

THE IMPACT OF INTEGRATED INFORMATION SYSTEMS ON MANAGEMENT ACCOUNTING: CASE OF CROATIA

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Abstract. *The main aim of this study is to analyze how implementation of integrated information systems (IIS) effects management accounting. Findings based on data collected from 108 Croatian firms confirmed that IIS implementation caused significant management accounting changes. Estimated regression models revealed that the most important IIS characteristic were the analytical capabilities since it positively influenced management accounting changes in four dimensions: internal reporting, budgeting, application of modern accounting techniques and management accounting employees' jobs. The quality of IIS implementation statistically significantly and positively influenced changes related to data collection and internal reporting. In the segment of budgeting, the quality of implementation of specialized budgeting software had significant and positive influence. The only negative*

correlation found was the one between the uncertainty of business environment and adoption of modern accounting techniques. Findings from this study provide unique insight into effects of IIS implementation in Croatian firms and can be used by different stakeholders. Firms and IIS vendors should put special focus on implementation of business analytics modules in order to achieve comprehensive benefits in management accounting practices. Providers of accountant's education should consider the fact that contemporary IIS systems' environment calls for development of additional skills in the area of information technology, business processes and business communication.

Keywords: *management accounting, management accounting change, integrated information systems, Croatia*

1. INTRODUCTION

Information technology has been developing very quickly during the last few decades due to rapid technological advances. At the beginning of 1990s large firms

started purchasing Enterprise Resource Planning systems (ERP), while at the beginning of 21st century around 90% of large firms had ERP systems already implemented (Grabski et al., 2009). Today, large

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firms often use leading ERP solutions (SAP and Oracle), but many SMEs use local and global (Microsoft Dynamics) program solutions. As reported by Microsoft [1] public communication in 2015 there were more than 230,000 firms using Microsoft Dynamics worldwide. ERP market research analysis [2] for 2016 indicated the following four global ERP market leaders: SAP (19%), Microsoft Dynamics (16%), Oracle (13%) and Infor (13%).

ERP systems represent organization-wide information systems, which archive all business data into a single database. Such system architecture enables efficient control of all business functions and the use of firm's resources. Although modern ERP systems are designed for users from different business functions many of accounting processes are directly related to the implemented system. Implementation of ERP system triggers many organizational changes, some of which can be related to management accounting. Management accounting in modern business environment is providing management with financial and nonfinancial information relevant for decision-making. Traditional role of management accounting was financial planning and control (budgeting), while in recent times management accounting has also been providing information required for long-term planning and strategic decision-making.

Alongside with worldwide large-scale implementation of ERP systems academia has started researching the effects of ERP implementation. Among ERP organizational impact studies (Grabski et al. 2011) one stream of research has been exploring the impact of ERP implementation on management accounting for almost 20 years. In new ERP environment, which offered integrated, flexible, real-time financial and nonfinancial information, the early studies

expected significant changes in management accounting practices. Research has confirmed that ERP implementation results in significant positive changes related to the transactional aspect of management accounting (Colmenares, 2009; Kanellou & Spathis, 2011; Etemadi & Kazeminia, 2014), while findings on adoption of modern accounting techniques are ambiguous (Booth et al., 2000; Granlund & Malmi, 2002; Galani, et al, 2010; Gullkvist, 2013).

The fact that the effects of ERP implementation on management accounting changes are still unclear was the main motivation for this research. In addition, according to the available literature this type of academic research is very rare in Croatia and other CEE emerging countries.

This paper contributes to the existing body of literature in several ways. Firstly, we use a more sophisticated statistical methodology, i.e. factor analysis, in order to measure management accounting changes in five dimensions (data collection, internal reporting, budgeting, use of modern accounting techniques and management accounting employees' jobs). In addition, in comparison with the majority of previous studies, we are not focused only on ERP and we define the Integrated Information System (IIS) variable more broadly, following Rom and Rohde's (2006) approach. Therefore, this study uses a more comprehensive definition of IIS, which includes ERP and other Best of Breed (BoB) specialized applications. Such approach results in better variable measurement and, thus, in more reliable findings. In order to improve the knowledge on influence of implementation of IIS on management accounting changes we took into account the characteristics of IIS and firm characteristics, which were often omitted from the previous empirical analysis. This is one of

the first studies exploring the effects of IIS implementation on management accounting in Croatia and one of only a few in CEE emerging countries. In this paper, the term ERP is mainly used in chapters 1 and 2, when referencing previous research related with ERP and when describing the practical use of ERP. However, to indicate the variable which is used for modeling, in this study the term IIS will be used.

