Determinants of Cybernetic Controls in Croatian Manufacturing Companies

Ivica Pervan
Department of Accounting
University of Split, Faculty of Economics
Cvite Fiskovića 5, 21000 Split, Croatia
ivica.pervan@efst.hr

Ivana Dropulić
Department of Accounting
University of Split, Faculty of Economics
Cvite Fiskovića 5, 21000 Split, Croatia
ivana.dropulic@efst.hr

***Abstract*—Research is aimed to investigate the influence of several contingency variables on the design of cybernetic controls as a part of management controls systems (MCS). Cybernetic controls are conceptualized in terms of four dimensions: budgets, financial measurement systems, non financial measurement systems and hybrid measurement systems to form a composite measure of cybernetic controls. The methodology comprises an analysis of 43 responses to a postal questionnaire survey carried out among the medium and large manufacturing companies in Croatia. Using contingency theory framework we investigated the influence of business strategy, external environment, company size and organizational life cycle on cybernetic controls of company. Research findings indicate that business strategy and company size are significant predictor of cybernetic controls utilized by companies.**

Keywords*—cybernetic controls; contingency-based research; contingency variables; Croatia; manufacturing companies

I. Introduction

Contingency theory claims that "there is no universally acceptable model of the organization that explains the diversity of organizational design", therefore, "organizational design depends on contingent factors relevant to the situation" [1]. The framework used in this study recognizes that the business strategy, external environment, company size and stage in the organizational life cycle influence the choice of cybernetic controls as a part of management controls systems (MCS) design within an organization. Research was conducted in Croatia, on a sample of manufacturing companies. Here we must point out that research on the issues from the area of managerial accounting is very limited in Croatia and other Eastern European countries. Limited number of papers [2], [3], [4], [5] have analyzed practices of cost behavior and management, budgeting and other issues in mentioned countries.

The paper is organized as follows. The next section provides a literature review of the definitions of cybernetic controls and introduces the contingency approach as the theoretical framework of this study. In section III, various contingency factors that theoretically influence on cybernetic controls as a part of MCS are provided. The contingency variables are business strategy, external environment, company size and organizational life cycle. The research results are discussed in section IV. Finally, Section V summarizes the empirical findings and provides a brief outlook for further research.

II. Definition of Cybernetic Controls as a Part of Management Control Systems

A number of descriptions and definitions of MCS exist. Anthony [6] defines management control as "the process by which managers ensure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives." According to Malmi and Brown [7] "management controls include all the devices and systems managers use to ensure that the behaviors and decisions of their employees are consistent with the organization's objectives and strategies, but exclude pure decision-support systems." There are five types of controls in their typology of MCS: planning, cybernetic, reward and compensation, administrative and cultural controls. Green and Welsh [8] defined cybernetic control as "a process in which a feedback loop is represented by using standards of performance, measuring system performance, comparing that performance to standards, feeding back information about unwanted variances in the systems, and modifying the system's comportment."

There are four basic cybernetic systems that have been identified in MCS research that will be considered in this research: budgets, financial measurement systems, non-financial measurement systems and hybrids measurement systems that contain both financial and non-financial measures [7]. Budgets are a major feature of most MCS and are used by management as a means of coordinating and communicating strategic priorities and are often used to facilitate lower-level managers' commitment to these priorities [9]. A master budget is a comprehensive set of budgets covering all phases of an organization's operations [10].

A common form of control is holding employees accountable for specific financial measures [7]. Examples of financial performance measures used in this study include indicators of liquidity, solvency, profitability and activity. Non financial measures are becoming an increasingly important and they may be used to overcome some of the perceived limitations in financial measures. Examples of non financial performance measures used in this study are new product/service development, quality of product/service,

market share, customer relations and relationships with suppliers. Finally, hybrid performance measurement systems contain both financial and non-financial measures. In more recent times the Balanced Scorecard (BSC), which is a comprehensive MCS with both financial and non-financial performance measures, has become quite dominant [7] and it was used in this research.

