % of

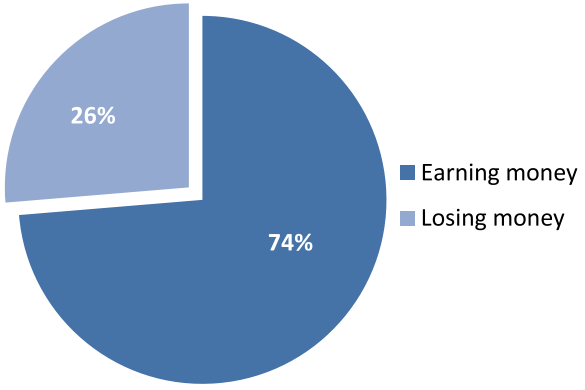


Fig. 1 The ratio of loss-making and profit-making participants in the program

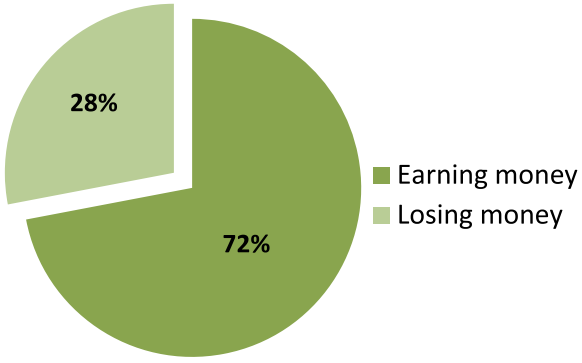


Fig. 2 The ratio of loss-making and profit-making enterprises in the manufacturing industry of the Republic of Croatia (Hrvatska gospodarska komora 2009)

registered enterprises come from the category of small and medium enterprises (HUP-Udruga malih i srednjih poduzetnika 2009), while in 20 Keys that percentage amounts to only 60 % (Fig. 3), it can be concluded that there are real explanations and barriers that are not conducive to small businesses entering the program. Similar findings were present in Slovenia, where the participation of small, medium, and large businesses amounted to 11, 33, and 56 %, respectively (Jug 2004, p. 47).

Forty percent of large companies in the program prove the above theories, because what represents a barrier for small businesses does not figure as a significant problem for large enterprises. Management departments of such companies view 20 Keys as an element in attaining stated goals by means of assistance from external advisers.

Analysis according to ownership structure

The ownership structures of companies participating in 20 Keys are shown in Fig. 4.

Most companies participating in the Republic of Croatia had a mixed ownership structure. Thus, the owners may be individuals, companies (both domestic and foreign), various funds, and state agencies. The state-owned participants accounted for only 8 %

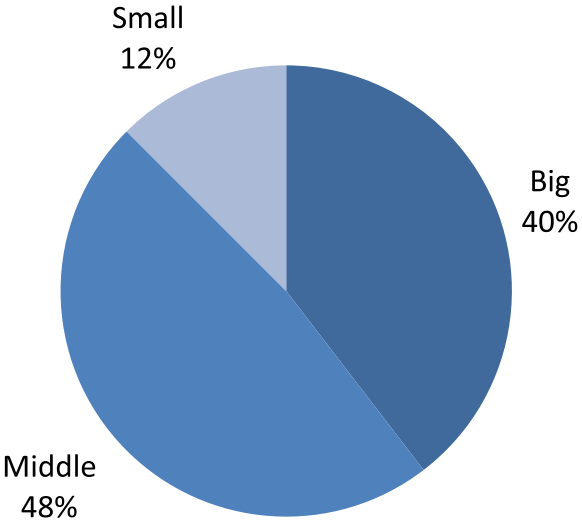


Fig. 3 Enterprise size in 20 Keys in Croatia

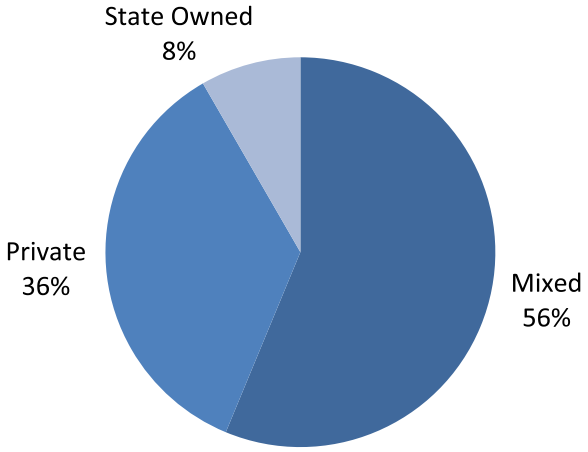


Fig. 4 Ownership structure of participating companies

of the total number of participants, but it is interesting to note that some of the largest companies (by number of employees and revenues) were state owned.

Analysis of achieved results after the implementation of the methodology

In order to assess the effects of the introduction of the 20 Keys methodology in Croatia, it is necessary to analyze the business performance of enterprises that have participated in the program. For companies that made their financial data available during the study, we analyzed the growth of revenues, profits, employment, and productivity per employee. Each of these data indicates some of the trends that this study will try to sort out. Of all the industries, the most interesting for observation will be the manufacturing industry, which was also represented by most participants. The observation of 39 companies provides statistically reliable results, which may indicate the existence of trends and confirm some of the research propositions.

Analysis of income growth according to National Classification of Business Activities

If we observe the seasonally adjusted volume indices of industrial production in Croatia (Table 3) for mining and manufacturing industries, and then compare it with the results of analysis of revenue growth of companies participating in 20 Keys in the period after implementation, we can detect discrepancies among the data. The companies participating in the program achieved average annual growth in income of 10.7 % in the manufacturing industry (compared to 4.38 % at the national level) and 3.2 % in mining and extraction (compared to 1.9 % at the national level). Growth was

Table 3 Comparison of growth from 2004 to 2008 of total Croatian (Državni zavod za statistiku 2005–2009) and companies participating in 20 Keys

National Classification of Business Activities	2005/2004 (%)	2006/2005 (%)	2007/2006 (%)	2008/2007 (%)	CAGR 2008–2004 (%)	CAGR of program participants (%)
B—Mining and extraction	−1.2 %	10.6 %	1.4 %	−2.7 %	1.90 %	3.2 %
C—Processing industry	6.8 %	5.2 %	6.4 %	−0.7 %	4.38 %	10.7 %

calculated in accordance with the formula laid out in the "Research methodology" section (Eq. 1).

