

IMPACT OF RIGHT-TIME BUSINESS INTELLIGENCE TOOLS ON EFFICIENCY IN DECISION MAKING

UTJECAJ RIGHT-TIME ALATA POSLOVNE INTELIGENCIJE NA EFIKASNOST POSLOVNOG ODLUČIVANJA

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Abstract: *As a result of the dynamics of modern business the risks of modern business demand that business applications have a rational component in making decisions. By using the data, a rational component in the decision making is enabled, as well as the knowledge needed to process and interpret the data when making business decisions, and using the concept of business intelligence is applied. The growing dynamics of business contributed to the need for growth in speed in making business decisions, which induced the evolution of a new concept in terms of business intelligence that has been made in the form of right-time business intelligence tools. As a new concept that has only recently emerged from the theoretical framework, right-time business intelligence concept blurs the distinction between rational strategic and operational decision-making, allowing the operational level of decision-making to use platforms and tools that were until recently reserved for strategic decision-making. Business intelligence greatly improves business decision-making, in particular through the reduction of latency in business decision, which was confirmed by conducted primary research. Its general conclusion is that there is cohesion between performance and the successful application of business intelligence tools.*

Keywords: *Business intelligence, right-time business intelligence tools, rational business decision*

Izvorni znanstveni članak

Sažetak: *Rizici suvremenog poslovanja koji su posljedica dinamičnosti suvremenog poslovanja od poslovnih subjekata zahtijevaju aplikaciju racionalne komponente u odlučivanju. Racionalna se komponenta u odlučivanju osigurava upotrebom podataka te znanja potrebnih za njihovu obradu i tumačenje prilikom donošenja poslovnih odluka, a aplicira se kroz koncept poslovne inteligencije. Porast dinamičnosti poslovanja utjecao je na potrebu rasta brzine poslovnog odlučivanja, što je induciralo nastanak novog koncepta u okvirima poslovne inteligencije koji je opredmećen u vidu right-time alata poslovne inteligencije. Kao novi koncept koji je tek nedavno izašao iz teorijskih okvira, right-time koncept poslovne inteligencije briše razlike između racionalnog strateškog i operativnog odlučivanja, omogućujući operativnoj razini odlučivanja da koristi platforme i alate koji su donedavno bili rezervirani za strateško odlučivanje. Poslovna inteligencija uvelike unapređuje poslovno odlučivanje, posebice kroz smanjenje latencije u poslovnom odlučivanju, što je potvrđeno provedenim primarnim istraživanjem, čiji je generalni zaključak kako postoji kauzalnost između uspješnosti poslovanja i uspješne primjene alata poslovne inteligencije.*

Ključne riječi: *poslovna inteligencija, right-time alati poslovne inteligencije, racionalno poslovno odlučivanje*

1. INTRODUCTION

In the last twenty years, human society has been going through a phase of profound changes mainly induced by the enormous increase in processing and communicational skills of information and communication technology. The consequences of the changes caused by information and communication technology on modern businesses, especially those operating in the areas of developed market conditions, are the globalization and the increase in transparency. This, as a consequence, implies intensifying competitive relationship among the participants in the competition. In addition, global growth of general and specific knowledge of people arising from

the global transparency of information and knowledge has an impact on consumer emancipation. This further complicates the position of the companies, which are therefore forced to take care of the needs and behavior of each individual with whom they have or intend to establish an interchanging relationship. In general, these evolved business conditions have led to a decrease in average margins and fierce fighting between companies for each job and for every consumer. In these conditions, businesses have almost no right to make an error, because any significant error can affect the survival of enterprises. To avoid mistakes in business, companies are investing considerable effort to use a rational approach to business

decision making, which means an approach that is based on data and knowledge.