The proper evaluation of an organization and its segments requires that multiple performance measures are defined and used [10]. In this study we used the cybernetic controls (CC) as a part of MCS with related techniques used for the purpose of guiding and motivating employees to accomplish organizational goals. In the questionnaire, with 6 questions, were measured the use of different parts of master budget and with 7 questions were measured the use of budgets for different purposes. Also, with 12 questions were measured the use of financial, non-financial and hybrid measures. Respondents were asked, on a five-point Likert-type scale ranging from 1 (never used) to 5 (always used), to indicate the use of cybernetic controls along the above 25 questions.

III. The Contingency Variables

In designing and using MCS managers must consider a large number of situational factors that individually and collectively affect the effectiveness of the various management controls [11]. In this study, using contingency theory framework, we investigated the influence of business strategy, external environment, company size and organizational life cycle on cybernetic controls.

A. Business Strategy

This research is based on Porter's generic strategies for the reason of being the most empirically tested and present concept that the participants can easily understand [12]. Although Porter [13] also identifies broad focus as a strategy it has been argued that broad focus is not an explicit strategy. Since this confusion researchers have tended to examine only the cost leadership and the differentiation strategy as the main strategic options. Therefore this study will focus on the cost leadership and differentiation strategies.

To measure business strategy, cost leadership and differentiation, we adopted the instrument [14] which includes nine items: product selling price, percent of sales spent on research and development, product quality, product features, brand image, introduction of new products, changes in design, fast and delivery, and post sales support. Using a five-point scale, 1 for significantly lower and 5 for significantly higher, respondents were asked to position their company relative to their competitor across the nine dimensions above. The questions were intended to signify the strategic choice of the companies where a higher score indicates product differentiation and lower score indicates low cost strategies [12].

The concern of this study is that cybernetic controls well be contingent on business strategy (BS). The preceding arguments lead to the following hypothesis

H1: Business strategy will affect cybernetic controls.

B. External Environments

„The external environment is a powerful contextual variable that is at the foundation of contingency-based research“ [15]. Environmental uncertainty refers to the broad set of factors that make it difficult to predict the future in a given area [11]. According to Milliken [16] environmental uncertainty will be defined as "an individual's perceived inability to predict something accurately. In this study environment will be considered by the aspect of “perceived environmental uncertainty” (PEU) to recognize the fact that environmental uncertainty is assessed using perceptual measures, rather than objective measures, as only through managerial perception environmental becomes known to the organizations [17].

PEU was measured using eight variables. Respondents were asked, on a five-point Likert scale ranging from 1 (very predictable) to 5 (very unpredictable), to indicate their perceptions of the relative predictability of the eight items of the company’s environment. The eight items were supposed to measure the respondents’ perceptions on the predictability of various aspects of their organization’s suppliers, competitors, customers, economic environment, government regulation, production and information technologies, industrial relations and deregulation and globalization [18]

The concern in the study is that external environment (PEU) will affect cybernetic controls. The hypothesis of this research question is then as follows:

H2: External environment will affect cybernetic controls.

C. Company Size

Few MCS studies have explicitly considered size as a contingency variable and the most of the studies that have examined size have considered its effects together with other elements of context. The design and role of MCS in smaller or medium sized entities has received little attention in the contingency-based MCS researches, and, thus many opportunities for future MCS research are likely to be found in the area of small and medium sized business.

There are several ways of measuring size and these include profits, sales volume, assets, share valuation and employees, but the most contingency-based MCS studies have defined and measured size as the number of employees [15]. This study measures company's size according to the criteria of Croatian Accounting Act [19]. Concerning measurement, this law classifies entrepreneurs as small, medium and large according to the following criteria: total assets, revenues and average number of employees during the year.

The concern in the study is that company size (CS) will affect cybernetic controls. The hypothesis of this research question is then as follows:

H3: Company size will affect cybernetic controls.

D. Organizational Life Cycle

The organizational life cycle has been recently introduced as contingent variable in the contingency-based research that influences management control. The potential impact of the life

cycle stage on cybernetic controls, and so far little attention of researchers, provides an opportunity for future research [20]. Life cycle theories can be used to predict how cybernetic controls vary across the organizational life-cycle stages [21].