Findings based on the data, collected from the sample of 108 Croatian firms, confirmed that implementation of IIS results in changes in all five proposed dimensions of management accounting. However, the findings also confirmed that the observed management accounting changes are related to some characteristics of the implemented IIS and some firm's characteristics. The paper is organized into five sections: an introduction, a review of relevant literature, research methodology and data collection, empirical findings and conclusions, including suggestions for future research.

2. LITERATURE REVIEW

The use of information technology in modern business has increased dramatically over the last few decades (Granlund & Mouritsen, 2003) and general conclusion is that information technology plays a critical role in business processes, management accounting and management control (Granlund, 2007). Kallunki et al. (2011) indicated that a more extensive use of operational ERP considerably improves the financial and non-financial performance. Although the number of studies in this field of research is increasing, academia in general has a limited understanding of the interface between information systems and management accounting, both theoretically and practically. Some of the previous

studies on the relation between information technology and management accounting have examined effects of information technology on management accounting while others have focused how management accounting drive information technology solutions (Granlund & Mouritsen, 2003; Granlund, 2007; Maraghini, 2010).

One of the main benefits of ERP implementation is data integration, since all data collected within firm and outside of firm is stored into a centralized repository. Centralized database allows users across the firm direct access to any piece of information, which may be limited only by user's knowledge or access privileges, according to different users' roles. In line with expectations prior studies confirmed that data is collected and processed more easily and more quickly with the support of an ERP system. In addition, previous studies showed considerable reduction of time for closing the accounts and for processing payroll after ERP implementation (Colmenares, 2009; Kanellou & Spathis, 2011; Etemadi & Kazeminia, 2014). ERP systems are expected to improve decision-making, by providing reliable and timely enterprise-wide information (Poston & Grabski, 2001, 277). Regarding the data collection benefits, special attention must be given to data accuracy, scope and timeliness. Any type of information system requires the collected data to be accurate, i.e. without errors, because errors in data can cause bad decisions. The approach to data collection, which involves different departments or information systems, can result in ambiguity, insecurity and problems of data interpretation. Modern business environment in which management accounting operates requires broader scope of collected data which, alongside with financial data, requires non-financial and future-oriented information. In modern, fast-changing

business environment managers need timely or even real-time information to make appropriate decisions.

ERP implementation is also expected to facilitate the changes in the internal reporting practices. As the capacity to store, collect and analyze data increases, the potential to report multidimensional information also increases (Granlund & Malmi, 2002). With the implementation of sophisticated information systems opportunities to explore the multidimensional database become enormous enabling management accountants to quickly perform profitability analysis from different perspectives (firm segment, product line, single product, market or a single customer). If any negative budget deviations are observed, drilling down into data (revenues, costs, quantities, purchase prices, selling prices, etc.) causes of such deviations can be found very quickly. According to Kanellou & Spathis (2011, 362), the most significant benefits due to ERP implementation were: *“increased flexibility in information generation, increased integration of accounting applications, improved quality of reports – statement of accounts, improved decisions based on timely and reliable accounting information and reduction of time for closure of annual accounts.”* ERP systems are able to produce all routine reports so management accountants spend the extra time to produce more frequent reports and new types of reports (Etemadi & Kazeminia, 2014).

Since one of the traditional roles of management accounting is planning and control (budgeting) some of the previous papers explored how ERP systems affected this aspect of management accounting. Granlund & Malmi (2002) concluded that ERP systems had had some implications for enhanced forecasting, but only a limited effect on budgeting because annual budgeting

is operated by separate software. Malinić & Todorović (2012) reported that after the implementation of the SAP ERP system, budgeting becomes dynamic and more flexible, while consuming less of management accountant's time. After the implementation of ERP, the role and focus of management accountants change because now they provide information for planning and predicting future performance (prospective analysis) instead of retrospective analysis which report the events of past (Etemadi & Kazeminia, 2014). ERP systems allow budgeting, forecasting and performance measurement to be more detailed, more accurate and reported more quickly (Ponorica et al., 2014).

