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Examining management tools that characterise the corporate internal information system and their impact on corporate performance[1]

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Corporate management tasks cannot successfully be executed without decision-support functions of appropriate quality. The importance of producing and achieving relevant, accurate and up-to-date information is unquestionable as such information provides stand-alone value. According to current trends, the need for reporting systems based on specific expectations, which can be used to provide decision-makers with a long-term competitive advantage, has increased. In our research, we set out to investigate how different management techniques (e.g. performance tracking) can support decision-making. Our findings are based on the data from the World Management Survey carried out in 2004, involving more than 700 companies from 34 countries (Bloom–Van Reenen 2007). The impacts of each management method on company performance are also examined. It is hypothesised that using information support management methods for decision-making can influence the overall success of a company. We also look for relations between the company's ownership status (i.e. family, founder, institution manager, private, or other ownership) and the corporate internal information system.

Keywords: decision support, management tools, information system, reporting system, business intelligence.

JEL codes: M29, M49.

Introduction

The competitive environment of companies is in a state of constant change due to the following factors: disappearance of market boundaries, increasing competition, appreciation of information and knowledge, changing consumer habits, rapid change of companies, and expanding product and service portfolio.

The need to respond to changes increases the role of decision support, and executives ought to rely on the available information throughout their decision-making process.

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We have endeavoured to study the quality of corporate internal information systems because we perceive the management expectations associated with data delivery. We look at the information system not as an IT solution, but as a complex toolkit for leadership, regardless of how it is implemented.

Literature review

A number of microeconomic models are based on the assumption that both sellers and buyers possess complete information on the quality of goods available on the market. However, in practice, most frequently market players do not possess complete information (in other words, they lack some necessary information about the goods in question). Consequently, a common problem in decision-making situations derives from the fact that information is not necessarily available for free.

As Stigler's (1961) model of optimal economic research suggests, market players have incomplete information, while corporate management does not possess all the necessary information to make decisions in the vast majority of cases. Akerlof's (1970) "Market for Lemons" explains the phenomenon of asymmetric information as observed during day-to-day operations. Spence's (1973) signalling model focuses on investment decisions in uncertain circumstances. These approaches highlight the nature of information in companies.

Resources are essential to business operation (Barancsi et al. 2001). These essential resources can be categorised as human resources, raw materials, energy, capital, and information.

Information can also be defined as goods because it can be referred to as public goods (exclusion is not possible), and as a luxury property as the value of information decreases in accordance with the reproduction by its owner (Kiss et al. 2000). The use of market information contributes to the development of products by companies (Moenaert–Souder 1990; Moorman 1995).

Information supports decision-making as a factor in reducing uncertainty. Information can be regarded as a resource when corporate interests can be established. Its use has three closely related elements: decision-making, communication, and the operation of processes. Decisions, according to the conceptual definition, turn information into actions (Forrester 1961). According to another approach, decisions are meant to turn information into information (Nemény 1973). Therefore, from a corporate perspective, decisions stand for the use of the available information and the creation of new information. Communication,

on the other hand, is information flowing into the use of information. The final element of information use is the execution of processes (Chikán 2006).

The corporate internal information system serves information purposes. The task of the corporate internal information system is to provide target-oriented information systematisation and processing. Its function is to satisfy stakeholders' information needs. The information needs of the companies can be divided into external and internal categories: internal information is generated within the organisation, so it can only be accessed through its own information system, while external information may be embedded into the corporate information system, if needed.

The corporate internal information system consists of several closely related elements (Szalay 2009):

- People: leaders, analysts, IT professionals.
- Databases: structured data storage.
- Hardware: physical IT tools which are necessary for the operation of the system.
- Software: programmes that are responsible for controlling hardware.
- Data processing methods and reporting tools.

It should be assumed that all leadership levels focus on the information relevant to them, which is detailed according to their individual needs (Anthony–Vijay 2013). It is vital for reports produced in a meaningful and consumable fashion to be timely available, with specific content available to the selected user circle (Szalay 2009). The individual integration of functional points (such as purchasing, controlling, accounting, sales, marketing) and establishing a relationship between reports should become standard practice. The lack or inadequate functioning of the above creates the need to improve the performance of the information system.

