UNIVERSITÀ DEGLI STUDI DI UDINE
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Corso di dottorato di ricerca in:

"Scienze Manageriali e Attuariali"

in convenzione con Università di Trieste

Ciclo 33°

Titolo della tesi

"**Strategic Performance Measurement in complex settings: A multi-perspective analysis.**"

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Anno 2021

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Introduction

1. Abstract and literature positioning

The common thread of the dissertation is the relation between Management Control Systems (MCS) and strategy (Huff & Reger, 1987; Simons, 1987; Dent, 1990; Simons, 1990, 1991, 1994, 1995; Chapman, 1997; Langfield-Smith, 1997; Shields, 1997; Chenhall & Langfield-Smith, 1998; Otley, 1999; Chenhall, 2003; Bisbe & Otley, 2004; Chenhall, 2005; Henri, 2006; Langfield-Smith, 2006).

Despite business strategy field has emerged during the 1950s, strategy has become an explicit variable in the MCS research only during the 1980s (Langfield-Smith, 1997) with the contingency-based studies affirmation (Simons, 1987).

The interest in the relationship between MCS and strategy has significantly advanced knowledge by developing two different research streams (Dent, 1990; Langfield-Smith, 1997).

The first one is related to the exploration of the effect of strategy on MCS (Simons, 1987; Bruggeman & Stede, 1993; Chenhall & Langfield-Smith, 1998; Ittner et al., 2003). This stream of research has focused the attention to the impact of strategy on MCS by examining different concept of strategy (Henri, 2006). For instance, Govindarajan (1988) uses Porter's strategy framework for examining the linkage between strategies and administrative mechanism: cost leadership and differentiation; Simons (1987) explains the relations between accounting control systems, business strategy and firm performance by examining the two Miles & Snow's antithetic strategic types: prospector and defender; and Govindarajan and Gupta (1985) examine the linkage between strategy, incentive bonus systems and strategic effectiveness using their build/hold/harvest strategic taxonomy. The common approach to the MCS of this research stream is the structural approach (Chapman, 1997). MCS is studied as a static system, primarily part of the strategic deployment process and later in the process of strategic management (Henri, 2006). Consequently, findings are mainly related to the MCS technicalities and design (Dent, 1987; Simons, 1987; Langfield-Smith, 1997).

The second is focused to the investigation of the effect of MCS on strategy (Chapman, 1997; Davila, 2000; Bisbe & Otley, 2004; Chenhall, 2005). This stream of research, less extended and more recent, is focused on the study of the MCS impact on strategy by changing the overall perspective (Huff & Reger, 1987). MCS is conceptualized as a dynamic system by adopting a processual approach (Chapman, 1998). The system influences the strategic management processes with a continues interaction (Dent, 1987). The role of the MCS do not regards only the strategic deployment but is also focalized in

the dialog and in the interaction between the system and strategy. MCS and strategy establish a systematic relation that are part of the strategic actions within organizations (Simons, 1990; Archer & Otley, 1991). Following this approach, several studies have started to focus their attention to the active role of MCS in the process of strategic formulation and implementation (Langfield-Smith, 1997). First Simons work (1990) and his following studies (Simons, 1991, 1994) have highlighted the processual approach in the MCS conceptualization. However, as pointed out by Ittner et al. (2003), Chenhall (2003), and Langfield-Smith (2006) the findings of this research stream continue to appear fragmentary and contradictory. Different MCS design and several strategic approaches used in the studies of MCS-strategy relationship have drawn some different research paths (Kald et al., 2000).

In this context, the integrated approach for studying the complex relations between MCS and strategy has emerged in the literature (Otley, 1999; Otley & Ferreira, 2005). MCS-strategy relation is studied with the aim to understand the integrative nature of these elements by analyzing its integration in a holistic way (Otley, 1999).

Following this approach is possible to identify four different models of integrated performance measurement systems (Langfield-Smith, 2008; Berry et al., 2009): (1) Strategic Performance Measurement Systems (Kaplan & Norton, 1996); (2) Levers of control framework (Simons, 1995); (3) Performance management and control framework (Otley & Ferreira, 2005) (4) Strategic Management Accounting (Simmonds, 1981). Key topic of these systems is the link between strategy and performance measures by understanding the role of the formal and informal control (Kaplan & Norton, 1996), and to use MCS as a system for managing the organizational behavior and the effects of strategic change (Simons, 1995). MCS-strategy relation becomes explicit by the interconnection of the elements that constitute the integrated performance measurement system (Otley & Ferreira, 2005).

However, MCS-strategy relation continues to represent one of the most resisting concern in management accounting literature (Bisbe et al., 2016). Several researches have underlined various association between strategy and MCS practices with the aim of correlate MCS practices to different strategic context (Langfield-Smith, 2006).

The dissertation tries to advance knowledge in the relations between MCS and strategy by investigating two different perspectives: (1) the effect of strategy on MCS and; (2) the effect of MCS on strategy. These perspectives have been investigated through the adoption of two different approaches: (1) contingency-based approach (Chenhall, 2003); and (2) integrated approach (Simons, 1995; Kaplan & Norton, 1999). This study is based on different MCS practices: narrowed focus on financial control and extended focus on financial and non-financial control (Berry et al., 2009). Along with the first practices, Value Based Management systems (VBM), a traditional system of financial control, is

analyzed with the aim to make the effect of strategy on MCS' use more evident (Ryan & Trahan, 2007). The second practice analyses the effect of Performance Measurement System (PMS), a dynamic system of formal and informal control, on strategy by adopting an integrated approach (Neely et al., 2002).

The dissertation is divided in three sections, each with a rather different focus on both theoretical and empirical evidence. Each section gives a specific contribution to advance knowledge in the MCS-strategy relation. First part "*Literature review*" has the aim of understand the literature debate - the specific streams of research. The analysis of the relevant literature has significantly contributed to understand the nature of the VBM systems. This part has also the role of the research knowledge development as a sort of first research pillar. The second "*First empirical investigation*" is made up by the empirical test of the MCS-strategy relation. Adopting a contingency-based approach, the first empirical study tries to understand the effect of strategy on a particular MCS practice – VBM system. This study has contributed to the knowledge advancement by highlighting the positive effect of the firm's strategic-choice in enhancing the stronger relation between VBM systems and firms' performance.

Finally, the third part of this dissertation "*Second empirical investigations*" attempts to empirical investigate the relation of MCS (PMS) on strategy by adopting an integrated approach. Findings show that PMS has a relevant contribution in supporting the firms' strategic positioning.

For the structure of this dissertation, the three parts can be separately analyzed but, at the same time, they constitute a unitary study about the MCS-strategy relation.

2. Part 1 – Literature review

First pillar of this dissertation is represented by a literature review about VBM systems. The contribution of this part to the overall study is related to the development of the research knowledge about a particular MCS practice – VBM system.

Literature review has been developed by following the structured approach. Using NVivo software as the fundamental tool for developing the qualitative research, this study has identified the main streams of the VBM systems literature: (1) studies focused on the tools, models, and technicalities for the VBM systems implementation; (2) studies focused on the VBM systems characteristics and its relations with the firms' characteristics; and (3) studies focused on the VBM systems relation with the firm's performance. Many theoretical evidence show that the VBM systems implementation increase the firm's performance, in terms of economic value creation. This study points out an important gap in the Accounting literature, it regards the non-presence of a

theoretical framework for defining this type of systems and the relation with the firm's characteristics.

3. Part 2 - First empirical investigation

Second part of the dissertation regards the empirical investigation of the effect of strategy on MCS (Value Based Management system - VBM). Adopting a contingency-based research framework, this study tries to better explain this relation.
VBM systems are integrated performance measurement systems that encourage management to pursue value creating strategies (Rappaport, 1998). According to the literature, the investigation of the contingency factors' role may explain the inconsistent evidence of the previous studies about the VBM systems performance effect. Through the analysis of strategy - measured by a firm's ambidextrous strategic positioning, and environment - analysed by the degree of environmental turbulence, this study tries to fill this lack of consistency.

VBM adoption, not available in extant databases, is deducted from the firms' corporate annual report by using the content analysis. Contingency factors are measured by adopting two different measurement frameworks.

The application of the GMM regression model to 367 non-financial firms featured in the period 2013-2018, demonstrate that the adoption of VBM system enhances the firm performance. This effect is magnified for firms that adopt an ambidextrous strategic positioning and that are influenced by a turbulent environment. VBM becomes a powerful system for managing the need of flexibility that arises from internal (corporate strategy) and external contexts (environmental factors).

4. Part 3 – Second empirical investigation

Third part of the dissertation tries to advance the knowledge about the relations between MCS and strategy – from a different perspective, by analyzing the effect of MCS (PMS) on strategy.

This study aims to explore the relation between knowledge management (KM), performance measurement systems (PMS) and SMEs economic performance in knowledge-intensive sectors.

Through an OLS regression of data collected for 219 Italian medium firms operating in knowledge intensive sectors, this study provides evidence on how a specific KM approach supports the SME economic sustainability and how a consistent implementation and use of PMS amplify the relationship between KM and economic sustainability. Data

analysis extends the empirical evidence of the PMS supports on the KM-performance relationship.

These findings lead to some managerial implications, especially they encourage SME entrepreneurs and managers to design a coherent KM approach and to implement an adequate PMS to support the economic sustainability.

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Acknowledgments

These three years of PhD studies were a very important moment for the author personal skills development. The author would like to thank his supervisor Prof. Eugenio Comuzzi for his insightful suggestions and comments, and Prof. Filippo Zanin for his fundamental support during this research path.

1. LITERATURE REVIEW

Value Based Management Systems.
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Abstract

The study helps in summing up the international research on Value Based Management (VBM) systems by critically reviewing the existing knowledge on the Accounting, Management and Strategic literature.

According to the literature review process highlighted by Massaro, Dumay and Guthrie (2016) the use of Content Analysis has allowed to identify the main streams of the VBM systems literature. Results show that the VBM debate is still open and is articulated in three main streams of research: (1) the studies related on the tools, models, and technicalities for the VBM systems implementation; (2) the studies focused to the relation between VBM systems characteristics and firm characteristics; and (3) the studies focalized on the VBM systems relation with the firm performance. These studies point out a necessary relation between firm characteristics and the characteristics of the control system. In this case, VBM systems is a useful tool for managing value creating strategy, enhancing the firm performance, in terms of economic value creation. The Accounting literature shows an important gap, that regards the absence of a theoretical framework for defining and analyzing this type of systems and the relation with the firm characteristics. Principal contribution of this paper lies in understanding the state-of-the-art of the "top quality" literature. It will be hoped that this advancement will be a useful resource for anyone interested in developing an integrated framework.

Keywords: Value Based Management systems, Structured Literature Review, Value Based metrics, firm characteristic, firm performance, economic value.

1. Introduction

Over the last two decades of the twentieth century, we have seen some remarkable changes in the managerial accounting practices. From the traditional attention to the financial measures and the budget's control, managerial accounting has shifted more and more to a strategic approach directed to the control of the economic value drivers. Some relevant empirical studies looked at the analysis of new techniques and models, as the Activity Based Costing, the Balanced Scorecard, the strategic control, and at the economic value measures (Ittner & Larcker, 2001). A contribution to this was also given by the success of the financial theory in which the economic value becomes the fundamental parameter for the strategic choice. As a matter of fact, the centre of attention is the value measurement in uncertain and complex contexts. These principles have shifted the management's attention from the idea of economic value to the drivers of that same value. An answer to these measurement problems - initially the measurement in complex business and environmental contexts, and the research of explanations to the economic value dynamics, comes from Value Based Management systems (VBM) (Comuzzi, 2016). The interest in VBM of scholars, companies, and managers increased towards the end of the '90s and the beginning of the new century (Ittner & Larcker, 2001; Beck & Britzelmaier, 2012; Blume, 2016).

VBM is a management accounting practice that support the decision-making process by adopting the value creation perspective as an overall objective (Ittner & Larcker, 2001). Value Based (VB) measures become the key-driver for translating value creation strategies into formal control mechanisms. The implementation of these managerial control systems allows to connect the strategic goals to the 'drivers' – the determiners of the business' economic value, creating a cause-effect relationship that can explain all business phenomena (Burkert & Lueg, 2013). These managerial systems have been developed mainly for managing the business' economic value (in a shareholder's perspective) and for reducing conflicts between ownership and management (Ryan & Thran, 2007), caused by the misalignment between the strategic and the operative goals (Schultze et al., 2018).

The main goal of VBMS is to express the strategic goals in Value Based measures (VB) able to link the strategic actions to the creation of economic value for the shareholders (Knauer et al., 2018).

In general, a management control system is a system of information useful for management and organization for implementing and maintaining a series of preordained behaviours and "directions" (Otley, 1999). Therefore, it is a scheme and a system useful for the control and management of the firm's economic phenomena. VBM systems can be defined as a particular management control technique (Otley, 1999), the economic

value becomes the fundamental measure for the management choices. The needs to explain the causes and the determinants of the economic value led to the creation of VBM systems. For the same motivations other tools such as Performance Management Systems (PMS) were created (Comuzzi, 2016). PMS are systems that are part of the management control system, whose fundamental objective is to provide specific measures of performance focused on specific goals. (Kloot & Martin, 2000) (Baldry, 2002) (Aguinis, 2011). Otherwise of the VBM systems, these systems are placed at a lower level than the process of strategy formulation.

For the purposes of this study, VBM systems can be defined as a systems of management control based on economic value measures, that became the base and the guide for the strategic formulation processes (Forker & Powell, 2008) (McLaren et al., 2016). The fundamental objective of these systems is to translate the strategic objectives in measures of firm's economic value (Knauer et al., 2018), with the purpose of linking the decisions and strategic choices with the fundamental drivers that explain the business phenomena, in particular the creation of economic value.

The aim of this paper is to give a literature review of the Accounting, Management and Strategic literature, identifying the state-of-the-art, its recent evolution, and the possible future trajectories.

The method used for the literature review is that introduced by Massaro, Dumay and Guthrie (2016).

The remaining part of the study is structured as follows: 2. Methodology, 3. Results, and 4. Discussion and Conclusion.

2. Methodology

The method used as a guiding line in this literature review is the one described by Massaro, Dumay and Guthrie (2016). The process of conducting a Structured Literature Review (SLR) is a process that must be logical and based on methodological rigor (Hart, 1998). The authors present, with the use of 10 steps, a process for preparing a SRL.

The steps followed along this literature review are reported below:

1. Definition of the research hypotheses;
2. Establishment of the review protocol: (1) selection of the articles; (2) definition of the coding systems; (3) test of the literature review validity and reliability;
3. Analysis of the publications: (1) analysis of the articles; (2) systematization of the coded dominant themes; (3) identification of future research paths and questions.

These steps are consistent with the logical structure of an SLR (Massaro, Dumay & Guthrie, 2016). For the fluid implementation of the literature review, the chronological order defined by Massaro, Dumay and Guthrie (2016) are rearranged in line with the aim of this study.

2.1. Research hypothesis

The research questions to be solved normally relate two important areas: (1) problems related to the knowledge of a state of an object; and (2) problems related to the research of the correlation between defined variables. The problem definition and the formulation of the relative hypotheses are the first step, with the literature analysis, for the creation of clear and logic cognitive framework (Kothari, 2004). Aim of this study requires the development of the hypotheses related to the knowledge of the state of the international VBM systems debate. Therefore, the related research hypotheses are reported below:

D.1 How is the VBM systems literature developing?
D.2 Which is the state of the art of the literature?
    D.2.1 Which is the state of VBM systems literature in Accounting?
    D.2.2 Which is the state of VBM systems literature in the other fundamental fields as Management and Strategy?
    D.2.3 Can be identified the same streams of VBM research?
D.3 Which are the possible future paths of VBM research?