Focus on rational decision-making has led to the evolution and increasingly intensive use of the concept of business intelligence, which focuses on the pursuit of the collection of a large volume of data from different data sources in order to ensure reliable and high-quality components for rational decision-making management. However, growth in data quantity derived latency in the creation of management information. Therefore, on a scientific level, informational management has been increasingly focused on problem solving latency data in the process of business decision-making. The solution which has recently imposed from the perspective of scientific theories came in the form of right-time business intelligence tools. It is a new approach that is just making its way into business practice, which aims to provide necessary well-timed management information for the management, even when it comes to the operational level of management. Since this is a new concept, right-time business intelligence tools are placed in the focus of research. Accordingly, the aim of the study was to determine the essential features of these tools and to explore the causality between the quality of business decision-making and performance of application business intelligence tools. To prove the initial hypothesis which argues that there is proportional relationship between the quality of business decisions and success using right-time business intelligence, a survey was conducted by interviewing experts from business entities in Croatia that use business intelligence tools, and the results obtained by statistical analysis, are presented in this paper. The results presented here are part of a broader research that generally explored the assumption that the application of business intelligence tools means greater success of those businesses that use right-time business intelligence tools.

2. RIGHT-TIME BUSINESS INTELLIGENCE TOOLS

Right-time business intelligence tools present a separate, relatively new concept in terms of business intelligence. As well as traditional business intelligence tools, right-time business intelligence tools rely on the concept of storing data as a function of data transformation in the management information. In his definition of a data warehouse, Inmon [1] states the time invariance of data as one of four key features that affect the quality of data, and tells how the data is time-dependent - it means that the data in the data warehouse has the dimension of time, further claiming that the warehouse data consists of images (*snapshots*) of transaction data taken at regular intervals. This feature enables analytic functionality and trend analysis of business over time, as the transactional systems always keep only the current value of the transaction. This means that in order to obtain the condition at some point, it is necessary to sum up all the transactions within the required period. Timeliness deals with the age of the data, and timeliness of data. Zmud [2] and Hilton [3] were early supporters of timeliness as a specific dimension of the quality of data or information. Similarly, Miller [4]

underlines the timeliness, as one of the fundamental characteristics of quality information. Given the correlation between timeliness and quality of information it makes sense to analyze the time cycle, and the lifetime of information. Therefore, it can be concluded that timeliness of information is an essential feature of a quality information system. Hence the importance of the right-time business intelligence tools, as a concept whose basic idea is to provide well-timed information. However, not all information at all times is equally important. In today's time of rapid market changes, the amount of information grows intensely, and their timeliness is the key factor in business success. Therefore, the concept of timeliness is the one concept that is constantly changing and is in constant need for redefining. Alongside the timeliness, accuracy and accuracy are essential features of information.

According to the theory of decision-making, what is relevant is the relationship between the speed of decision-making and management levels. Strategic decisions relate to the longest period of time; therefore, for the purposes of rational strategic decision-making, usually the highest volume of aggregated data is used. Consequently, making such decisions approach is systematic and lasts the longest. Until recently, business intelligence is used mainly for making strategic decisions. A powerful tool in this sense was the data warehouse as a data repository, subjectively oriented, comprehensive in-time and aggregated. Under certain circumstances, data warehouse was consumed by the tactical decision-making level. In principle, until recently the operational decision-making levels were focused on transactional data sources; small amounts of native (transactional) data were used for operational decision-making. Such decisions were taken by very quickly, but due to time-limited sources of information, the relevance of such decisions was often questionable. The problem of the significance of such operational decisions is proportional to the level of correspondence between operational decisions and strategic business principles.

The changes, which modern society implies, especially in terms of speed of change, reduce significantly the period in which strategic decisions are made. Also, they increase the importance of operational decisions since an increasing number of operational decisions corresponded to the strategic decisions. As a result of these conditions, the loss of a clear division between the strategic, tactical and operational decision-making often happens. Thus, on the one hand, for management to make strategic decisions there is often equal or less time than time to make operational decisions; on the other hand, a clear distinction between strategic and operational decisions is lost. In such conditions, a growing need has been developed for increasing speed of decision-making at all levels of decision-making. The term, which is linked to the speed of business decision-making, is latency of decisions. Decision latency is the time that is necessary to make people understand the situation, decided on a course of action and initiate action. Bara and Knežević indicate that: "Reducing data and analysis latency primarily depends on technical solutions. Recent technologies especially in real-time data warehousing provide help in this regard. But, the main thing dealing with decreasing decision latency

requires changes in business processes as well as how people use provided information while carrying out their jobs. Providing real time data does not automatically create business value and quality business decisions unless it is used in a well-timed manner. Dealing with decision latency is usually more challenging than data and analysis latency.” [5] The benefit of reducing latency is shown in Figure 1.