Development plans should be implemented so that users enjoy optimal freedom when using the information available to them (Phillips-Wren–Carlsson 2014). To achieve this, business intelligence systems offer a variety of solutions designed to improve the decision-making process (Cser et al. 2010). Business intelligence stands for the necessary processes, technologies and tools designed to turn data into information, transform information into knowledge, and translate knowledge into plans for driving a profitable business. Business intelligence includes data warehouses, business analytics tools, and knowledge management (Loshin 2012).

In addition to development purposes, the major intent behind improving information management is: "the efficient management of information resources and the ability of the organisation to provide everything needed for the use of information systems, access to information and the proper assistance of end users" (Wormell 1991. 208). The need to exploit the opportunities offered by the information environment and the need to develop the information acquisition process aim to improve the performance of management tasks.

Considering the literature analysed above, it can be argued that information as a resource is of the utmost importance and significantly contributes to the success of the company. The main task of the corporate information system is to support managerial work by transforming the information generated during operation into consumable information. In our paper, we wish to further investigate how different management techniques, such as performance tracking, can support decision-making.

Research hypothesis

Our research focuses on mapping the corporate internal information system. This paper examines the relationship between the management techniques describing the company's internal information system and the ownership of the company. The initial assumption is that family-owned companies pay less attention to the corporate internal information system than manager-owned companies.

Based on this, we formulated our first hypothesis:

H1: There is a relationship between the quality features of the corporate internal information system and the ownership status of the companies.

We also analyse the relationship between the company's internal information system and revenue changes. Our hypothesis is that the nature of the corporate internal information system influences the revenue change. Considering that a higher level information system leads to more grounded managerial decision-making and increases revenue, this could be seen as a logical statement. Thus, our second hypothesis is as follows:

H2: There is a relationship between the quality features of the corporate internal information system and revenue changes.

Research methodology

Data

Our hypotheses were tested by using the data of the World Management Survey from 2004 (WMS 2004). This research involved more than 700 companies from 34 countries and the number of employees ranged from 50 to 10 000, with a median of 675 (Bloom–Van Reenen 2007). In the survey, respondents assessed the levels of management tools applied at their companies, on a scale of 1 to 5.

In our paper, we only analysed responses where all the necessary information was available.

A total of 20 variables are included in the WMS database as follows:

1. Introduction of modern lean manufacturing techniques
2. Rationale for lean manufacturing introduction
3. Success of modern manufacturing techniques
4. Process documentation
5. Performance tracking
6. Review of performance
7. Performance dialogue
8. Consequence management
9. Type of targets
10. Interconnection of goals
11. Time horizon
12. Goals are stretching
13. Clarity of goals and measurement
14. Instilling a talent mindset
15. Recruiting talent
16. Building a high-performing culture
17. Making room for talent
18. Developing talent
19. Creating a distinctive employee value proposition
20. Retaining talent

In addition, the most relevant corporate data are also included in the database. We will use only the variables that need to be defined in order to interpret the results.

The database contains information about the changes in company revenue.

Regarding the company's ownership structure, the founder had ownership rights at 114 of the companies observed. There were 336 companies owned by another company (including banks, insurance companies, etc.). A distinct category was made up of 21 companies where managers had acquired the property rights and another category was that of 59 individual entrepreneurs who ran their own businesses without central management. Other types of non-profit organisations, such as charity foundations and associations (41 observed), were included. The country in which the company operated was also defined.

Defining variables related to the internal information system

As a tool for compiling information, we will use the factor analysis method. For an efficient analysis, it is necessary to reduce the number of variables

(originally 20), while maintaining as much of the data-based information content as possible. In order to achieve this, we will perform the Principal Component Analysis, which allows a number of variables (criteria) to be considered together. The main components will be represented by the common meanings of the variables, which will be used for further analysis.

As a solution, we employ a correlation matrix that contains the pairwise correlation coefficients between the variables. The conformity of the model was verified by the KMO and the Bartlett test (Munro 2004). The model assumes a value of 0.954 for the KMO, which means that it has a strong factorisation potential. The Bartlett test has a significance value below 0.05. Communality shows how some variables explain the extent of factors. The desired value limit has an explanatory power above 0.5. From the 14 remaining variables, the first two factors explain more than 60% of the model, resulting in a 2-factor model for the variables.

The rotated component matrix can be used to determine which variables are found in the first and second components (Table 1).