2.2. Literature review protocol

The following sub-sections describe the stages of the literature review protocol:

a) Sample and research criteria;
b) Analysis and selection of articles;
c) Definition of the coding framework; and
d) Test of the literature review validity and reliability.

a) Sample and research criteria

Selection of the articles has regarded only journals that are part of the Academic Journal Rating 2015 defined by Chartered Association of Business School[1], in the following categories: Accounting; General Management, Ethics and Social Responsibility; and Strategy. Management and Strategy are only a benchmark-categories,

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[1] This guide is based on the top review judgment members of the scientific committee. It is a guide of the quality of journals in which economics and managements academics develop their research (Academic Journal Guide, 2015).

related to the hypothesis 2.2.2 and 2.2.3. The selected journals have a qualitative rating at least of 3 stars[2].

The main research keywords implemented in the articles selection are: Value Based Management system, Value Based measure, and Value Key Performance Indicator. Economic Valued Added, Residual Income Model, Cash Flow ROI, Discount Cash Flow Method, Return on Invested Capital are implemented as they represent models and metrics identified by the literature as application of VBM systems (Lee, 1999) (Young & O'Byrne, 2000) (Ryan & Trahan, 2007).

b) Analysis and selection of the articles

First, keywords were searched inside each journal's search engine, in order to guarantee the significance of the articles sample. No limit of time was set in the articles research procedure.

The number of articles identified in the research are equal to:

- 40 within Accounting;
- 23 within General Management, Ethics and Social Responsibility;
- 14 within Strategy.

Second, founded articles have been read from the researcher to identify the articles more relevant and significant for the purpose of this study.

The total number of selected articles is equal to 52, divided as follows:

- 31 within Accounting;
- 11 within General Management, Ethics and Social Responsibility;
- 10 within Strategy.

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[2] Meanings of the AJG classification (Academic Journal Guide, 2015):

4* Journals: are part of this category a restricted number of 4 star journals, which represent outstanding excellences worldwide. These journals have a higher impact factor score and represent the best theoretical advancement of this research field.

4 Journals: this type of journals have generally a higher impact factor scores in the reference field. They have a higher level of submissions and a lower level of acceptance.

3 Journals: this type of journals have generally a good rate of acceptance and are very selective journals. They have a good metric score but not all of the journals in this category have an impact factor score.

Table 1.1 - *Journals of Accounting*

Journal	Qualitative Rating AJG 2015[3]	H-factor[4]	Number of Paper	% of total article
Accounting Review	4*	2,245	1	3,23%
Accounting, Organizations and Society	4*	2,077	0	0,00%
Journal of Accounting and Economics	4*	3,282	1	3,23%
Journal of Accounting Research	4*	4,542	1	3,23%
Contemporary Accounting Research	4	2,065	0	0,00%
Review of Accounting Studies	4	n.a.	2	6,45%
Abacus	3	0,609	0	0,00%
Accounting and Business Research	3	1,271	0	0,00%
Accounting Forum	3	n.a.	0	0,00%
Accounting Horizons	3	1,730	1	3,23%
Accounting, Auditing and Accountability Journal	3	2,911	5	16,13%
Auditing: A Journal of Practice and Theory	3	2,409	0	0,00%
Behavioral Research in Accounting	3	n.a.	0	0,00%
British Accounting Review	3	2,232	3	9,68%
British Tax Review	3	n.a.	0	0,00%
Critical Perspectives on Accounting	3	3,182	1	3,23%
European Accounting Review	3	2,169	2	6,45%
Financial Accountability and Management	3	n.a.	0	0,00%
Foundations and Trends in Accounting	3	n.a.	0	0,00%
International Journal of Accounting	3	0,969	0	0,00%
Journal of Accounting and Public Policy	3	1,796	0	0,00%
Journal of Accounting Literature	3	n.a.	0	0,00%
Journal of Business Finance and Accounting	3	1,541	3	9,68%
Journal of the American Taxation Association	3	n.a.	0	0,00%
Management Accounting Research	3	3,800	11	35,48%
		Total	**31**	**100%**

Source: The Author.

Table 1.1, 1.2 and 1.3 show the research results and the main characteristics of each journal as: qualitative rating, impact factor, number of papers found, and the percentage of total article founded.

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[3] Academic Journal Guide 2015 (Chartered Association of Business Schools, 2015).
[4] Journal Citation Report Social Science Edition (Clarivate Analytics, 2018).

Table 1.2 – *Journals of Management*

Journal	Qualitative Rating AJG 2015[3]	H-factor[4]	Number of Paper	% of total article
Academy of Management Journal	4*	6,700	1	9,09%
Academy of Management Review	4*	8,855	2	18,18%
Administrative Science Quarterly	4*	5,878	2	18,18%
Journal of Management	4*	8,080	0	0,00%
British Journal of Management	4	3,059	3	27,27%
Business Ethics Quarterly	4	1,757	1	9,09%
Journal of Management Studies	4	5,329	1	9,09%
Academy of Management Perspectives	3	4,686	0	0,00%
Business & Society	3	3,214	0	0,00%
California Management Review	3	3,302	0	0,00%
European Management Review	3	n.a.	0	0,00%
Harvard Business Review	3	4,374	0	0,00%
International Journal of Management Reviews	3	6,489	0	0,00%
Journal of Business Ethics	3	2,917	1	9,09%
Journal of Business Research	3	2,509	0	0,00%
Journal of Management Inquiry	3	n.a.	0	0,00%
MIT Sloan Management Review	3	2,569	0	0,00%
		Total	**11**	**100%**

Source: The Author.

Table 1.3 – *Journals of Strategy*

Journal	Qualitative Rating AJG 2015[3]	H-factor[4]	Number of Paper found	% of total article
Strategic Management Journal	4*	5,482	6	60,00%
Global Strategy Journal	3	2,121	0	0,00%
Long Range Planning	3	3,221	4	40,00%
Strategic Organization	3	2,225	0	0,00%
		Total	**10**	**100%**

Source: The Author.

c) Definition of the coding framework

Constant Comparison Analysis (CCA) is one of the most used qualitative data analysis technique (Leech & Onwuegbuzie, 2011) for the literature review (Onwuegbuzie et al., 2012).

This type of analysis – adopted in this study, is related to the systematically reduction of the sources with an inductive approach. The text is read by the researcher and then the principal themes of the review are derived from the codes (Onwuegbuzie et al., 2012). The qualitative analysis software NVivo is used for coding data using the developed framework.

The main steps of this type of analysis are the following:

- Step 1 – Sources reading: the 31 reference articles included in the Accounting category was read and identified according to the described procedure. The text was reduced. First level codes were created;
- Step 2 – Nodes coding: nodes were created with the aggregation of each code from its source.
- Step 3 – Analysis of the tree nodes: the result of the analysis of the code relation was the hierarchical nodes tree, that divides the principal theme of the international debate.

In the figure 1.1 it is schematized - with the use of the conceptual maps, the aggregation mechanisms between codes and nodes (i.e. coding framework).

Figure 1.1 – *Coding framework*
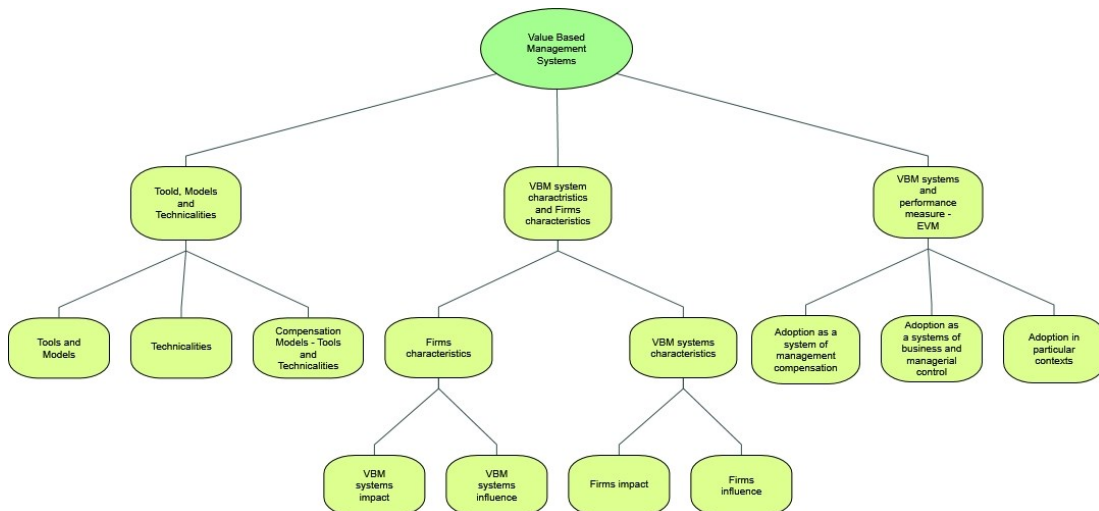
Source: personal elaboration of the data with Nvivo software.

d) Test of the literature review validity and reliability

Coding framework relating to VBM research were defined by the author, using the CCA approach for the content analysis. Other two researchers, who all have academic experience in the area, were engaged as reviewers. Each of them has classified the selected portion of the sample articles. After this process of review, the research group discussed the articles where the two reviewers were uncertain. Agreement in the coding framework has ensured the validity and reliability of the literature review.

Validity of the literature review is also confirmed by the evidence of the previous studies. As a matter of fact, Knauer, Silge and Sommer (2018) identify two principal streams of VBM research, related to:

- The relation between firms' characteristics and VBM systems;
- The VBM systems performance effect.

This study adds another stream of studies, the analysis of VBM systems tools, models, and technicalities.

3. Results

3.1. Analysis of the publications

Distribution of the studies (figure 1.2) shows that the international literature about VBM systems is more concentrate in the period from 2002 to 2018. There is a huge number of articles included in the period 2016-2018, that represent the 25% of the total sample.

Figure 1.2 - *Distribution of studies*
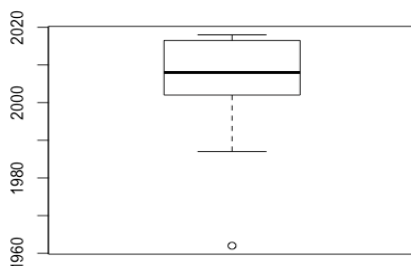
Source: personal elaboration of the data with R Software.

Instead, the analysis of the three-journal's category, Accounting, Management and Strategy, show different type of results. The distribution of each category is substantially

different. Accounting articles are homogeneously distributed in the period from 1998 (oldest article) to 2018 (youngest articles). Period from 1998 to 2002, and from 2014 to 2018 show the main articles concentration. This result is completely different than the other two categories (Management and Strategy). Management studies are mainly concentrated in the period from 2000 to 2007, in this period there is the 50% of the total sample.

The 75% of the strategic literature articles are included in the period from 2015 to 2018, highlighting a more recent interest in the international debate. The analysis of each categories evidences different evolutive trends. (figure 1.3).

Figure 1.3 – *Accounting, Management and Strategic distribution of studies*
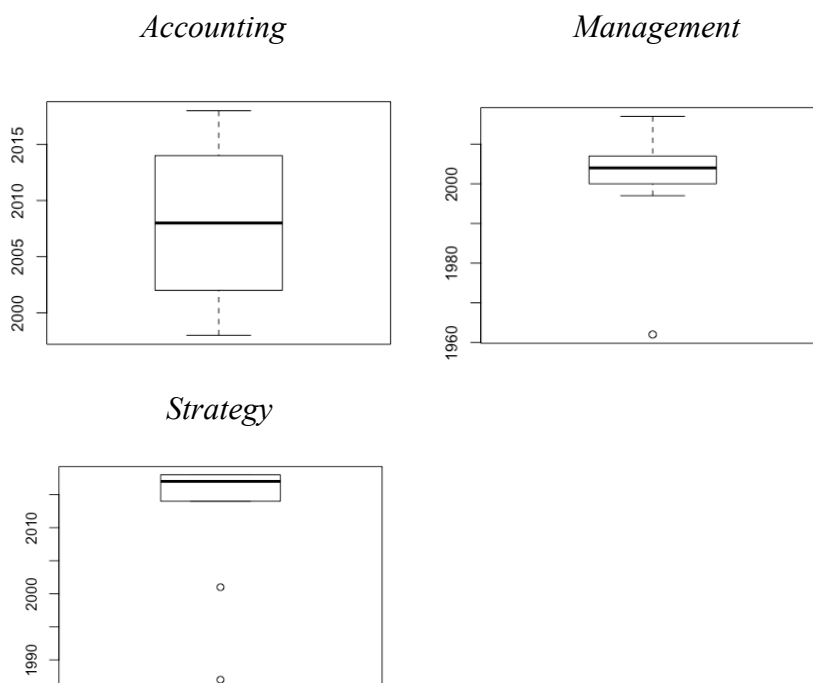
Source: personal elaboration of the data with R Software.

Shifting the attention to the article's nature, it is possible to see that most are quantitative (29 out of 52, 55,77%) (figure 1.4).

However, the international debate about VBM systems is still open, but it is not possible to define a clear literature's trend for each category part of the analysis.

Finally, it must be reported that the 21,15% of the total sample (35,48% of the Accounting category) is published by Management Accounting Research Journal. Indeed,

in the period from 2000 to 2009 the main topics of this journal are: techniques of costing, change in the management accounting and in the management control, performance measurement and managerial practices (Scapens & Bromwich, 2010). This journal is very closed with this study.

Figure 1.4 – *Nature of the articles*
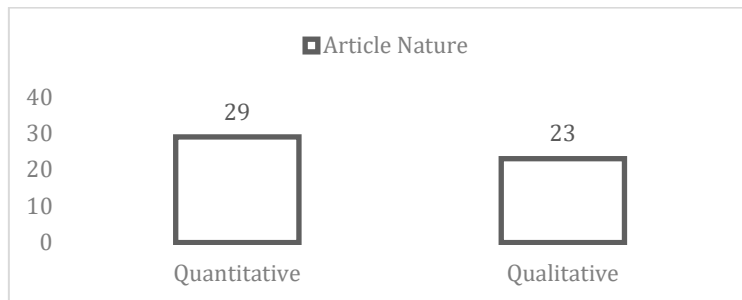
Source: The Author.

3.2. Identification and analysis of the dominant themes

This paragraph proceeds by deeply analyzing the dominant VBM research streams of the accounting literature. This section outlines the result of the SLR and critically review existing knowledge about the international VBM research.

VBM systems. Definitions and conceptual evolution.

VBM systems were object of greater literature attention from the end of 90s and the beginning of the new century (Ittner & Larcker, 2001; Beck & Britzelmaier, 2012). Since the '90s the economic value measures were the "classical" approach for the corporate strategy formulation and valuation (Barsky et al., 1999).

It was possible to attend to the success of the Economic Value Added (EVA) model introduced by Stewart Bennett and of the other similar models that derives from the Residual Income approach. These systems are used as a fundamental tool for assessing managerial performance and as central measures for the management control systems (Malmi & Ikäheimo, 2003). The theoretical formulation of these systems derives from the theory of agents. Indeed, many contributions are focused on VBM systems as a tool to align property and management interests, reducing the cost that derive from the conflicts of interest (Lovata & Costigan, 2002; Ryan & Trahan, 2007; Firk et al., 2016; Knauer et al., 2018; Shultze et al., 2018). VBM systems can be defined as a systems of management control based on economic value measures (Forker & Powell, 2008) (McLaren et al., 2016). The aim of these systems is to translate the strategic goals to

measures of firm's economic value (Knauer et al., 2018). Thus, the strategic goals are linked to the drivers of the company's economic value creation. This process formally explains the chain of cause-effect relationships, the base of the business phenomena (Burkert & Lueg, 2013).

Table 1.4 systematize the main VBM definition and its theoretical implications for the purpose of the literature review.