There are a great number of multi-stage life cycle models that focus on a diverse array of characteristics to describe organizational development [22]. Perhaps the most widely applied model of organizational life cycle is Miller and Friesen's model. Miller and Friesen's [23] life-cycle model includes five stages, i.e. birth, growth, maturity, revival and decline, after which the organization can try to renew itself and go back to basics or shut up shop [21].

In this research we apply the Miller and Friesen [23] model for two main reasons. First, it is a model of life-cycle which classification is based mainly on the age, size and form of organization [21]. Second, this model has a strong empirical background and has also been tested in the empirical accounting research [20, 21, 22, 24, 25].

The concern in the study is that organizational life cycle (OLC) will affect cybernetic controls. The hypothesis of this research question is then as follows:

H4: Organizational life cycle will affect cybernetic controls.

IV. The Results of the Research

The study was based on data collected using post questionnaires sent to the financial managers of companies from manufacturing industry. Only medium and large companies, with at least 100 employees, were included in the target sample. It is expected that small companies and companies with less of 100 employees are less likely to have a real need for complex cybernetic control systems [26].

Each of the respondents was sent the following materials: a letter explaining the purpose of the study, the questionnaires, and a self addressed, stamped return envelope. Each questionnaire consists of three sections. The first section asks respondents for general information's about business and manager. The second section requests information about cybernetic control, the three section requests information about business strategy, organizational life cycle and external environment as influencing contingency factors. Data about company size were collected from database of Croatian Chamber of Economy [27].

There were 150 questionnaires distributed to the respondents based on the predetermined sample number and selection procedure. Of 150 questionnaires sent out, a total of 43 questionnaires were returned. Thus, the 43 responses were used in the data analysis of this study, making a usable response rate of 29%. Thus, it was decided that the response rate reached was adequate for conducting statistical analyses.

Tab. I presents the statistics on respondents in terms of size (medium and large) and type of company (public limited company and private limited company).

TABLE I. Profile of the Respondents

Type of Company	Size of Company		
	Large	***Medium***	***Total***
Public limited company	7	13	20 (46.51%)
Private limited company	6	17	23 (53.49%)
Total	13 (30.23%)	30 (69.77%)	43 (100%)

Descriptive statistics for cybernetic controls are presented in Tab. II for the overall sample of 43 respondents. With 6 questions were measured the use of different parts of master budget (MB), with 7 questions were measured the use of budgets for different purposes (BDP), and with 12 questions were measured the use of financial (FM), non-financial (NFM) and hybrid measurement systems (HM).

TABLE II. Descriptive Statistic for Cybernetic Controls

	MB	**BDP**	**FM**	**NFM**	**HM**
N	42	42	43	43	38
Missing	1	1	0	0	5
Mean	4.0421	3.6219	4.2733	2.2824	3.0000
Std. Deviation	0.7997	0.7267	0.8535	0.8120	1.1150
Minimum	2.33	2.29	1.75	1.00	1.00
Maximum	5.00	5.00	5.00	4.43	5.00

As indicated by the mean scores, it appears that the respondents placed the highest score on the usage of financial measurement systems (mean = 4.2733), followed by the use of different parts of master budget (mean = 4.0421). Findings also indicate that non-financial (mean = 2.2824) and hybrid measurement systems (mean = 3.0000) are rarely used as a part of cybernetic controls.

Tab. III presents the descriptive statistics for business strategy. The respondent companies in the study were split based on the average score calculated across the nine strategy items for each company. Companies with a strategy value of less than 3 (i.e. the mean value) were considered as companies following a cost leadership strategy and companies that had an average strategy value of 3 or more were considered as following a differentiation strategy.

TABLE III. Descriptive Statistic for Business Strategy

	Business strategy (BS)
N	43
Missing	0
Mean	3.4832
Std. Deviation	0.63546
Minimum	1.89
Maximum	4.67

Tab. III indicates that manufacturing companies in Croatia most frequently utilize product differentiation strategy apart from low cost strategy. According to results, a total of 33 (77%) sample elements belonged to the product differentiation strategy group while the remaining companies were found to be following the low cost strategy.