Table 1. Rotated component matrix[a]

Variables	Component	
	1	2
Introduction of modern lean manufacturing techniques	.806	
Success of modern manufacturing techniques	.789	
Performance tracking	.774	
Rationale for lean manufacturing introduction	.758	
Review of performance	.749	
Process documentation	.729	
Performance dialogue	.711	
Consequence management	.652	
Interconnection of goals	.602	
Goals are stretching	.593	
Recruiting talent		.759
Creating a distinctive employee value proposition		.751
Instilling a talent mindset		.688
Developing talent		.650

a. Rotation converged in 3 iterations.

Extraction method: Principal Component Analysis. Rotation method: Varimax with Kaiser Normalisation.

Source: authors' own calculation based on the WMS (2004) database

The first component has 10 variables which define the level of the corporate internal information system. The other component has four variables that show the level of corporate knowledge management. Our aim is to research the level of the corporate internal information system, so we continue with the first factor defined in the Principal Component Analysis.

Analysis and findings

Relationship between the corporate internal information system and the company's ownership type

We established a hypothesis on whether there is a relationship between the corporate internal information system and the type of company ownership. Variance analysis was used to compare variable averages in order to find out whether there was a definite difference between certain corporate characteristics (company ownership types) and the corporate internal information system. According to the null hypothesis that there is no correlation between the two criteria, the expected value of each type is the same.

$H0 = \mu1 = \mu2 = \mu3 = \mu4 = \mu5 = \mu6 = 0$, where μ is the expected value of the analysed report (the value of a corporate internal information system based on each type of ownership).

Table 2. Level of the corporate internal information system by ownership type

Company ownership	N (items)	Mean	Standard deviation	Standard error	95% confidence interval for the mean		Minimum	Maximum
					Lower bound	Upper bound		
family	1182	-.1864860	1.07945390	.03139752	-.2480871	-.1248849	-2.95755	2.25443
founder	879	-.1459121	1.16214953	.03919833	-.2228455	-.0689788	-3.10769	2.06446
institution	2697	.0940627	.88018722	.01694863	.0608291	.1272963	-2.73711	2.18682
manager	171	.3907152	.76671900	.05863247	.2749737	.5064566	-.87077	1.94571
other	276	.0176897	1.07877174	.06493443	-.1101420	.1455214	-1.97213	2.08228
private	440	.0529578	1.02620485	.04892240	-.0431934	.1491091	-2.14279	1.81900
Total	5645	.0000000	1.00000000	.01330969	-.0260921	.0260921	-3.10769	2.25443

Source: authors' own calculation based on the WMS (2004) database

Table 2 presents the descriptive statistics for the variables. If we look at the column of the average values, we can see that family businesses have the

lowest-level enterprise information systems. On average, the best results for the company's internal information system were achieved by manager-owned companies.

Table 3. Test of homogeneity of variances

Levene statistic	df1	df2	Sig.
45.733	5	5639	.000

Source: authors' own calculation based on the WMS (2004) database

Levene's (Levin) test shows that the value of the significance level is low (≤0.05), thus the null hypothesis is rejected (Table 3). However, these findings do not provide a sufficient basis to draw conclusions from without further investigation, therefore we will perform an analysis of variance (ANOVA).

Table 4. Difference between the companies' information levels (ANOVA)

	Sum of squares	df	Mean square	F	Significance
Between groups	111.108	5	22.222	22.648	.000
Within groups	5532.892	5639	.981		
Total	5644.000	5644			

Source: authors' own calculation based on the WMS (2004) database

Table 4 shows the calculated value of F and the level at which it is significant. This level approaches zero, below the 5% limit. If the null hypothesis were true, then the value would approach 1. The likeliness of reaching such an F ratio is approximately 0%, which is very rare. As a result, we must reject the null hypothesis and conclude that the levels of companies' internal information systems differ significantly.

The result of the Post Hoc Test is shown in Table 5, where the mean of each group is compared to the average of all other groups. Where the significance level is below 0.05, the null hypothesis is rejected. This applies to almost all groups except family – founder, founder – other, institution – other and private – other ownership, where the differences between the averages are not significant.