Growth of 10.7 % is a result, when we take into account the number of the 39 companies analyzed, significantly outpacing the growth in volume (in this analysis, it was assumed that the increase in volume approximately follows the growth of sales revenues) on the level of industrial production in Croatia.

When observing the achieved growth by participants according to industry branches, growth in most of the sectors and business activities is noticeable. The company engaged in the production of machinery and equipment with a mean increase of 49.1 % per year stands out especially.

All participating enterprises, when viewed together, achieved average annual growth of 9.5 % (Fig. 5), which exceeds the overall growth of the Croatian economy according to the observed increase in gross national income.

Analysis of EBIT according to the National Classification of Business Activities

While the companies participating in 20 Keys grew at an average annual rate of 9.5 %, the achieved profit margin (viewed as a share of profit before tax to total income) in the observed period grew by 2.9 %, calculated by the formula presented in earlier (Eq. 2). If we were to observe absolute amounts of achieved profit, the percentage would be even higher because it is related to business income, which has also grown.

Profit margins in different sectors have grown at an average of 2.9 %, while in the most represented of industries—manufacturing—it rose by 3.3 %. In companies dealing with finished metal parts (C25), profit margin has grown by 27.1 %. Bearing in mind that these are profit margins, and not absolute value, it can be argued that this represents a significant increase in profits. Companies engaged in these activities achieved the average annual growth of 9.7 % in the period of observation (Fig. 6).

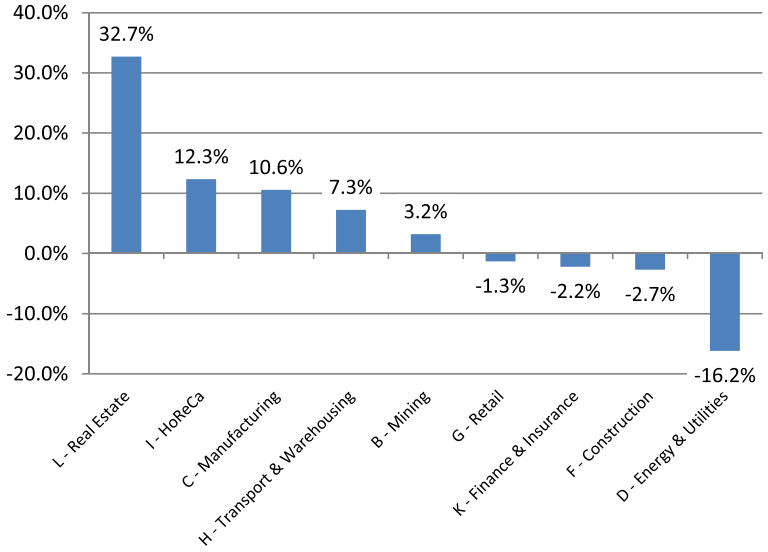


Fig. 5 Average annual growth of income (CAGR) by main National Classification Business Activities

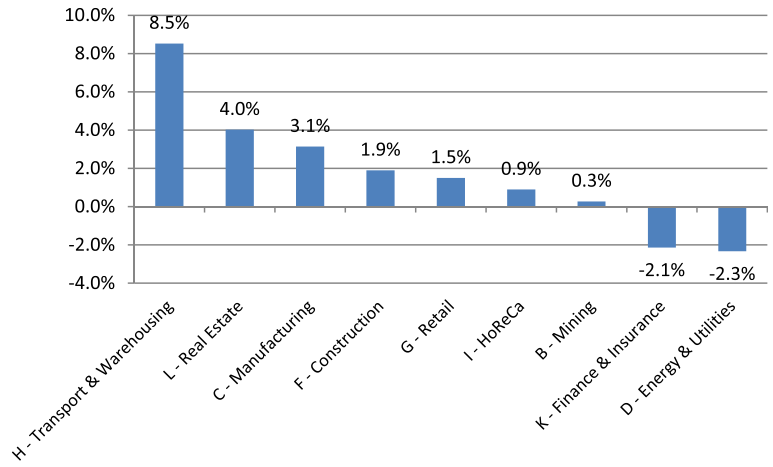


Fig. 6 Analysis of EBIT according to the National Classification

Analysis of the change in the number of employees by the National Classification Activities

It is interesting to note that the total number of employees employed in the analyzed enterprises has actually decreased by 556 from the period preceded by implementation. There are two main reasons: first, larger companies have gradually laid off redundant staff during the period covered by our analysis, and secondly, enterprises have achieved productivity growth so that incomes were rising faster than their offers for employment.

When we pay attention to the average of all companies participating in the program, it appears that the average number of employees grew by 11.8 %. However, such a figure is the result of fourfold increase (440 %) in the number of employees in one of the smaller companies.

It is also clear that the most notable decline in employment is in the construction sector, which can be partly explained by the saturation of the market in 2008 due to negative global economic trends.

Analysis of productivity growth per employee in the National Classification Business Activities

Productivity per employee was observed during the period of participation of every enterprise. Aggregate value of average annual growth for certain sectors was calculated according to the formula (Eq. 4; Figs. 7 and 8).

Categories L and F have the highest annual growth in productivity per employee. The reason lies in reducing the number of employees, which confirms the fact that companies in these categories (one in each) had a surplus of employees and that productivity growth was achieved through dismissals and not by improving business processes. Program participants operating in the manufacturing industry have generated on average 6.9 % productivity growth per year, which, when we take into account that in this period the total number of employees of enterprises in this sector increased by an average of 14.1 % (Fig. 17), represents an increase in productivity achieved by means of changes in the work process, rather than layoffs.