Table 1.4 – *VBM systems. Definitions and theoretical implications*

Author	Concept	Theoretical implications
Barsky et al., (1999)	"Shareholder value creation has been advocated as a standard for evaluating corporate strategy" (pp. 587)	The Economic Value measure was in the past the traditional way for the strategy valuation.
Ittner & Larcker, (2001)	"The value-based management approach represents an extension of more than four decades of managerial accounting research and practice. The value-based management approach builds on the preceding practices to provide an integrated framework for measuring and managing business, with the explicit objective of creating superior long-term value for shareholders" (pp. 351-352)	VBM systems are viewed as a bureaucratic defined framework for studying the firm's realities. This is the normative approach of a VBM systems.
Malmi & Ikäheimo, (2003)	"The goal of the company is to deliver value to investors. The most commonly used metrics include the Economic Value Added (EVA™) framework introduced by Stern Stewart & Co., and the Cash Value Added (CVA) model by Boston Consulting Group and Holt Value Associates. These metrics and their value drivers should solely be used to evaluate performance from the top-to- bottom of an organization" (pp. 237)	Based on the Ittner and Larcker (2001) VBM systems normative approach, VBM systems are view as a performance control mechanism, for evaluating the managerial and corporate performance.
Ryan & Trahan, (2007)	"Value-based management systems (VBM) provide an integrated management strategy and financial control system intended to increase shareholder value by mitigating agency conflicts. VBM systems attempt to accomplish this goal by providing managers with a set of decision-making tools (metrics) that, at least in theory, identify which alternatives create or destroy value, and often by linking compensation and promotions to shareholder value" (pp. 111-113)	Main goal of the VBM systems is to mitigate the cost of agency conflicts by aligning the managerial and shareholder interests.
Forker & Powell, (2008)	"The measurement and presentation of economical-financial performance is central to the process by which investors set and revise expected cash flows" (pp. 472)	Value Based measures of performance are the basis for the management decisions.

Dekker et al., (2012)	"VB measures is a financial performance measures that include a capital charge for the use of (debt and equity) capital… The literature on strategic performance measurement posits that to guide and induce congruent decision making, performance measurement choices should be aligned with a firm's strategy and value drivers" (pp. 1216)	In their approach, the decision-making process may be aligned with the firm economic value drivers. Strategy must be based on VB measures.
Burkert & Lueg, (2013)	"VBM supports decision making directed toward the objective of shareholder value creation. Emanating from a super ordinate key financial figure, VBM links the company's strategic objectives to a coherent set of performance measures through cause-and-effect-chains ('value drivers') that include all relevant processes and all pertinent information systems across a company" (pp. 5)	VBM systems are useful tool not only for managing shareholder value creation but also for understanding the value creation processes.
McLaren et al., (2016)	"EVA philosophy and MAS represented a radical departure. It was extensively implemented in performance measure and control systems throughout the organization and also used for many important managerial decisions involving planning, investment, control and remuneration determination" (pp. 342)	EVA adoption and EVA-based accounting systems are a control system not only for managerial decision but also for the alignment of the organization.
Knauer et al., (2018)	"Value-based (VB) management is an approach that directs corporate actions toward the objective of creating shareholder value. B performance measures are central components of VBM systems that operationalize the abstract goal of shareholder value creation. The aim of using VB metrics is to mitigate agency problems and facilitate decision making" (pp. 1)	VBM are systems for interest alignment (between management and shareholder). The focus of these systems is to maximize the firm economic value, in terms of shareholder value creation.
Shultze et al., (2018)	"VBM systems are specifically designed as mechanisms to align managers' interests with those of shareholders to reduce agency conflicts. The implementation of VBM can be considered a signal of management's commitment to act in the shareholders' best interest" (pp. 511-512)	VBM systems are viewed as an organizational control mechanism, for aligning interests and reducing the cost of capital.

Source: The Author.

VBM systems. Tools, Models and Technicalities.

Part of the VBM systems literature is focused on the study of tools, models, and technicalities for the implementation of these systems.

One of the first model widespread on a large scale was the Economic Value Added (EVA) introduced by Stewart Bennett - "The Quest for Value" (1991). EVA is a measure used for the decision-making and for the valuation of the performance (Riceman et al., 2002). It was therefore a base of the VBM systems, so some scholars define this measure

as a Performance Measurement Innovations (Malmi & Ikäheimo, 2003; Chiwamit et al., 2017). It allows the determination of an "Economic Value Added", able to link the strategic implementation with the goal of maximizing the economic value for the shareholders (Riceman et al., 2002; Gleadle & Cornelious, 2008).

EVA is a specific formulation of the Residual Income Model (RIM) (Schueler & Krotter, 2008) - Stewart proposes an adjustment to the accounting measures in respect to the originally identified variables. History of this performance measure is much longer than EVA – epicentre of the management sccounting debate during the 60s-70s (O'Hanlon & Peasnell, 2002). The basic idea of the formulation is that managers must guarantee a greater result than the cost of capital employed (Lovata & Costigan, 2002). Many scholars have placed their attention on models and measures derived from EVA, such as the Redefined Economic Value Added (REVA), the Return on Net Assets (RONA), the Economic Profit (EP) and the Cash Flow Return on Investments (CFROI) (Young & O'Byrne, 2000). At the beginning of the '00s, it was possible to identify more or less 160 different adjustments of the main components of the EVA model: the operating income and the cost of invested capital (Lovata & Costigan, 2002).

One of the goals of a VBM system is to align the managements and shareholders' interests for decreasing the cost of interest's conflicts (Lovata & Costigan, 2002; Ryan & Trahan, 2007; Firk et al., 2016; Knauer et al., 2018; Shultze et al., 2018). Therefore, a series of measures, technicalities and models were developed for the management remuneration systems, an important mechanism of Corporate Governance (Garvey & Milbourn, 2000). VB measures of performance become the base for the management compensation systems, for aligning the strategic goals with the corporate value (Garvey & Milbourn, 2000).

Other studies of these models have tried to unify the previous contributions and the possible implications of the RIM within VBM systems (Lee, 1999) as a tool for the management remuneration. Differently, other empirical contributions have placed their emphasis on the valuation of assets and investments as a managerial control tool, a particular RIM technicality (Dutta & Reichelstein, 1999).

Finally, the studies on the tools of VBM systems have also involved specific business areas such as Research and Development (Stark & Thomas, 1998), where the introduction of economic value measures becomes the driver for the strategic implementation (Jazayeri & Scapens, 2008).

The debate on VBM systems tools, models and technicalities is still open today, but grater literature attention was placed in the period between the late '90s and early '00s. Analysis of the systems was performed in a heterogeneous way, some studies have involved specific parts of these complex systems in which the main goal is directly connected to the systems implementation.

VBM systems. Characteristics of the systems and firm's characteristics.

As outlined by the literature framework, second part of the VBM research considers the relations between VBM and firms' characteristics.

In the 1990s, it is possible to attend at the affirmation of the VBM systems, many large multinational companies such as Coca-Cola and Briggs & Stratton (Young & O'Byrne, 2000) adopt measures of economic value as a guide of management control systems and in the compensation plans of the management, with the aim of align the ownership interests with those of management.

VBM were initially adopted for contributing to the primary goal of maximizing shareholder value. Empirical literature of the late 90s and early '00s have highlighted particular incongruences and errors in the implementation of these systems (Ittner & Larcker, 2001). Malmi and Ikäheimo (2003) study six large Finnish multinational companies to verify the application and the level of implementation of these systems, and do not identify a coherent implementation of these systems. For the same reason, Ittner and Larcker (2001) through a regulatory and bureaucratic approach try to define the characteristics of a VBM system and its implementation. The authors try also to identify the possible solutions for each dimension of these systems. Proper implementation of a VBM system consists - according to the authors, in the following six steps:

1. Choosing specific internal objectives that lead to shareholder value enhancement;
2. Selecting strategies and organizational designs consistent with the achievement of the chosen objectives;
3. Identifying the specific performance variables (value drivers) that actually create value in the business given the organization's strategies and organizational design;
4. Developing action plans, selecting performance measures, and setting targets based on the priorities identified in the value driver analysis;
5. Evaluating the success of action plans and conducting organizational and managerial performance evaluations;
6. Assessing the ongoing validity of the organization's internal objectives, strategies, plans, and control systems considering current results, and modifying them as required.

This comprehensive approach is based on the coherence between corporate characteristics, organizational characteristics, and the characteristics of these systems as a necessary condition for their implementation.

In this context, the study of McLaren et al. (2016), conduct on three New Zealand companies in the period 2012-2015, highlights that the implementation of a VBM system represents a significant investment for the company, and the necessity to institutionalize

these models. According to the authors, EVA model did not survive at the shocks of regulatory changes and financial crises because it was not closely aligned with the corporate and organizational culture.

Even the organizational actors such as CEO and CFO have an important effect on the VBM systems characteristics. The study of Burkert and Lueg (2003) on 52 German companies over the period 1990-2000 focus the attention on the cognitive characteristics of the organizational actors. In particular, the authors assert that the figure of the CFO compared to the CEO figure is the one that most influences and modifies the management control systems based on economic value measures. Organizational actors have also a relevant effect on the economic value determinants, such as the specific firm's risk (Toms, 2010).

Another body of studies concerns the analysis of the characteristics of the companies that implement these systems. Lovata and Costigan (2002) study a sample of 1386 companies, and identify 115 companies that adopt VBM systems, in particular EVA model. The study shows that the EVA adopters are those that have a higher percentage of institutionalized ownership and a lower frequency of internal ownership. Adopters are those pursue defensive strategy, measured by the low rate of new investments in research and development.

Finally, other type of studies has focused their attention on the adoption of these models within different environmental contexts (Gray, 2006; Dekker et al., 2012; Woods et al., 2012; Adams, 2017; Chiwamit et al., 2017).

This VBM research stream emphasizes the coherence between the organizational characteristics, as a necessary condition for supporting the firm's value creation.

VBM systems. Systems and firm's Performance.

Third VBM research stream investigates the performance effect that arise from the VBM adoption (Knauer et al., 2018).

The positive effects of VBM systems adoption on the firm's performance are based on several factors, mainly from the alignment of the organizational goals with the strategy of value creation, and from other contingent factors such as the institutional environment (Firk et al., 2016).

One of the main goals of these systems is to reduce the agency costs (Lovata & Costigan, 2002; Ryan & Trahan, 2007; Hughes, 2009; Firk et al., 2016; Knauer et al., 2018; Shultze et al., 2018). The study of Riceman et al. (2012) based on a survey submitted to 117 financial managers of New Zealand firms shows that firms' that adoption of VBM as a management compensation system enhance the firm performance. The positive performance effect is higher when the managers compensation is based on

VBM models, such as the EVA. According to the authors, this effect changes according to the level of the systems adoption.

The same conclusions are reached by Ryan and Trahan (2007). Analysis of 84 VBM adopters' companies in the USA shows that the use of these systems as a management compensation system increase the firm's performance. The authors have also pointed out that these systems enhance the firms' performance only in a long-time perspective.

The study of Firk et al. (2016) carry out on the companies that are part of the MSCI Europe Index and of the S&P 500 Index in the period from 2005 to 2010, have also confirmed that the adoption of a VBM system increases the firm's performance, in terms of shareholders value creation. In this context, other contingent factors such as the institutional environment, the financial orientation and the specific model of Governance can increase the positive performance effect that arise from the VBM adoption. These factors can support the VBM performance effect by enhancing the strengths of the system.

In other perspective, the disclosure of Value Based measures is considered part of a VBM system (Schultze et al., 2018). VB disclosure enhance the economic value creation. The study of Schultze et al. (2018) is focused on the effect of the VBM adoption on the firm's performance. The authors study the financial report of 118 large corporation listed in the German large-cap and mid-cap index in period from 2000 to 2004. Evidence demonstrate that the VB disclosure is correlated to low information asymmetry and low cost of capital. Adoption of these systems allows the control of the internal operation, aligning the shareholder and management interests.

VBM systems are also useful as management control systems in particular firm's complex operations. The research of Knauer et al. (2018) based on a sample of 235 M&A of German listed companies in the period between 2003 and 2012, shows that the adoption of economic measures improves the market positive reaction to the investment operations. However, in the long term, there is not significant differences between VM users and non-users.

The analysis of the empirical contributions allows to identify a strong correlation between VBM adoption and firm's performance. Relevant studies confirm this empirical evidence. Adoption of these systems as managerial and management control systems enhance the firm's performance, in terms of economic value creation.

3.3. VBM in Management and Strategic literature

In relations to the research questions 2.2 and 2.3 tables 1.5 and 1.6 summarize the studies analysed for each of the two categories - Management and Strategy.

Table 1.5 – *VBM research in Management literature*

Concept	Study
Corporate Governance Model based on VB measures	Bernthal, (1962); Westphal & Zajac, (1998); Francis & Minchington, (2002); Jensen, (2002); Fiss & Zajac, (2004); Shin & You, (2017).
VB measures adoption and organizational approach	Winterton & Winterton, (1997); Van Marrewijk, (2004); Lepak et al., (2007); Priem, (2007); O'Cass & Ngo, (2011).

Source: The Author.

Table 1.6 - *VBM research in Strategic literature*

Concept	Study
VB measures in strategy and Business Model implementation processes	Varaiya et al., (1987); Hillman & Keim, (2001); Sakhartov & Folta, (2014); Chatain & Mindruta, (2017); De Andrés et al., (2017); Dyer et al., (2018); Gans & Ryall, (2017); Bauer et al., (2018); Priem et al., (2018); Spieth et al., (2018).

Source: The Author.

VBM Management research can be divided in two main streams:

- Studies of the VB measure and its implementation within the Corporate Governance mechanisms;
- Studies of VB measures and its implementation as a system of organizational control.

For this reason, it is possible to identify a substantial difference with the state-of-the-art of the Accounting literature.

On the other hand, the studies analyzed in the Strategic field can be recognized within the same research stream. These articles are related to the adoption of VB measures within the processes of strategy's formulation and implementation, and as a specific tool for the Business Model implementation. International debate has a different orientation approach in comparison of what highlighted in Accounting' literature. Therefore, it is not possible for the different VBM systems approach to unify the Management and Strategic contributions, with those of Accounting. Based on the analysis carried out, it is possible to state that the international debate on VBM systems is developing in a substantially different way along the three different fields of analysis. So, this debate cannot be defined as a transversal research topic.

4. Discussion and Conclusion

This study tries to systematize and critically review existing knowledge and provide an overview of the state-of-the-art of the international VBM systems' research, focusing on the Accounting, Management and Strategic literature.

First, this study uses the AJG as a reliable criterion for the journal identification. Articles is selected on the basis of the relevant systems and measures recognized by the relevant VBM research studies (Lee, 1999; Young & O'Byrne, 2000; Ryan & Trahan, 2007). The sample articles were coded using the Content Analysis technique. Coding framework relating to VBM research were defined by the author. Other two researchers, who all have academic experience in the area, were engaged as reviewers for ensuring validity and reliability of the study.

Second, this study advance research by structuring the Accounting, Management and Strategic VBM literature and by suggesting a research future direction.

Based on a SLR of 25 journals of Accounting, 17 journals of Management, and 4 journals of Strategy, evidence shows that the debate about the VBM systems is still open today. Recent study of Firk et al. (2016), Chiwamit et al. (2017), Knauer et al. (2018) and Shultze et al. (2018) is a clear evidence of this.

Review of the Accounting' literature shows that recent research stream is related on the study of VBM performance effect. Other research streams regard the implementation of these systems, and the relation between VBM systems and firms' characteristics. Furthermore, review of the literature underlines a lack of a theoretical framework able to define univocally the characteristics of these systems. In this context, this study makes several contributions to VBM research.

