Is More Really Better?

Performance Measure Variety and Environmental Uncertainty

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Is More Really Better? Performance Measure Variety and Environmental Uncertainty

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Is More Really Better? Performance Measure Variety and Environmental Uncertainty

Abstract

Purpose: This paper asks the question of whether more environmental uncertainty affects the design of performance measurement systems in terms of a greater variety of performance measures and whether this leads to more management satisfaction with the performance measurement system and improved firm performance.

Design/methodology/approach: Information processing theory is used to frame the hypotheses and findings. A questionnaire was sent to the 300 largest companies in Iceland, where environmental uncertainty has been prevalent.

Findings: The results indicate that increased uncertainty leads to a larger variety of non-financial performance measures, such as customer measures. A positive relationship is found between management satisfaction with the performance measurement system and firm performance. However, the variety of performance measures was not linked to management satisfaction or firm performance.

Research limitations/implications: The results suggest that managers increase the variety of performance measures when uncertainty increases. However, it is not the variety itself that increases management satisfaction or improves firm performance.

Practical implications: Performance measurement design is affected by environmental uncertainty. Managers focus on important stakeholder groups such as customers under such conditions and can consult research and practice for the purpose of customer relationship management and customer profitability measurement to improve measurement selection.

Originality/value: This work focuses on performance measurement system design, examining the use of more than 50 different performance measures, and differentiates between small and medium-sized firms and between service and non-service firms.

Keywords

Information processing theory, Performance measures, Environmental uncertainty, Firm performance

Article Classification: Research paper

1. Introduction

Jack Welch, the former CEO of General Electric, once said,[1] "There are only three measurements that tell you nearly everything you need to know about your organisation's overall performance: employee engagement, customer satisfaction, and cash flow". It seems, however, that managers today need a significantly greater number and variety of performance measures. Currently, we see managers grappling with how to measure performance in, for example, innovation, customer relations, social responsibility, globalization, employee diversity and risk management (PwC, 2019). Measures such as these are seen as a critical part of the management control process (Chenhall and Langfield-Smith, 2007; Emmanuel, 1995; Malmi and Brown, 2008; Otley, 1994). Thus, one has to wonder the following: Given the need

[1] https://jackwelch.strayer.edu/winning/three-ways-take-company-pulse/ (Accessed April 20, 2020)

for this variety of performance measures, what influences measurement selection and performance measurement design?

Although performance measurement has been researched extensively, this question is under-researched according to Endrikat et al. (2020). Their meta-analysis concludes that "we strongly urge future research to be more explicit in describing the features and the design characteristics of the SPMS (strategic performance measurement system) studied" (Endrikat et al., 2020: 125). Our study answers this call.

An important force affecting managers when they design performance measurement systems is the external environment and its uncertainty (Chenhall, 2003, 2006; Otley, 2016). As uncertainty in the external environment increases, managers seem to be inclined to add more performance measures (Chenhall, 2006). For example, changes in quality requirements lead to a greater focus on quality measures; changing customer preferences lead to different customer measures; and added emphasis on social responsibility leads to measures being added to social performance (Bititci et al., 2012; Franco-Santos et al., 2012; Garengo and Bititci, 2007; Ittner et al., 2003b). In this paper, we examine this topic through the lens of information processing theory (Galbraith, 1973, 1974, 1977). According to this theory, as uncertainty increases, companies have two organisational design strategies to facilitate decision making (Haussmann, et al., 2011). They can (i) expand their information processing capacity through slack resources or self-contained tasks or (ii) reduce uncertainty by creating lateral relationships or investing in vertical information systems. Here, we focus on changes in vertical information systems, where one design strategy is to condense information flows into a formalized language, enabling managers to process more information (Galbraith, 1973, p. 73). Performance measures are an example of such a formalized language. With this view, increasing uncertainty should motivate managers to increase the variety of performance measures. If doing so reduces uncertainty, then managers should make better decisions, which will make them more satisfied with the performance measurement system. Improved decisions should then lead to better firm performance (Hoque, 2004, 2005; Ittner et al., 2003a; Olson and Slater, 2002).

This paper explores this critical link between the external environment and how it impacts the design of performance measurement systems. The overall aim is to explore whether the variety of performance measures in use changes with different levels of environmental uncertainty. Furthermore, this paper examines whether this uncertainty affects management satisfaction with the performance measurement system and if it impacts firm performance. The research adds to the knowledge generated by other studies (Hariyati et al., 2019, Hariyati and Tjahjadi, 2018; Chenhall, 2003; Chenhall and Langfield-Smith, 2007; Gosselin, 2005; Hoque, 2004) and offers a view on the use of performance measures in both large and small firms (Pekkola et al., 2016) and in both service and non-service firms. This topic has been explored in production firms (see, e.g., Hariyati et al., 2019, Hariyati and Tjahjadi, 2018), but relatively few studies have presented evidence from the service sector (Amizawati et al., 2010).

Our main research questions are as follows:

1. Does higher environmental uncertainty lead to a greater variety of performance measures used by managers?
2. Does a greater variety of performance measures lead to greater management satisfaction with the performance measurement system?
3. Does a greater variety of performance measures lead to better firm performance?

Our data come from an electronic survey of the chief financial officers (CFOs) of the 300 largest companies in Iceland. We aimed the survey at CFOs, as we assumed that they have the best knowledge of the performance measures being used by their companies. We chose Iceland as the setting for two main reasons. The first is that Iceland, due to the financial crisis of 2008, went through a very turbulent period a couple of years prior to the survey being conducted. This made environmental uncertainty an important topic and promised a fruitful context in which to explore the research questions. The second is that being the first such study in an Icelandic context adds to our knowledge about performance measurement in different national settings.

The response rate was 27%, which is satisfactory for a survey of this type (Hoque, 2004; Ittner et al., 2003a; Olson and Slater, 2002). The findings indicate that higher perceived environmental uncertainty to a degree leads to a greater variety of performance measures being used by managers—particularly customer measures. However, the variety of performance measures itself is not correlated with management satisfaction with the performance measurement system, nor does increasing the variety of performance measures correlate with firm performance. We interpret this as greater variety itself not leading to more management satisfaction and improved performance. This is important, as organisations are facing rising levels of environmental uncertainty, including technological disruptions, periodic crises such as financial crises and "Black Swan" events such as the COVID-19 pandemic. As uncertainty rises, managers tend to include more performance measures. Carefully selecting these measures and linking them to strategy are critical when managers respond to higher environmental uncertainty.

The paper is structured as follows. In the next section, we develop hypotheses based on the literature, and section three describes the methodology employed and variable measurement. Section four describes the results, section five discusses the results, and section six concludes the paper.

2. Background and hypothesis development

In the last three decades or so, firm performance measurement has developed into a research field of its own (Chenhall and Langfield-Smith, 2007; Eccles, 1991; Endrikat et al., 2020; Franco-Santos et al., 2012; Johnson and Kaplan, 1987; Kaplan, 2012) focusing, e.g., on performance measurement systems, modes of performance measurement, the impact of performance measurement systems, the organisation of performance measurement and performance measures (Bititci et al., 2012). In this field, contingency theory is a well-established theoretical framework (Chenhall, 2003, 2006; Otley, 2016; Otley 1994). It is based on the view that "organizational effectiveness results from fitting administrative practices, such as performance measurement, to the contingencies within which the organization operates" (Chenhall, 2006: 93). This includes environmental uncertainty and how it impacts the design and use of management control systems such as performance measurement systems (Otley and Soin, 2014). Environmental uncertainty includes the unpredictability of external forces acting on the company, such as the actions of suppliers, customer behaviour, labour market changes, economic development and technological developments (Daft, 2002; Dess and Beard, 1984; Hartmann, 2005). The performance of the organisation is dependent on the ability of managers to achieve a fit between the organisational systems and the external environment (Volberda et al., 2012). Performance measurement is a crucial information flow that informs managers about the quality of this fit through performance measures related to, e.g., financial results, customers, suppliers, production processes, compliance and strategy.