One of the focal points in literature is influence of ERP implementation on the use of modern accounting techniques (Activity-Based Costing, Balanced Scorecard, Target Costing, Benchmarking, Key Performance Indicators, customer satisfaction, life-circle costing, etc). Early findings indicated that ERP implementation had very little impact on adoption of modern accounting techniques (Booth et al., 2000; Granlund & Malmi, 2002; Scapens & Jayazeri, 2003) unlike some more recent studies that have found that modern management accounting techniques were adopted following the implementation of ERP. In the case of Danish firms Rom & Rohde (2006) concluded that Strategic Enterprise Management systems (SEM) supported application of modern accounting techniques better than ERP systems. Analysis conducted on the sample of Greek firms (Galani et al., 2010) found small differences among ERP and non-ERP firms concerning the adoption of advanced management accounting techniques. Malinić & Todorović (2012) conducted their analysis on a sample of nine firms and reported that limited numbers of SAP adopters increased usage of ABC and Target

Costing. Gullkvist (2013) provided some stronger evidence based on a larger sample of 70 Finish firms. The study showed that the use of new management accounting techniques was related to ERP success, use of business intelligence tools, ERP scope and ERP age.

With regard to the effects of IIS implementation on budgeting and usage of modern accounting techniques a few problems should be pointed out. Majority of previous studies focused only on ERP systems ignoring the possibility of employing other types of specialized software. Such software in literature are sometimes called BoB (Best of Breed) and are often related to very specialized tasks like consolidation, budgeting, costing and performance measurement (Vakalfotis et al., 2011). Instead of BoB Rom & Rohde (2006) use the term SEM (Strategic Enterprise Management systems) and describe them as analytical applications that do not contain any data. SEM systems are analysis-oriented, unlike ERP that is transaction-oriented. In recent times authors have also been using the term Business Intelligence (BI) in order to describe information system functionalities related to data analysis, forecasting, modelling, data consolidation, etc. (Appelbaum et al., 2017). Accordingly, it can be concluded that focusing on ERP only is not a good approach since researchers can omit significant amount of information related to the information system variable. Therefore, this study advocates a comprehensive approach, which combines ERP and other specialized software into IIS variable.

Furthermore, it is to be noted that IIS constantly evolve, integrating new functionalities, the fact often not analyzed in previous research. Many software have separated business analytics modules, which are analysis-oriented and therefore

it would be useful to analyze the scope of implemented IIS (number of modules), analytical capabilities of implemented modules and the quality of their implementation. Perceived quality of ERP implementation has been confirmed as a significant variable in few previous studies (Sangster, 2009; Gullkvist, 2013). One of IIS characteristics that may be significant for management accounting changes is age. Namely, after the initial implementation additional time is required to educate employees on all system functionalities. In Malinić & Todorović's (2012) study one of the interviewed managers commented that **SAP** must stand for "Slowly And Painfully". This may be especially the case for more complex analytical functionalities, which may be practically adopted with time lag.

All changes in an organization introduced by IIS implementation are also reflected through employees and their jobs. In line with that, some of the authors analyzed effects of ERP implementation on change of management accountants' jobs and required skills. In this regard, Maraghini (2010, 28) found that ERP implementation "*provides much more information, which is also now more reliable, timely, integrated and articulated so controller can provide more articulated budgets and more frequent reports*". According to Etemadi & Kazeminia (2014) "*role of management accountants is changed extensively, from data collection from different sources and creating the sheets which report retrospective events they are changed to active partners in management planning and control processes that use retrospective data prepared by ERP system.*" In general, ERP implementation results in major reductions in the routine tasks of management accountants and the subsequent transition from their transaction-orientated role to the business-orientated role (Vakalfotis et al., 2011). However,

ERP implementation does not have a significant influence on personnel reduction of the accounting/control department, which would, consequently, lead to major cost benefits for the firm (Kanellou & Spathis, 2011). According to Sangster et al. (2009), changed role of management accountants after ERP implementation is related to the success of implementation. The same study found that in ERP environment three most important skills for management accountants were software skills, cross-functional work skills and analytical skills. Grabski et al. (2009) reported similar findings and pointed out that ERP working environment requires change in the set of management accountants' skills. Management accountants are required to be more analytical and forward-looking, while their communication and presentation skills should be upgraded.

3. RESEARCH METHODOLOGY

3.1. Survey and data

The data used in the study was collected by an online questionnaire, distributed to Croatian firms of different sizes that use any type of IIS. The original draft of the questionnaire was piloted and adjusted, in order to eliminate any vague items. The survey was conducted in January 2018 by e-mailing questionnaires to 500 randomly selected managers (finance managers, business controllers, accounting managers and equivalent job positions), who were expected to have adequate knowledge about the IIS implementation and their effects on changes of management accounting. The e-mail included a cover letter and a link to the web-based anonymous questionnaire. The respondents had a ten weeks' period to complete the online questionnaire. After ten weeks, 133 responses were collected, giving a response

rate of 26.6%. Out of these 133 responses, 25 were incomplete, leaving 108 valid responses that were included in statistical analysis. Sample size was larger in comparison with similar studies from Australia, N=55 (Boot et al., 2000); Finland, N=99 (Hyvonen, 2003); UK, N=60 (Sangster, 2009); Greece, N=30 (Galani et al., 2010); Finland, N=70, (Gullkvist, 2013). Table 1 reports the summary of statistics about the responding firms.