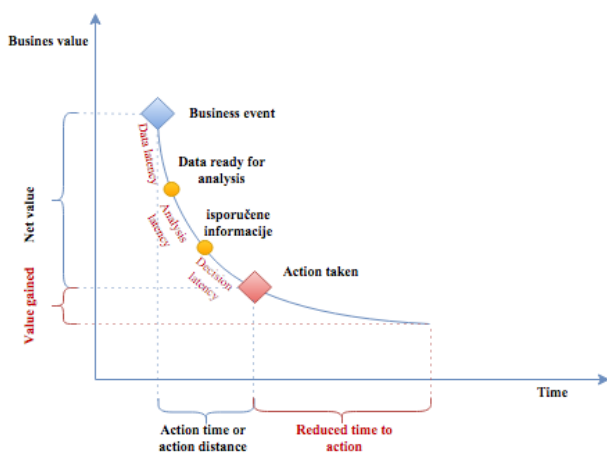


Figure 1. The benefit of reducing latency

It can be concluded from Figure 1 that the quality of information, and thus the quality of decisions made, correlates with shortening the latency. Modern business conditions dictate that increased amounts of data is collected, especially from the environment, which logically results in the growth of latency.

However, apart from the volume of data, the size of the latency is affected by the available knowledge that serves as a function of business decision-making. Under the influence of the increase in the dynamics of business, there is also considerable growth in the volume of data. In a similar manner, under the influence of the volume of science, scientific method increases the number of data processing. Primary focus of this research is solving latency problem in decision-making caused by the abundance of data.

When it comes to the growth in the volume of data, it is primarily related to the data that is being generated in the environment of a business entity. With the growth of the sensitivity and complexity of the market, which is caused by globalization and the intensification of competitive relationship in the market, the need for collecting data on actual consumers and their needs and behavior is growing. Today, the information that the customers provide is the key data for the survival of most businesses, but such data are the basis for the creation of knowledge about customers, based on which customer relationships are managed.

In late 1996 and early 1997, Ernst & Young and Business Intelligence Ltd. conducted a joint survey [7]. 563 senior executives in Fortune 1000 enterprises in North America and Europe responded to questions about their opinions on knowledge. Eighty-seven percent (87%) of the respondents reported that they worked in businesses intensive in knowledge. The types of knowledge reported as “very important” or “extremely important” were:

- Knowledge about customers (96%),
- Knowledge about best practices/effective processes (87%),
- Knowledge about our own competence and capabilities (86%),
- Knowledge about our own products and services (85%),
- Knowledge about emerging market trends (83%), and
- Knowledge about competition (81%).

In the same survey, five key benefits of active knowledge management were listed by more than 80% of the respondents during the above mentioned survey by Ernst & Young and Business Intelligence Ltd., these were:

- Increased responsiveness to customers (83%),
- Innovation: more consistent success in designing new products/services and processes (83%),
- Efficiency: increased productivity of knowledgeable workers (83%),
- Improved decision-making (83%), and
- Flexibility: ability to change and adept to change more rapidly (82%).

From the above research, two important conclusions can be drawn. First, for the adoption of orientation towards customer value, organizations must have extensive knowledge of their markets and target consumers. Second, managers must use the advantage of learning about consumers in high-performance with consumers. For example, the internal processes of the organization that work to deliver value must be matched with values of the consumers.

“Despite this conscious awareness of the strategic need for knowledge, most enterprises have more knowledge than their employees are aware. Thus, it is vital that relevant information and knowledge is communicated to decision-makers who can analyze and implement the wisdom.” [8] Arguments in favor of management that is oriented towards consumers are convincing, and frameworks that exist describe the concept that managers should develop a focused competitive advantage towards consumers. [9]

In one view of organizational management, it is argued that the creation and delivery of world-class value to consumers at the same time increases the value of the organization. [10]

Over the past 15 years, the database technology has progressed to the point where providing information to business people has become easier. The enormous increase in the quantity of data available in a single business should at first glance be enough to analyze data about their consumers, but businesses “as much information as they have about their customers, it seems that they still want more.” [11]

The fact is that businesses are buying information about their customers from credit bureaus, telecommunications companies, banks, etc., and thus the amount of data is growing rapidly [12]. In many cases, businesses are buying external data to compare with their own data, test their data at regular intervals in order to

verify the accuracy of their own data, for example, location data, demographic data and more. Also, businesses buy extra data for mitigating operational risks. For example, understanding the consumer's credit history can help an entity to determine the risk of doing business with the consumer.