Information processing theory is a contingency-based view of how managers deal with uncertainty. It proposes that managers reduce uncertainty through different types of organisational designs (Galbraith, 1973, 1974, 1977). These designs are context-based, as "(i) there is no one best way to organise, and (ii) all ways of organising are not equally effective" (Galbraith, 1973, p. 2). Thus, organisations strive to achieve a fit with the environment; these fits are not random, and the quality of the fit changes as the environment changes (Volberda, et al., 2012). Information processing theory assumes that organisational designs (called rules, hierarchical referral, or goal setting) are effective up until a certain level of uncertainty, after which the organisation has to either reduce the amount of information that needs to be processed or increase its information processing capacity. This theory has been tested and validated in a number of studies in a variety of research fields (Egelhoff, 1991; Gattiker and Goodhue, 2004; Premkumar et al., 2005; Rogers et al., 1999; Tushman and Nadler, 1978; Tybout et al., 1981).

Information processing capacity can be increased by changing the decision frequency, increasing the scope of the database available to managers, increasing the capacity of the decision mechanisms or increasing the degree of the formalization of the information flows to managers (Galbraith, 1973, 1974; Haussmann et al., 2011). The last element—the increasing degree of formalization of information flows to managers—refers to the usage of formalized languages that allow managers to process more information (Haussmann et al., 2011, p. 77). Accounting and the process of measurement is a formalization of information when performance is quantified, which gives managers information about the size and direction of changes in a condensed form, enabling comparisons and visibility across functional areas (Burchell et al., 1985; Hall, 2010).

Performance measurement is a formalization of information flows that enables managers to exert control over what is measured (Ferreira and Otley, 2009; Chenhall, 2006; Otley, 1994). There are five characteristics of such a system (Green and Welsh, 1988). The first is that there are measures that enable the quantification of the object of measurement. Second, there are criteria for judging whether performance is good or bad. Third, there is a process that compares the outcome of the measurement process with the performance criteria. Fourth, there is an analysis of any difference between measured performance and the criteria for performance. Fifth, there is a governance process that enables managers to act on the information provided and modify the object of measurement to improve performance. From an information processing perspective, we focus on the first characteristic, as it is the basic building block of the system. Without measures that quantify the object of measurement, the system as a whole will not be effective.

In their literature review, Franco-Santos et al. (2012) classify performance measurement systems into four different categories according to their components and purpose. However, in their study, as well as in other studies, there is not much focus on the actual design of the performance measurement system, including the variety of performance measures used (Endrikat et al., 2020). A performance measure captures the performance characteristics of an organisational system, process, object, event or person. These performance characteristics are expressed through a numerical performance indicator. There is a large variety of possible performance measures available to managers (Eccles, 1991; Ittner and Larcker, 2003; Ittner et al., 2003a; Ittner et al., 2003b) and thousands of performance indicators from which to choose. Performance measures can measure inputs, processes or outputs, and indicators can be presented as absolute, relative or indices and be financial or non-financial (Chenhall and Langfield-Smith, 2007; Dilla et al., 2010; Eccles, 1991). For example, the performance

measure “service quality” can be measured using indicators such as “percentage of on-time deliveries”, “number of customer complaints”, and “customer evaluation”. Performance measures and performance measurement systems are evident in public and private organisations and can be based on various organisational frameworks, such as strategy maps, balanced scorecards and business excellence models (Endrikat et al., 2020, Kristensen and Westlund, 2004; Laitinen, 2002).

Several studies have applied information processing theory in the study of performance measurement systems (Banker et al., 2004; Cardinaels and van Veen-Dirks, 2010; Dilla and Steinbart, 2005; Grafton et al., 2010; Kaplan and Wisner, 2009; Lipe and Salterio, 2000). Many of these have applied experimental methodologies using MBA students or postgraduate students as subjects (Banker et al., 2004; Cardinaels and van Veen-Dirks, 2010; Dilla and Steinbart, 2005; Kaplan and Wisner, 2009; Lipe and Salterio, 2000). These studies focus on different dependent variables, such as the formatting of balanced scorecards (Cardinaels and van Veen-Dirks, 2010; Kaplan and Wisner, 2009; Lipe and Salterio, 2000), the impact of managerial training on balanced scorecard design (Dilla and Steinbart, 2005), and organisational capabilities (Grafton et al., 2010). Although the results of these studies are interesting, none of these studies have used information processing theory to interpret the variability in performance measures as a dependent variable, and none have focused on environmental uncertainty as a contextual variable. These studies demonstrate, however, the validity of using information processing theory in studying performance measurement.

Information processing theory suggests that managers facing uncertain environments call for a more formalized language of performance measurement to increase their information processing capacity. This would mean increasing the variety of performance measures as performance-related information flows are condensed into formal performance measures. Some empirical evidence supports this. Bastian and Muchlish found that more perceived environmental uncertainty leads to more non-financial measures being used (Bastian and Muchlish, 2012). Another study found that managers in uncertain environments favour more financial performance measures, customer measures and employee measures (Gosselin, 2005). Pedersen and Sudzina found no uniform evidence that market uncertainty influences the adoption of more comprehensive performance measurement systems, although they found a positive correlation between perceived uncertainty and the use of several types of performance measures, including marketing measures (Pedersen and Sudzina, 2012). Hartmann found that managers facing high environmental uncertainty are more likely to rate financial accounting measures as more appropriate for performance measurement (Hartmann, 2005). Hoque found no evidence of companies adopting more non-financial performance measures in the face of increasing environmental uncertainty (Hoque, 2004). Pekkola et al. (2015) found evidence in their case study that smaller firms in turbulent environments tend to use a set of core performance measures and a set of measures that support strategic targets that change with new strategies. Additionally, surveying smaller firms, Rawashdeh and Al-namlah (2017) found evidence of managers using a greater variety of measures in the face of uncertainty. Thus, there seems to be evidence suggesting that managers facing uncertain external environments are more inclined to change their performance measurement systems than are managers in less uncertain environments. The evidence, however, is inconclusive in regard to the exact nature of these changes concerning what measures are used, the use of organising frameworks or, as addressed in our research, if a greater variety of performance measures is used.

Although the evidence is not conclusive, we construct our first hypothesis in a positive direction:

H1: A greater variety of performance measures is associated with higher environmental uncertainty.

Performance measures and performance measurement processes play an important role in planning and framing decisions, measuring the effects of decisions, communicating results, assessing employee and management actions and executing strategic initiatives (Chenhall and Langfield-Smith, 2007). A manager who can access reliable performance information is be expected to make better decisions and therefore be more satisfied with the performance measurement system. The degree of satisfaction with a performance measurement system is indicative of the manager's perceived ability to use and trust the information from this system and the value created by the performance measurement system.

As discussed by Jusoh and Parnell (2008) and shown in Chenhall and Langfield-Smith (2007), performance measurement in companies has to be measured in multiple dimensions within the financial and non-financial categories to capture the different aspects of performance. When measuring the performance of employees, departments and organisations as a whole, as well as different processes such as sales, operations, service and purchasing, it is not enough to focus on a small number of performance measures (Hariyati et al., 2019, Hariyati and Tjahjadi, 2018; Bititci et al., 2012; Jusoh and Parnell, 2008). Frigo (2002) reports that few managers are generally satisfied with their performance measurement systems, often because they lack performance measures. Other evidence indicates that management satisfaction with performance measurement systems increases as the system includes more types of financial and non-financial indicators. Ittner et al. (2003a), for example, find a significant correlation between management satisfaction with the performance measurement system and the diversity of performance measures used. Malmi, in several case studies, finds evidence that the measures and dimensions of the balanced scorecard impact management's use of it (Malmi, 2001). A study in German-speaking countries shows that the more advanced balanced scorecards are, the higher the management satisfaction with the performance measurement system (Speckbacher et al., 2003).

This leads us to our second hypothesis:

H2: Management satisfaction with the performance measurement system is positively associated with variety in performance measures.

Effective and efficient performance measurement systems that are aligned with the characteristics of the external environment should help managers make better decisions that should improve firm performance (Chenhall and Morris, 1998, Hariyati et al., 2019, Hariyati and Tjahjadi, 2018, Tjahjadi et al., 2019). Some research indicates that a greater diversity of performance indicators is positively associated with firm performance. That is, firms that use more diverse performance measures perform better than those that do not. Bastian and Muchlish (2012) find that the increased use of non-financial indicators is associated with better firm performance. Ittner et al. (2003a) find evidence that firms making more extensive use of a broad set of performance measures have higher stock market returns. Van der Stede et al. (2006) find that performance measurement diversity benefits performance, as firms with more extensive performance measurement systems have superior performance compared that of those with lower variety. A study amongst Malaysian companies found that the greater use of non-financial measures is positively associated with firm performance (Jusoh and Parnell,

2008). Baird and Su (2017) find evidence of a positive association between performance measure multidimensionality and firm performance.