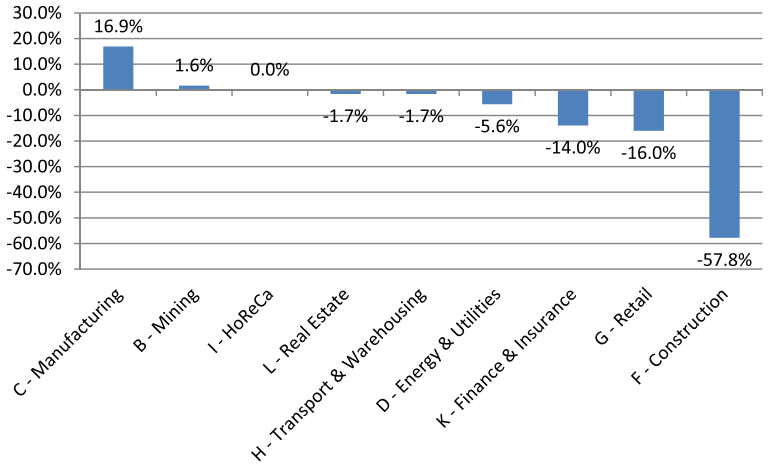


Fig. 7 Variation in FTE according to National Classification of Business Activities

Analysis by number of implemented keys in Croatian enterprises

In his book, Kobayashi advocates a simultaneous implementation of all of the 20 Keys in a given enterprise. The first year of the program needs to be devoted to training future program managers if this ambitious plan is to be realized. Implementation of all of the keys is to commence after the first year of training key managers. Kobayashi locates the reasons for this approach in the synergy of separate keys' effects and increased productivity as a result of synergies achieved (Kobayashi 1995, p. 7). His son, Yoshiyuki Kobayashi, confirmed the same mode of reasoning as the current president of PPORF Institute at a conference held in Moscow in January 2008 (Kobayashi 2008). According to Kobayashi, synergy is one of the fundamental elements of success of this methodology. Therefore, it is interesting to observe the frequency of introduction of certain keys during program implementation in Croatia (Fig. 9).

It is clear that the approach in Croatia was more oriented towards the introduction of individual keys, rather than to a comprehensive approach to the introduction of all

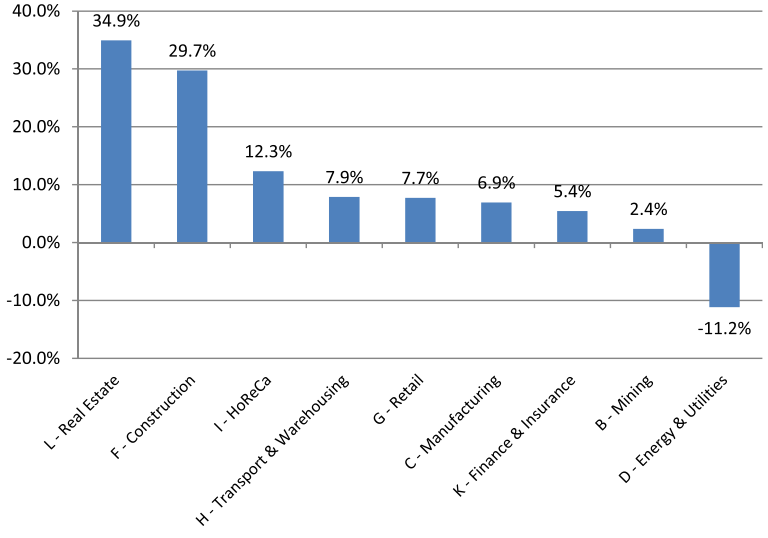


Fig. 8 Productivity growth per employee in the National Classification Business Activities

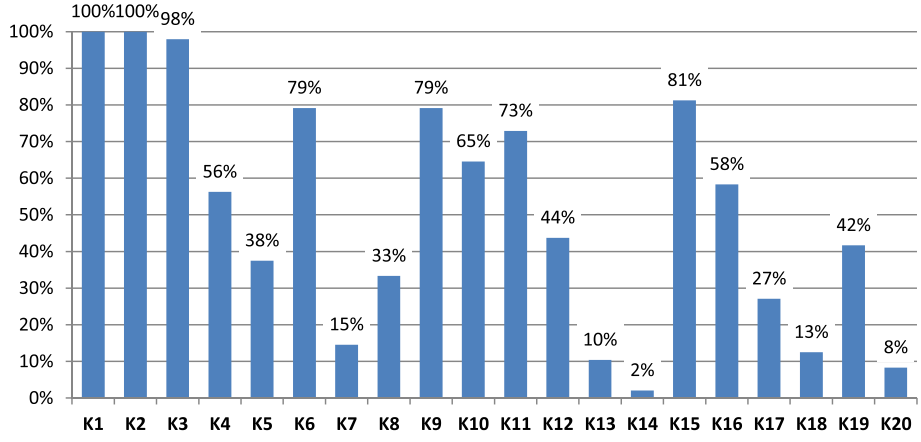


Fig. 9 Frequency of keys implementation ($N = 48$ companies)

keys advocated by Kobayashi. It is interesting to note that only key 1 (cleanliness and organization) and key 2 (alignment of goals) have been introduced in all businesses. If we observe the average rate of introduction of keys for each category, a peculiar impression arises (Fig. 10).

Except for the generally low percentage of implemented keys, what is unusual is the fact that the keys corresponding to the categories of cost and rapidity of delivery were implemented in such a small number of companies (costs 32.1 %; delivery 46.4 %). The reason for these unusual data lies in the fact that one of the main objectives of introducing the methodology is to raise efficiency and productivity of organization, and the keys that are mostly directed towards these goals were the least implemented.