Table 1 indicates that majority of responding firms belong into the category of large firms (53.7%), while the smallest number of responses was collected from the micro firms (2.85). Majority of the responding firms had a domestic owner (77.8%), while 22.2% of the responding firms had majority owner from abroad. According to the Croatian industry classification (NKD from 2007) 27.8% of sampled firms were from manufacturing sector, followed by 22.2% from retail and wholesale trade, repair of motor vehicles/motorcycles sector and 13.9% from accommodation and food service sector. Other sectors contributed to the remaining 36.1% of the firms included into analysis. Average working experience of respondents was 7.06 years with maximum of 24 years and minimum of 1 year. Majority of respondents held positions of heads of finance departments (34.3%), followed by controllers (25.9%), members of management board (15.7%) and heads of accounting departments (11.1%). The remaining 13% of respondents held other types of managerial positions. Such structure of respondents certainly ensures that questionnaire answers were provided by employees who are familiar with the research topic. Analysis of the collected data indicated that SAP was most frequently used program solution in the sample since it was reported to be used by 24 firms (22.2%). SAP was followed by Pantheon (10.2%), Microsoft Dynamics

Table 1: Summary statistics on responding companies

Firm size	Number of firms	%
Micro	3	2.8
Small	14	13.0
Medium	33	30.6
Large	58	53.7
Total	108	100.0
Firm ownership	Number of firms	%
Domestic	84	77.8
Foreign	24	22.2
Total	108	100.0
Industry	Number of firms	%
Agriculture, forestry and fishing	4	3.7
Mining and quarrying	1	0.9
Manufacturing	30	27.8
Supply with electric energy, gas, steam and air-conditioning	4	3.7
Water supply, sewerage and waste management	2	1.9
Construction	5	4.6
Retail and wholesale trade, repair of motor vehicles and motorcycles	24	22.2
Transporting and storage activities	10	9.3
Accommodation and food service	15	13.9
Information and communication	2	1.9
Real estate activities	1	0.9
Other service activities	10	9.3
Total	108	100.0

Source: Authors

(7.4%), Opera (7.4 %) and Diventa (5.6%). Implemented IIS had average age of 3.43 years with maximum of 5 years and minimum of 1 year.

3.2. Variables description and measurement

As explained earlier the basic purpose of this study is to analyze the effects of IIS implementation on the changes in management accounting. Therefore, in order to explore this relationship, it was necessary

to define and measure the variables of our interest. Dependent variable in this study, management accounting changes, is not easy to define and measure, but for the modelling purposes, we have decided to follow definitions of management accounting given by most respected international institutions, Chartered Institute of Management Accountants (CIMA) and The Institute of Management Accountants (IMA). According to CIMA [3] management accounting “*is the sourcing, analysis, communication and use of decision-relevant*

financial and non-financial information to generate and preserve value for organizations.“ IMA [4] describes management accounting as “*a profession that involves partnering in management decision making, devising planning and performance management systems, and providing expertise in financial reporting and control to assist management in the formulation and implementation of an organization’s strategy*”. These definitions indicate that management accounting is characterized by the following four most important dimensions, i.e. constructs:

- data collection,
- internal reporting for managers,
- planning and control (budgeting),
- use of modern accounting techniques.

Regarding the data collection, we expect that IIS implementation will result in benefits in terms of an improved scope, accuracy and timelines of data. In the case of internal reporting IIS use is expected to reduce report production time, while increasing frequency and number of management-oriented reports. Similar positive effects were expected regarding budgeting, while IIS might also facilitate implementation of modern accounting techniques (ABC, BSC, Target costing-TC, Benchmarking and Key performance indicators-KPI). Besides the four previously described dimensions of management accounting, we have decided to explore an additional dimension-construct, related to the changed role of management accountants. Namely, changes in organization caused by IIS implementation are expected to influence management accountants’ jobs and, therefore, we included questionnaire items related to work time distribution, role of management accountants and changes in the required knowledge and skills.