Many businesses are buying consumer data in order to target marketing campaigns, which, when successful, generate more revenue than what the data was paid for. Marketing departments have changed their decision making strategies, from the ones based on emotions in their campaigns to the ones which are based on careful analysis of the facts on the basis of massive data sets of customers [13]. Even businesses with a large amount of their own data decide to purchase data. Usually, it is the information on annual household income, the model and age of cars that consumers have, on the frequency and the places where consumers go on vacation, and more. Therefore, businesses constantly aim to enhance the volume of data in order to create more complete information about its customers. Dyche and Levy [14] consider that consumers are the biggest assets of businesses, and therefore the data on consumers should be adequately treated.

In view of the above, the latency problem becomes one of the central problems related to the efficiency of business decision-making. In recent years, the problem of latency has been tried to be solved, primarily in academic terms, but lately more and more in pragmatic terms as well. The very concept, given the importance of the time dimension, has been named real-time business intelligence.

According to Tank [15], the implementation of real-time business intelligence can result in significant benefits to the organization, reducing the time spent in making decisions, which gives the decision-maker enough time and information to make a decision. This will result in more efficient decision-making process and reducing the cost, because the decisions are made in a well-timed manner in a competitive environment.

The meaning of real-time business intelligence mainly depends on understanding what real-time means for a business. Not surprisingly there are no agreed definitions here either. Real-time can mean: [16]

- the requirement to obtain zero latency within a process,
- that a process provides information whenever it is required by management or other processes,
- the ability to derive key performance measures that relate to the situation at the current point in time and not just to some historic situation.

The primary goal of real-time business intelligence is to connect the analysis of the management functions so that the analysis becomes an integral part of doing business to managers and teams of employees. [17]

When it comes to real-time business intelligence, data warehouse repositories need to be updated with the transaction data in real time. This type of update repository data is called feeding leaks. As the transactions are received, they are saved and become the repository of data growing historical record of activity.

Furthermore, real-time business intelligence system must have a very fast engine management rules that can analyze incoming traffic in the context of the historical database, and which can make decisions quickly enough so that the entity may have a value of immediate action. [18]

The global survey of 400 large businesses, revealed that businesses that utilize advanced analytics, are twice more likely to have better financial performance in their respective industries, three times more likely to make decisions as they imagined, twice as likely to be very frequently used data to make decisions, and five times more likely that a decision will be much faster than their market competitors. [19]

Traditional business intelligence systems have helped improve the strategic decisions that affect the success of a business entity. This, however, is not enough for the complete resolution of issues in today's dynamic marketplace. Real-time business intelligence gives businesses the power to automate many tasks and processes in the database, and thus provides more time to work on knowledge. [20]

Often, in theory and practice, for this type of business intelligence tools, as a kind of synonymous, instead of the term right-time appears the term real-time. But the prevailing attitude [21] to the right-time is actually a better word to use than real-time. When the notion of right-time emphasis is to deliver information at the right time which may include latency tolerant (up to a fraction of a second, and up to several days), while the real-time meant giving information without latency.

Since the latency is in pragmatic terms almost impossible to avoid, the advantage given to the concept of right-time is understandable. It goes in favor of the concept of right-time that in practice business processes are significantly slower than the data processing. Rutz et al. [22] state that there are significant benefits from the use of right-time business intelligence tools in relation to the real-time tools.

In order to succeed in the transition to digital operations, or the use of right-time business intelligence tools, businesses must take a few steps: [23]

1. Define what it means for their organization to be a right-time enterprise.
2. Determine what business problems the organization is trying to solve.
3. Take a systematic, iterative, and long-term approach to introducing new technologies and business processes.
4. Create a more responsive and open corporate culture, from the management ranks to the front lines.

In order to overcome all the problems and challenges in the way of the introduction of right-time business intelligence tools, in the transition to digital business or to right-time business intelligence businesses should overcome several technological obstacles: [24]

- **right-time data collection** - for a particular business, real-time and right-time can mean collecting data every five minutes, while for some other tasks that period is smaller or larger, which means that before defining the time of collection, it should be defined

what this means for business processes, which are the objectives to be achieved, and so on.