As we mentioned in "Analysis according to companies' size" section, the role of external consultants during the implementation of the methodology is extremely important as they conduct their advice and direct the entire course of project implementation. The results of this analysis unequivocally show the overall orientation of the 20 Keys program in Croatia towards the keys and themes that are less

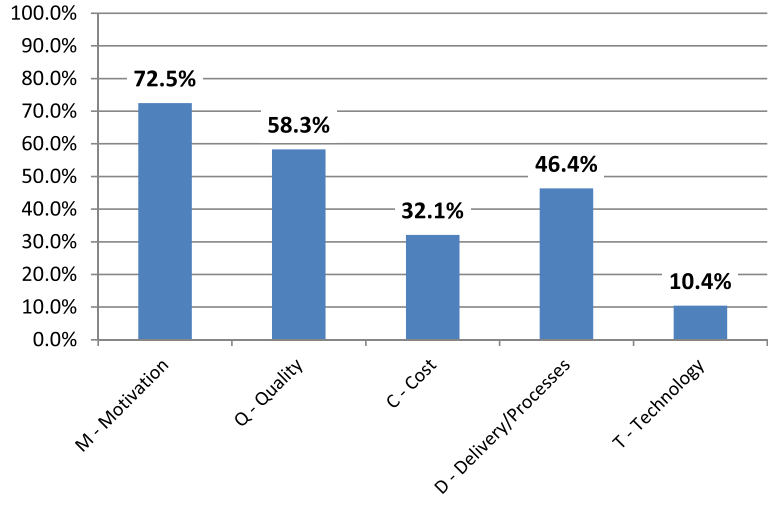


Fig. 10 Frequency of key implementation by category

technically oriented (motivation and quality), despite the fact that 81.25 % of participants were companies engaged in manufacturing activities where these keys are applicable with minimal deviation from the recommendations in the manuals for the introduction.

Also, the correspondence between the frequency of keys' implementation by categories (Fig. 21) and the results of satisfaction surveys in "Analysis of Croatian participants' satisfaction derived from survey results" section, where the frequency of the introduction of keys in the category of motivation (1, 2, 3, and 10) corresponds to the response of the surveyed companies which assessed motivation an area of greatest impact due to the effects of the program.

Analysis of achieved results in relation to the number of implemented keys and time spent in the program

When receiving a subsidy from the Ministry of Economy, Labour, and Entrepreneurship, companies have signed contracts with Deloitte CE for the period lasting at least 2 years (24 months). Introduction of the project was organized by the project team composed on the client side and by the external consultant from Deloitte. The intensity of cooperation and frequency of visits by Deloitte advisers depended on the size of the company and the company's willingness to support the project. Cooperation was most commonly reduced to two visits per month. During the working visits, key managers, project managers, or groups were trained—depending on the agreement—according to different themes (keys). Some clients have decided to work on only a few keys, while others educated the most important staff in a large number of keys. The consequence of this approach is the variations in the number of keys implemented by various companies (Fig. 11).

Although the terms of granting subsidies stipulated that larger companies were to provide one full-time job concerned with project administration (while this value was stipulated at 50 % in the case of medium-sized companies), in reality, the individuals who administered the project (project administrators) spent much less time on work tasks associated with deploying 20 Keys within the company. The consequence of this mode of work is neglected implementation, which was manifested, alongside the failure to understand the methodology and the non-fulfillment of certain critical factors of success (p. 27), in premature departures of certain companies from the program. This

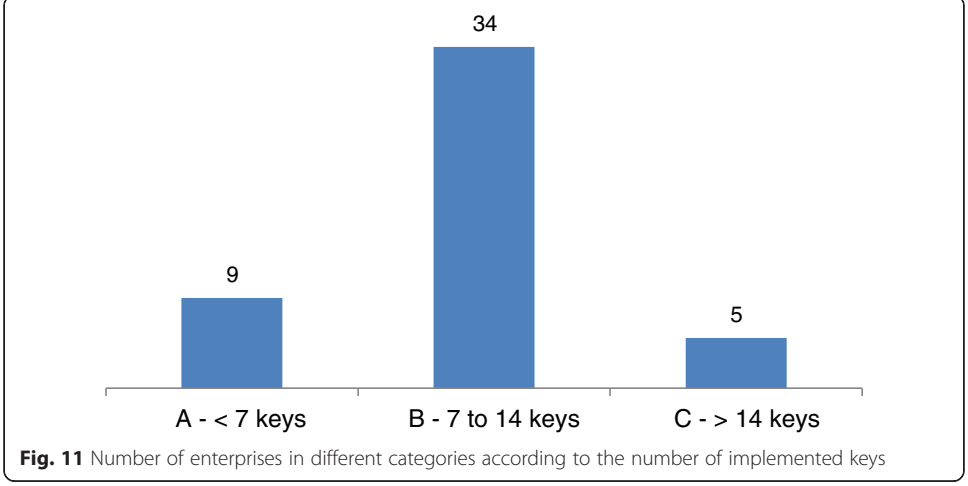


Fig. 11 Number of enterprises in different categories according to the number of implemented keys

trend was particularly evident in the case of companies that have entered the program without support from the Ministry after 2008.

Enterprises that remained in the program for less than a year are not included in this analysis, for reasons mentioned above. 20 Keys is a methodology that targets the long-term use to achieve results, so that the results of operations of these companies were not taken into account in the analysis conducted in this section of the paper.

Most businesses completed the contract with regard to its minimal time period stipulation, usually with a few extra months, while ten companies decided to extend the contract with Deloitte CE and will continue working with Deloitte on program implementation (category C—Fig. 12).

In order to identify possible trends and correlations between realized business results and the number of keys implemented, as well as the time spent in the program, an analysis is made pursuant to categories A, B, and C (Figs. 11 and 12). This analysis is made for manufacturing companies only, with a goal to obtain information associated with the industry for which the 20 Keys methodology was originally intended. Most companies that provide statistically reliable results also operate in the manufacturing sector. Growth of profit before tax and revenue are observed, and average values are listed in Figs. 13 and 14.