Our third hypothesis is therefore as follows:

H3: Firm performance is positively associated with variety in performance measures.

Given that we expect the variety in performance measures to have a positive impact on both management satisfaction (H2) and firm performance (H3), we consequently also expect a positive link between management satisfaction and firm performance. Although reverse causality might exist in the sense that firm performance could positively influence management satisfaction with performance management, we assume that causality runs from management satisfaction with performance management to firm performance in accordance with the logic underlying H3. Hypothesis 4 therefore more directly reflects the assumption that managers who are more satisfied with the performance measurement system make better decisions.

Our fourth hypothesis is as follows:

H4: Firm performance is positively associated with management satisfaction with the performance measurement system.

Figure 1 shows the overall research model. Regarding the variables and directions of causality, we consulted the research model proposed by Chenhall (2006) for studying performance measurement. It proposes that the external environment in general impacts the use of performance measures that lead to the outcomes desired by managers. This is similar to the research models used by Hariyati and Tjahjadi (2018), Franco-Santos et al. (2012), Haldma and Lääts (2002) and Chenhall and Morris (1986), where the dependent variables are financial performance or management satisfaction, and the independent variables are, e.g., the types of performance measurement systems in use, accounting system characteristics, or perceptions of innovation strategy and management information. Our research model is similar to that of Chenhall and Morris (1986), with environmental uncertainty impacting the characteristics of the performance measures used, which, in turn, affect management satisfaction with the performance measurement system and firm performance. Similar models are also used in other research contexts (Ward and Duray, 2000).

- PLACE FIGURE 1 HERE -

3. Methodology and variable measurements

A web-based questionnaire was sent to the CFOs of the 300 largest private or semi-private companies in Iceland. As companies in Iceland are relatively small, we chose to focus on the largest companies, as these would be expected to have formalized performance measurement systems. We chose the CFO as a respondent, as we would expect him or her to have engaged both in strategic and tactical decision-making processes as well as be knowledgeable about the performance measurement system. By using the 300 largest Icelandic companies, the research covers all listed firms in Iceland and most large and medium-size firms[2], with great variety in ownership structure, from fully family owned firms to private equity-owned firms and multi-nationals.

[2] This is similar to the definition of what constitutes a small and medium-sized firm by the European Union, as shown here: https://ec.europa.eu/eurostat/web/structural-business-statistics/structural-business-statistics/sme (Accessed April 20, 2020)

The questionnaire itself was in Icelandic and divided into four main sections:

1. Questions regarding satisfaction with the performance measurement system.
2. Questions regarding the use of performance measures in several performance areas. These are shown in the Appendix.
3. Questions regarding the unpredictability of the external environment.
4. Questions regarding perceived performance and background variables including company size and industry.

To test the hypotheses presented above, we need measures for four variables: (i) environmental uncertainty; (ii) the use and variety of performance measures; (iii) management satisfaction with the performance measurement system; and (iv) firm performance.

3.1 Measuring environmental uncertainty

We use the construct of perceived environmental uncertainty (PEU), which has been used and verified in a number of other studies (Bastian and Muchlish, 2012; Pedersen and Sudzina, 2012). Generally, using this construct involves listing aspects of the external environment and asking managers to rate the uncertainty of these elements. We adopt the same construct that is used by Hoque (2004), Hartmann (2005) and Ekholm and Wallin (2011). Similar to Hoque (2004), we use a five-point Likert scale, ranging from 1 (very unpredictable) to 5 (very predictable), to rate the perceived unpredictability of (i) suppliers' actions; (ii) customer demands, tastes and preferences; (iii) deregulation and globalization; (iv) market activities of competitors; (v) production and information technologies; (vi) government regulation and policies; (vii) economic environment; (viii) industrial relations; (ix) new competing products; (x) new competitors; (xi) developments in raw material markets; and (xii) developments in labour markets.

3.2 Measuring the use and variety of performance measures

Operating differences among companies, industry variations, customer characteristics, management attitudes, etc., can lead to performance being measured in different ways, even in the same industry (Pedersen and Sudzina, 2012). To develop the list of performance measures, we drew on various surveys and lists (Chenhall and Langfield-Smith, 2007; Chow and Van der Stede, 2006; Ittner et al., 2003a; Kaplan and Norton, 2007; Olson and Slater, 2002). Consulting online resources, including the KPI library[3], we also included newer performance measures such as corporate social responsibility. We asked about the presence of and emphasis on performance measures rather than specific indicators (Chow and Van Der Stede, 2006). The aim was not to construct a comprehensive list of all possible indicators, which would have been impossible (the KPI library, for example, contains thousands of possible indicators), but rather to construct a list of performance measures that could represent a broad spectrum of possible indicators. For example, the performance measure of "occupational safety" could include a variety of indicators such as the "number of days since the last accident", "serious occupational accident ratio", and "lost working hours due to work-related illnesses". In our list, we group performance measures into the following categories: (i) financial performance, (ii) customer performance, (iii) processes and human resources, and (iv) risk and corporate social responsibility. Within these four groups, there were 59 different performance measures, as shown in the Appendix. This list was informally tested on selected industry contacts in both service and non-service firms as well as discussed with academic colleagues. In the survey

[3] http://kpilibrary.com/ (accessed April 15, 2020).

itself, participants were asked to indicate the performance measures currently being used by managers in their firms and to assess the importance of these measures. Importance and use were measured on a four-point Likert scale, ranging from 0, labelled as "we do not use", to 3, labelled as "used and very important". We operationalize the notion of the variety of performance measures by a simple count measure of the total number of measures in use in the four groups and overall.

3.3 Measuring management satisfaction

Using satisfaction measures has a long tradition in business studies, including employee satisfaction (e.g., job satisfaction surveys) in human resources studies, customer satisfaction in marketing studies, end user satisfaction in information systems studies and accounting system satisfaction in accounting studies. In operationalizing this variable, we consulted studies by Kanellou and Spathis (2013), Hou (2012), Ittner et al. (2003a) Haldma and Lääts (2002) and Mendoza and Bescos (2001), who all measured management satisfaction with some accounting information system characteristics. However, the scales used in these studies differ, with Mendoza and Bescos (2001) using a three-point scale for management satisfaction, Ittner et al. (2003a) using a six-point scale and Kanellou and Spathis (2013) using a seven-point scale. In our study, we asked CFOs to rate their satisfaction with the performance measurement system on a five-point Likert scale, ranging from very unsatisfied to very satisfied.

3.4 Measuring firm performance

We chose to measure firm performance as perceived performance on a five-point scale for six firm performance variables: (i) operating profit increase in the past three years, (ii) return on investment, (iii) return on assets, (iv) cost developments, (v) increase in turnover, and (vi) overall performance. We realize that the subjective perception of performance cannot be as accurate as objective measures such as annual reports or stock market variables, as used by Ittner et al. (2003a). Most of the companies in the population, however, are not publicly traded. Furthermore, as confidentiality was emphasized in the survey, financial data from annual reports could not be obtained and matched with the survey data. Other studies in the same field have adopted measures of perceived performance upon which we draw, such as Van der Stede et al. (2006), who use a five-point scale to measure perceived performance in four categories, and Olson and Slater (2002), who measure the overall performance of the company on a five-point scale. Obviously, our approach to measuring perceived firm performance is only based on financial measures, whereas the questions on performance measures used in firms' performance measurement system include both financial and non-financial measures. However, we assume that CFOs will use a broader variety of financial and non-financial measures in decision-making than, e.g., investors, who will have access mainly to financial performance measures.

4. Results and hypothesis testing

4.1. Descriptive statistics

Of the 300 CFOs to whom we sent the questionnaire, 81 responded to our survey, giving us a survey response rate of 27%. Compared to other surveys of this type, this response rate is considered satisfactory (Hariyati, 2019; Hariyati and Tjahjadi, 2018; Ittner et al., 2003a; Olson and Slater, 2002). The descriptive statistics for the 81 respondents are shown in Table 1. Overall, the figures reveal that the distribution of our respondents largely matches the overall distribution regarding industries and size. However, compared to the 300 largest firms, a lower number of respondents classify their industry as *services,* and a higher number of respondents

classify their industry as *other*. In addition, our dataset appears to contain a smaller proportion of small firms and a higher proportion of large firms than the overall sample.