- **right-time processing** - one of the major problems of the concept of right-time business intelligence is the need for different processing speeds for different types of data. Since all data is not included in the data warehouse at the same time, even with the same frequency, its treatment is a major challenge.
- **right-time insight availability** - these tools must have the ability to create reports on demand, unlike traditional business intelligence tools that have the predefined reports at the agreed time.
- **right-time use of insights** - a key use of this technology is not in solving technological assumptions but in the manner in which it is used. The obvious challenge is to implement the use of these technologies into existing business processes.

Right-time business intelligence tools have recently released the theoretical framework and become applied technology for decision making in the developed world. Due to this fact it is interesting to examine what the situation is with the application and the application effects of right-time business intelligence tools in the Croatian businesses.

3. ANALYZING THE IMPACT OF RIGHT-TIME BUSINESS INTELLIGENCE TOOLS ON EFFICIENCY

Research on the interdependence of the successful application of right-time business intelligence tools and quality of business decision-making was carried out in the context of wider research whose overall results are presented in the doctoral thesis of Danijel Bara, co-author of this article. The questionnaire was completely filled in by 125 respondents. The sample consists of those experts that in their businesses apply some of the tools of business intelligence.

Therefore, all those respondents whose business entities do not use business intelligence tools were excluded from further analysis (10 respondents). The two respondents that gave inconsistent and mutually exclusive answers were also excluded. In the final analysis, responses from 113 respondents were taken into account and statistically analyzed.

3.1. Analysis of socio-demographic characteristics of respondents

For the purposes of the relevant overview of answers, primarily their socio-demographic characteristics were explored. Table 1 shows the respondents by gender, age, education level and occupation.

Table 1. Respondents by gender, age, education level and occupation.

	Respondents	%
Gender		
Male	95	84,1
Female	18	15,9
Total	113	100

Age		
18-27	3	2,7
28-35	25	22,1
36-50	77	68,1
51-65	8	7,1
Total	113	100
Education level		
Secondary education	6	5,3
College education	8	7,1
University qualifications	66	58,4
Master's degree and Ph.D.	33	29,2
Total	113	100
Occupation		
CEO	9	8,0
Economist	24	21,2
Informatics, IT experts	29	25,7
Other	48	42,5
Missing answers	3	2,7
Total	113	100

The following table shows the distribution of respondents according to the characteristics of a business entity in which they are employed (Table 2).

Table 2. Characteristics of a business entity where respondents are employed

	Respondents	%
Size		
Micro and small	35	31
Medium	23	20,4
Large	55	48,7
Total	113	100
Company activities		
Financial and insurance	20	17,7
Information and communication	56	49,6
Other	37	32,7
Total	113	100

3.2. Analysis of the link between the quality of business decisions and successful application of business intelligence tools

In this study methods of descriptive and inferential statistics were used, as well as factor analysis. Exploratory factor analysis was used to determine the latent variables relating to the sources and the importance of information in an enterprise. According to the hypothesis, classification of particles is expected according to sources of information, where the answers should be classified according to the way the estimated volume of the collection of data from internal or external sources of information. When it comes to interpretation of the results, the fact that an entity applies the tools of business intelligence is not sufficient for the business entity to be called successful. Even if a business entity displays the need, desire, knowledge, understanding the process, and finally the use of business intelligence tools, this still does not indicate the actual application of business intelligence tools. In other words, if the management of a business entity on a daily basis does not use business intelligence tools, and business intelligence tools are not used as the basis in making business decisions, the issue of cost-effectiveness of these tools should be raised, as well as understanding of the tools, regardless of whether it is the

business entity applies right-time business intelligence tools or classic business intelligence tools.

This research analyzed the connection between the quality of business decision-making on the success of the application of business intelligence tools, and tested the assumption that the application of business intelligence tools successfully applies only to those businesses that used the right-time business intelligence tools. The methodological challenge in testing these hypotheses is in the measurement variable quality of business decision-making, and the success of the application of business intelligence tools.

One of the variables, which is created on the basis of pre-existing variables, represents business success. Business success is often measured by financial indicators, and in this context, we look at business success through frequency of use business intelligence as the basis for decision-making by management. Successful businesses are those who do so to a greater extent. Table 3 shows the successful application of business intelligence tools.