When we observe growth (Figs. 13 and 14), it is possible to notice that the companies which have participated in the program for more than 36 months achieved the highest average annual growth rate. The annual growth rate of 22.4 % exceeds by far the average growth rate of domestic producers in the manufacturing sector during the period from 2004 to 2008 (4.38 %). The data gain in informational value if we take into account that this category includes eight companies. There are more reasons which could explain this trend in the category of companies which have participated in the program for more than 3 years. First of all, we can conclude that companies which 3 years in a row devote part of their resources, including time, to introduce new methodologies and tools have long-term vision and understand the sacrifices necessary to establish a culture of continuous improvement. The willingness to direct a part of the resources (human, time, and financial) towards such programs shows that the operative part of the business is being kept under control and that company management works with a long-term business vision. On the other hand, the number of implemented keys was

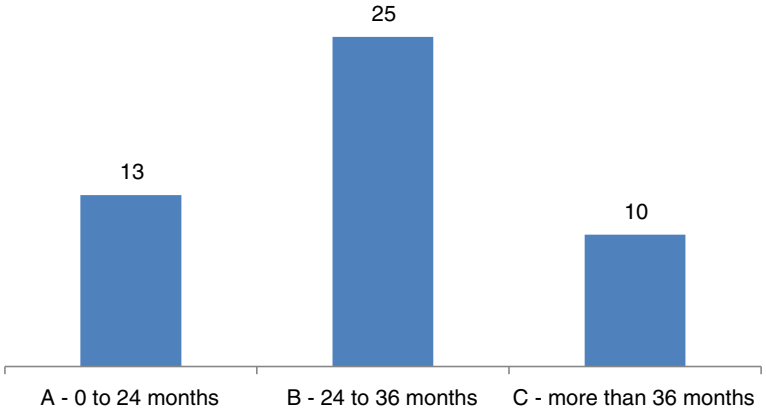


Fig. 12 Number of companies in different categories according to time spent in the program

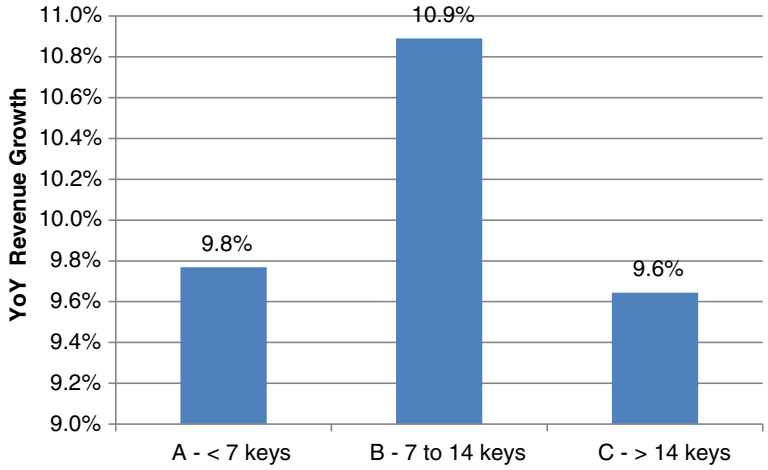


Fig. 13 Average annual growth in revenue in relation to the number of keys introduced by the participants operating in manufacturing industry—*N* = 39

not a crucial factor in achieving growth in business income. In this case, the companies generating the largest growth have participated in the program for 2 or 3 years (10.9 %). When this fact is highlighted against the backdrop of the fact that the companies that have participated in the program longer than 3 years recorded the highest growth, we are led to the conclusion that certain keys did not result in improvements and did not establish a synergy effect of all the keys, according Kobayashi's ideas.

The margin of profit before tax, as well as its dependence on the time spent in the program, can be clearly seen in Figs. 15 and 16.

In contrast to the revenue growth that has demonstrated certain trends and correlation with the observed variables, profit before tax is shown to behave in exactly the opposite way. The growth of before tax profit margin of 8.7 % was achieved by enterprises that have implemented the most of keys (five of them), while productive enterprises which were involved in the program for more than 36 months achieved an average reduction in profit margins of 4.2 % (Fig. 16). Productivity growth—especially in

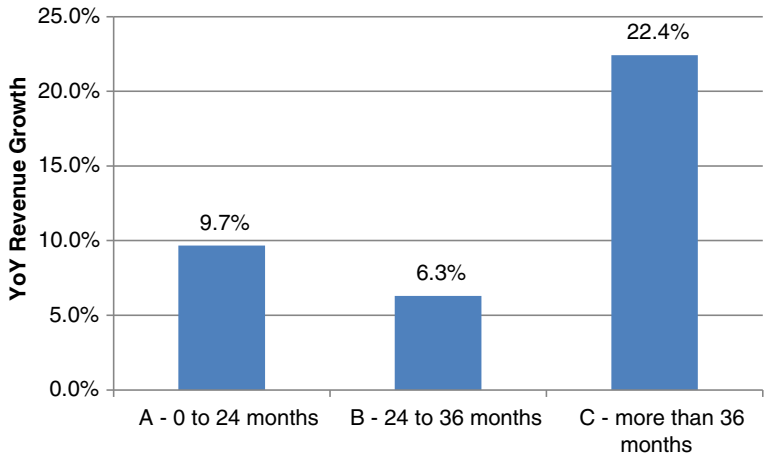


Fig. 14 Average annual growth in revenue in relation to the time spent in the program by participants operating in manufacturing industry—*N* = 39

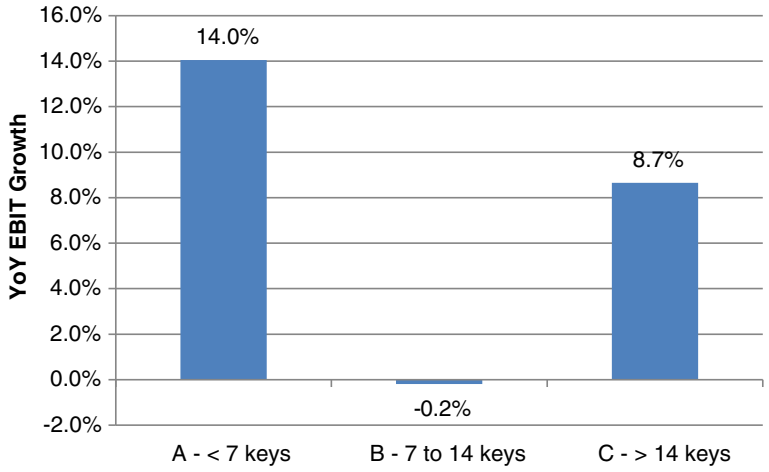


Fig. 15 Average change in profit margin in relation to the number of keys implemented by the participants operating in the manufacturing industry—*N* = 39

manufacturing—is one of the best indicators of success of an enterprise, viewed from the perspective of managing business processes. While profits can be manipulated by financial management, concealing the actual operating results of business operations, productivity per employee is the most direct indicator of the efficiency of business processes of a company. The following figures show the relationship of productivity growth on an annual basis and categories dependent on the number of keys implemented and the time spent in the program.