- PLACE TABLE 1 HERE -

The results for overall perceived environmental uncertainty are shown in Table 2. As we use a five-point Likert scale ranging from 1 (very unpredictable) to 5 (very predictable), low values in predictability represent a high degree of uncertainty. The last row includes the overall predictability across the twelve external factors. The economic environment is by far the most uncertain environmental variable, with a median value of 2 (mean value of 2.5). This well reflects the developments in the Icelandic economy before and after the financial crisis of 2008, when the Icelandic economy went through a very turbulent period (Mixa and Sigurjonsson, 2012, Rikhardsson et al., 2012). The behaviours of suppliers and customers appear to be largely predictable, with median values of 4. All other dimensions exhibit median values of 3; however, the mean values indicate less predictability for the threat of new competitors (2.8), raw material markets (2.8), new competing products (2.90), and competitor behaviour (2.9). Further analysis reveals Cronbach's alpha values of below 0.7 when deleting the individual items, which indicates that we actually measure different aspects of environmental uncertainty with the items included. In testing the hypotheses, we use the combined score of overall predictability.

- PLACE TABLE 2 HERE -

Table 3 displays the results for the usage and importance of performance measures for financial performance measurement, customer performance measurement, processes and human resources (HR) performance measurement, and risk and corporate social responsibility (CSR) performance measurement. The number of performance measures that we asked about in each area is included in parentheses in the left column. We report the overall number of measures *used* (i.e., reported as being important, fairly important or very important) and the number of measures assigned to the three importance categories. In addition, we report the overall importance as the median across all measures considered. We split the dataset into three size subsamples: the subsamples *small, medium, and large* include firms with less than 50, with 51 to 200 and with more than 200 employees, respectively. In addition, we split that dataset into two industry subsamples encompassing service and non-service companies (see Table 1). This is based on research showing that service companies share certain characteristics that differentiate them from non-service companies, including the importance of perceived environmental uncertainty (Amizawati et al., 2010). This also reflects the context in terms of the turbulence in the Icelandic economy, with consultancies and information technology companies seeing lower demand for their services following the financial crisis (Rikhardsson et al., 2012). The subsample *services* includes financial firms, firms that offer expert services and firms in the information and telecommunication sector; the subsample *non-services* includes firms in the following sectors: production, wholesale, fisheries, and retail. The median values and significance of the tests of equality are based on the non-parametric Mann-Whitney *U*-test. The symbols ***, **, and * denote statistical significance at the one, five, and ten percent levels, respectively.

- PLACE TABLE 3 HERE -

The figures in Table 3 indicate that the responding firms use a great variety of performance measures overall. According to respondents' answers, the firms use nearly all the financial

measures that we included in the survey. Measures related to customer performance, processes and HR, and risk and CSR are used relatively less but still to a considerable degree. Small firms tend to use fewer performance measures overall and fewer performance measures related to customers, to processes and HR, and to risk and CSR than medium-sized and large firms; however, not all differences are statistically significant. Firms categorized in the services sector appear to use more customer-oriented measures than do non-services firms, but fewer risk and CSR measures and slightly fewer financial measures, the differences being statistically significant at least at the ten percent level.

Table 4 displays the results for management satisfaction with the performance measurement system. Satisfaction is measured on a five-point Likert scale, ranging from 1=very dissatisfied to 5=very satisfied. Panel A includes mean and median values and the standard deviation for the 78 companies included. Panel B displays the frequencies for the five values on the Likert scale as absolute numbers and percentages of mentions. Overall, CFOs appear to be largely satisfied with the performance measurement system, as shown by the mean (3.4) and median value (4.0), and 55% of the respondents are satisfied or very satisfied.

- PLACE TABLE 4 HERE -

Table 5 displays the results for management satisfaction with the performance measurement system for the small, medium-sized, and large firms and for service and non-service firms. We report median values and significance of the tests of equality based on the non-parametric Mann-Whitney *U*-test. The symbols ** and * denote statistical significance at the five and ten percent levels, respectively. The results indicate less satisfaction in medium-sized firms than in small and large firms, but we do not find a significant difference between services and non-services firms.

- PLACE TABLE 5 HERE -

The responses to the questions about company performance are shown in Table 6. Factor analysis holds all items except for *cost development* together on one factor with high loadings. Cronbach's alphas support the notion that the six items measure the same underlying construct. Interestingly, respondents report company performance above average performance in five out of six performance categories, which might indicate either that mainly CFOs from firms with above-average performance responded or that the responding CFOs might have an over-optimistic view of their company performance.

- PLACE TABLE 6 HERE -

4.2. Testing of Hypotheses 1 and 2

Table 7 shows the Spearman's rank correlation coefficients between the numbers of performance measures used on the one hand and the overall predictability of the environment and the satisfaction with the performance measurement system on the other hand. For the number of performance measures, we include the overall number used (*Overall*) and the number used in the four performance areas. Overall predictability is the median value of the twelve variables included to measure perceived environmental uncertainty. Predictability and satisfaction are measured on a five-point Likert scale. Below each correlation coefficient, we report the value of the t-statistic and the number of pairs included. The symbols ** and * denote statistical significance at the five and ten percent levels, respectively.

- PLACE TABLE 7 HERE -

Since low values in predictability indicate high levels of perceived environmental uncertainty, the negative correlation coefficients reveal that the higher the perceived uncertainty is (i.e., the lower the predictability), the larger the number of performance measures used. These findings provide support for Hypothesis 1. However, only the correlation coefficients regarding the overall number of performance measures used and the number of customer performance measures used are statistically significant. We do not find support for Hypothesis 2, which stated that management satisfaction is positively associated with the variety of performance measures used.

4.3. Testing of Hypotheses 3 and 4

Table 8 displays the Spearman's rank correlation coefficients between the numbers of performance measures used and the perceived performance. For the variety of performance measures, we include the overall number used (*Overall*) and the number used in the four performance areas. For perceived performance, we include our six performance variables. Below each correlation coefficient, we report the value of the t-statistic and the number of pairs included. The symbol ** denotes statistical significance at the five percent level.

- PLACE TABLE 8 HERE -

Given that except for one correlation coefficient, we do not find any significant results, there is no support for Hypothesis 3. This means that a greater variety in performance measures used in firms' performance measurement systems does not lead to better performance, as measured with our six financial performance indicators.

Table 9 shows the Spearman's rank correlation coefficients between satisfaction with the performance measurement system and perceived performance. Below each correlation coefficient, we report the value of the t-statistic and the number of pairs included. The symbols ***, **, and * denote statistical significance at the one, five, and ten percent levels, respectively.

- PLACE TABLE 9 HERE -

The results reported in Table 9, particularly the positive and statistically significant correlation coefficients regarding return on assets, increase in turnover and overall performance, offer support for Hypothesis 4, that management satisfaction with the performance measurement system is positively associated with firm performance. As discussed above, however, we cannot unambiguously identify whether more satisfaction leads to better performance or whether more satisfaction results from better performance.

5. Discussion of results

Our first research question concerned whether greater perceived uncertainty leads to more variety in performance measures. The answer to this question is yes. There was a significantly higher variety of indicators in use when the environment was perceived as being more uncertain. As information processing theory predicts, our findings show that when the external environment becomes more uncertain, managers respond by increasing information processing capacity by formalizing information flows to reduce uncertainty. This supports the evidence from the study by Bastian and Muchlish (2012) and (partly) the evidence from the study by Pedersen and Sudzina (2012). This result means that when uncertainty increases, managers

need more information. Although some information might be collected in an informal manner (such as external information sources, word of mouth, and dialogue with colleagues), increasing the formalization of information streams means electing to measure new performance objects (such as innovation, risk and social responsibility) and expressing them as formal quantified measures in a performance measurement system. The results also indicate that managers who perceive their environments as being more uncertain add non-financial indicators, mainly focusing on customers. This confirms the general conclusion by Bastian and Muchlish (2012) that managers in more uncertain environments focus more on non-financial indicators. Gosselin (2005) and Pedersen and Sudzina (2012) also found that managers in more uncertain environments place more emphasis on customer measures. This was summarized by Pedersen and Sudzina (2012: p. 10): "Managers who perceive the environment as unpredictable spend more time and resources on collecting and analysing information about important external stakeholders and trends in order to cope more effectively with this uncertainty". Customers are one of the primary stakeholders of a company, as without demand for its products and services, the company would not exist. When uncertainty is high, this group becomes of critical importance, leading to the formalization of customer-related information streams. In such environments, management could, for example, draw on developments in customer relationship management and customer profitability management practices, including measures of customer relationship quality, customer profitability and customer equity (Čermák, 2015; Fang et al., 2016; Gleaves et al., 2008; Hariyati et al., 2019; Holm and Ax, 2020; Holm et al., 2012).