Another important research future direction could be the analysis of these systems using the complexity theory, to unify the study of the object – these systems- and the study of the context in which VBM systems are implemented. Firms can be examined as a complex object, that is part of another complex object, the environment. Firms are complex entities because it is difficult to identify, in a clear way, its boundaries and its contents (Comuzzi, 2016). The number of the parts, the connections, the relations, and the link between the company's parts, as well as the speed of change and the characteristics of the change, are the factors that allow to find the complexity within the company. For the same reasons, the general environment is another complex object. The boundaries and the firms' ties appear faded and not clearly definable. Complexity can be studied and observed by using the "3V Model" (Comuzzi, 2005; Comuzzi, 2015; Comuzzi, 2016; Zanin et al., 2018):

- Variety: it refers to a static analysis and involves the diversity of the part's characteristics and the connections between the parts;
- Variability: it refers to a dynamic analysis and involves the characteristics, the magnitude and the intensity of the part's change and the connections between the firm's part;
- Speed: it refers to a dynamic analysis and reflects the rapidity of the changes.

These three dimensions constitute a conceptual approach to the complex phenomena. Complexity and the link with the business phenomena can be the object of study, at in the same time the key for examining the economic value dynamics. In this context, complexity becomes also a "lens". Companies can be methodologically analyzed as a complex entity. A complex company is qualified by a systematic and non-linear relationships of choices and actions through three main level: strategy, operation, and resources (Zanin et al., 2018).

For the same reasons, complexity is also reflected in the Performance Measurement System. Economic value represents the synthesis of the company's characteristics (strategy, operations, and resources), and the company's relations with the environment, then the complexity and the phenomenon of change are "absorbed" by this measure. Business and environmental complex contexts impose the measurement of economic value as an "approximate synthesis" of a complex object such as the firm (Comuzzi, 2015).

The aim of a VBM systems is to translate the strategic goals in measures of economic value (Melnyk et al., 2014; Forker & Powell, 2008; McLaren et al., 2016; Knauer et al, 2018). Measures of economic value constitute the fundamental driver for business decisions. Economic value represents, as seen, the maximum synthesis of the company characteristics, the relationship that links the management control systems in general, and more specifically the VBM systems to the concept of complex firms and environment. Analysis of these systems cannot ignore the assumption of complexity as a conceptual and crucial element in the implementation of VBM systems. Uncertainty and change, the substantial impalpability of objects and measures, the variability of the connections between parts and its relation, the speed and the magnitude of changes are complex characteristics of a firms and environment, that must inevitably be considered in each measurement tools, such as these control systems.

The main limit of this research concerns the articles sample. The main goal of this study is to point out the state-of-the-art of the "top quality" literature, i.e. journal that has a greater influence in its respective academic sectors, identified by the Academic Journal Guide. This journal selection guaranteed to this review a higher degree of "reliability", but this procedure has also limited the sample of the article. Another type of research

approach as for example using Scopus and Web of Science search engines would be more dispersive but could provide more international contributions for analysing the VBM systems research.

In the end, the analysis of the empirical contributions has allowed to highlight the direction on which the VBM systems research has developed from the late of '90s.

Literature reviews identify three important areas of VBM system's studies: (1) studies that concerns tools, models and technicalities useful for the implementation of these systems; (2) studies focused on the relations between VBM systems and firms' characteristics; and (3) studies focused on the relations between the firm's performance and the adoption of this kind of systems.

From the empirical point of view, many studies have confirmed the empirical evidence that VBM systems adoption as managerial and management control systems enhances the firm's performance, in terms of economic value creation.

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2. FIRST EMPIRICAL INVESTIGATION

Value Based Management Systems performance effect.

The moderating role of the strategic ambidexterity and of the environmental turbulence.

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Abstract

This paper contributes to the VBM literature debate about the corporate performance effects that arise from the adoption of these systems. Through the analysis of two contingency factors – strategy measured by a firm's ambidextrous strategic positioning and environment analysed by the degree of environmental turbulence; this paper tries to better explain the VBM performance effects. The GMM regression model represents the statistical model for the regression of the 367 non-financial firms featured in the MSCI Europe index in the period 2013-2018. Measuring VBM with the use of a content analysis software (Nvivo), the firm strategic positioning with the Balsam et al. model (2011) and the degree of environmental turbulence with the use of the variables developed by Hamlick and Finkelstein (1987), it was possible to determine the VBM performance effects and the moderating role of the two contingency factors. Adoption of VBM systems enhances firm performance. This effect is magnified for firms that adopt an ambidextrous strategic positioning and that are influenced by a turbulent environment. VBM became a powerful system for managing the need of flexibility that arises from internal (corporate strategy) and external contexts (environmental factors). This paper responds to the literature call for contingency factor analysis within VBM performance relations. The two contingency factors examined have allowed to deeply understand the positive effects that derive from VBM adoption. Future research may continue to analyse other factors that affect this relationship. Exploring the role of the contingency factors, this paper is the first within VBM literature that analyses the moderating role of a firm's strategic positioning and of the environmental dimension in the relation between VBM systems and corporate performance.

Keywords: Value Based Management Systems, Strategic Ambidexterity, Environmental Turbulence, Residual Income, VBM performance effects, Corporate Performance.

1. Introduction

Since the 1990s, the studies on the relation between strategy and managerial accounting tools have shown an important role in the advancement of knowledge within these streams of research (Langfield-Smith, 1997). In particular, the strong relationship between managerial accounting tools and strategy is based on the fundamental coherence between the characteristics of this object and the strategic choices, in order to sustain business competitive advantage and to enhance corporate performance (Dent, 1990; Simons, 1990). Different strategic classifications have been suggested to study this relationship. Many leading authors studied different paradoxical strategic orientations; Miles and Snow described the prospector/defender strategy typologies (1978); Porter used the product differentiation/cost leadership classifications of strategy (1980); Gupta and Govindarajan used the build/harvest strategy taxonomy (1984). However, the affirmation of Porter's generic strategy framework has opened a new literature debate about the hybrid strategy (Lapersonne et al., 2015), which consists in a combination of two paradoxical strategies: product differentiation and cost leadership strategies.

Hybrid strategies have been commonly recognised by recent studies as a mixed strategic approach focused on low costs and differentiation strategies (Claver-Cortès et al., 2012). These strategies are involved in simultaneously pursuing two paradoxical strategic behaviours.

In the mid-70s, a new stream of strategic literature became central in the study of strategic positioning. It focused on the role of strategic ambidexterity (Duncan, 1976). Similarly, to the definition of hybrid or mixed strategies, the original concept of ambidexterity was referred to the ability of an organisation to simultaneously manage two different paradoxical strategies with an exploitative or explorative focus, in order to achieve superior performance (March, 1991). Strategic ambidexterity and hybrid strategy have the common purpose of pursuing two paradoxical strategies to enhance firm performance. For this reason, ambidexterity and the hybrid strategy concept can be recognised by the same point of view. Recently, many authors have extended the view of ambidexterity by focusing on the integration of strategic choices and the definition of the coexistence of paradoxical strategies as strategic ambidexterity (Birkinshaw & Gibson, 2004; Han, 2007).

The simultaneous adoption of two paradoxical strategies enhances firm flexibility, developing an adaptive capacity that is able to interact with a complex environment (Tushman & O'Reilly, 1996; Chakravarthy & Lorange, 2008). The link between a turbulent, dynamic, and volatile environment and a firm's strategic ambidexterity is very close. On the other hand, a turbulent environment imposes the adoption of flexible combinations of strategies (Haleblian & Finkelstein, 1993).

Generally, the instability of the industry influences any kind of firm in its process of strategic formulation and in its general operations. This instability is generally called Environmental Turbolence (ET) (Calantone et al., 2003). It can be described by: high level of inter-period of change that creates uncertainty and unpredictability of a firm's future conditions; discontinuous change in demand and in a firm's growth rates; continuous reshaping of the competitive advantage and the ceaseless modification of the industry competitive structure (Dess & Beard, 1984; Bourgeois,et al., 1988; Ansoff & Sullivan, 1993; Glazer & Weiss, 1993; Chakravarthy, 1997).

The environmental effect and the particular strategic positioning pursued by a firm need to be guided by particular managerial accounting tools able to achieve the superior objectives of value-creating strategies.

Arguably, Value Based Management systems (VBM) can be analysed as an important approach to keep the strategic goal of ambidextrous firms operating in a turbulent environment clear. A VBM system is a management control system that supports the implementation of corporate strategy toward the objective of shareholder value creation. By means of superordinate value-based metrics, VBM systems allow to align strategy, firm processes, decision making, performance measurement, and the overall view of the organisation with the main purpose of value creation (Malmi & Ikäheimo, 2003; Burket & Lueg, 2013). Recently, many scholars have tried to empirically investigate the positive association between the use of VBM systems and firm performance (Lueg & Schäffer, 2010), basing their assumption on several factors (Firk et al., 2016). First, by aligning manager and shareholder interests, VBM systems should decrease agency costs. Second, VBM systems facilitate the sharing of strategic goals to all levels of organisation. Third, they develop and reinforce value-creating strategies.

The empirical evidence on the VBM system performance relation is inconsistent, because it is based on many different factors (Ittner & Larcker, 2001; Lueg & Schäffer, 2010; Firk et al., 2016). For the purpose of solving the inconsistent evidence of the VBM performance effects, scholars are increasing their attention on the strategic and external factors that may magnify or mitigate the impact of VBM on firm performance (Brück et al., 2018; Knauer et al., 2018).

Now, can strategic ambidexterity and/or environmental turbulence have any influence on the VBM systems performance effect?

According to Lueg and Schäffer (2010), the strategic factor and the environmental factor within the adoption of VMS Systems may clarify their performance effect.

Strategic ambidexterity is recognised by the simultaneous adoption of two paradoxical strategies – hybrid strategies. This concept is rooted in Porter's generic model of strategy. Moreover, the complementarity of two strategic positioning allows to achieve not only

the short-term goals, but also the long-terms goals linked to the main goal of increasing shareholder value. Focusing on cost leadership strategy emphasises firm efficiency, concentrating in particular on the economy of scale, cost reduction, and optimisation. Otherwise, product differentiation strategies are focused on the main goal of the distinction to sustain the firm's competitive advantage in a long-term perspective (Porter, 1980). Combining these two paradoxical strategies it is possible to reach short-term strategic goals – mainly connected with cost leadership strategies, and at the same time long-term strategic goals – mainly linked with differentiation strategies.

On the other hand, environment uncertainty is one of the most important contingency factors studied in literature since the affirmation of the Contingency Theory within the managerial accounting field (Otley, 1980; Chenhall, 2003; Chenhall, 2007). High levels of uncertainty (turbulence) mainly reduce the ability of predicting a firm's future conditions. Moreover, ET causes difficulties in planning due to an increase of subjectivity. Managerial Accounting Systems (MAS) are studied to reduce the level of uncertainty in order to sustain a firm's competitive advantage (Chenhall, 2006; Abdel-Kader & Luther, 2008). VBM systems represent an advanced form of MAS (Ittner & Larcker, 2003) and in particular they represent a Management Control System technique. The adoption of VBM Systems is more powerful in an environment characterised by a high level of turbulence.

Considering strategic ambidexterity as a particular strategic positioning (simultaneous positioning on differentiation and cost leadership strategies) and environmental turbulence as a measure of environmental uncertainty and instability, this study investigates the role of these factors in the positive relation between VBM systems and corporate performance.

Following this stream of research, our study tries to understand if strategic ambidexterity and environmental turbulence enhance the relation between VBM systems and firm performance.

We empirically analyse our research questions on a sample of non-financial indexed firms from the MSCI Europe index in the period between 2013-2018, with 2.072 firm-year observations.

Results indicate that ambidextrous strategy and turbulent environment as moderating factors enhance the VBM systems performance positive effects.

The relevance of this study regards the exploration of the performance effect resulting from the adoption of VBM systems (Ittner & Larcker, 2001; Lueg & Schäffer, 2010; Firk et al., 2016; Knauer et al., 2018), by deeply understanding the role of two important contingency factors: strategy – studied by the ambidextrous firm strategic positioning, and environment – analysed through the ET level.

This study is organised as follows: the literature review of VBM Systems, strategic ambidexterity, environmental turbulence and their inter-relationships; research methodology; hypothesis testing; analysis and findings; and conclusion.

2. Literature review and hypothesis development

2.1. Value Based Management systems

VBM systems are holistic systems (Lueg & Schäffer, 2010; Firk et al., 2016) with the main goal of shareholder value creation (Ittner & Larcker, 2001; Coopeland, 2002; Ryan & Thran, 2007; Forker & Powell, 2008; Firk et al., 2016; McLaren et al., 2016; Knauer et al., 2018; Schultze et al., 2018). VBM systems are also management control systems techniques (Otley, 1999) involved in the process of corporate management.

VBM can be defined as an integrated framework of performance measures to guide the management of company business (Ittner & Larcker, 2001), pursuing the superior goal of long-term shareholder value creation (Ryan & Trahan, 2007). Consequently, one object of these systems regards the translation of strategic value-creating goals into financial measures of shareholder value (Knauer et al., 2018). This process allows to deeply understand the business phenomena cause-effect relationships (Burkert & Lueg, 2013), through the use of value-based (VB) measures, commonly recognised as the key element of these systems (Coopeland, 2002; Lovata & Costigan, 2002; Malmi & Ikäheimo, 2003).

Since the first adoption of VBM systems, the use of metrics as Residual Income (Rappaport, 1986) and EVA (Stern & Stewart, 1995) has permitted the combination of invested-capital and profitability measures, increasing the alignment of managers and shareholders' interests (Coopeland, 2002).

These financial measures are adopted for designing the Value Based management control systems (Knauer et al., 2018), involving strategy formulation and implementation, firm processes, performance measurement, decision making, incentive systems and communication activities (Ryan & Trahan, 1999; Ittner & Larcker, 2001; Lueg & Schäffer, 2010; Firk et al., 2016; Knauer et al., 2018).

Using VB metrics, these systems should (1) decrease agency costs by aligning manager and shareholder interests with the common goal of shareholder value creation; (2) facilitate the sharing of strategic goals in organisations by operationalizing VB metrics in value-creating activities; (3) reinforce value-creating strategies by extending VB metrics in the mechanism of managers' incentives (Ittner & Larcker, 2001; Burkert & Lueg, 2013; Firk et al., 2016; Knauer et al., 2018; Firk et al., 2019).

The overall goal of shareholder value creation pursued by the implementation of these systems, and consequently the potential benefits that can arise from the use of VB metrics, have a necessary relationship with corporate performance (Ittner & Larcker, 2001; Lueg & Schäffer, 2010).

2.2. Relationships between VBM systems and firm performance

The adoption of VBM systems, in particular of VB metrics, suggests positive corporate performance effects. It derives mainly from the alignment of strategies and operations with the superordinate goal of shareholder value creation (Firk et al., 2016). Formulation of long-term value-creating strategies and its translation into value-creating activities through the implementation of a holistic control system as VBM systems, can enhance the corporate performance; all corporation levels are engaged in the same superordinate goal: shareholder value creation.

Many empirical studies have focused their attention on the VBM systems performance effect (Wallace, 1997; Coirdero & Kent, 2001; Ittner et al., 2003; Griffith, 2004; Hogan & Lewis, 2005; Ryan & Trahan, 2007; Rapp et al., 2011; Riceman et al., 2012; Firk et al., 2016; Knauer et al., 2018; Schultze et al., 2018; Firk et al., 2019), pointing out several differences in their evidence (Ittner & Larcker, 2001; Lueg & Schäffer, 2010; Firk et al., 2016; Knauer et al., 2018). Previous studies have investigated the relation between VBM systems and corporate performance using accounting measures without considering other factors that can directly influence corporate performance or the VBM systems performance effect (Ittner & Larcker, 2001; Lueg & Schäffer, 2010).