Figure 17 clearly shows that productive companies which have implemented the greatest number of keys achieved the highest annual rates of productivity growth. Although the highest rates of revenue growth were achieved by companies located in category B, this indicator makes it clear that, despite slower revenue growth, productivity of the enterprise increased. It is actually productivity that is commonly referred to as the main goal of implementation in Kobayashi's book, and a fundamental goal of methodologies aimed at improving the efficiency of business processes (such as lean manufacturing).

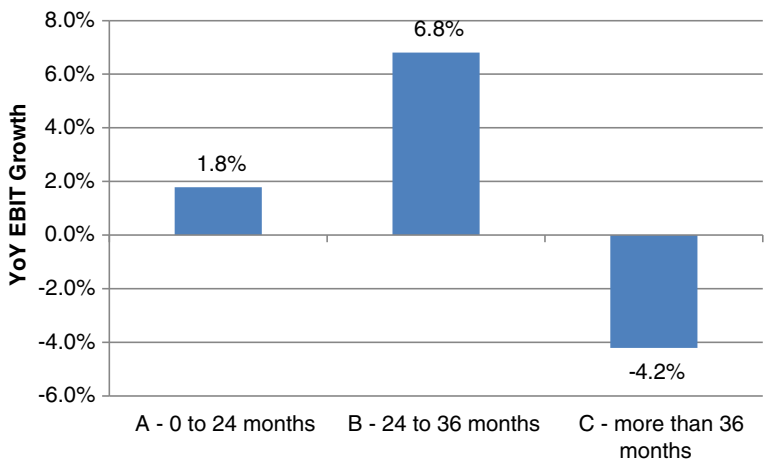


Fig. 16 Average change in profit margins in relation to the time spent in the program by participants operating in the manufacturing industry—*N* = 39

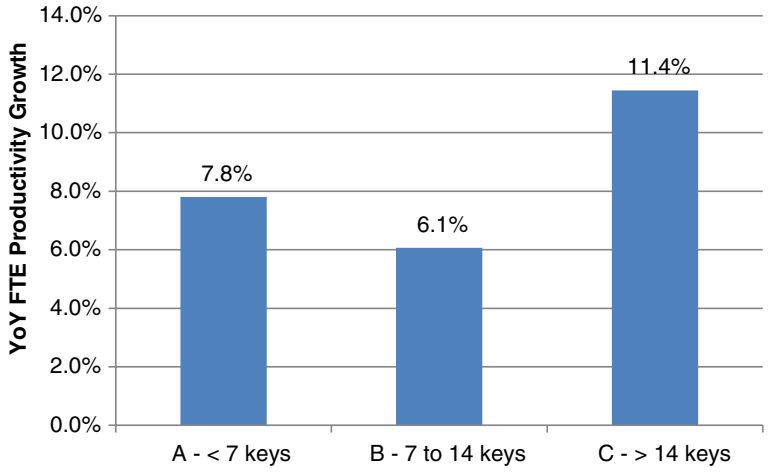


Fig. 17 The average change in productivity per employee in relation to the number of keys implemented by participants operating in the manufacturing industry—*N* = 39

Time spent in the program, according to the research, does not play a role in raising productivity but had a major role in raising the income of the enterprise (Fig. 18), which ultimately confirms the proposition that prolonged application of the 20 Keys methodology provides noticeable results.

Analysis of Croatian participants' satisfaction derived from survey results

An electronic survey was conducted among the participants in the program in order that their satisfaction and perception of achieved gains might be evaluated. Twenty-six participating companies have answered the poll questions, and their answers provide the basis for some of the conclusions reached in this paper.

The following questions were posed:

1. Which keys have you implemented by now in your company?

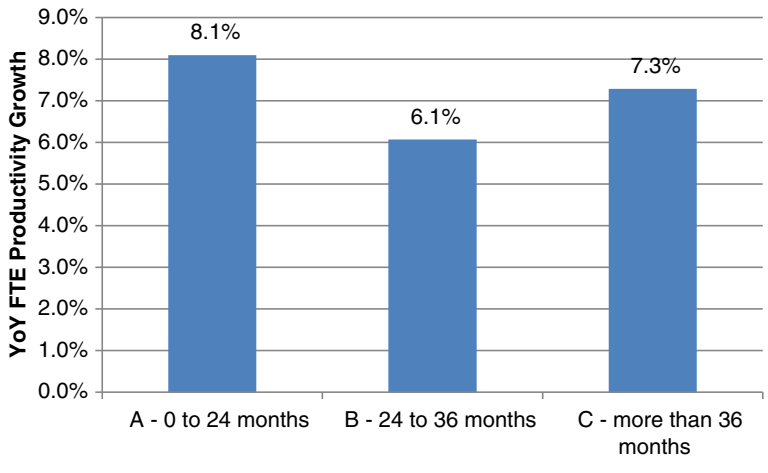


Fig. 18 The average change in productivity per employee in relation to the time spent in the program by participants operating in the manufacturing industry—*N* = 39

2. How would you evaluate the program? (Ratings 1 poor, 3 mediocre, 5 excellent)
   a. The program has enhanced our companies competitiveness (1, 3, 5)
   b. The program is understandable and practical (1, 3, 5)
   c. The program has helped our employees' motivation to grow (1, 3, 5)
   d. We would recommend this program to other companies (1, 3, 5)
3. How would you evaluate the Ministry's co-financing scheme? (Ratings 1 do not agree, 3 partially agree, 5 agree completely)
   a. The co-financing method is good (1, 3, 5)
   b. The Ministry's investments into this program is completely justified (1, 3, 5)
   c. The Ministry should continue with this program and expand it to other companies (1, 3, 5)
4. Which business areas were improved due to 20 Keys? (multiple answers possible)
   a. Motivation
   b. Quality
   c. Costs
   d. Delivery

Figure 19 shows the result of satisfaction and the way participants evaluated each of the elements of the program. The statement "The program has enhanced the competitiveness of our businesses" received the lowest score (3.40), while the claim which was received best is "I would recommend the program to other companies." If we take into account that 20 Keys was propagated as a program for raising the competitiveness of the Croatian economy (Deloitte 2005) and the fact that the assessment program was not anonymous, then the rating of 3.40 does not represent complete client satisfaction, especially with regard to the original objective of implementation—increasing competitiveness. On the other hand, the program was evaluated as practical and easy to understand which speaks in favor of Kobayashi and his intention that the program should be easy to understand by all employees of the company.