In answering the first research question, we found—not surprisingly—that size is a contextual factor in regard to the use of performance measures. Smaller firms tend to use fewer measures than large firms and focus less on non-financial measures. In general, size influences the formalization and scope of information systems, including accounting information systems (Otley, 2016; Chenhall, 2006; Chenhall, 2003). Information processing theory tells us that in smaller firms, the level of information flows might not have reached the capacity of the decision-making mechanism, i.e., the managers and owners of the firm. As the firm grows, the need for the formalization of information flows and increasing the scope of the databases available to managers to support their decisions increases (Davila and Foster, 2007). Today, managers in smaller growing firms can draw both on lessons from research in performance measurement, such as the choice of indicators, and on the availability of information systems for processing and displaying performance information (Rikhardsson and Yigitbasioglu, 2018).

The second research question was whether a greater variety of performance measures leads to greater management satisfaction with the performance measurement system. The answer to this question is no. We find no link between management satisfaction with the performance measurement system as a whole and the variety of the performance measures in use. This is in contrast with Ittner et al. (2003a) and Speckbacher et al. (2003), who found evidence of increasing management satisfaction with the increasing variety of performance measures and development level of the performance measurement system. However, the respondents were generally satisfied with their performance measurement systems. This indicates that variety itself is not enough to impact managers' perceived ability to use and trust the information from the performance measurement system and increase the perceived value created by it.

The final research question was whether a greater variety of performance measures leads to better firm performance. The answer is as follows: not directly. We did not find a direct link between the variety of performance measures and firm performance, but we found a link between management satisfaction with the performance measurement system and firm

performance. The higher the management satisfaction is with the system, the better the firm performance. Other studies, however, have found a direct link between performance measure variety and firm performance (Ittner et al., 2003a; Jusoh and Parnell, 2008; Van der Stede et al., 2006). Our interpretation is that it is not enough just to increase the variety of performance measures to improve firm performance or to increase management satisfaction with the performance measurement system. Performance measures must fit the company, link to its strategy and provide relevant information to managers. This makes managers more satisfied with the system, as it allows them to make better decisions, which then improves firm performance. This interpretation is supported by the overall conclusions in a review of the studies on performance measurement systems. As this review states, "The growing consensus in the literature seems to be that performance measurement systems do not automatically improve firm performance. Evidence suggests that it is the way these systems are designed, developed, and more importantly used that brings about performance improvements" (Franco-Santos et al., 2012, p. 97). Furthermore, developments in information processing theory also point in this direction, showing that the fit between the quantity and quality of information makes information useful and helpful (Haussmann et al., 2011). There is a caveat regarding this last link. The causality in the research model developed by Franco-Santos et al. (2012) is assumed to be unidirectional. However, we cannot show conclusive proof that this is the case in our research. In fact, a reverse causality might exist. That is, if firm performance is good, then managers might be more satisfied with the performance measurement system.

Finally, in answering the research questions above, we examined whether there was a difference between service-sector firms and non-service-sector firms. There was no significant difference in management satisfaction or in the impact of the use of performance measures on firm performance. However, service-sector firms use fewer financial measures, more customer-focused measures and fewer measures of risk and CSR than do non-service-sector firms. The difference in the use of financial measures can be explained by some of the measures being of lesser relevance for service-sector companies, such as the costs of goods sold, material costs and contribution margin of products. However, the risk and CSR measures include regulatory compliance, climate change, employee health, occupational safety and human rights. These measures should be universal given the focus on these issues in society. Managers in service-sector firms in Iceland should be aware of this, as these measures are only going to become more important as nations and organisations move forward with implementing the United Nations Sustainable Development Goals by 2030 (AICPA, 2018).

6. Conclusions

In summary, our main conclusions are threefold. First, when external environments become more uncertain, managers have a tendency to add non-financial performance measures. However, as more variety does not add value per se, managers should think carefully when choosing measures and link them to the strategy that the firm wants to pursue. Second, more uncertain environments make managers add customer-related measures, customers being a critical stakeholder group. This can only be expected to increase given the rising economic turbulence in the wake of the current COVID-19 crisis. In doing so, it is important that managers draw on current research and practice within customer relationship management and customer profitability management and link these measures to strategy and tactics. Third, there seems to be a lesser focus on risk and CSR measures in service-sector firms than in non-service-sector firms in Iceland. Given the importance of service-sector companies in Iceland, where tourism is the largest sector, it would seem important that managers consider these types of measures as an integral part of firm performance going forward.

In this paper, we contribute with a novel view on performance measurement by using information processing theory and the formalization of information flows as the basis for interpreting the results of a questionnaire survey administered to CFOs. However, as stated in Franco-Santo et al. (2012) and Endrikat et al. (2020), the links between performance measures and firm performance need further investigation, as such evidence is still inconclusive. First, we need to understand more fully what moderating variables affect the link between performance measurement and firm performance. Second, we need to understand how the design of the performance measurement system, including the types and variety of measures, impacts the performance and quality of decision making. This call echoes similar calls made by Endrikat et al. (2020), Hariyati et al. (2019) and Hariyati and Tjahjadi (2018). Related to this, we also need to understand in more detail what influences the choice of measures and the lifecycle of performance management systems such as balanced scorecards and business excellence. Are these selected and used based on business considerations and strategic imperatives, or as some researchers have expressed concerns about, is their use governed by management fads and fashions (Newell et al., 2001; Granlund and Lukka, 1998)?

Finally, there are some obvious limitations to our study. We survey managers in one country and focus on one type of theory to explain developments in performance measurement. We are also affected by a relatively low response rate, similar to many other surveys in social sciences, although the response rate of our survey is similar to those of other surveys. We also acknowledge that the choice of performance measures shown in the Appendix may have influenced the results. Considering the number of possible measures and the context in which they are used, there is always a risk that the measurement areas chosen are too general. However, the development of the list of measures was a critical activity in the project with several consultations with academic partners and practice to counter this risk. Finally, asking CFOs to rate their satisfaction with a system that might have been designed by them opens up a potential measurement bias. However, we did not use this measure to rate absolute performance but rather to assess relative performance and differences between companies.

Jack Welch, whom we cited in the introduction, observed the need for only three different performance measures. Given the uncertainty of the external environment and the complexity of decisions facing managers today, there is a need for more variety. We hope, despite its limitations, that this study has provided insights into what governs the design of firm performance measurement in uncertain environments and management actions in this context.

Appendix: List of performance measures used in the survey

Financials	Budget variances
	Operating profit
	Return on investments
	Return on assets
	Cost development
	Contribution margin of products
	Contribution margin of customers
	Contribution margin of company
	Cost of goods sold
	Labour cost
	Material cost
	Indirect costs (overhead)
	Revenue
Customers	Market share
	Sales volume
	Customer satisfaction
	Customer retention
	Customer complaints
	Reputation and image
	Account management
	Public relations
	Marketing campaigns
	Media use
	IT availability
	IT service levels
	Social media use
	Company web site impact
Processes and HR	Production volume
	Labour Productivity
	Machine productivity
	Material usage
	Setup efficiency
	Supplier performance
	Outsourcing partners performance
	Product or service quality
	Facility maintenance
	Operating asset maintenance
	Employees satisfaction
	Employee skills
	Employee training/education
	Employee loyalty/turnover
	Absenteeism
Risk and CSR	Regulatory compliance

	Governance standards compliance
	Risk assessment and management
	Internal audit and control
	Occupational safety
	Employee health
	Climate change
	Waste management
	Human rights
	Code of conducts compliance

References

AICPA. (2018), *The Role of the Accountant in Implementing the Sustainable Development Goals*, available at: https://www.cgma.org/resources/reports/the-role-of-the-accountant-in-implementing-the-sustainable-development-goals.html (accessed April 16, 2020).

Amizawati, M. A., Nik Nazli, N. A., and Muslim Har, S. M. (2010). "An investigation on PMS attributes in service organisations in Malaysia". *International Journal of Productivity and Performance Management,* Vol. 59 No 8, pp. 734-756.