Descriptive statistics for perceived environmental uncertainty (PEU) are presented in Tab. IV. The eight items were supposed to measure the respondents' perceptions on the predictability of various aspects of their environment. The aggregate mean of the eight items served as the overall perceived environmental uncertainty score for a company.

TABLE IV. DESCRIPTIVE STATISTIC FOR PERCEIVED ENVIRONMENTAL UNCERTAINTY

	Perceived environmental uncertainty (PEU)
N	43
Missing	0
Mean	3.1250
Std. Deviation	0.80132
Minimum	1.00
Maximum	4.88

According to results perceived environmental uncertainty (PEU) seems to be perceived as rather high by the respondent as indicated by high mean. High perceived environmental uncertainty scores may be subject to the perceptual limitations that affect the measures of perceived environmental uncertainty and thus, limit the results of the study.

Tab. V presents the summary statistics for organizational life cycle (OLC). We use a self-categorization measure to identify the organizational life-cycle stage of the company [20]. In the questionnaire, we asked respondents to choose whether their company was in the birth, growth, maturity, revival or decline stage. The profile of each life-cycle stage is created to ensure that the choice of the respondents matches the right life cycle stage because the life-cycle classification is based on respondents' own descriptions of the life-cycle stage of their company [21].

TABLE V. SUMMARY STATISTIC FOR ORGANIZATIONAL LIFE CYCLE

	Organizational life cycle (OLC)				
	Birth	**Growth**	**Maturity**	**Revival**	**Decline**
Number of companies	0	5	20	8	9
R&D personnel	0	8.25	23.71	11.50	22.16
Growth of net sales (%)	0	33.50	6.51	63.22	2.37
Age of the company	0	28	46	43	44
Net sales (million HRK)	0	8.9426	3.7103	2.0280	1.4198

Miller and Friesen's [23] classification criteria include age less than 10 years for birth stage companies and more than 10 years for growth companies. The growth companies in our study are on average 28 years old. Miller and Friesen's [23] also define the criteria for the growth of sales, which should be higher than 15% for growth companies, less than 15% during the mature stage and again higher than 15% for revival companies. The companies in our sample meet these criteria.

The summary statistics in Tab. V indicate that respondents have classified their companies in accordance with Miller and Friesen's life-cycle model. We divide our sample into the four groups according to the life-cycle stage of the companies. The data contains 5 growth companies, 20 mature companies, 8 revival companies and 9 decline companies.

Tab. VI displays a Pearson correlation matrix for all variables in model. Examination of the correlation matrix suggest there were not too highly correlated, thus, multicollinearity problem is unlikely to exist.

TABLE VI. PEARSON CORRELATION MATRIX

Variables	**1**	**2**	**3**	**4**
CC				
PEU	-0.006			
BS	0.264[c]	0.095		
CS	0.523[a]	0.088	0.165	
OLC	-0.158	-0.168	-0.327[b]	-0.129

[a.] p<0.01 (two-tailed).

[b.] p<0.05 (two-tailed).

[c.] p<0.10 (two-tailed).

Validity test is conducted for all variables to determine the appropriateness of research instrument. The result of test has indicated that, all variables consisting of 25 items for cybernetic controls, 8 items for perceived environmental uncertainty and 9 items for business strategy are valid (significant at 5%). Based on the reliability test, the variables have a Cronbach's alpha of 0.706 for cybernetic controls (CC), 0.853 for perceived environmental uncertainty (PEU) and 0.882 for business strategy (BS).

Model test the effect of contingency variables (perceived environment uncertainty, business strategy, company size and organizational life cycle) on cybernetic control systems.

In all four hypotheses, individual contingency variables were expected to influence on cybernetic controls. Logically, a variable that influences on cybernetic controls of a company individually should also influence on cybernetic controls in combination with other variables. However, further analysis has provided clear insight about the two variables, business strategy and company size, that significantly influences on cybernetic controls design.