Riceman et al. (2002), through the survey administration to financial managers of New Zealand firms, shows an increase in firm performance resulting from the adoption of a management compensation system based on EVA measure. Ryan and Trahan (2007), after the analysis of large American firms, conclude that the adoption of VBM systems increases firm Residual Income. Rapp et al. (2011) link VBM adoption to the stock market excess of return.

Recently, two studies (Firk et al., 2016; Knauer et al., 2018) have tried to deeply understand the VBM performance effect by analysing the role of other factors or conditions. Analysing the firms indexed in the MSCI Europe Index and in the S&P 500 Index, Firk et al. (2016) confirm the positive performance effects that derive from the adoption of VBM systems. This research takes into consideration the role of the contingency factor to explain the baseline relation between VBM systems and corporate performance – the institutional environment. Knauer et al. (2018) focus their analysis on the role of the VBM system in a particular context, the acquisition and divestment

operations. Conversely, in a long-term perspective they do not find significant differences between VBM adopters and the others in this context.

Contingency factors should be taken into account in the study of this relation (Lueg & Schäffer, 2010), because VBM systems are advanced Managerial Accounting Systems (MAS) (Ittner & Larcker, 2001). Related researches on MAS have consolidated the opinion that the corporate performance effects of these systems can be partially explained by contingency factors (Chennal, 2006; Chenhall, 2007). These factors can directly influence corporate performance or should moderate the VBM systems corporate performance effect. Their analysis should clearly define the VBM performance effect in order to complete previous research that has studied whether VBM adoption affects corporate performance (Lueg & Schäffer, 2010).

In this stream of research focused on the study of VBM performance effects, this study analyses this relation in European non-financial firms indexed in the MSCI Europe Index in the period 2013-2018, trying to deeply understand the VBM systems performance effect through the analysis of two contingency factors: strategy – studied by the firm ambidextrous strategic positioning, and external environment – analysed by the level of Environmental Turbulence that directly influences firm characteristics.

Basing the baseline expectation of this research on the fact the VBM systems adoption should guide the management and the overall corporation to the superordinate goal of shareholder value creation, the first hypothesis of this study regards the positive effect on corporate performance resulting from the adoption of VBM system.

H.1 VBM Systems adoption has a positive relation with firm performance.

2.3. The moderating role of Strategic Ambidexterity on VBM systems performance effect

Since the '90s a growing interest in the study of the contingency factors relation with MAS has developed (Langfield-Smith, 1997; Simons, 1990; Kald et al., 2000; Cadez & Guilding, 2008). Contingency theory assumes that the structure of accounting systems as MCS, is determined by the context in which it works (Chenhall, 2003; Chenhall, 2007). Strategy displays an important role in determining the context in which these accounting systems are developed, and in reinforcing the managers' mindset (Simons, 1990). Consequently, firm strategic positioning, defined as firm strategic orientation (Lapersonne et al., 2015), influences the nature and the performance effects of these systems.

In strategic literature, many leading authors studied different paradoxical strategic orientations to explore a firm's strategic positioning and its organisational consequences and characteristics (Gupta & Govindarajan, 1984). E.g.: Miles and Snow described the

prospectors/defender's strategy typologies (1978); Porter used the product differentiation/cost leadership classification of strategy (1980); Govindarajan and Gupta used the build/harvest strategy taxonomy (1984). Porter's generic strategy framework has also opened a new literature debate between those who defend the inseparability of the two paradoxical strategies "Cost leadership" and "Product differentiation" and those who sustain the adoption of hybrid strategies, derived from a mixed situation called "Stuck-in-the-Middle" (Magretta, 2011). Hybrid strategies are recognised as a mixed strategic positioning that simultaneously pursues, e.g, "Cost leadership" and "Product differentiation" strategies (Claver-Cortès et al., 2012). Hybrid strategies are defined as the ability to simultaneously pursue two paradoxical strategic behaviours – it is a similar concept to ambidexterity (Han & Celly 2008).

Ambidexterity refers to the organisational management of dual structure (Duncan, 1976). The origins of this concept derive from the ambidextrous organisation (Duncan, 1976; McDonough & Leifer, 1983). Ambidextrous organisation is defined by the contemporary pursuant of different styles, structures, cultures and skills (Tushman & O'Reilly, 1996). Organisational ambidexterity allows firm flexibility but does not guarantee the sustainment of a firm's competitive advantage (O'Reilly & Tushman, 2004).

The original concept of organisational ambidexterity has been extended to different perspectives: structural ambidexterity (Tushman & O'Reilly, 1996), contextual ambidexterity (Birkinshaw & Gibson, 2004) and to other levels of conceptual analysis (Adler, 1999; Ghoshal & Barlett, 1994). Recently, a new stream of research extends the concept of ambidexterity to strategy (Birkinshaw & Gibson, 2004; Han, 2007), by focusing on the integration of two paradoxical strategic choices. Hybrid strategies and ambidexterity have the same purposes: (1) to manage different strategic behaviours; (2) to sustain a firm's competitive advantage; and (3) to enhance corporate performance (Han, 2007; Lapersonne, 2015).

In the original model of Porter's generic strategy (1980) the two paradoxical strategies ("Cost leadership" and "Product differentiation") are related to different resources, activities and effects.

Cost leadership strategies emphasise cost reduction and operational efficiency, by using low-cost raw materials, developing economies of scale and activities based on cost efficiency and reduction (Porter, 1980). Conversely, product differentiation strategies emphasise the unique offer to the premium price of the core product in a long-term perspective, by improving product technology, enhancing product quality and sharing a premium quality and service of the product (Porter, 1980). Porter's two paradoxical strategies emphasize two different strategic orientations. Cost leadership strategies are

more oriented on a short-term perspective. Otherwise, product differentiation strategies are linked to a long-term perspective (Dess & Davis, 1982). From a different point a view, the hybrid strategy (i.e. strategic ambidexterity) – firms that adopt the combination of Cost leadership strategy and Product differentiation strategy – develop an ambidextrous approach in their activities, capabilities and resources (Han & Celly, 2008). Ambidextrous firms can be: (1) more agile and responsive to external changes and environmental turbulence; (2) more adaptable to organisational changes and governance model changes; and (3) more precise in the prevision of the trajectories of future strategy (Tushman & O'Reilly, 1996). Porter (1980) warns against the strategic positioning in the "Stuck-in-the-Middle" strategy ("Cost leadership" and "Product differentiation"), but literature claims that many organisations are experimenting the hybrid strategy to achieve both low-cost production and the quality demanded by the consumer, to sustain their competitive advantage and survive the competitive pressures that arise from the external context (Chenhall, 2003).

VBM systems represent an advanced form of MAS – sophisticated MAS (Ittner & Larcker, 2001), the main goal of which is to support the processes of value-creating strategies formulation and implementation (Coopeland, 2002; Ryan & Thran, 2007; Forker & Powell, 2008). Advanced MASs are likely to be appropriate with flexible structures, unstandardised procedures, dynamic processes and incremental change in firm characteristics (Abdel-Kader & Luther, 2008). These systems are able to interact with "faster" firms in order to constantly modify their characteristics (Elgharbawy & Abdel-Kader, 2013). An ambidextrous firm that keeps balancing its characteristics between two paradoxical strategic positioning behaviours (Han & Celly, 2008), needs the support of a sophisticated MAS, able to guide the overall organisation to the superordinate goal of shareholder value creation. For these reasons, the efficiency and the potential benefit of VBM adoption is higher in a firm that adopts hybrid strategies.

Based on this, the second hypothesis of this paper regards the moderating effect of strategic ambidexterity on the VBM systems performance effect. The expectation is that a firm's ambidextrous strategic positioning magnifies the positive effect of VBM adoption.

H.2 A positive relation on performance that derives from the adoption of VBM is greater for a firm that pursues ambidextrous strategies.

2.4. The moderating role of Environmental Turbulence on VBM Systems performance effect

An important factor that is at the foundation of the contingency-based research is represented by the external environment (Chenhall, 2003). Many different taxonomies were developed in literature to study the aspects that affect the external environment (Chenhall, 2007). E.g.: Khandawalla (1977) defines the environment by its levels of turbulence, hostility, diversity, and complexity. Duncan (1972) studies complexity and dynamism as environmental measures. Ouchi (1979) examines environmental ambiguity. Simple-context, static nature and dynamicity are the variables chosen by Waterhouse and Tiessen (1978) for analysing the environment. Controllability was the focus of the Ewuis-Mensah (1981) studies. Chenhall & Morris (1986) analyse the intensity of competition as an important factor that determines environmental characteristics. Differently, contingency-based research within MAS has focused its attention on the role of environmental uncertainty (Chenhall, 2003). Indeed, many empirical studies have demonstrated that environmental uncertainty has an effect on the nature of the MAS (Khandwalla, 1972; Gordon & Narayanan, 1984; Chenhall & Morris, 1986). Environmental turbulence should be an important measure of the degree of environmental uncertainty (Calantone et al., 2003). Environmental turbulence can be defined as the unpredictable market or technological changes within an industry that accentuates global riskiness. It can be described by: high levels of inter-period of change that create uncertainty and unpredictability of a firm's future conditions; high level of environmental discretion; discontinuous change in demand and in a firm's growth rates; continuous reshapings of the competitive advantages, and by the ceaseless modification of industry competitive structure (Dess & Beard, 1984; Ansoff & Sullivan, 1993; Glazer & Weiss, 1993; Chakravarthy, 1997). In a turbulent environment, characterised by a higher level of turbulence, there is higher unpredictability and industry risk (Ansoff & Sullivan, 1993). A turbulent environment imposes some limitations of a firm's prediction ability (Glazer & Weiss, 1993), increasing the firm's difficulties in planning its future conditions (Chenhall, 2007). Consequently, difficulties in the activities of planning increase the subjectivity of the decision maker – they become likely to consider external, non-financial and ex-ante information (Gordon & Narayann, 1984).

Contingency-based research within MASs have focused their attention on the potential role and design of these systems in particular conditions (Chenhall, 2006), for example in a turbulent environment. Generally, advanced MASs can enhance a firm's prediction ability, improving the decision-making process (Chong & Chong, 1997) by guiding the management with the use of sophisticated forms of reports that consider a lot of information from many different sources.

VBM systems are an advanced MAS (Abdel-Kader & Luther, 2008) – the latest stage of the management accounting evolution (Ittner & Larcker, 2001). Literature claims the use of advanced MAS, as VBMs, to sustain a firm's competitive advantage in a competitive environment (Athanassakos, 2007).

Based on these reasons, the VBM systems performance effects will be magnified in firms that are influenced by a turbulent environment. Consequently, the third hypothesis of this paper regards the moderating effect of environmental turbulence on the VBM systems performance effect. The expectation is that a firm influenced by a turbulent environment will obtain a higher performance than the others, from VBM adoption.

H.3 Positive relation on performance that derives from the adoption of VBM is greater for firms directly influenced by a turbulent environment.

The adoption of two paradoxical strategic positioning enhances firm flexibility, developing an adaptive capacity, able to interact with a complex environment (Tushman & O'Reilly, 1996; Chakravarty & Lorange, 2008). Relationships between turbulent environment and strategic ambidexterity are very close, because a turbulent environment imposes the adoption of a flexible combination of strategies (Kim et al., 2004).

Based on this, the fourth hypothesis of this empirical research wants to examine the relation between the simultaneous moderation of the two contingency factors: strategy – measured by a firm's ambidextrous strategic positioning, and environment – analysed by the level of environmental turbulence. Moreover, the expectation is related to the enhancing effect on VBM systems performance – an effect that arises from the strategic ambidextrous firms that are directly influenced by a turbulent environment.

H.4 VBM positive relation on performance is enhanced for firms that pursue ambidextrous strategies and that are directly influenced by a turbulent environment.

3. Empirical design

3.1. Sample strategy

The MSCI European Index represents the source of this research. The MSCI index covers the main large publicity securities among 15 European countries, listing 442 Western-European securities. Non-financial MSCI indexed firms for the period 2013-2018 are the sample of this study. Data collections regard the available data at the end of each year of the corresponding firms.

Specifically, the final sample has been selected using the following criteria: (1) the MSCI European index allows to analyse large firms, where it is likely to find the implementation of management control systems. The dimension and characteristics of these companies should qualify, for economic and performance reasons, the adoption of VBMS systems (Ryan & Trahan, 2007; Rapp et al., 2011; Firk et al., 2016; Knauer et al., 2018); (2) exclusion of financial-firms – SIC codes 6000 to 6999, to ensure the endogeneity of the VBM adoption performance evidence (Rapp et al., 2011); (3) elimination of firms that have VBM systems adoption missing value; (4) reduction of the firm-years observation for the double listed firms in the MSCI index, with some firms listed for different securities e.g. A and B share class; (5) elimination of the firms that have other important missing values that regard the independent, moderating and control variables in the regression model.

The final sample covers the observation of 2.072 firm-years; the next table shows the main results for each step of the data base building process.

Table 2.1 – *Sample steps*

Sample steps	Firm-year observations
+ Firm-years observations listed in MSCI European index, period 2013-2018	2.652
- Firm-years observations of financial companies	448
- Firm-years observations about VBM systems missing data	54
- Firm-years observations about double-index firm's securities	42
- Firm years observations with other important variable missing data	36
Final sample	**2.072**

Source: The Authors.

Figure 2.1 – *Research Framework*
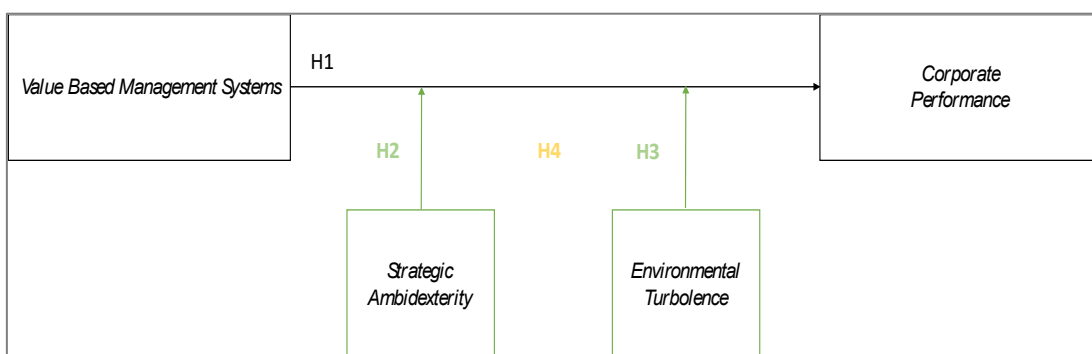
Source: The Authors.

3.2. Dependent variable – firm performance

VBM is a holistic system composed by an integrated framework of performance measures with the main goal of long-term value creation (Ittner & Larcker, 2001; Coopeland, 2002; Ryan & Thran, 2007; Forker & Powell, 2008; Firk et al., 2016; McLaren et al., 2016; Knauer et al., 2018; Schultze et al., 2018). This system allows the translation of the strategic value-creating goals in financial measures of shareholder value (Knauer et al., 2018). Using an integrated framework of VB metrics, these systems should align corporate strategies and operations with the superordinate goal of shareholder creation (Firk et al., 2016). Thus, VBM performance effects are linked to the internal creation process of economic value. Since the origin of these systems, Residual Income (RI) has displayed an important role as a central VB metric in the VBM framework (Rapp et al., 2011). For these reasons, RI is the dependent variable of the research regression model for the measurement of the internal process of value creation. This metrics as a measure of corporate performance follows the previous empirical studies about the VBM systems performance effects (Wallace, 1997; Balachandran, 2006; Ryan & Trahan, 2007; Firk et al., 2016).