Baird, K., and Su, S. (2018). "The association between controls, performance measures and performance". *International Journal of Productivity and Performance Management*, *67*(6), pp. 967–984.

Banker, R.D., Chang, H. and Pizzini, M.J. (2004), "The Balanced Scorecard: Judgmental Effects of Performance Measures Linked to Strategy.", *Accounting Review*, Vol. 79 No. 1, pp. 1–23.

Bastian, E. and Muchlish, M. (2012), "Perceived Environment Uncertainty, Business Strategy, Performance Measurement Systems and Organizational Performance", *International Congress on Interdisciplinary Business and Social Sciences 2012 (ICIBSoS 2012)*, Vol. 65 No. 0, pp. 787–792.

Bititci, U., Garengo, P., Dörfler, V. and Nudurupati, S. (2012), "Performance Measurement: Challenges for Tomorrow.", *International Journal of Management Reviews*, Vol. 14 No. 3, pp. 305–327.

Burchell, S., Clubb, C., Hopwood, A., Hughes, J. and Nahapie, J. (1985), "The Roles of Accounting in Organizations and Society.", *Accounting Organizations and Society*, Vol. 5, pp. 5–27.

Cardinaels, E. and van Veen-Dirks, P.M.G. (2010), "Financial versus non-financial information: The impact of information organization and presentation in a Balanced Scorecard.", *Accounting, Organizations and Society*, Vol. 35 No. 6, pp. 565–578.

Čermák, P. (2015), "Customer Profitability Analysis and Customer Life Time Value Models: Portfolio Analysis", *16th Annual Conference on Finance and Accounting, ACFA Prague 2015, 29th May 2015,* Vol. 25, pp. 14–25.

Chenhall, R. (2003), "Management Control Systems Design Within its Organisational Context: Findings from Contingency-based research and Directions for the Future", *Accounting, Organizations and Society*, Vol. Vol. 28, pp. 127–168.

Chenhall, R. (2006), "The Contingent Design of Performance Measures", in Bhimani, A. (Ed.), *Contemporary Issues in Management Accounting*, Oxford University Press, Oxford, pp. 92–116.

Chenhall, R. and Langfield-Smith, K. (2007), "Multiple Perspectives of Performance Measures", *European Management Journal*, Vol. 25, pp. 266–282.

Chenhall, R.H., and Morris, D. (1986). "The impact of structure, environment, and interdependence on the perceived usefulness of management accounting systems". *Accounting Review*, Vol. 6, No. 1, pp. 16-35.

Chow, C. and Van der Stede, W. (2006), "The Use and Usefulness of Nonfinancial Performance Measures", *Management Accounting Quarterly*, Vol. 7, pp. 1–8.

Daft, R. (2002), *Management*, South-Western College Publishing, Ohio.

Davila, A. and Foster, G. (2007), "Management Control Systems in Early-Stage Startup Companies", *The Accounting Review*, Vol. 82 No. 4, pp. 907–937.

Dess, G. and Beard, D. (1984), "Dimensions of Organizational Task Environments", *Administrative Science Quarterly*, Vol. 29 No. 1, pp. 52–73.

Dilla, W., Janvrin, D.J. and Raschke, R. (2010), "Interactive Data Visualization: New Directions for Accounting Information Systems Research", *Journal of Information Systems*, Vol. 24, pp. 1–37.
Dilla, W.N. and S., P.J. (2005), "Relative weighting of common and unique balanced scorecard measures by knowledgeable decision makers", *Behavioural Research in Accounting*, Vol. Vol.17, pp. 43–53.
Eccles, R.G. (1991), "The Performance Measurement Manifesto", *Harvard Business Review*, Vol. 69, pp. 131–137.
Egelhoff, W.G. (1991), "Information-Processing Theory and the Multinational Enterprise", *Journal of International Business Studies*, Vol. 22 No. 3, pp. 341–368.
Ekholm, B. and Wallin, J. (2011), "The Impact of Uncertainty and Strategy on the Perceived Usefulness of Fixed and Flexible Budgets". *Journal of Business Finance and Accounting*, Vol. 38, pp. 145-164.
Emmanuel, C., D. Otley and. K. Merchant. (1995), "Accounting for Management Control", *London: Chapman and Hall*.
Endrikat, J., Guenther, T.W. and Titus, R. (2019), "Consequences of Strategic Performance Measurement Systems: A Meta-Analytic Review", *Journal of Management Accounting Research*, American Accounting Association, Vol. 32 No. 1, pp. 103–136.
Fang, K., Jiang, Y. and Song, M. (2016), "Customer profitability forecasting using Big Data analytics: A case study of the insurance industry", *Computers & Industrial Engineering*, Vol. 101, pp. 554–564.
Ferreira, A. and Otley, D. (2009), "The Design and use of Performance Management Systems: An Extended Framework For Analysis.", *Management Accounting Research*, Vol. 20 No. 4, pp. 263–282.
Franco-Santos, M., Lucianetti, L. and Bourne, M. (2012), "Contemporary Performance Measurement Systems: A Review of their Consequences and a Framework for Research", *Management Accounting Research*, Vol. 23, pp. 79–119.
Frigo, M. L. (2002). Nonfinancial Performance Measures and Strategy Execution. *Strategic Finance*, *84*, 6–9.
Galbraith, J. R. (1973). *Designing complex organizations*. Reading, MA: Addison-Wesley.
Galbraith, J. R. (1977). *Organizational Design*. Reading, MA: Addison-Wesley.
Galbraith, J.R. (1974), "Organization Design: An Information Processing View", *Interfaces*, Vol. 4 No. 3, pp. 28–36.
Garengo, P. and Bititci, U. (2007), "Towards a contingency approach to performance measurement: an empirical study in Scottish SMEs.", *International Journal of Operations and Production Management*, Vol. 27 No. 8, pp. 802–825.
Gattiker, T.F. and Goodhue, D.L. (2004), "Understanding the local-level costs and benefits of ERP through organizational information processing theory", *Information and Management*, Vol. 41 No. 4, pp. 431–443.
Gleaves, R., Burton, J., Kitshoff, J., Bates, K. and Whittington, M. (2008), "Accounting is from Mars, marketing is from Venus: establishing common ground for the concept of customer profitability", *Journal of Marketing Management*, Vol. 24, pp. 825–845.
Gosselin, M. (2005), "An empirical study of performance measurement in manufacturing firms.", *International Journal of Productivity and Performance Management*, Vol. 54 No. 6, pp. 419–437.
Grafton, J., Lillis, A.M. and Widener, S.K. (2010), "The role of performance measurement and evaluation in building organizational capabilities and performance.", *Accounting, Organizations and Society*, Vol. 35 No. 7, pp. 689–706.
Granlund, M. and Lukka, K. (1998), "It's a small world of management accounting practices", *Journal of Management Accounting Research*, Vol. 10, pp. 153–179.