Table 5. Post Hoc Test of the companies' information levels by ownership type

(I) Predominant ownership type	(J) Predominant ownership type	Mean difference (I-J)	Standard error	Significance	95% confidence interval	
					Lower bound	Upper bound
family	founder	-.04057386	.04411750	1.000	-.1701227	.0889750
	institution	-.28054870*	.03455300	.000	-.3820119	-.1790855
	manager	-.57720118*	.08104331	.000	-.8151809	-.3392215
	other	-.20417568*	.06622021	.031	-.3986281	-.0097233
	private	-.23944384*	.05531786	.000	-.4018820	-.0770056
founder	family	.04057386	.04411750	1.000	-.0889750	.1701227
	institution	-.23997484*	.03847148	.000	-.3529445	-.1270052
	manager	-.53662731*	.08278987	.000	-.7797357	-.2935189
	other	-.16360181	.06834662	.251	-.3642983	.0370947
	private	-.19886998*	.05784644	.009	-.3687332	-.0290067
institution	family	.28054870*	.03455300	.000	.1790855	.3820119
	founder	.23997484*	.03847148	.000	.1270052	.3529445
	manager	-.29665247*	.07811350	.002	-.5260290	-.0672760
	other	.07637303	.06260045	1.000	-.1074502	.2601962
	private	.04110486	.05092904	1.000	-.1084458	.1906555
manager	family	.57720118*	.08104331	.000	.3392215	.8151809
	founder	.53662731*	.08278987	.000	.2935189	.7797357
	institution	.29665247*	.07811350	.002	.0672760	.5260290
	other	.37302550*	.09639982	.002	.0899521	.6560989
	private	.33775734*	.08926295	.002	.0756410	.5998736
other	family	.20417568*	.06622021	.031	.0097233	.3986281
	founder	.16360181	.06834662	.251	-.0370947	.3642983
	institution	-.07637303	.06260045	1.000	-.2601962	.1074502
	manager	-.37302550*	.09639982	.002	-.6560989	-.0899521
	private	-.03526816	.07605901	1.000	-.2586117	.1880754
private	family	.23944384*	.05531786	.000	.0770056	.4018820
	founder	.19886998*	.05784644	.009	.0290067	.3687332
	institution	-.04110486	.05092904	1.000	-.1906555	.1084458
	manager	-.33775734*	.08926295	.002	-.5998736	-.0756410
	other	.03526816	.07605901	1.000	-.1880754	.2586117

*. The mean difference is significant at the 0.05 level.

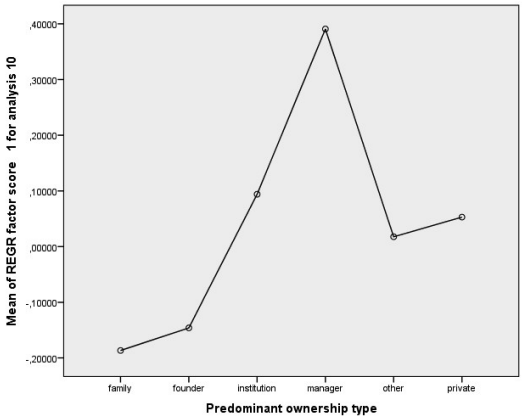
Source: authors' own calculation based on the WMS (2004) database

Let us look at the cases where the difference between the averages is positive. Table 5 shows that the information levels of institution – family, institution –

founder, institution – other, and institution – private ownership pairs are higher than those of other types of enterprises (family, founder, other, and private ownership). Those companies where the owners were managers had a higher average value than any other type.

Thus, it can be argued that management-controlled companies reach the best information provision levels. In the case of individual entrepreneurs, we see positive averages for private – family, private – founder and private – other pairs, which means that the level of information is better for private entrepreneurs than for family, founder and other owner types. The information level of the "other owner type" company group is higher than in family-owned companies, so family-owned companies are the least likely to report on the company's situation, which is not a surprising outcome.