The measurement was based on the five-point Likert scales, with values ranging from 1 (not at all) to 5 (very significantly). The analysis of questionnaire items was performed by using factor analysis, i.e. the statistical technique, aiming to define the underlying structure among the original items (Hair et al., 2010). Principal component analysis was used to reduce the amount of data. For the purpose of management accounting changes, we have decided to use only those variables that resulted with loadings higher than 0.55. Such an analysis resulted in five factors, as presented by Table 2. Created factors incorporate from three to five variables. Since econometric literature (Hair et al., 2010) suggests that, in factor analysis there should be at least ten observations per variable, the required sample size should be at least 50 observations. Since our sample incorporates 108 usable responses, minimal sample size requirement was satisfied. According to the more conservative approach explained by previously referenced authors sample size of at least 100 observations is required if loadings are higher than 0.55. Even with a more conservative approach to defining the sample size, our research sample of 108 observations is acceptable.

Internal consistency (reliability) of measurement scale used in research was tested by using the Cronbach’s Alpha. Since estimated values of Cronbach’s Alpha presented in Table 2 were very high (in range from 0.822 to 0.929), it can be concluded that the instrument used in this study was reliable. Kaiser-Meyer-Olkin Measure of sampling adequacy was higher than 0.7 in case of all five constructs, indicating that there was no problem of sampling adequacy. Bartlett’s test of sphericity for all five constructs resulted with desirable values, with the values lower than 0.05, indicating that the null hypothesis must be rejected, i.e. tests indicated that there might be a

significant interrelationship between variables. In the case of all five constructs, related to management accounting changes, the factor analysis resulted with a single

extracted component, with initial eigenvalues higher than 1, while percentage of variance explained was in range from 78.1% up to 86.7%¹.

Table 2: Managerial accounting changes factors

Managerial Accounting Change – Data collection (MAC_DC)	
Cronbach's Alpha	0.911
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.692
Bartlett's Test of Sphericity Sig.	0.0001
Cumulative % of Variance explained by extracted component	85.10
Principal component loadings:	
Increased data accuracy	0.959
Increased data timeliness	0.926
Increased data scope	0.881
Managerial Accounting Change – Internal reporting (MAC_IR)	
Cronbach's Alpha	0.918
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.757
Bartlett's Test of Sphericity Sig.	0.0001
Cumulative % of Variance explained by extracted component	86.04
Principal component loadings:	
Increased number of internal reports type	0.939
Increased frequency of internal reporting	0.924
Reduced internal report production time	0.920
Managerial Accounting Change – Budgeting (MAC_B)	
Cronbach's Alpha	0.915
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.749
Bartlett's Test of Sphericity Sig.	0.0001
Cumulative % of Variance explained by extracted component	0.855
Principal component loadings:	
Reduced time for budget preparation	0.940
Analysis of budget deviations with IIS	0.926
Use of IIS for budgeting	0.908
Managerial Accounting Change – adoption of Modern accounting techniques (MAC_MAT)	
Cronbach's Alpha	0.929
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.867
Bartlett's Test of Sphericity Sig.	0.0001
Cumulative % of Variance explained by extracted component	0.851
Principal component loadings:	
Adaptation of KPI	0.903

¹ As to keep the presentation of research results focused, the entire factor analysis output (correlation matrixes, anti-image matrixes, communalities, scree plots, etc.) is not presented in the paper, but it is available from authors upon request.

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Adaptation of TC	0.898
Adaptation of BSC	0.892
Adaptation of Benchmarking	0.886
Adaptation of ABC	0.839
Managerial Accounting Change – Management Accountants Jobs (MAC_MA)	
Cronbach's Alpha	0.822
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.786
Bartlett's Test of Sphericity Sig.	0.0001
Cumulative % of Variance explained by extracted component	0.781
Principal component loadings:	
Improvement of business process knowledge	0.922
Improvement of IT skills	0.874
Improvement of communication skills	0.802
Reduced working time for data collection	0.698

Source: Authors

In this study, we follow Rom & Rohde's (2006) approach to measuring information system variable and define IIS as a set of ERP modules accompanied by other specialized BoB applications. In order to explore the relationship between IIS and management accounting changes of we have decided to use several IIS characteristics,

while also controlling for some firm characteristics. The list of independent variables that are expected to influence management accounting changes are given in Table 3. Beside the independent variables, related with the IIS characteristics, which are in focus of our interest, we have decided to control for some firm characteristics. Namely,