Green, S. and Welsh, M. (1988), "Cybernetics and dependence: Reframing the control concept", *Academy of Management Review*, Vol. 13 No. 2, pp. 287–301.
Haldma, T. and Lääts, K. (2002), "Contingencies influencing the management accounting practices of Estonian manufacturing companies", *Management Accounting Research*, Vol. 13 No. 4, pp. 379–400.
Hall, M. (2010), "Accounting information and managerial work", *Accounting, Organizations and Society*, Vol. 35 No. 3, pp. 301–315.
Hariyati, H. and Tjahjadi, B. (2018), "Contingent Factors Affecting the Financial Performance of Manufacturing Companies: The Case of East Java, Indonesia", *Asian Journal of Business and Accounting;* Vol. 11 No. 1, pp. 121-150.
Hariyati, Tjahjadi, B. and Soewarno, N. (2019), "The mediating effect of intellectual capital, management accounting information systems, internal process performance, and customer performance.", *International Journal of Productivity and Performance Management*, Vol. 68 No. 7, pp. 1250–1271.
Hartmann, F. (2005), "The effects of tolerance for ambiguity and uncertainty on the appropriateness of accounting performance measures.", *Abacus*, Vol. 41 No. 3, pp. 241–264.
Haussmann, C., Dwivedi, Y., Venkitachalam, K. and Williams, M. (2011), "A Summary and Review of Galbraith´s Organizational Information Processing Theory", in Dwivedi, Y., Wade, M. and Schneberger, S. (Eds.), *Information Systems Theory*, Vol. 29, Springer Verlag, pp. 71–93.
Holm, M. and Ax, C. (2020), "The interactive effect of competition intensity and customer service competition on customer accounting sophistication—Evidence of positive and negative associations", *Management Accounting Research*, Vol. 46, p. 100644.
Holm, M., Kumar, V. and Rohde, C. (2012), "Measuring customer profitability in complex environments: an interdisciplinary contingency framework", *Journal of the Academy of Marketing Science*, Vol. 40, pp. 387–401.
Hoque, Z. (2004), "A contingency model of the association between strategy, environmental uncertainty and performance measurement: impact on organizational performance.", *International Business Review*, Vol. 13 No. 4, pp. 485–502.
Hoque, Z. (2005), "Linking environmental uncertainty to non-financial performance measures and performance: a research note.", *British Accounting Review*, Vol. 37 No. 4, pp. 471–481.
Hou, C.-K. (2012), "Examining the effect of user satisfaction on system usage and individual performance with business intelligence systems: An empirical study of Taiwan's electronics industry", *International Journal of Information Management*, Vol. 32 No. 6, pp. 560–573.
Ittner, C. and Larcker, D.D. (2003), "Coming Up Short on Nonfinancial Performance Measurement", *Harvard Business Review*, Vol. 81, pp. 88–95.
Ittner, C., Larcker, D. and Meyer, M. (2003a), "Subjectivity and the Weighting of Performance Measures: Evidence from a Balanced Scorecard", *Accounting Review*, Vol. 78, pp. 725–758.
Ittner, C., Larcker, D. and Randall, T. (2003b), "Performance implications of strategic performance measurement in financial services firms", *Accounting, Organizations and Society*, Vol. 28, p. 715.
Johnson, H.T. and Kaplan, R.S. (1987), *Relevance Lost - The Rise and Fall of Management Accounting*, Harvard Business School Press, Harvard.
Jusoh, R. and Parnell, J.A. (2008), "Competitive strategy and performance measurement in the Malaysian context: An exploratory study", *Management Decision*, Vol. 46, pp. 5–31.

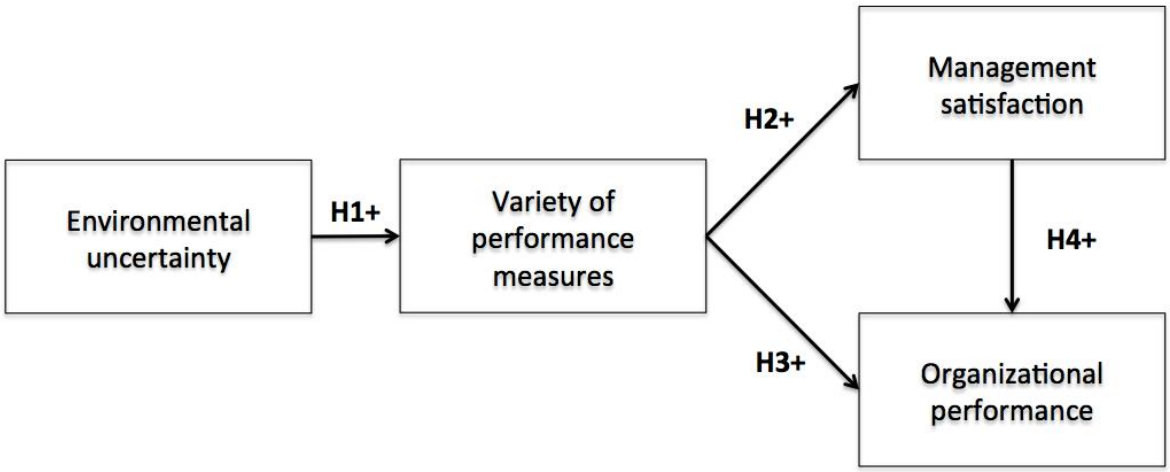
Kanellou, A. and Spathis, C. (2013), "Accounting benefits and satisfaction in an ERP environment", *International Journal of Accounting Information Systems*, Vol. 14 No. 3, pp. 209–234.
Kaplan, R. (2012), "The balanced scorecard: comments on balanced scorecard commentaries", *Journal of Accounting and Organizational Change*, Vol. 8, pp. 539–545.
Kaplan, R. and Norton, D. (2007), "Using the Balanced Scorecard as a Strategic Management System", *Harvard Business Review*, Vol. 85, pp. 150–161.
Kaplan, S.E. and Wisner, P.S. (2009), "The Judgmental Effects of Management Communications and a Fifth Balanced Scorecard Category on Performance Evaluation", *Behavioral Research in Accounting*, Vol. 21 No. 2, pp. 37–56.
Kristensen, K. and Westlund, A. (2004), "Accountable Business Performance Measurement for Sustainable Business Excellence", *Total Quality Management*, Vol. 15 No. 5–6, pp. 629–643.
Laitinen, E.K. (2002), "A dynamic performance measurement system: evidence from small Finnish technology companies", *Scandinavian Journal of Management*, Vol. 18 No. 1, pp. 65–99.
Lipe, M.G. and Salterio, S.E. (2000), "The Balanced Scorecard: Judgmental Effects of Common and Unique Performance Measures.", *Accounting Review*, Vol. 75 No. 3, p. 283.
Malmi, T. (2001), "Balanced scorecards in Finnish companies: A research note", *Management Accounting Research*, Vol. 12 No. 2, pp. 207–220.
Malmi, T. and Brown, D.A. (2008), "Management control systems as a package—Opportunities, challenges and research directions", *Management Accounting Research*, Vol. 19 No. 4, pp. 287–300.
Mendoza, C. and Bescos, P.-L. (2001), "An explanatory model of managers' information needs: implications for management accounting.", *European Accounting Review*, Routledge, Vol. 10 No. 2, pp. 257–289.
Mixa, M. and Sigurjonsson, T.O. (2013), "Lessons not Learned - Iceland's Financial Crisis Compared to the Nordic Countries", in Hawthorne, C. (Ed.), *Financial Crises: Identification, Forecasting and Effects on Transition Economies*, Nova Science Publishers, New York.
Newell, S., Robertson, M. and Swan, J. (2001), "Management Fads and Fashions", *Organization*, SAGE Publications Ltd, Vol. 8 No. 1, pp. 5–15.
Olson, E.M. and Slater, S.F. (2002), "The balanced scorecard, competitive strategy, and performance", *Business Horizons*, Vol. 45, p. 11.
Otley, D. (1994), "Management control in contemporary organizations: towards a wider framework", *Management Accounting Research*, Vol. 5, pp. 289–299.
Otley, D. (2016), "The contingency theory of management accounting and control: 1980–2014", *Management Accounting Research*, Vol. 31 No. June, pp. 45–62.
Otley, D. and Soin, K. (Eds.). (2014), *Management Control and Uncertainty*, Palgrave-Macmillian, New York.
Pedersen, E. and Sudzina, F. (2012), "Which firms use measures?", *International Journal of Operations and Production Management*, Vol. 32, pp. 4–27.
Pekkola, S., Saunila, M., and Rantanen, H. (2016). "Performance measurement system implementation in a turbulent operating environment". *International Journal of Productivity and Performance Management*, *65*(7), pp. 947–958
Premkumar, G., Ramamurthy, K. and Saunders, C.S. (2005), "Information Processing View of Organizations: An Exploratory Examination of Fit in the Context of