H1of this study is as follows: Business strategy will affect cybernetic controls. As indicated in Tab. VII, research findings have confirmed the hypothesis suggesting the variable can

contribute significantly to use of cybernetic controls (probability of 8%<10%).

TABLE VII. LINEAR REGRESSION ANALYSIS FOR BUSINESS STRATEGY

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.Error	Beta		
(Constant)	2.845	0.33		8.39	0.00
Business strategy	0.168	0.09	0.264	1.75	0.08

H2 predicting that external environment will affect the use of cybernetic controls was rejected on the basis of test shown in Tab. VIII (H2 has been rejected; probability of 96% > 5% and 10%).

TABLE VIII. LINEAR REGRESSION ANALYSIS FOR PERCEIVED ENVIRONMENTAL UNCERTAINTY

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.Error	Beta		
(Constant)	3.439	0.25		13.5	0.00
PEU	-0.003	0.07	-0.006	-0.04	0.96

H3 predicting that size will affect cybernetic controls was accepted at the significance of 1%, suggesting that the company sizes contribute to use of cybernetic controls (Tab. IX).

TABLE IX. LINEAR REGRESSION ANALYSIS FOR COMPANY SIZE

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.Error	Beta		
(Constant)	2.38	0.272		8.77	0.00
Company size	0.45	0.116	0.52	3.93	0.001

H4 suggesting the organizational life cycle will affect the cybernetic controls was rejected (probability of 26% > 5% and 10%, Tab. X).

TABLE X. LINEAR REGRESSION ANALYSIS FOR ORGANIZATIONAL LIFE CYCLE

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.Error	Beta		
(Constant)	3.69	0.23		15.6	0.00
OLC	-0.07	0.06	-0.17	-1.1	0.26

V. CONCLUSION

This study was designed to empirically test the contingent relationship between business strategy, external environment, company size, organizational life cycle and cybernetic controls systems in a sample of Croatia manufacturing companies.

One of the fundamental questions in the field of MCS is how to define and measure the influence of contingency factors on cybernetic controls design as a part of MCS. Although there is a large number of studies of contingency factors and their impact on cybernetic controls, the results of these studies are contradictory and largely incomparable. The reason for this lies primarily in different definitions and measurements of variables used in research and, finally, interpretations of results.

This study is subject to a number of potential limitations. First, the findings of this study are based on data from a single industry that might not necessarily reflect the general pattern of companies. Therefore, caution should be taken in making inferences from the results of this study. Second, the model is tested using survey data and thus is subject to the usual limitations associated with such data. Third, the model is relatively simplistic. While this is not necessarily a limitation we recognize that MCS involves multiple control systems and this study only focuses on cybernetic controls.

Despite the potential limitations of the study, this is one of the first empirically study conducted in the field of MCS in Croatia. Future studies need to focus their attention on MCS as a "package" of controls and explore the influence of multiple contingency factors on MCS design.

REFERENCES

[1] Z. Hoque, Strategic management accounting: concepts, processes and issues, 2nd ed. London; Rollinsford, NH: Spiro Press, 2003.

[2] M. Radu and V. Radu, G. C. Giju and D. E. Nicolae. Interest of cost management within the context of accounting system development in Romania, 2012. [Online]. Available: http://.wseas.us/e-library/conferences/2011/.../SOSOMACTS-16.pdf

[3] M. Pervan and I. Pervan, I.. Sticky costs: evidence from Croatian food and beverage industry, International Journal of Mathematical Models and Methods in Applied Sciences, No. 8, Vol. 6, pp. 963-970, 2012. [Online]. Available: http://www.naun.org/multimedia/NAUN/ijmmas/16-513.pdf

[4] C. M. Creiu, V. Ghonea, G. Talaghir, M. Manolache and M, Oconomescu Budget - Performance Tool in Public Sector, 2010. [Online]. Available: http://www.wseas.us/e-library/conferences/2010/TimisoaraW/EMT/EMT1-58.pdf

[5] M. Otrusinova and K. Steker, (2012). Comparison of usage accounting information in business and non-profit enterprises in the Czech Republic, Advances in Finance and Accounting [Online]. Available: http://www.wseas.us/e-library/conferences/2012/Zlin/FAA/FAA-15.pdf

[6] R.N. Anthony, Planning and control Systems: a framework for analysis. Graduate School of Business Administration, Harvard University: Boston, 1965.