Table 3. The success of the application of business intelligence tools

The success of the application of business intelligence tools	N	%
Yes	70	61,9
No	43	38,1
Total	113	100

Successful application of business intelligence tools was recorded in almost 62% of businesses in the sample. Once new variable was created, it opened the possibility of seeking the existence of links between the use of right-time business intelligence tools and successful application of business intelligence tools. In other words, the assumption that businesses that use the right-time tools are more successful in applying (exploitation) business intelligence tools than those used by traditional business intelligence tools (Table 4) will be investigated. Since both variables were measured at the nominal level of measurement mentioned, assumption is tested by chi-square test of independence.

Table 4. The success of the application of business intelligence tools

		The success of the application of business intelligence tools		Total	Test indicators
		Yes	No		
Application of right-time business intelligence tools	Yes	37	10	47	$\chi^2 = 9,608$ $p = 0,002$
		78,7%	21,3%	100,0%	
		52,9%	23,3%	41,6%	
	No	33	33	66	
		50,0%	50,0%	100,0%	
		47,1%	76,7%	58,4%	
	Total	70	43	113	
		61,9%	38,1%	100,0%	
		100,0%	100,0%	100,0%	

Businesses that are successful, that have a constant in the application of business intelligence tools, in equal proportion are those who apply the right-time tools (52.9%) or classic (47.1%) business intelligence tools.

How do the businesses differ when it comes to the success of the application of business intelligence tools? From a more close-up comparison of the data only for those who apply right-time business intelligence tools, it is evident that there are more of those who successfully apply these tools (78.7%) than those who are less successful (21.3%). According to the results of the chi-square test between the analyzed characteristics, there is a statistically significant correlation.

If you consider the claim that in applying business intelligence tools, businesses that apply right-time business intelligence tools are more successful and then the results presented in the table above, it is possible to conclude that such a claim is rejected. However, it was observed that those businesses that use right-time business intelligence tools have a higher percentage of successful application of business intelligence tools (78.7%) than those businesses that apply classical tools of business intelligence (50%).

It is obvious that there is some link between business performance and selecting the degree of application business intelligence tools.

Furthermore, we analyzed whether there was an observed significant change in the operations of businesses due to the successful application of business intelligence. To test the changes that are visible in an enterprise by introducing business intelligence tools, but also changes the future brings, 22 statements measured at 5-graded Likert scale were used. In this variable, responses of respondents who applied right-time business intelligence tools and of those who applied classic business intelligence tools were not divided, but the emphasis was on changes that were adopted (made) by business intelligence tools.

With the intention of discovering dimensions which can describe the expected and current changes factor analysis was used. The appropriateness of conducting factor analysis was confirmed by KMO measure (KMO = 0.78) and Bartlett's test ($2 = 936.616$, $p < 0.001$). Rotated factors table (Varimax method using the Kaiser criterion) yields the distribution of the particles (Table 5) to six factors with the total explained variance of 65.7%.

Table 5. Factor analysis (rotated factor matrix)

Factor	Particles (statements)	Loading	Cumulative % of explained variance
1	Ensuring integration with business strategy	0,78	14,55
	The wider aspect of understanding the business as a whole	0,77	
	Strengthening strategic planning	0,76	
	Faster and better decision-making ability	0,71	
2	The desire to increase profitability	0,84	25,81
	The desire to increase competitiveness	0,78	
	improved efficiency	0,53	
	Better overview of threats and opportunities		
3	Excellence in Customer Service	0,80	36,84
	Increasing professionalism in the collection and analysis of information	0,79	
	Optimization of resource allocation	0,53	
	Harmonization in the mindset of the employees of a business entity		

4	The increase in information exchange	0,71	46,9
	The growth of the knowledge base	0,69	
	The rapid increase in the volume of data	0,66	
	Understanding the importance of information	0,51	
5	A deeper insight into data	0,82	56,8
	Easier data collection and analysis	0,79	
	Reducing costs	0,49	
	Better quality of information		
6	The requirements of regulators	0,80	65,7
	Requirements of stakeholders	0,80	

With factor analysis, six dimensions (constructs) were proposed which measures changes in an enterprise through the application of business intelligence tools. Analyzing the answers, it can be concluded that the particles are classified into meaningful dimensions. On the basis of clusters of particles dimensions have been named as follows:

- Factor 1: Changes in the quality of decision-making
- Factor 2: Changes to the market economy
- Factor 3: Changes in the quality of business
- Factor 4: Changes relating to data
- Factor 5: Changes relating to information
- Factor 6: Changes regulatory nature

Before testing the difference, according to the established dimensions depending on the degree of success of the application of business intelligence tools, justification of the use of these proposed dimensions is confirmed based on the value of Cronbach Alpha.