Interorganizational Relationships", *Journal of Management Information Systems*, Vol. 22 No. 1, pp. 257–294.
PwC. (2019). *22nd Annual Global CEO Survey*. London: PwC. Retrieved from https://www.pwc.com/mu/pwc-22nd-annual-global-ceo-survey-mu.pdf (accessed April 16, 2020).
Rawashdeh, A., and Al-namlah, L. (2017). "Factors influencing electronic data interchange adoption among small and medium enterprises in Saudi Arabia", *Asian Journal of Business and Accounting,* Vol. 10, No. 2, pp. 253-280.
Rikhardsson, P. and Yigitbasioglu, O. (2018), "Business intelligence & analytics in management accounting research: Status and future focus", *International Journal of Accounting Information Systems*, Vol. 29, pp. 37–58.
Rikhardsson, P., Karlsson, T., Sigurjonsdottir, T.A. and Hilmarsson, S.T. (2012), "Rear-view mirror navigation: pre-crisis management accounting and control practices in Iceland", *International Journal of Managerial and Financial Accounting*, Vol. 4 No. 4, pp. 402–422.
Rogers, P.R., Miller, A. and Judge, W.Q. (1999), "Using information-processing theory to understand planning/performance relationships in the context of strategy", *Strategic Management Journal*, Vol. 20 No. 6, pp. 567–577.
Speckbacher, G., Bischof, J. and Pfeiffer, T. (2003), "A descriptive analysis on the implementation of Balanced Scorecards in German-speaking countries", *Management Accounting Research*, Vol. 14 No. 4, pp. 361–388.
Tjahjadi, B., Soewarno, N., Astri, E., & Hariyati, H. (2019). "Does intellectual capital matter in performance management system-organizational performance relationship? Experience of higher education institutions in Indonesia", *Journal of Intellectual Capital*, Vol. 20 No. 4, pp. 533-554.
Tushman, M.L. and Nadler, D.A. (1978), "Information Processing as an Integrating Concept in Organizational Design", *The Academy of Management Review*, Vol. 3 No. 3, pp. 613–624.
Tybout, A.M., Calder, B.J. and Sternthal, B. (1981), "Using Information Processing Theory to Design Marketing Strategies", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 73–79.
Van der Stede, W., Chow, C. and Lin, T. (2006), "Strategy, Choice of Performance Measures, and Performance", *Behavioral Research in Accounting*, Vol. 18, pp. 185–205.
Volberda, H.W., van der Weerdt, N., Verwaal, E., Stienstra, M. and Verdu, A.J. (2012), "Contingency Fit, Institutional Fit, and Firm Performance: A Metafit Approach to Organization-Environment Relationships", *Organization Science*, Vol. 23, pp. 1040–1054.
Ward, P.T. and Duray, R. (2000), "Manufacturing strategy in context: environment, competitive strategy and manufacturing strategy", *Journal of Operations Management*, Vol. 18 No. 2, pp. 123–138.

Is More Really Better? Performance Measure Variety and Environmental Uncertainty

FIGURE

Figure 1: The research model, number of hypotheses and the expected direction of the relationship.



Is More Really Better? Performance Measure Variety and Environmental Uncertainty

TABLES

Table 1: Survey respondent statistics

	Respondents statistics	*300 largest companies in Iceland (Population statistics)*
Industry		
Non-Service		
Production	20%	24%
Fisheries	11%	9%
ICT	4%	7%
Services		
Finance	9%	8%
Expert services	17%	37%
Wholesale	9%	6%
Retail	9%	6%
Other	22%	3%
Size (Number of employees)		
Less than 50	27%	40%
51-200	40%	36%
More than 200	33%	25%

Note: Data for the population statistics of 300 firms are obtained from a database published annually in Iceland that contains data regarding size and industry.

Table 2: Measures of Environmental Uncertainty

Predictability of …	***N***	***Mean***	***Median***	***Sdv***	***Cronbach's Alpha if item deleted***
Suppliers' behavior	76	3.6	4	0.9	0.614
Customers' behavior	78	3.3	4	1	0.606
Globalization	76	3	3	1	0.609
Competitors' behavior	75	2.9	3	1	0.615
Technical change	76	3.3	3	0.9	0.622
Regulation	76	3.1	3	1.2	0.664
Economic environment	75	2.5	2	1	0.617
Industrial relations	75	3	3	1.1	0.628
New competing products	72	2.9	3	0.8	0.606
New competitors	75	2.8	3	1	0.597
Raw material markets	69	2.8	3	0.9	0.639
Labor market	75	3.1	3	0.7	0.631
Overall predictability	78	3.1	3	0.4	0.641

Table 3: Performance measure variety in size and industry subsamples

	Median			***Significance***			***Median***		***Significance***
	Small	*Medium*	*Large*	*Small vs. Medium*	*Small vs. Large*	*Medium vs. Large*	*Services*	*Non-services*	
Financials (13)									
Number used	11	12	11				11	12	**
Very important	5	8	7				7.5	8	
Fairly important	3	3	2				1.5	3	
Important	1	0	0				0	0	
Overall importance	2	3	3	**			3	3	
Customers (14)									
Number used	8	11	10.5	**	*		11	9	*
Very important	4	5	5.5				5	4.5	
Fairly important	2	3	2			*	2	2.5	
Important	1	2	2				1	2	
Overall importance	1.5	2	2				2	2	
Processes and HR (15)									
Number used	8	10	9.5		*		8	10.5	
Very important	5	5	5.5				5	5.5	
Fairly important	1	3	2	*			2	3	
Important	0	1	1				0	1	
Overall importance	1	2	2		*		2	2	
Risk and CSR (10)									
Number used	7	8	8				6	10	***
Very important	4	3	5			*	3	4	
Fairly important	1	2	1				2	1	
Important	0	1	0			*	0	1	
Overall importance	2	2	2.75				1.75	2	
Overall number used	34	40	38	**			34.5	40	

Table 4: Management satisfaction with the current performance measurement system

Panel A: Overview				
Mean	*Median*	*Sdv*		*N*
3.4	4.0	0.9		78
Panel B: Frequency				
1 Very dissatisfied	*2 Dissatisfied*	*3 Neither/ nor*	*4 Satisfied*	*5 Very satisfied*
2	9	24	39	4
3%	12%	31%	50%	5%

Table 5: Management satisfaction with the current performance measurement system in size and industry subsamples

Median			*Significance*			*Median*		*Significance*
Small	*Medium*	*Large*	*Small vs. Medium*	*Small vs. Large*	*Medium vs. Large*	*Services*	*Non-services*	
4	3	4	*		**	4	3.5	

Table 6: Perceived firm performance

Perceived performance	***N***	***Mean***	***Median***	***Sdv***	***Loading Factor 1***	***Loading Factor 2***	***Cronbach's Alpha if item deleted***
Operating profit	61	3.7	4	1	0.931	-0.164	0.796
Return on investment	50	3.5	4	0.9	0.849	-0.294	0.819
Return on assets	50	3.5	4	1	0.882	-0.284	0.814
Cost development	59	3.1	3	0.8	0.311	0.778	0.902
Increase in turnover	61	3.6	4	0.9	0.660	0.527	0.859
Overall performance	63	3.9	4	0.9	0.870	0.073	0.811

Table 7: Correlations between predictability and satisfaction with performance measurement and the number of performance measures used

	Number of performance measures used				
	Overall	*Financials*	*Customers*	*Processes and HR*	*Risk and CSR*
Overall perceived predictability of the environment	**-0.192***	-0.114	**-0.247****	-0.139	-0.133
	-1.706	-1.004	-2.223	-1.222	-1.153
	78	78	78	78	76
Satisfaction with performance measurement system	-0.007	0.022	0.152	-0.081	-0.042
	-0.064	0.188	1.339	-0.706	-0.365
	78	78	78	78	76

Table 8: Correlations between numbers of performance measures used and perceived performance

Number of performance measures used	***Operating profit***	***Return on investments***	***Return on assets***	***Cost development***	***Increase in turnover***	***Overall performance***
Overall	0.081	-0.031	-0.166	0.213	0.098	0.035
	0.627	-0.214	-1.165	1.642	0.759	0.270
	61	50	50	59	61	63
Financials	0.027	0.045	-0.137	0.115	0.210	0.059
	0.206	0.315	-0.962	0.877	1.648	0.462
	61	50	50	59	61	63
Customers	0.026	-0.055	-0.018	0.071	-0.070	-0.019
	0.197	-0.380	-0.122	0.535	-0.535	-0.151
	61	50	50	59	61	63
Processes and HR	0.175	0.024	-0.087	**0.310****	0.193	0.111
	1.369	0.165	-0.605	2.461	1.509	0.874
	61	50	50	59	61	63
Risk and CSR	-0.015	-0.113	-0.207	0.062	-0.022	0.007
	-0.113	-0.782	-1.454	0.467	-0.169	0.058
	60	49	49	58	61	62

Table 9: Correlations between satisfaction with performance measurement system and perceived performance.

	Perceived Performance					
	Operating profit	*Return on investments*	*Return on assets*	*Cost development*	*Increase in turnover*	*Overall performance*
Satisfaction with performance measurement system	0.174 1.356 61	0.001 0.004 50	**0.254*** 1.821 50	-0.043 -0.322 59	**0.252**** 1.999 61	**0.348***** 2.898 63