Respondents rated the subsidy program by the Ministry of Economy, Labour, and Entrepreneurship very favorably (Fig. 20). The Ministry has subsidized all implementation costs, amounting to 40 % of total costs submitted by the Deloitte CE. Of course, subsidies have significantly improved the expansion of the program in new businesses and facilitated the financial burden of participation in the program. It is obvious that

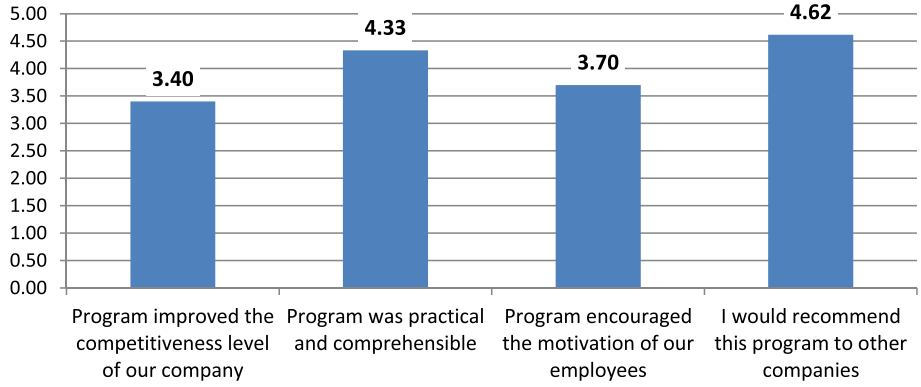


Fig. 19 How would you evaluate the program? (Ratings *1* poor, *3* mediocre, *5* excellent), *N* = 26

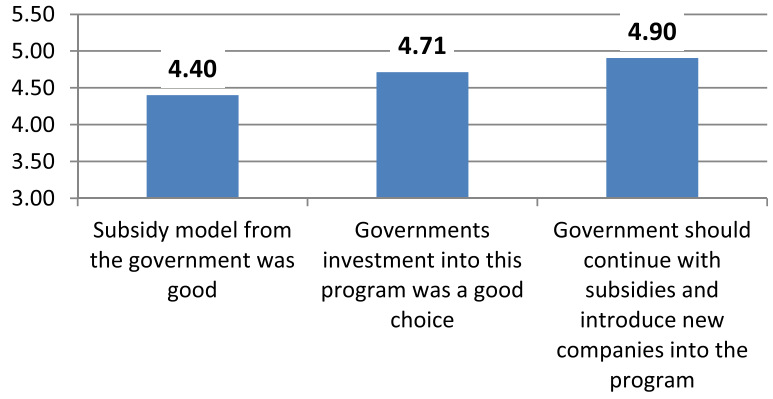


Fig. 20 How would you evaluate the Ministry's co-financing scheme? (Ratings *1* do not agree, *3* partially agree, *5* agree completely); *N* = 26

the program did not manage to take hold on the market without the subsidies since the number of participating companies has been drastically reduced after the end of the scheduled period (2004 to 2008). Today, only six companies are active in the program (Deloitte Savjetodavne Usluge d.o.o. 2009).

The respondents most often highlighted motivation as the area in which 20 Keys has produced results. These results are in correlation with the most frequently introduced keys in Croatian enterprises—keys for motivation group (keys 1, 2, 3, and 10). A very small part of the respondents confirmed achieved results in quality, cost reduction, and especially in increased speed of delivery. An increase in the speed of delivery, for example, was not accompanied by the implementation of appropriate keys in that category (Fig. 21), suggesting a different focus at Deloitte CE as an advisory body for the introduction of the methodology in Croatian companies.

This focus is certainly at odds with the original ideas of Kobayashi and goals that he had in mind for implementation of the methodology, because all of Kobayashi's activities were directed towards the achievement of productivity growth. He used all

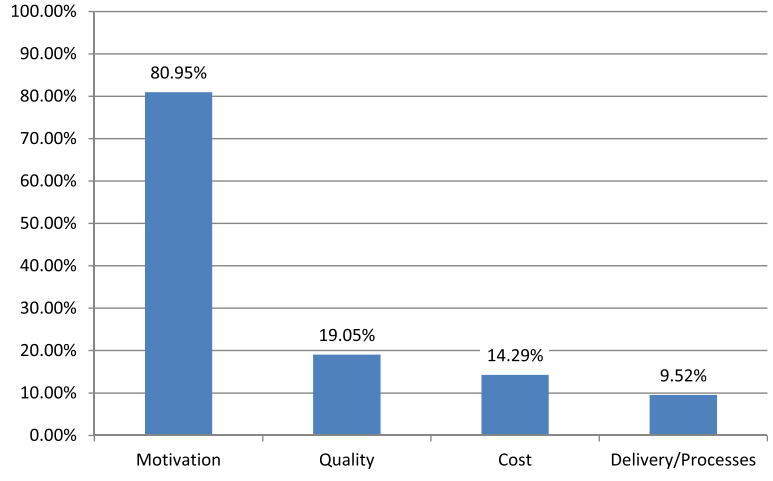


Fig. 21 Which business areas were improved due to 20 Keys? (Multiple answers possible); *N* = 26

categories as leverage to enable the realization of the ultimate goal of the methodology—productivity growth (Kobayashi 1995, p. 3).

Discussion

The following can be concluded regarding our initial propositions:

> Proposition no. 1: 20 Keys methodology is the most appropriate for and provides best results in manufacturing companies.

When viewing the results achieved by companies in 20 Keys, the processing (manufacturing) industry has achieved average annual growth of 10.7 %, an increase in profit margins of 3.3 %, employment growth of 14.1 %, and average annual productivity growth of 6.9 %. Taking into account that this is a sample of 39 companies, representing 81.25 % of the total number of participants, the results are respectable. Companies from other industries were represented in smaller numbers, and it is difficult to determine the applicability of the methodology and the trend in these sectors.