Table 3: List of independent variables

Variable	Acronym	Measurement
i) IIS characteristics		
Scope of IIS	IIS_SCOPE	Number of ERP and BoB modules
Age of IIS	IIS_AGE	Average number of years of IIS modules use
Analytical capabilities of IIS	IIS_AC	Construct measured by nine items with application of five points Likert scale (1-not at all...5-very significantly)
Perceived quality of IIS implementation	IIS_IQ	Average value calculated on individual module quality evaluations with application of five points Likert scale (1- very successful ...5-very unsuccessful)
Perceived quality of BoB implementation	BoB_IQ	Individual BoB quality evaluations with application of five points Likert scale (1- very successful ...5-very unsuccessful)
ii) Firm characteristics – control variables		
Firm size	SIZE	Classification according to EU guidelines with four groups (large, medium, small or micro)
Perceived firm business environment uncertainty	BEU	Construct measured by nine items with application of points Likert scale (1-very predictable...5-very unpredictable)
Industry	ID	1-firm belongs to the industry; 0- firm does not belongs to the industry

Source: Authors

management accounting systems may be designed under influence of other variables, such as the firm size, industry or environment uncertainty.

For the purpose of modelling, it was necessary to develop additional two constructs related to analytical capabilities of IIS (IIS_AC) and perceived firm's business environment uncertainty (BEU). Since the obtained values of Cronbach's Alpha were high (0.907 and 0.763) (Table 4) it was confirmed that the instrument was reliable. Kaiser-Meyer-Olkin measure of sampling adequacy was higher than 0.8 in case of

both constructs, indicating no issues with sampling adequacy. Empirical value of the Bartlett's test of sphericity was lower than 0.05, indicating that there might be a significant interrelationship between variables. In the case of constructs IIS_AC, factor analysis resulted with only one extracted component, with initial eigenvalues higher than 1, while percentage of variance explained by such component was 57.3%. BEU construct estimated two extracted components with initial eigenvalues higher than 1, while the selected component for the BEU construct explained 42.6% of variance.

Table 4: Factors for IIS analytical capability and Business environment uncertainty

IIS analytical capability (IIS_AC)	
Cronbach's Alpha	0.907
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.895
Bartlett's Test of Sphericity Sig.	0.0001
Cumulative % of Variance explained by extracted components	0.573
Principal component loadings:	
IIS supporting forecasting	0.798
IIS supporting data-mining	0.789
IIS supporting business planning and simulations	0.786
IIS supporting real time project control	0.771
IIS supporting business analytics trough Dashboards	0.761
IIS supporting control of key financial indicators	0.733
IIS supporting control of key non-financial indicators	0.728
IIS supporting business process analysis and ABC	0.724
IIS supporting control of key financial and non-financial indicators for business segments	0.717
Business Environment Uncertainty (BEU)	
Cronbach's Alpha	0.763
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.811
Bartlett's Test of Sphericity Sig.	0.0001
Cumulative % of Variance explained by extracted component	0.426
Principal component loadings:	
Uncertainty of technology related with business	0.750
Uncertainty of competitors actions	0.698
Uncertainty of suppliers actions	0.668
Uncertainty of buyers preferences	0.650
Uncertainty due to globalization and deregulation	0.569

Source: Authors

4. RESEARCH RESULTS

In order to analyze the effects of IIS implementation on management accounting changes we have decided to regress all independent variables from Table 3 on five dependent variables, which represent different aspects of the management accounting changes (data collection, internal reporting, budgeting, use of modern accounting techniques and management accountant’s jobs). All regression models were estimated with the IBM SPSS 23 software and the obtained results are presented in Table 5. Only statistically significant independent variables are included in the final models.

According to the F-ratio values, all regression models have good overall fit since calculated F ratios are significant at 1% level. Explanatory power of estimated models was measured by adjusted coefficient

of determination - R^2 , which was in range from 25.1% (model 1) to 69.1% the (model 4). Potential problem of multicollinearity among predictor variables was measured with Variance Inflation Factors (VIFs). Since none of the VIF values was higher than 5, it can be concluded that multicollinearity is not a significant problem. Potential autocorrelation among regression residuals was tested by using the Durbin-Watson test (D-W test). Because all of D-W test values are close to 2.0, it appears that in the estimated models, there is no problem in autocorrelation of residuals.

IIS analytical capabilities (IIS_AC) appeared as the most important IIS feature, since it was confirmed as statistically significant in four of five specifications. Given the positive correlation with IIS_AC, we conclude that an increase in analytical

Table 5: Estimated regression models

	Model 1	Model 2	Model 3	Model 4	Model 5
Dependent variable	MAC_DC	MAC_IR	MAC_B	MAC_MAT	MAC_MA
Constant	-3.565** (0.603)	-1.446* (0.604)	-0.189* (0.086)	-0.0001 (0.053)	-0.684** (0.261)
IIS_SCOPE	0.078** (0.027)				0.081** (0.029)
IIS_IQ	0.705** (0.139)	0.351** (0.089)			
IIS_AC		0.474* (0.145)	0.647** (0.069)	0.846** (0.054)	0.372** (0.094)
BUDG_IQ			0.107** (0.034)		
BEU				-0.108* (0.054)	
Model significance:					
F ratio	18.570	29.383	74.639	120.860	22.916
Sig.	0.0001	0.0001	0.0001	0.0001	0.0001
Adj. R ²	0.251	0.351	0.579	0.691	0.291
Durbin-Watson	2.29	2.31	2.33	2.23	2.03

Notes: ** $p < 0.01$, * $p < 0.05$. Standard errors are presented in parentheses.