Table 6. Descriptive description constructs changes in the business entity as a result of the application of business intelligence tools

Changes to the business entity as a result of the application of business intelligence tools	Arithmetic mean	Standard deviation
The quality of decision-making	4,03	0,78
Market operations	3,97	0,77
Business quality	3,54	0,77
Data	4,01	0,67
Informing	3,75	0,71
Regulation	3,21	1,09

Businesses differ in their perception of the changes brought by the application of business intelligence tools. In identifying statistically significant areas with the visible positive change through the application of business intelligence tools, new constructs were compared to the success of the application of these same tools. The results of t-test for independent samples are shown in Table 7.

Table 7. The results of t test procedures for independent samples

Changes to the business entity as a result of the application of business intelligence tools	The success of the application of business intelligence tools	Arithmetic mean	Standard deviation	t-test	
				t	p
The quality of decision-making	Yes	4,07	0,72	0,710	0,479
	No	3,96	0,89	0,671	0,504
Market operations	Yes	4,10	0,67	2,393	0,018*
	No	3,74	0,87	2,232	0,029*

Business quality	Yes	3,68	0,64	2,526	0,013*
	No	3,30	0,91	2,315	0,024*
Data	Yes	4,06	0,63	0,964	0,337
	No	3,93	0,74	0,924	0,359
Informing	Yes	3,81	0,67	1,190	0,237
	No	3,64	0,78	1,144	0,257
Regulation	Yes	3,30	1,06	1,160	0,249
	No	3,04	1,14	1,135	0,260

* p<0,05

Statistically significant differences at a significance level of 5% were observed for the constructs of market operations and the quality of operations. The construct that measures changes in businesses related to market operations differs depending on the degree of success of the application of business intelligence tools. This indicates that businesses which have successfully applied the tools of business intelligence noticed positive changes in their operations in terms of market operations. In other words, it can be concluded that businesses that have successfully implemented business intelligence tools, or use them on a daily basis as a basis for decision-making in business decisions generate positive changes in terms of profitability, competitiveness, efficiency and clarity the threats and opportunities (construct market operations). Apart from market operations, those businesses that are successful in implementing business intelligence tools recorded a significantly higher average score on the construct of quality business.

4. CONCLUSION

The growth dynamics of business in the past two years contributed to the change of a large number of principles that were used in the industrial age. Many of these are associated with the management. One of the important changes is reflected in the ever increasing rise of the share that rational decision-making components have in the growth of the data amount on the one hand and methods of data processing on the other. Furthermore, due to the growth dynamics of the business, the available time limits for decision-making are increasingly shorter, both at the operational and at the strategic decision-making level. This leads to changes in the principles of the decision making, which is reflected in the requirement that the operational and strategic decision-making share the same platform and the same tools of business intelligence, which was almost unthinkable until a couple of years ago. In this respect, the tendency to reduce latency in business decision making, gets an increasingly important role as a measure of the efficiency of business decision-making. As a result of these tendencies right-time business intelligence tools were developed and are slowly but surely entering the business practices from the academic sphere and systematically pull down all prejudices related to the principles of business intelligence.

In order to measure the correlation between the quality of business decision-making on the success of the application of business intelligence tools, the research was carried out by interviewing experts from business practices in Croatia. The research results indicate that businesses that have successfully implemented business

intelligence tools, or use them on a daily basis as a stepping stone for business decisions, generate positive changes in terms of profitability, competitiveness, efficiency, and are given better overview of the threats and opportunities in business.

Further research in this area certainly should answer the question of systematic measurement of the quality of implementation of right-time business intelligence tools and adequately quantify them, in order to define standards of the success of right-time business intelligence tools applications.

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