Furthermore, based on the analysis of tools that are part of individual keys, models of organization and management of project implementation, Kobayashi's descriptions of individual keys and personal experiences of the author of this paper in introducing the methodology in Croatian companies, the conclusion is that 20 Keys methodology is best suited for companies dealing with manufacturing activities. This does not preclude the applicability in other (e.g., services) industries, but many of its tools find their full application only in companies which are engaged in production.

> Proposition no. 2: Manufacturing companies which have opted for the implementation of 20 Keys generate above-average growth in revenue compared with an average of Croatian companies in the manufacturing sector (manufacturing industry)

According to the analysis presented in Table 3, it is evident that the manufacturing companies with an average income increase of 10.7 % per year significantly outpace the increase in national industrial production index in the period from 2004 to 2008 (4.38 %) after the start of implementation. Also, the average realized productivity growth of 6.9 % per year and the increase in profit margins of 3.3 % confirm the success of companies that have decided to apply 20 Keys. The number of analyzed enterprises operating in the manufacturing industry ($N = 39$) minimizes the variance and thus confirms this proposition.

> Proposition no. 3: Enterprises which participated in the program for a longer period of time and introduced a greater number of keys generate higher revenue and profit growth than the companies which participated for a shorter period of time.

We discussed the dependency of results achieved by companies in the manufacturing industry on two factors—the number of implemented keys and time spent in the program. Although the research shows deviations from the claims put forward in this proposition, the following trends are clearly observable—companies that participated in the program longer than 36 months have achieved average annual revenue growth of 22.4 % and companies which implemented more than 14 keys achieve average annual growth in productivity per employee of 11.4 %. These figures are clearly dominant in

relation to those pertaining to companies which implemented a lesser number of keys and spent shorter time in the program, which represents a confirmation of the proposition.

> Proposition no. 4: Application of the methodology in Croatia from 2004 to 2008 did not fully utilize all the resources of the methodology, because an insufficient number of companies took advantage of all the knowledge and tools offered in 20 Keys and participated in the program long enough to realize the necessary improvements.

Several data confirm the veracity of this proposition. First of all, the number of implemented keys did not reach its possible maximum in any company, and a large number of companies failed to implement some keys. This fact is in direct conflict with the recommendation of Mr. Kobayashi that simultaneous implementation of all keys provides maximum results and synergies necessary for the growth of productivity.

Furthermore, keys belonging to the categories of cost and speed of delivery have been implemented to a lesser extent than those from the categories of quality and, especially, motivation. This information indicates that only 46.4 % of participants had the opportunity to familiarize themselves with themes that function as the foundation of many other methodologies around the world, especially lean manufacturing—that is, topics that are directly aimed at raising the productivity of business processes.

The results of the survey also represent an indicator of the under-utilization of the methodology. Respondents evaluated the claim that "The program has enhanced our company's competitiveness" with the rating of 3.4, while the category of speed of delivery was marked by only 7.68 % of the respondents as an area where direct gains of the methodology could be seen. This is a relatively low score for a program that is advertised as a methodology for raising competitiveness. A positive aspect of implementation was the impact on motivation and employee involvement, which companies participating in the survey most commonly chose as a category in which the results were achieved.

Conclusions

The introduction of 20 Keys methodology in Croatian enterprises was subsidized by the Ministry of Economy, Labour, and Entrepreneurship in the period since 2004 to 2008. More than 50 companies which participated in the program to increase competitiveness were granted subsidies amounting to 40 % of the cost of introducing the methodology, conducted by the license holder in the Republic of Croatia—Deloitte CE. This represents a significant government investment in the Croatian economy, and in this sense, the direction and goal of this study were determined as twofold—to establish the position of the methodology in the world by comparing it with some of the more familiar and better known methodologies and to objectively assess results and the course of implementation in companies which participated in the program.

Comparing 20 Keys with ISO systems, six sigma, lean manufacturing, and balanced scorecard, we discovered many common tools and techniques of approach to solving business problems. The highest degree of similarity was observed between 20 Keys methodology and lean manufacturing. The degree of similarity was such that it can be concluded that these represent the same basic principles and goals enveloped in a

different model of implementation and presentation. Both methodologies derive a multitude of techniques from renowned Toyota production system and share common primary goals—productivity growth and the establishment of a culture of continuous improvement in companies.

However, when we consider the distribution of the methodology throughout the world, especially in comparison with the abovementioned methodologies, we come to the conclusion that 20 Keys is not nearly as widespread and accepted in the world like other methodologies are. A few countries like Japan, South Africa, Slovenia, and Croatia represent exceptions. Despite the relative anonymity in the world, the Ministry of Economy, Labour, and Entrepreneurship adopted the methodology as a program for raising sustainable development and holistic approach of competitiveness of Croatian companies, thereby following a similar scenario to that in the Republic Slovenia a few years earlier.

Despite the relative anonymity of the methodology in the world, our analysis has shown that companies that have participated in the program achieved higher rates of revenue growth and productivity than the average rates in the Republic of Croatia. The manufacturing industry was the most represented sector with 39 participating in the program, and the results achieved by companies in this sector clearly show that there is a correlation between participation in the program and revenue growth, as well as productivity growth—which is logical given that the methodology is intended primarily for manufacturing companies. Companies operating in the manufacturing industry recorded an average growth of 10.7 %, which compared against the average growth of 4.38 % at the national level, represents a significant improvement. Also, there is a positive correlation between the greater duration of the period of time spent in the program, as well as the number of implemented keys, and achieved business results.

However, the fact is that the full potential of the methodology was not utilized in the Republic of Croatia. The tools and techniques of 20 Keys were not completely transferred to Croatian companies during the period of implementation and monitoring, especially those of management costs and speed of delivery categories.

The final assessment of the actual introduction of the methodology in Croatian companies, based on the previous analysis and the data collected, is as follows: achieved results alongside under-utilization potential offered by the methodology.

Competing interests
The authors declare that they have no competing interests.

Authors' contributions
All authors contributed to this project equally from the inception to the end. All authors read and approved the final manuscript.

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