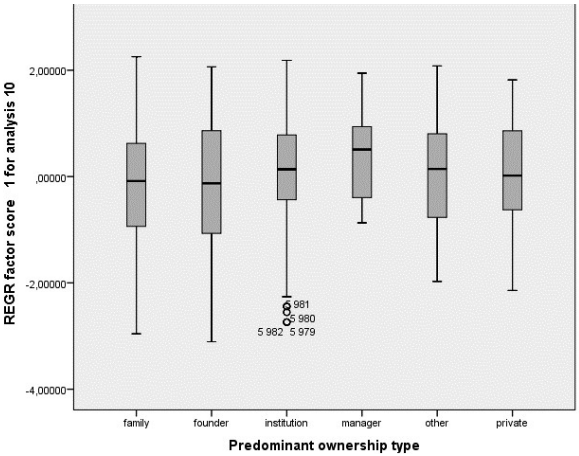
The above result is illustrated by the Means Plots chart (Figure 1). The information supply value of companies with a manager-based ownership is high. In the case of family businesses, variables are low, meaning that they use minimal information management tools.



Source: authors' own design based on the WMS (2004) database

Figure 1. Means plots of the information supply value

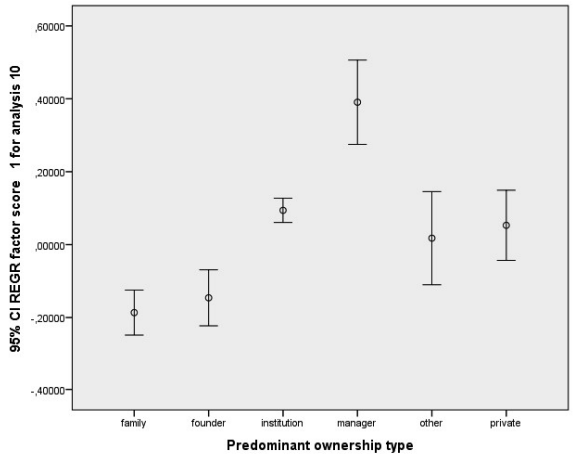
In Figure 2, the highest and lowest values of each group show the maximum or minimum scores of information level by ownership type (excluding the outlier values). The median information level is the highest in managerial companies and the lowest in founder-owned companies, which means the difference between average information levels is the highest for these two types.



Source: authors' own design based on the WMS (2004) database

Figure 2. Minimum and maximum scores of information level by ownership type

Figure 3 shows the results, taking into account the averages and standard errors. We can see that the average of manager-owned companies is the highest, whereas that of family businesses is the lowest. The standard error is high for manager-based and other ownership and it reaches the lowest value for institutional ownership.



Source: Authors' own calculation based on the WMS (2004) database

Figure 3. Error bar of information level by ownership type

In the light of these findings, we will accept the H1 hypothesis: there is a measurable relationship between the quality features of the company's internal information system and its ownership type.

Relationship between the company's internal information system and its revenue

In relation to our second hypothesis, we will look at the relationship between the company's internal information system and the changes in its revenue. As we use several variables in this section, we will employ a multivariate regression analysis.

We included as independent variables the following: the corporate internal information system factor, the knowledge management factor, the ratio of graduate employees, the number of weekly average manager hours, and the value of corporate capital (property, machines, equipment, total assets).

The correlation table resulted is shown in Table 6. For the multivariate regression calculation, we consider the correlations between dependent and independent variables. Additionally, we also test for the correlation between independent variables (multicollinearity).

The company's internal information system has a correlation of 0.036 with sales growth rate, which indicates a weak link. The highest correlation value is for the ratio of graduates among employees, but with 0.068 this also indicates a very low correlation.

Based on the findings above, the H2 hypothesis can be verified: there is a measurable relationship between the quality features of the company's internal information system and the changes in its revenue. While this relationship is weak, it is statistically verifiable.

With regard to multicollinearity, the highest correlation value is between the number of graduates among employees and the level of knowledge management (value of 0.216). This sounds logical since both are human resource management KPIs (Key Performance Indicators).

Table 7 shows the explained amount of the dependent variable (sales growth rate). This is statistically low; however, since we are talking about changes in sales revenue, this may be noteworthy. In addition, it is important to note that the standard error rate is 0.22182.