RI is calculated, similarly to Firk et al., (2016), by subtracting the capital charge on the book value of equity (cost of equity multiplied by book value of equity at the end of the observation-year) from the firm's net income before the extraordinary items (Bennet, 2008). Cost of equity is calculated by the use of Capital Asset Pricing Model (CAPM), previously qualified by the VBM systems literature, as a coherent method (Bacidore et al., 1997; Hogan & Lewis, 2005; Ryan & Trahan, 2007; Firk et al., 2016). Moreover, all the parameters of this model – risk free return, Beta index, and the equity risk premium – are derived specifically for each firm from the Bloomberg financial database. Following this methodology, the cost of equity represents the market cost of equity.

The VBM systems performance effects will be measured by RI, because the main expectation is directly related to the internal process of value-creation. VBM is mainly useful to link the overall organisation to the subordinate goal of shareholder value creation.

3.3. Independent variable – Value Based Management systems

VBM systems should be qualified as Advanced MASs (Ittner & Larcker, 2001; Abdel-Kader & Luther, 2008; Elgarbawy & Abdel-Kader, 2013) that also incorporate the MCS, partition of the overall holistic system (Lueg & Schäffer, 2010). The central element of these systems is represented by the presence of VB metrics (Coopeland, 2002; Lovata & Costigan, 2002; Malmi & Ikäheimo, 2003). Previous empirical researches on VBM based

their analysis of VBM adoption on the annual data through a hand-collecting data process on the company's annual report (Hogan & Lewis, 2005; Lovata & Costigan, 2002; Firk et al., 2016; Knauer et al., 2018; Firk et al., 2019). Following this approach, in this research the identification of VBM adoption is based on the annual report for each company included in the final sample; recognising the presence of VB metrics – central element of the overall VB system.

The research step can be summarised as follows: (1) identification of the corporate financial report for each firm-year observations; (2) annual report analysis with the use of a Content Analysis software, Nvivo; (3) measurement of the VBM adoption. Following Ryan & Trahan (2007), Rapp et al., (2011), Firk et al., (2016) and Knauer et al., (2018), it should be possible to consider a firm VB metrics for the codification systems: (a) measures of profitability and cash flow spread as Economic Value Added (EVA), Cash Value Added (CVA), Shareholder Value (SVA), Cash Flow Return on Investment (CFROI); (b) metrics that compares measures of profitability or cash flow with the cost of capital as Return on Capital Employed (ROCE) or Return on Invested Capital (ROIC) and finally, (4) process of hand coding (the ambiguous case was analysed separately to ensure the presence of VBM adoption).

Finally, the measure of VBM adoption (variable *vbms*) is represented by a dummy variable that identifies with the value 1 the adopters (for each firm-year observation) and non-adopters with the value 0.

3.4. Moderating variables – Strategic ambidexterity and environmental turbulence

Recent studies on VBM point out the needs to deeply understand the VBM performance effects by analysing the role of the contingency factors that might influence this relation (Lueg & Schäffer, 2010; Firk et al., 2016; Knauer et al., 2018). This research tries to fill this gap through the analysis of two important contingency factors: strategy – measured by the firm's ambidextrous strategic positioning, and environment – analysed by the degree of environmental turbulence.

Strategic ambidexterity. Strategic ambidexterity refers to the integration of two paradoxical strategic choices (Birkinshaw & Gibson, 2004; Han, 2007). Following Porter's model of generic strategy (Porter, 1980) the hybrid strategy is defined by the simultaneous adoption of two paradoxical strategies: Cost Leadership strategy and Product Differentiation strategy. Strategic ambidexterity and hybrid strategy can be defined as the same concept with the same purposes (Han, 2007). In this research, the concept of strategic ambidexterity is translated into the simultaneous adoption of Porter's two paradoxical strategies.

For the measurement of a firm's strategic positioning we assume the same variable used by Balsam et al., (2011) and later, tested by Banker et al., (2014). The analysis of six identified variables with the principal component analysis permits to identify a firm's strategic positioning. Previous authors have defined three variables that are expression of the efficiency and Cost Leadership strategies: SG&A/Sales; R&D/Sales and Sales/Cogs; and three other variables that represent Differentiation strategies: Sales/Capex; Sales/P&E; Employees/Total Assets. For each year of observation, the mean of the previous five years is computed in order to measure a firm's long-term strategic positioning (Balsam et al., 2011). The use of PCA analysis has allowed to identify two specific scores for each group of variables (two paradoxical strategies), assuming the Principal Component with Eigenvalue >1 and that represents at least 90% of the total variance. The two scores are used to identify the two-strategic positioning, in particular, by measuring the firm's positioning for each of the two scores.

Finally, the measures of Strategic Ambidexterity (variable *amb*) are represented by a dummy variable that identify with the value 1 the strategic ambidextrous firm (a firm that leads the highest position of the two scores to the regressed mean of the panel) and non-ambidextrous firm (reciprocal behaviour) with value 1.

Environmental turbulence. Environmental turbulence is an important measure of the environmental uncertainty (Calantone et al., 2003), the central measure of the contingency-based research within MAS (Chenhall, 2003). Environmental turbulence can be described by: high level of inter-period of change that creates uncertainty and unpredictability of a firm's future conditions; high level of environmental discretion; discontinuous change in demand and in a firm's growth rates; continuous reshaping of the competitive advantage and by the ceaseless modification of the industry competitive structure (Dess & Beard, 1984; Bourgeois et al., 1988; Ansoff & Sullivan, 1993; Glazer & Weiss, 1993; Haleblian & Finkelstein, 1993; Chakravarthy, 1997). Previous works of Hambrick and Finkelstein (1987), and Haleblian and Finkelstein (1993), provide an important framework for the measurement of environmental turbulence and discretion degree. This research follows this approach and assumes: (1) the average coefficient of a firm's return on asset and the average coefficient of variation of a firm's sales as a measure of environmental turbulence; and (2) the average advertising expenditure, the average R&D expenditure, the average annual sales growth and the standard deviation of annual sales growth as a measure of the environmental discretion. For each year observation, the mean of the previous five years is computed for each corresponding measure. Whereupon, the PCA analysis has allowed to identify one specific score, assuming the Principal Component with Eigenvalue >1 and that represents at least the 90% of the total variance. The measures of Environmental Turbulence (variable *envt*)

correspond on a dummy variable that identifies with the value 1 the firms that are influenced by a turbulent environment and with the value 0 the firms that are part of a "stable" environment.

3.5. Control variables

The regression model includes some control variables to account the specific effects of other variables that can influence statistical relations. To measure the effects of a firm's size in the relation between *VBM* and firm performance in the analysis, the natural logarithm of the net sales – *sales* (year-end observation), has been employed. The role of this variable is to take into account the size effect on the firm's performance. Large companies should achieve higher performance than the others for many clear factors, e.g. economies of scales. Two other variables are employed in the analysis to control the *VBM* performance effects, which are *intang* and *lev*. *Intang* calculated by the division of the intangible asset to a firm's total assets. This variable should control the effect of the firm's intangible value – a higher intangible investment can influence a firm's economic value. Lev is defined as the total net debt divided by the book value of equity. This value may represent the role of the financial leverage on corporate performance. The two variables have been standardised on the [0, 1] interval, coherently with the other variables of the model.

To control the industry effects on the strategic variable of the model (*amb*), *revgrow* has been employed, calculated as the five-year sales growth. Otherwise, the role of the environment is controlled by *cashgrow*. This variable represents the firm's five-year volatility of cash flow – it considers the risk and the fundamental level of environmental uncertainty (riskiness).

All control variables are extracted by the same database – Bloomberg Finance – to ensure the coherence and reliability of the variables. For the same reason, *revgrow* and *cashgrow* have been standardised on the [0, 1] interval.

3.6. Regression Model

Attention to exponential regression models has increased in recent years (Windmeijer, 2006). Traditional regression models such as Ordinary Least Squares (OLS) have pointed out many difficulties in their application in a situation influenced by the role of the time series (Sun & Phillips, 2008). The regression of aggregated time-series is contaminated by the role of the unobservable heterogeneity (Tauchen, 1986). Another problem that affects traditional regression models regards the reverse causality and simultaneously. GMM aims to solve these problems by the use of instrumental variable estimation (Baum

et al., 2003; Wintoki et al., 2012). Recent studies in the VBM performance effects (Firk et al., 2016) have confirmed the appropriateness of these regression models with the overall statistical hypothesis.

In this study, the one step GMM estimator has been used to mitigate the reverse causality problem that affects traditional regression models. Implementation of this model has been done by using the *xtabond* module on Stata 14 provided for the first time by Arellano and Bond (1991).

Model variables are measured by the use of dummy variables standardised on the [0,1] interval. Consequently, *vbm*, *amb*, *env* and *control variables* have the same scale of measurement to fit the model, and the statistical model that underlines the baseline hypothesis (H:1) assumes the following formulation:

$$(1) \; corporate \; performance_t = \alpha + \beta \, (vbm)_t + \gamma(controls)_t + \eta_t + u_t$$

In this model, the time effects (η_t) and the random errors (u_t) that are part of the regression, are also taken into consideration.

The second and third hypotheses, regarding the analysis of the moderating variables effect, are represented by the following model:

$$(2) \; corporate \; performance_t = \alpha + \beta_1 \, (vbm)_t + \gamma_1(amb)_t + \beta_2 \, (vbm \; x \; amb)_t$$
$$+\gamma_2(control)_t + \eta_t + u_t$$

The other moderating variable as environmental turbulence (*env*) has the same model equation of the strategic ambidexterity (*amb*). Finally, the last hypothesis (H:4) is related to the simultaneous moderation of the two variables: strategic ambidexterity and environmental turbulence. For this reason, the equation of the model is represented only by an addition to the previous ones for considering the cumulative moderating effects.

4. Results

Table 2.2 – *Model results*

Dependent variable	(1) Residual Income	(2) Residual Income	(3) Residual Income	(4) Residual Income
vbm	**0.159*****	**0.386**	**0.288**	**0.237**
	(0.051)	**(0.062)**	**(0.062)**	**(0.064)**
vbm x amb		**0.295*****		
		(0.059)		
vbm x env			**0.175****	
			(0.058)	
vbm x amb x env				**0.145****
				(0.074)
sales	0.059			
	(0.093)			
inta	0.002			
	(0.033)			
lev	0.018			
	(0.026)			
revgrow		0.011		0.0107
		(0.049)		(0.050)
cashgrow			0.011	0.005
			(0.084)	(0.034)
Constant	-0.106	-0.046	-0.085	0.066
	(0.150)	(0.234)	(0.469)	(0.216)
Year effect	Yes	Yes	Yes	Yes
Wald X^2	33.16	37.43	42.31	44.73
Chi-square	0.0001	0.0001	0.0002	0.0002
Year-end observations	2.072	2.072	2.072	2.072

***, **, * indicates value of p-value less than 0.001, 0.01 and 0.05. Standard error in parentheses. The four hypotheses (vbm, amb, vbm x amb, vbm x env, vbm x amb x env) are reported in bold.

Source: The Authors.

The previous table displays the results of the GMM regression. The value report in bold refers to the p-value for the predictor variable of the model and for the other variables. Each theoretical hypothesis corresponds to a specific statistical model – with a specific equation (previously analysed). The results of the model application are

displayed in column; each line indicates the reference value for the key variables of the models. The next paragraphs will analyse the statistical implication for each theoretical hypothesis.

4.1. VBM systems corporate performance effect (1)

The application of the GMM regression model to the panel of 367 non-financial firms indexed in the MSCI European index confirms the main expectation of the paper. VBM systems adoption influences corporate performance. Firms that adopt VBM systems as a Managerial Accounting System achieve a higher performance than the others. This relation is significant. The p-value underlines a strong evidence of the VBM positive performance effects under the control variables of sales, intangible and financial leverage. This result is also confirmed by the analysis of the correlation; the independent variables (*vbm*) and the dependent variables (*residual income*) have a positive correlation index (equal to 0.159). VBM adoption positively influences corporate performance, linking strategies and operations with the superordinate goal of shareholder value creation (Firk et al., 2016).

In the final section of this part the robustness of the statistical model will be tested.

4.2. The moderating role of the Strategic ambidexterity (2)

An iterated variable (vbm x amb) is the reference variable to test the second hypothesis of this research – firms that pursue an ambidextrous strategic positioning (strategic ambidexterity) and that adopt VBM have a higher performance than the others. The level of the p-value indicates a positive effect that derives from the simultaneous interaction between VBM systems and a firm's ambidextrous strategic positioning. Analysing the effects of the *amb* on corporate performance is possible to affirm that strategic ambidextrous firms tend to achieve a higher performance than the other firms. For this reason, it is possible to confirm the second hypothesis of this research. Sophisticated MASs as VBM systems are able to guide the overall organisation to the superordinate goal of value creation under the main conditions derived by the "hybrid" firms' strategic positioning (flexible structures, unstandardized procedures, dynamic processes and incremental changes in firms' characteristics) (Abdel-Kader & Luther, 2008).

4.3. The moderating role of the Environmental turbulence (3)

Vbm x env measures the interaction between the independent variable (vbm) and the environmental moderating variable – environmental turbulence. The second hypothesis

of this paper is linked to the moderating effect of environmental turbulence. Firms influenced by environmental turbulence and that adopt VBM systems achieve higher performance than the others. The p-value indicates a positive effect of this variable on corporate performance under the five-year volatility of cash flow as a control measure (representation of a firm's volatility).

Third hypothesis of this paper is confirmed. VBM systems are advanced MAS useful to sustain a firm's competitive advantage in a turbulent environment (Athanassakos, 2007).

4.4. The moderating role of the Contingency factors (4)

The fourth model (4) investigates the role of the simultaneous interaction of the two contingency factors – strategic ambidexterity and environmental turbulence. The iterate variable *vbm x amb x env* considers the interaction between the independent variable of this model (*vbm*) and the moderating variable (*amb* and *env*) to test the multiple interactions. Strategic ambidextrous firms (that pursue ambidextrous strategic positioning), influenced by a turbulent environment that adopts VBM systems, obtain a higher performance than the others. This hypothesis is confirmed by the GMM regression model. Analysis shows a consistent p-value under the control value measured by the five-year firm's growth and the five-year volatility of cash flow control variables. For this reason, the fourth hypothesis of this analysis is confirmed. Paradoxical strategic positioning enhances firm flexibility, developing an adaptive capacity – necessary to interact with a complex environment (Tushman & O'Reilly, 1996). VBM represents the accounting tool able to guide the organisation to the superordinate goal of shareholder value creation under these conditions.

4.5. Model test

Wald X^2 – Wald Chi-squared, is normally used in the statistical model to the ability of the exploratory variables to give a contribution to the statistical model (Wald, 1973). If the value of the Wald test is equal to zero the independent variable (explanatory variable) should be removed from the statistical model, otherwise the variable is tested and can be incorporated in the statistical analysis. In this case, the contribution of the variable to the overall model is significant (Agresti, 1990). The fourth statistical model developed to test the main hypotheses of this research displays a positive value of Wald X^2 for each of them. Exploratory variables in the model are significant.

The second test implemented for validating the model is the original Chi-squared test. It is implemented to demonstrate the difference between the expected frequencies and the

observed frequencies (Plakett, 1983; Rao & Scotto, 1984). The value assumed in the whole model confirms the validity of the independent variable for representing the baseline hypothesis of this research.

All statistical models are significant at the same p-value level ($p \leq 0.001$).

To test the choice of the Residual Income as dependent variable of the statistical model, we follow previous research and introduce as a new dependent variable the market-to-book ratio (measured as stock market capitalization divided by the book value of equity) as a proxy of the firm's market value (Firk et al., 2016). GMM regression with the market-to-book ratio as an alternative dependent variable confirm our baseline expectation. VBM adopters achieve a higher performance than non-adopters. Market-to-book ratio model confirms also the other moderating hypothesis. Contingency factors – strategic ambidexterity and environmental turbulence (single o simultaneous effect) magnify the positive performance effect that arise from the VBM adoption, in terms of shareholder market value creation. For these reasons, all regression models are supported, and our result is not influenced by the choice of the dependent variable.