Source: Authors

capabilities of IIS leads to increase in management accounting changes, related to internal reporting, budgeting, adoption of modern management accounting techniques and management accountant's jobs. Such a finding is in line with our theoretical expectations, since increased analytical capabilities of implemented IIS results in benefits, related to the main analytical aspects of management accounting. Increase in the IIS analytical capabilities results in a wider range of reports, higher frequency of reports, reduced time needed for data collection/reporting/budgeting, more frequent adoption of modern accounting techniques and changes in management accountant's skills. Although IIS analytical capabilities variable was not designed in the same way in previous research, in terms of its positive effect on the adoption of modern accounting techniques our results are similar to the findings on business intelligence tools (BI) variable, used by Gullkvist (2013).

IIS feature IIS_SCOPE, measuring the scope of implemented IIS was statistically significant for model 1 (changes in data collection) and model 5 (changes in management accountants' jobs). Positive correlation with IIS_SCOPE in these models indicates that increased scope of IIS (measured by number of IIS modules) results in increased changes related to data collection and management accountants' jobs. Regarding the data collection, we can claim that the implementation of larger number of IIS modules results in higher benefits related with quantity, accuracy and timeliness of collected data. Namely, data quantity, accuracy and timeliness were questionnaire items that were combined into the construct MAC_DC (dependent variable in the model 1). Such a finding is in line with our theoretical expectations that higher integration of IIS in different functions should result in higher data collection benefits. Similarly,

model 5 reveals that implementation of IIS with larger number of modules requires more improvements in management accountants' skills (IT skills, business process skills and communication skills), while it reduces the time necessary for data collection. Such a finding was consistent with our expectations and it is comparable with findings of previous studies (Sangster, 2009; Grabski, 2009).

One of the very important characteristics of IIS is implementation quality, which, for the purpose of this study, was captured by the IIS_IQ variable. IIS_IQ variable appears as statistically significant in regards of both, data collection and internal reporting. Model 1 indicates that increase in quality of IIS implementation results in higher benefits regarding the quantity, accuracy and timeliness of collected data. In addition, model 2 reveals that an increase in IIS implementation quality results in higher benefits regarding the internal reporting – MAC_IR (reduced time of report production, increased frequency of reporting and increased number of reports). In the case of changes related to budgeting practices (MAC_B), we were able to obtain even a more accurate evaluation of the IIS implementation quality. Namely, firms, beside ERP, often employ additional BoB applications for specialized areas, such as budgeting. Therefore, one of the questionnaire items refers to the implementation quality of BoB used for budgeting (BUDG_IQ). In the model 3 specification, it was confirmed that the higher the quality of implementation of BoB budgeting the higher are benefits in budgeting practices. Findings that confirmed the importance of IIS and BoB implementation quality are comparable with findings from two previous studies that included similar ERP implementation success variable into modelling (Sangster, 2009; Gullkvist, 2013).

In contrast with our theoretical expectations, IIS age was insignificant in all five specifications, meaning that management accounting changes are not correlated with the length of IIS implementation. The only firm characteristic that was statistically significant was the perceived business environment uncertainty – BEU. This variable was significant and negatively correlated with the adoption of new management accounting techniques. Such finding may indicate that with the increase of environment uncertainty managers rely less on management accounting information, since environment changes are not so easily predictable by management accounting techniques. In such instances, managers may refer to some other sources of information required for decision-making. Other two control variables, firm size and industry, were not statistically significant in neither of the five models.

5. CONCLUSION

Modern business environment is characterized by a large amount of information which has to be processed before managerial decisions are made. Therefore, many firms use IIS in order to support management accounting, which is a crucial source of financial and non-financial information. In order to explore the effects of IIS implementation on management accounting changes we have conducted a questionnaire based empirical research on the sample of Croatian firms. In line with theoretical expectations and similar recent studies (Sangster, 2009; Grabski, 2009 and Gullkvist, 2013) the main conclusion is that IIS adoption results in changes in management accounting, not only in the dimensions of data collection and reporting, but also in the analytical dimensions of managerial accounting like budgeting and use of modern accounting techniques.