Table 6. Correlations between variables

Variables		Sales growth rate	Corporate internal information system	Knowledge management	% of all employees with a degree	Hours per week, managerial	Log capital (ppent)
Pearson Correlation	Sales growth rate	1.000	.036	.034	.068	.053	.001
	Corporate internal information system	.036	1.000	-.057	.098	.099	-.007
	Knowledge management	.034	-.057	1.000	.216	.103	.200
	% of all employees with a degree	.068	.098	.216	1.000	.199	-.022
	Hours per week, managerial	.053	.099	.103	.199	1.000	.207
	Log capital (ppent)	.001	-.007	.200	-.022	.207	1.000
Sig. (1-tailed)	Sales growth rate	.	.016	.020	.000	.001	.477
	Corporate internal information system	.016	.	.000	.000	.000	.337
	Knowledge management	.020	.000	.	.000	.000	.000
	% of all employees with a degree	.000	.000	.000	.	.000	.090
	Hours per week, managerial	.001	.000	.000	.000	.	.000
	Log capital (ppent)	.477	.337	.000	.090	.000	.
N	Sales growth rate	3666	3666	3666	3666	3666	3666
	Corporate internal information system	3666	3666	3666	3666	3666	3666
	Knowledge management	3666	3666	3666	3666	3666	3666
	% of all employees with a degree	3666	3666	3666	3666	3666	3666
	Hours per week, managerial	3666	3666	3666	3666	3666	3666
	Log capital (ppent)	3666	3666	3666	3666	3666	3666

Source: authors' own calculation based on the WMS (2004) database

Table 7. Model summary

Model	R	R square	Adjusted R square	Standard error of the estimate
1	.086[a]	.007	.006	.22182

Dependent variable: Sales growth rate

Predictors: (Constant); Log capital (ppent); Corporate internal information system; % of all employees with a degree; Hours per week, managerial; Knowledge management

Source: authors' own calculation based on the WMS database

Table 8. Analysis of variance (ANOVA)[a]

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	1.343	5	.269	5.461	.000[b]
	Residual	180.083	3660	.049		
	Total	181.426	3665			

a. Dependent variable: Sales growth rate

b. Predictors: (Constant); Log capital (ppent); Corporate internal information system; % of all employees with a degree; Hours per week, managerial; Knowledge management

Source: authors' own calculation based on the WMS database

The ANOVA test (Table 8) is also within the limit of 0.05 in this case, so the null hypothesis is rejected; therefore, there is a link between the dependent and the independent variables. Again, the relationship is very weak as many other factors can have an influence beyond the variables included in the model.

Table 9. Coefficients diagram of the sales growth rate dependent variable

Model		Unstandardised coefficients		Standardised coefficients	t	Sig.	95% confidence interval for B	
		B	Standard error	Beta			Lower bound	Upper bound
1	(Constant)	.011	.031		.344	.731	-.050	.072
	Corporate internal information system	.006	.004	.028	1.661	.097	-.001	.014
	Knowledge management	.005	.004	.022	1.276	.202	-.003	.013
	% of all employees with a degree	.001	.000	.053	3.041	.002	.000	.001
	Hours per week, managerial	.001	.001	.039	2.282	.023	.000	.002
	Log capital (ppent)	-.001	.002	-.010	-.597	.551	-.006	.003

Source: authors' own calculation based on the WMS (2004) database

However, the Coefficients diagram (Table 9) shows that the t-tests of corporate internal information system and knowledge management do not yield significant results because their value is greater than the expected 0.05 value. The Beta coefficient in the standardised coefficients column shows the importance of independent variables to each other in the linear context. The highest value (Beta = 0.053) is for the proportion of graduates among employees, which is not surprising as it was high compared to the other variables in Table 6. Based on these

findings, the most important variable in the weak relationship is the proportion of graduates among employees.

Thus, among the variables examined, it is not the quality of the company's internal information system that affects revenue changes to the greatest extent; regardless, there is a verified correlation.

Conclusions

The relationship between the corporate internal information system and the company's ownership model suggests that decision support is an important element of corporate governance.

Based on our research, the corporate internal information system arguably has a noticeable impact on the sales revenue. This effect is, however, low as sales growth is influenced by a number of other factors and the respondents' underestimation or overestimation of certain variables should also be considered in such research studies. Yet, we think that the result is not negligible and that it is worth investing in the development of company information systems.

Our study highlights the importance of internal information systems in supporting decision-making. An important research limitation is that all data refer to medium-sized companies from the manufacturing sector, where productivity is easier to measure.

We suggest two basic directions for future research: measuring the decision support capacity of corporate internal information systems by using key indicators and a methodology to assist in the design of corporate information system development directions.

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