The choices of the moderating variables have been verified in the principal models by the introduction of the control variables for accounting the specific effects of other factor that can influence the statistical relations.

5. Conclusions

5.1. Discussion and implications

This paper contributes to the debate on VBM performance effects (Wallace, 1997; Coirdero & Kent, 2001; Ittner et al., 2003; Griffith, 2004; Hogan & Lewis, 2005; Ryan & Trahan, 2007; Rapp et al., 2011; Riceman et al., 2012; Firk et al., 2016; Knauer et al., 2018; Schultze et al., 2018; Firk et al., 2019). Recent literature has underlined the necessary attention to the contingency factors that can influence the VBM performance effects (Ittner & Larcker, 2001; Lueg & Schäffer, 2010), to explain the several evidences pointed out by different empirical studies (Ittner & Larcker, 2001; Lueg & Schäffer, 2010; Firk et al., 2016; Knauer et al., 2018). Analysing a sample of 2.072 year-end observations of non-financial firms indexed in the MSCI European index, this research has tried to find out the VBM performance effects and the role of two important contingency factors – strategy, measured by a firm's ambidextrous strategic positioning and environment, analysed by the degree of environmental turbulence.

The first expectation of the empirical research regards the performance effects of the VBM adoption (baseline hypothesis). VBM is a holistic system with the main goal of

shareholder value creation (Ittner & Larcker, 2001; Coopeland, 2002; Ryan & Thran, 2007; Forker & Powell, 2008; Firk et al., 2016; McLaren et al., 2016; Knauer et al., 2018; Schultze et al., 2018). The main effect on the corporate performance is recognised by the literature as the capability to align the corporate strategies and its operations with the superordinate goal of economic value creation (Firk et al., 2016). For this reason, the expectation is that VBM adoption enhances the corporate performance.

In order to respond to the literature call to investigate more in depth the VBM performance effects, this research has considered the role of a firm's strategic positioning – the ambidextrous strategic positioning. Recently, the change of the external environment has forced firms to experiment the hybrid strategic positioning to achieve both low-cost production and the quality demanded by the consumer (Chenhall, 2003). Under these conditions, an advanced MAS as VBM system is appropriate to sustain firms' need of flexible structure, unstandardised procedures, dynamic processes, and an incremental change in firms' characteristics (Abdel-Kader & Luther, 2008). The expectation is that the VBM performance effect will be magnified for those firms that pursue ambidextrous strategic positioning.

In the same way, environmental turbulence has become the second contingency factor in the statistical model. External environment is one of the most important factors in the contingency-based research within MAS literature (Chenhall, 2003). Previous researchs have tried with different approaches to analyse many dimensions of the environment. The most studied – for its likeness to the object of the studies – dimension is represented by environmental uncertainty (Chenhall, 2007). One important measure of environmental uncertainty is environmental turbulence (Calantone et al., 2003). The main effect of a turbulent environment regards the limitation of a firm's prediction ability (Glazer & Weiss, 1993). VBM systems as advanced MAS can sustain a firm's competitive advantage in a turbulent environment (Athanassakos, 2007), by guiding the overall organisations to the superordinate goal of shareholder value creation. Therefore, the third main hypothesis of this research is that the VBM positive performance effect will be enhanced for firms influenced by a turbulent environment.

Lastly, this empirical study analyses the simultaneous moderating effect of the two contingency factors. The fourth hypothesis is related to the enhancing effects on the VBM performance effects that arise from the strategic ambidextrous firms that are directly influenced by a turbulent environment.

Results from GMM regression confirm all the hypothesis of the empirical research: (1) VBM adopters obtain a higher performance than the others; (2) VBM is a powerful MAS for firms that pursue ambidextrous strategic positioning and (3) also for firms that are part of a turbulent environment; and (4) VBM systems are useful MAS for the more

flexible firms – influenced by a turbulent environment and that pursue ambidextrous strategic positioning.

5.2. Limitations and future research

Despite the validity of this research, the results have some limitations. First, the main limitation regards the method of independent variable measurement. As pointed out by Lueg and Schäffer (2010), researchers have to analyse the sub-system of the VBM systems. The method used in this research – as in the previous VBM literature (Ryan and Trahan, 2007; Rapp, et al., 2011; Firk, et al., 2016; Knauer, et al., 2018), does not allow to understand the level of the VBM adoption (e.g. different business unit). In this study, the independent variable is measured by analysing a firm's public data. The information is corrupted by the will of a firm to disclose its data about VBM adoption. In this approach, VBM is interpreted as a holistic system applied to the overall organisations. Another analysis based on other research instruments (survey) can ensure the possibility to understand the different levels and subsystems of a VBM system, linking in a different way this system to its corporate performance effect.

Second, some studies have regressed VBM adoption with other measures of economic value, as a firm's current market value. Applications of this measure may strengthen the main conclusion about the VBM performance effects. However, the underlying assumption in this research about the VBM positive performance effects regards its ability to link the overall organisations to the superordinate goal of shareholder value creation (Firk et al., 2016), by translating the value-creating strategies into firm operations. Nevertheless, a firm's market value should be an accurate control measure for ensuring the validity of the main hypothesis.

Third, the nature of the sample is based only on a larger non-financial firm for ensuring the nature of a VBM and the VBM measurement approach. This analysis should be translated to medium and small enterprises, with the need to change the system of independent variable measurement.

Concluding, this paper has contributed to the literature debate by responding to the recent literature call regarding the need to explore the other factors that affect the VBM performance effects (Lueg & Schäffer, 2010). This paper participates in the VBM debate by empirically testing the VBM performance effect and the specific role of two contingency factors – strategy and environment. The two contingency factors have allowed us to deeply understand the positive effects that derive from VBM adoption. Following this approach, future research should: (1) take into account the role of other contingency factors to explain the fundamental relation between VBM and corporate performance; (2) consider the same contingency factors with other dimensions, e.g.

another dimension of the environment, such as riskiness; (3) correlate the different levels of VBM sophistication to specific contingency factors as previously done by Burkert and Lueg (2013).

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3. SECOND EMPIRICAL INVESTIGATION

Knowledge Management and Performance Measurement Systems for SMEs' Economic Sustainability.

Knowledge Management and Performance Measurement Systems for SMEs' Economic Sustainability.

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Abstract

This paper aims to explore the relationships between knowledge management (KM), performance measurement systems (PMSs), and small and medium enterprises' (SMEs) economic sustainability in knowledge-intensive sectors. The literature demonstrates that SMEs are often characterized by unstructured KM approaches and limited PMS implementation, being at the same time affected by scarce profitability and financial issues. Adopting the knowledge-based view of the firm and the integrated approach of PMSs, we tested the impact of two alternative KM approaches (exploitation and exploration) on SMEs' economic sustainability, measuring the moderating effect of PMS use (diagnostic and interactive). Through an ordinary least squares (OLS) regression of data collected for 219 Italian medium firms operating in knowledge-intensive sectors, this study provides evidence on how a specific KM approach supports the SME economic sustainability and how a consistent implementation and use of PMS amplify the relationship between KM and economic sustainability. Data analysis confirms the relevance of some key concepts of the knowledge-based view of the firm, especially the positive impact of the KM exploration approach on economic sustainability. Additionally, the paper extends empirical evidence for the PMS moderating effect on the KM–performance relationship. To the best of our knowledge, this is the first time that a study provides evidence for the relationships among KM, PMSs, and economic sustainability in the SME setting. Moreover, our findings lead to some managerial implications, especially they encourage SME entrepreneurs and managers to design a coherent KM approach and to implement an adequate PMS in order to support economic sustainability.

Keywords: economic sustainability; knowledge management (KM); performance measurement systems (PMSs); SMEs; KM exploration; KM exploitation

1. Introduction

In continuously changing and unpredictable environments (Isobe et al., 2014) , sustainability has become a key goal for business success (Benn et al., 2014). The sustainable management of financial, human, environmental, and social resources is a critical issue for business strategy and survival (Robinson et al., 2006). As literature widely demonstrated (Porter & Kramer, 2006), providing and sharing organizational values can help firms to reach superior profits benefitting from greater motivation, commitment, and loyalty of internal and external stakeholders as well as assuring the alignment between individual goals and sustainability efforts of the firm (Galpin & Whittington, 2012). Pursuing sustainability can create long-term competitive advantages related to a better brand reputation and a differentiated position from competitors (Galpin & Whittington, 2012). As widely demonstrated (Saeidi et al., 2015), such factors act as fundamental mediators between sustainability practices and firms' financial performance. Hence, it becomes crucial that a firm engages in environmental, social, and governance strategies slowly and consistently starting from economic dimension (Tang et al., 2012).

The literature highlights a growing interest in the field of sustainability for small and medium-sized enterprises (SMEs) (Lizano et al., 2019). In such context environmental and social sustainability are equally relevant for financial success (Torugsa et al., 2013), even if organizational practices are strongly influenced by the more limited SMEs' motivations and capabilities (Arend, 2014) and the economic side of sustainability becomes prevalent. Despite the incidence of SMEs in terms of global GDP and employment (OECD, 2017), the high failure rates (Egbu et al., 2005; Wee & Chua, 2013) still represent a major challenge in the current economic scenario. Due to the specific characteristics of SMEs, a problem of economic sustainability of SMEs is emerging (Lizano et al., 2019), as well as the need to detect the critical factors able to positively affect the firm's economic performance and survival. Therefore, there is a growing interest in researching the determinants of SMEs' economic sustainability (Cantele & Zardini, 2018), especially in country like Italy where the SMEs count for 92% of total, provide 82% of workforce and show heterogeneous level of competitiveness and profitability (Istat, 2018), similarly to many other European countries.

Companies are facing a knowledge economy (Beijerse, 2000) where everything rapidly changes, demanding a capacity to continuously readapt themselves to confront the new challenges. In the specific context of SMEs, knowledge and knowledge management (KM) have become a primary source to support firms' innovation and sustain economic survival. The question of knowledge is particularly relevant for SMEs, since they have to often rely on employees' knowledge and skill in order to build their

competitive advantages, instead of relying on physical and financial assets, as compared to larger firms (Cardoni et al., 2018; Castellani & Fassio, 2019).

According to the knowledge-based view (Grant, 1996), the knowledge located in various places within the firms, such as employees, organizational culture, routines, policies, systems, and documents (Alegre et al., 2011), is the main asset used to reach and sustain competitive advantages, since it is unique and hard to replicate and replace. Consequently, the enterprise must implement KM practices able to value and develop the knowledge resource (Beijerse, 2000; Donate & Sànchez de Pablo,2015). This makes it easier to understand how to manage people and processes, how to achieve growth and competitive processes, and how to organise new products and technologies (West & Noel, 2009). When implementing KM processes, conflictual tensions between two basic orientations must be adequately managed in order to link innovation and KM (March, 1991): exploitation and exploration. These tensions become one of the major issues related to KM because they influence the clear definition of the strategic approach to follow. Indeed, as addressed by Kyriakopoulous and Moorman's (Kyriakopoulous et al., 2004), exploitation and exploration compete for: a) scarce resources and opposite organizational structures/cultures; b) focus on self-excluding strategic priorities; c) best possible match with external environment opportunities. Particularly, the exploitation approach involves refinement, implementation, efficiency, production, and selection (Severgnini et al., 2018), pointing to more conservatism through stable revenues, maintaining key customers and efficiency for increasing the average performances (Raisch et al., 2009). The exploration approach relates to knowledge creation and is concerned with the development of new knowledge and experiments, in order to foster changes and variations to support radical innovations (Andriopoulos & Lewis, 2009). In the long-run, the continuous challenge for every organization is to simultaneously manage the conflicting demands derived from these two basic orientations (ambidexterity). However, the limitation of resources stimulates the enterprise to select a particular orientation. For some structural characteristics (Massaro et al., 2016), SMEs should then adopt a clear definition of KM approaches to assure the needed consistency in knowledge processes and finalize the use of limited resources. Therefore, in the short-run it is very important to evaluate the impact of a clear definition of the KM approach, be it exploration or exploitation, on SMEs economic sustainability.

In addition, our paper considers a moderating effect, which can be played by performance management systems (PMSs). Several studies (Centobelli et al., 2018) analyse the role of decision-making tools to enhance the impact of KM. Particularly, our paper focuses on PMSs because they may support and facilitate KM development, leading towards full knowledge resource use (Asiaei et al., 2018). Even though there are several

tools enabling KM processes relying on information technologies and web-based solutions (Sparrow, 2001), literature found PMSs as particularly suitable in a business context where "executives require timely and relevant information to augment the effectiveness of their decision making for ensuring success" (Asiaei, 2018, p.295). This is especially true for smaller firms where "the centrality of a managing director and managers in SME knowledge is most evident" (Speziale & Kloviene, 2014, p.7). In other words, PMSs are asked to support strategic and operative decision-makers by taking explicitly into consideration the sustainability perspective Ghani, 2009).

According to contingency theory (Otley, 1980), the implementation and use of PMSs in SMEs is influenced by some factors (Garengo & Bititci, 2007) affecting corporate governance, management information systems, strategy, organizational culture and the external environment. In the context of SMEs, resource constraints (Massaro et al., 2016; Garengo & Bititci, 2007) and personal control approaches can hinder the implementation of PMSs (Lavia & Hiebl, 2015) and influence their use (Bourne et al., 2000; Ferreira & Otley, 2016; Neely et al., 2000). A distinction is possible between (Simons, 1995; Simons, 2000): diagnostic controls and interactive controls. In the first case, PMSs are used to define rules which are widely recognized and used, measure organizational results, fulfil the planned objectives and, generalizing, support the implementation of the strategy. The interactive approach enables to detect strategic uncertainties, promote strategic dynamic relying on that informal and continuous dialogue at different managerial levels able to support the elaboration of the strategy.

Particularly relevant for the current research is the effect of PMSs on KM (Märtensson, 2000). Our point of view refers to a consistent use of different PMS (diagnostic and interactive) to leverage the KM strategic approaches (exploitation and exploration). Indeed, by combining the knowledge-based view of the firm with the contingency theory, it is expected that KM approaches and PMSs are able to simultaneously evolve (Asiaei et al., 2018) and find the needed coherence to support the SMEs economic sustainability (Henri, 2006). Thus, we are aligned with Simons' perspective (Simons, 1995) where a consistent use of PMS with respect to firms' strategy and other contextual variables can produce organizational learning, foster entrepreneurship and innovation (Henri, 2006; Aureli et al., 2019; Choong, 2013).

Based on the above literature, this study aims to evaluate the effect that KM approaches and PMSs use have on the economic sustainability of SMEs, focusing particularly on medium-sized companies operating in knowledge-intensive sectors. The medium-sized, in fact, allowed us to include in the sample only the companies that still have the typical characteristics of the SME, excluding however those entities that are too small to have a minimal structuring of KM and PMS systems. The sample was limited to

knowledge-intensive industries because the sector influence is considered an external context condition that requires companies to manage knowledge and implement a PMS, in a scenario where only large companies are usually able to compete.