[7] T. Malmi and D.A. Brown, "Management control systems as a package-opportunities, challenges and research directions," Management Accounting Research, vol. 19, pp. 287–300, December 2008.

[8] S.G. Green and M.A. Welsh, "Cybernetics and dependence: reframing the control concept," The Academy of Management Review, vol. 13, pp. 287-301, April 1988.

[9] M.A. Abernethy and P. Brownell, "The role of budgets in organizations facing strategic change: an exploratory study," Accounting, Organizations and Society, vol. 24, pp. 189-204, April 1999.

[10] R.W. Hilton, Managerial accounting, 4th ed. USA: The McGraw-Hill Companies, 1999.

[11] K.A. Merchant and W.A. Van der Stede, Management control systems: performance measurement, evaluation and incentives, 2nd ed. England: Prentice Hall, Pearson Education Limited, 2007.

[12] M. Tsamenyi, S. Sahadev, and Z.S. Qiao, "The relationship between business strategy, management control systems and performance: evidence from China," Advances in Accounting: Incorporating Advances in International Accounting, vol. 27, pp. 193-203, June 2011.

[13] M.E. Porter, Competitive strategy. New York: Free Press, 1980.

[14] J. Jermias and L. Gani, "Integrating business strategy, organizational configurations and management accounting systems with business unit effectiveness: a fitness landscape approach," Management Accounting Research, vol. 15, pp. 179-200, June 2004.

[15] R.H. Chenhall, "Management control systems design within its organizational context: findings from contingency-based research and directions for the future," Accounting, Organizations and Society, vol. 28, pp. 127-168, February-April 2003.

[16] F.J. Milliken, "Three types of perceived uncertainty about the environment: state, effect, and response uncertainty," The Academy of Management Review, vol. 12, pp. 133-143, January 1987.

[17] R. Jusoh, "The influence of perceived environmental uncertainty, firm size, and strategy on multiple performance measures usage," African Journal of Business Management, vol. 4, pp. 1972-1984, August 2010.

[18] Z. Hoque, "Linking environmental uncertainty to non-financial performance measures and performance: a research note," The British Accounting Review, vol. 37, pp. 471–481, December 2005.

[19] Accounting Law, Zagreb: Official Gazette of the Republic of Croatia No. 109/07.

[20] S.Md. Auzair and K. Langfield-Smith, "The effect of service process type, business strategy and life-cycle stage on bureaucratic MCS in service organizations," Management Accounting Research, vol. 16, pp. 399−421, December 2005.

[21] H. Silvola, "Do organizational life-cycle and venture capital investors affect the management control systems used by the firm?" Advances in Accounting, vol. 24, pp. 128–138, June 2008.

[22] M. Granlund and J. Taipaleenmäki, "Management control and controllership in new economy firms - a life cycle perspective," Management Accounting Research, vol. 16, pp. 21-57, March 2005.

[23] D. Miller and P.H. Friesen, "A Longitudinal study of the corporate life cycle," Management Science, vol. 30, pp. 1161−1183, October 1984.

[24] T. Davila, "An exploratory study on the emergence of management control systems: formalizing human resources in small growing firms," Accounting, Organizations and Society, vol. 30, pp. 223–248, April 2005.

[25] K. Moores and S. Yuen, "Management accounting systems and organizational configuration: a life-cycle perspective," Accounting, Organizations and Society, vol. 26, pp. 351–389, May-July 2001.

[26] Z. Hoque, "A contingency model of the association between strategy, environmental uncertainty and performance measurement: impact on organizational performance," International Business Review, vol. 13, pp. 485-502, August 2004.

[27] Croatian Chamber of Economy. "The Croatian Company Directory" [Online]. Available: http://www1.biznet.hr/HgkWeb/do/extlogon.