Empirical findings revealed that the critical IIS attribute was IIS analytical capabilities since this variable had positive effect on management accounting changes in four dimensions: internal reporting, budgeting, application of modern accounting techniques and management accounting employees' jobs. In other words, firms which have adopted IIS with higher analytical capabilities have experienced more comprehensive changes in management accounting. Here we can assume that such firms which have designed it's IIS to be more analytical effectively use advantages of such architecture in order to improve management accounting. As theoretically expected IIS implementation quality variable was statistically significant, positively influencing the changes in the segments of data collection and internal reporting. Here we can point out that special attention must be paid to obtaining high quality of IIS implementation since that contributes to exploiting the benefits related to data accuracy, data timeliness and data scope. Also, higher quality of IIS implementation results in reduced time of reporting, increased frequency of reporting and increased number of reports. Such finding is in line with the fact that the use of centralized database enables faster production of reports, while at the same time multidimensionality of database provides opportunity for creating new reports. Regarding the changes in budgeting practices in management accounting system, the quality of implementation of specialized budgeting software appeared as significant variable with positive influence. Among firm characteristics, only business environment uncertainty was negatively correlated with adoption of modern accounting techniques. Such finding can be explained by the fact that with increase of business environment uncertainty management accounting information is becoming less reliable and firms are not motivated to invest expensive resources

required for adoption of modern accounting techniques.

Findings from this study provide an unique insight into effects of IIS implementation in Croatian business environment, as well as suggest several useful practical guidelines for firms, IIS vendors and educational institutions. Empirical findings suggest that firms and IIS vendors should put special focus on analytical capabilities and business analytics modules, in order to achieve comprehensive benefits in management accounting practices. Educational institutions that provide accountant education (either at academic, professional, or life-long learning level) should be aware of the fact that contemporary, information system driven business environment requires management accountants to possess and development new skills. According to our findings management accountant's education

alongside with traditional management accounting skills should include acquiring new skills in the area of information technology, business processes and business communication.

Here we must point out some limitations of the study. All data required for modelling was collected at one point of time. Future research may be designed as longitudinal study in order to measure the IIS variable at point of implementation, while management accounting changes should be measured with a time lag. Although our sample included 108 valid observations and was acceptable, according to econometric requirements, a larger sample would certainly result in more reliable findings. Future research may be also improved by applying more sophisticated statistical methodologies, such as structural equation models.

Notes

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UTJECAJ INTEGRIRANIH INFORMACIJSKIH SUSTAVA NA MENADŽERSKO RAČUNOVODSTVO: HRVATSKI SLUČAJ

Sažetak

Glavni cilj ovog rada je analiza implementacije efekata integriranih informacijskih sustava (IIS) na menadžersko računovodstvo. Rezultati, utemeljeni na podacima, prikupljenim od 108 hrvatskih poduzeća, potvrđuju da implementacija IIS-a djeluje na značajne promjene u menadžerskom računovodstvu. Regresijski modeli pokazuju da su najznačajnije obilježje IIS-a njegove analitičke sposobnosti, s obzirom da pozitivno djeluju na promjene menadžerskog računovodstva u četirima dimenzijama: internom izvještavanju, budžetiranju, promjeni suvremenih računovodstvenih tehnika i poslovima menadžerskih računovođa. Kvaliteta implementacije IIS-a statistički je signifikantno i značajno utjecala na promjene, povezane s prikupljanjem podataka i internim izvještavanjem. Kod budžetiranja, kvaliteta implementacije specijaliziranog softvera za

budžetiranje je imala značajan i pozitivan utjecaj. Jedina negativna korelacija odnosi se na neizvjesnost poslovne okoline i prihvaćanje suvremenih računovodstvenih tehnika. Rezultati ovog rada pružaju jedinstven uvid u efekte implementacije IIS-a u hrvatskim poduzećima, a mogu ih koristiti različiti dionici. Poduzeća i dobavljači IIS sustava bi se trebali usredotočiti na implementaciju modula poslovne inteligencije, kako bi postigli značajne koristi u praksi menadžerskog računovodstva. Pružatelji računovodstvenog obrazovanja bi trebali razmotriti činjenicu da okruženje suvremenih IIS sustava zahtijeva razvoj dodatnih vještina u područjima informatičke tehnologije, poslovnih procesa i poslovne komunikacije.

Ključne riječi: *menadžersko računovodstvo, promjene menadžerskog računovodstva, integrirani informacijski sustavi, Hrvatska*