Despite the fact that all these topics are not new in literature, to the best of our knowledge they present the following gaps. First, the study of knowledge exploration and exploitation strategies on performance is highly developed (Lavie et al., 2010), with the prevailing part of the literature emphasizing the importance of ambidexterity (Raisch et al., 2009; Andriopoilos & Lewis, 2009; Lubatkin, 2006; Cao et al., 2009; Gupta, 2006), also with reference to SMEs (De Clercq, 2014). However, in our study, we believe that in the short term the limited resources of SMEs allow them to select, in the best case, only one KM approach in order to reach an adequate profitability. In our paper, we aim to verify whether the clear definition of a KM approach is able to bring these results and, if so, which KM approach is preferable. To the best of our knowledge, there are no studies on the relationship between exploration/exploitation and economic sustainability that adopt this perspective. Second, the literature also explores the relationship between knowledge management and sustainability, mostly focusing on the role of innovation (Seebode et al., 2012) and proposing an integrated model synthesizing the sustainable competitive advantage (Lopes et al., 2017). These papers are mostly qualitative and exploratory, supported by case studies and focusing on large companies. In our paper, we aim to test the relationship through a quantitative study, specifically devoted to SMEs, characterized by different contextual factors. Finally, there are contributions in the literature on the interplay between KM and PMSs, both at the network level (Lima & Carpinetti, 2012) and single-entity level. In this latter perspective, the relevant study of Ditillo (Ditillo, 2006) focuses on knowledge-intensive firms and demonstrates the influence of knowledge complexity on management control mechanisms, in order to foster coordination and knowledge integration. Even in this case, the study is qualitative and referred to a big company. Further insights on the combined effects between KM, innovation and PMSs have recently been conducted by Bedford (2015), Asiaei et al. (2018), Asiaei and Bontis (2019), leading to the conclusion that knowledge assets and innovation forms are able to produce higher performance if leveraged by a coherent use of PMSs. As those studies are not tailored to smaller dimensions, our research aims to expand these conclusions and test this relationship in SMEs.

Summarizing, the topics addressed in literature are often treated in a non-integrated way and are not contextualized with particular reference to SMEs. Given the actual relevance of SMEs survival and success, our paper aims to extend and integrate these streams of research and fill the above mentioned gaps, presenting a study which simultaneously combines KM, PMSs, and economic sustainability in the particular

context of SMEs. Furthermore, as previous research mostly relies on exploratory research based on case studies, useful in order to understand the "why" and "how" of a certain phenomenon, our study aims to get stronger generalizable outcomes, in order to fill the existing gap (Raisch et al., 2009; Cao et al., 2009).

In so doing, we aim to reply to several calls in the recent literature. Particularly, Cantele and Zardini (Calente & Zardini, 2018) call for major empirical contributions in order to investigate what the determinants which affect SMEs' sustainability are. The study also takes into consideration the call of Speziale and Kloviené (Ghani, 2009), claiming a scarcity of studies related to the relationship between PMSs and corporate sustainability (Bititci et al., 2012).

The paper is organized as follows. The second section describes our research framework and the hypothesis development. The third part presents the methodology used to empirically test the hypothesis. The fourth section shows the results of our empirical research and the last part offers conclusions, main results, and considerations for future research.

2. Literature Review and Hypothesis Development

2.1. Economic Sustainability in SMEs

Among the different proposals provided by the literature, sustainability may be defined as the ability to meet "the needs of a firm's direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities, etc.), without compromising its ability to meet the needs of future stakeholders as well" (Dyllick & Hockerts, 2002). Thus, sustainability plays a crucial role in identifying what products/services to provide, in which way (processes), to whom (people), and the consequences for stakeholders (investors, consumers, and society) (Robinson et al., 2006; Hay et al., 2014). In achieving these goals, organizations must improve stakeholders' loyalty and avoid mistaken, dangerous, and damaging actions (WWF, 2003), in order to maintain and increase their economic, social, and environmental capital (Dyllick & Hockerts, 2002).

According to the most consolidated approach, sustainability is based on three fundamental dimensions (Schaltegger, 2010): economic, social, and environmental. Respectively, it involves the firms' capacity to (Dyllick & Hockerts, 2002):

- "guarantee at any time cash-flow sufficient to ensure liquidity while producing a persistent above-average return to their shareholders" (economic);

- "add value to the communities within which they operate by increasing the human capital of individual partners as well as furthering the societal capital of these communities" (social);
- "use only natural resources that are consumed at a rate below the natural reproduction, or at a rate below the development of substitutes" (environmental).

Therefore, reaching a sustainability-oriented performance can guarantee appropriate liquidity and remuneration to owners, make the system of values and beliefs understandable to stakeholders, and avoid activities which may deteriorate the ecosystem (Dyllick & Hockerts, 2002; Schaltegger, 2010).

If the sustainability perspective is now universally affecting the strategic and managerial efforts of every kind of organization, the different dimensions of sustainability are significantly influenced by the operational and dimensional context.

According to Choi et al. (2018), SMEs have a different sustainability approach compared to larger firms, due to specific organizational features, particularly linked to:

- Small size of markets served;
- Personal ownership and/or family management;
- Financial and resources limitation;
- Prevalence of personal relationships and informal business practices.

Due to these characteristics, the authors demonstrate that the perception of low social and environmental impacts (Lawrence et al., 2006) and the limited impact on stakeholders cause two main consequences:

- Owners and managers are more sensitive to financial and marketing issues and more focused on internal and business-related stakeholders (employees, customers, and suppliers) than external;
- For sustainability practices, the strategic processes maintain a strong dependence on personal values of the owner/manager, and are influenced by profit maximization and family succession.

In this context, the economic component of sustainability becomes prevalent. Specifically focusing on the impact of stakeholders, Lizano et al. (2019) seek to verify what the main determinant is which affects SME's failure and find that the employees, customers, and suppliers play a crucial role. Indeed, they provide the needed resources to support the long-term sustainability of smaller firms (Lizano et al., 2019). According to them, the recent literature (Cantele & Zardini, 2018; Bourlakis et al., 2014) confirm that SMEs must pay particular attention to the main economic components of business

(clients, suppliers, and the entrepreneur himself) who represent the most influential stakeholders, together with the employees.

The SME's sustainability orientation and practices can also be influenced by other conditions (Günerergin et al., 2012), such as a decreasing level of government support, a strong perspective on efficiency and cost-saving and the owner's perception of receiving few benefits from environmental practices (Cantele & Zardini, 2018; Eikelenboom & de Jong, 2019).

Consequently, some authors (Bianchi et al., 2015) highlight the fact that, despite the increasing relevance of social and environmental sustainability, SMEs survival in the long-term still basically depends on achieving profitability results, as well as their capability to satisfy customer needs. Moreover, the authors (Bianchi et al., 2015) demonstrate that financial performance (economic dimension of sustainability) allows the firm to hire more employees (social dimension of sustainability) and improve product/service quality and customer base (competitive dimension). At the same time, recent literature (Cantele & Zardini, 2018) highlights that sustainability practices of SMEs can be not grounded on environmental aspects, since, contrary to what happens with larger firms (Schaltegger, 2010), these are perceived as not so necessary by employees and customers. Therefore, within the context of SMEs, the environmental dimension of sustainability can be seen as a cost rather than a benefit, negatively affecting competitive advantages (Lawrence et al., 2006; Günerergin et al., 2012; Eikelenboom & de Jong, 2019).

On the basis of these findings, our research focuses on the economic dimension as the main dimension of sustainability for survival and competitiveness of smaller firms. It is then fundamental to investigate what the determinants are that can positively affect the SMEs economic sustainability, considering tangible and intangible resources as well as financial aspects (Dyllick & Hockerts, 2002). Particularly, Cantele and Zardini highlight the relevance of financial indicators related to SMEs' sustainability, which is mainly composed by customers and suppliers' satisfaction (Cantele & Zardini, 2018). Therefore, in this perspective, it becomes particularly important to measure the firm's perception of higher performance on sales, profit margins, and return on investments over competitors (Cantele & Zardini, 2018).

2.2. Knowledge Management (KM) for Economic Sustainability in SMEs

In contrast to larger firms, within the SMEs context the economic sustainability and competitive advantages do not depend on physical and financial assets. Indeed, they are mostly influenced by entrepreneurs' ability and employees' knowledge (Cardoni et al., 2018; Castellani & Fassio, 2019). As clearly highlighted by Vasudevan and Chawan

(2014, p.1725), "in manufacturing SMEs, knowledge can come from owners, production managers, supervisors, workers, vendors, customers, consultants, conferences, social media, market orientation, knowledge portals, knowledge forums, books, case studies, research papers and the list goes on. The role of knowledge management in business strategy has to be justified in the context of survival in the competitive market today".

As the statistics show, SMEs' economic sustainability is now threatened by a very challenging business environment. The survival rate of small firms is particularly low: 36% and 50% of them perish after the third and fifth year of their life, respectively (Egbu et al., 2005; Wee & Chua, 2013).

Several reasons cause such failure rates (Egbu et al., 2005):

- Business is not able to reach or maintain a sustainable level of economic profitability;
- Strategic management and governance is interrupted by the death or retirement of the entrepreneur/owner, and
- Operations efficiency and effectiveness suffer due to changes in personal motivation and aspirations of the key players.

This demonstrates the importance of capturing the individual and organizational knowledge to foster competitive advantages within SMEs (Egbu et al., 2005). In this direction, the process of transferring tacit knowledge owned by the key members into explicit knowledge to spread within the organization (Nonaka & Takeuchi, 1995) becomes crucial.

By adopting a knowledge-based view of the firm (Grant, 1996), knowledge assets become the main sources of value added and competitive advantage. Consequently, in the context of SMEs, this view is particularly needed in order to implement strategies, practices and tools (Cerchione et al., 2015) which enable the firm to acquire, develop, manage, transfer and make productive the knowledge resources inside the company (Beijerse, 2000; Donate & Sànchez de Pablo, 2015). Through this perspective, a fundamental determinant of economic sustainability of SMEs is basically related to knowledge management (KM), as demonstrated by several studies. Some authors (Matlay, 2000; Penn et al., 1998) show that knowledge acquisition can have a greater role than environmental factors in the SME's business survival and success. Similarly, Salojärvi et al. (2005) address a positive relationship between high KM-maturity levels and sustainable growth in the long run. Alegre et al. (2011) find a positive relationship between KM practices and innovative performances of SMEs through a moderate effect of KM dynamic capabilities. In this perspective, Centobelli et al. (2019a) review KM practices within the context of SMEs, underscoring the importance of such practices on the economic-financial, market, technical, human, and, overall, organizational performances. However, considering the high complexity and integration of KM

processes, linking culture, people, finance, technology, and organizational structures (Egbu et al., 2005), the literature demonstrated that SMEs are often characterized by inefficient or ineffective behaviours when engaging in KM practices and/or tools (Centobelli et al., 2019a).

From a general point of view, knowledge management (KM) is a complex set of processes for the acquisition, storage, updating and dissemination of knowledge (Gornjak, 2014) that allows a company to manage significant data and information in order to make the knowledge resource productive (Beijerse, 2000). According to a consolidated approach (Durst & Runar, 2012), KM is composed of different processes, represented by: i) identification; ii) creation; iii) storage / retention; iv) knowledge transfer; and v) use.

All these KM components are influenced by the enterprise's basic orientation in terms of conflicting tensions between two strategic options (March, 1991): exploration and exploitation. More specifically, according to Donate and Sànchez de Pablo (Donate & Sànchez de Pablo, 2015):

- Exploitation strategies are related to knowledge storage, transfer, and application. They refer to the firms' ability to enhance or refine exiting products or services exploiting existing knowledge to hone and extend the existing routines guaranteeing a greater efficiency within the organization supporting an increase of average performances (Andriopoulos & Lewis, 2009). Therefore, exploitation involves refinement, implementation, efficiency, production, and selection (Servergnini et al., 2018) pointing to more conservatism through stable revenues, maintaining key customers and efficiency for increasing the average performances (Raisch et al., 2009);

- Exploration strategies are related to knowledge creation and are concerned with the development of new knowledge and experimentation, in order to foster changes and variations to support radical innovations. Therefore, it involves new breakthroughs, a "loose coupling" approach towards clients to explore new markets and products, and a lower strictness in relation to employees (Andriopoulos & Lewis, 2009), seeking innovative opportunities which foster higher variations of performance (Raisch et al., 2009). In other words, exploration fits with research, breakthrough, experiments, risk-taking, and innovation (Severgnini & Vieira, 2018).

The continuous challenge for every organization is to simultaneously manage the conflicting demands derived from the two basic orientations. This usually means dealing with latent dualisms, such as global vs. local integration, adaptability vs. alignment, efficiency vs. flexibility, and evolutionary vs. revolutionary changes (Severgnini & Vieira, 2018). To this extent, a relevant research stream (Raisch et al., 2009; Andriopoulos & Lewis, 2009; Lubatkin et al., 2006; Cao et al., 2009; Gupta et al., 2006)

has addressed the importance of achieving an organizational ambidexterity, that is, the ability to contextually reach conflicting and multiple goals, guaranteeing business survival and success in a long-term perspective. Particularly, Gupta et al. (2006) point out that both activities are needed to support innovation, in order to reach competitive advantages through learning processes. Lubatkin et al. (2006, p.2) stress that organizational ambidexterity is "capable of exploiting existing competencies as well as exploring new opportunities with equal dexterity". Gschwantner and Hiebl (2016, p.2) claim that although "exploration and exploitation are often considered to be contradictory activities, several authors argue that they need to be pursued at the same time in a healthy balance to achieve organizational ambidexterity".

Even if the focus on a single strategic orientation can lead to temporary advantages (March, 1991), some authors (Gupta et al., 2006) highlight that, in the short run, the limitation on resources must force the enterprise to select a particular orientation, as usually happens within the context of SMEs (Massaro et al., 2016). Consequently, exploration and exploitation may compete for the scarce resources and can be seen as "two ends of continuum" (Gupta et al., 2006, p.697). Similarly, in the university setting, Centobelli et al. (2019b) underline the need to balance exploration and exploitation strategies, also advising that it is not necessary to invest in the two processes simultaneously, reaching ambidexterity over time.

Based on the above mentioned positions, the paper aims to analyze the short-run effects of KM basic approaches in the specific context of SMEs and their limited resource availability. Regardless of the specific direction undertaken (exploration or exploitation), it is assumed that a clear KM orientation is able to positively influence the governance, strategy and operations of the company, enabling it to consciously implement the necessary processes and tools to consistently pursue the chosen direction. As claimed by most authors engaged in KM research, "knowledge acquisition, storing, retrieving and sharing processes should be seen as crucial and core by knowledge intensive companies, notably by SMEs" (Nunes et al., 2006; p.107). Indeed, knowledge-intensive firms are characterized by several factors, such as creativity, high educational and professionalization levels of workers. Especially in the context of SMEs, lesser centrality is played by physical assets and crucial role is linked to loyalty of key employees, their knowledge and clients relationship (Nunes et al., 2006). Based on these premises, in the light of prominent heterogeneity characterizing the SMEs specializations, we focus on knowledge-intensive companies and formulate the following research hypothesis.

2.2.1. KM Exploitation Approach in SMEs

According to Kyrgidou and Petridou (2011, p.700), the exploitation KM approach "captures the tendency of a firm to invest resources to refine and extend its existing knowledge, skills and routines". To this extent, a great role is played by organizational learning as key factor for SMEs' competitiveness and survival. Particularly, Migdadi (2009) finds that training, education, and human resource management are critical factors for SMEs' success. On the same line, Alvarez et al. (2012) point out that external training is a very relevant KM practice for smaller firms aiming to maintain or improve employees' skills and competences. Shirokova et al. (2013) point out that exploitation within SMEs can be achieved through investment in internal and knowledge resources, organizational learning, and the development of organizational changes. Shirokova et al. (2013) demonstrate the necessity to invest into resources such as know-how, technologies, patents, licenses and skilled employees, since they represent rare, valuable, hardly imitable resources and are not replaceable assets, according to a knowledge-based view of the firm (Grant, 1996). Particularly, the authors stress the importance of training and development of human resources investments to continuously exploit the existing opportunities needed for growth. In this lens, Abiola (2013) also stress the importance of organizational learning for enhancing the strength of smaller firms' sustainability practices and increasing their financial performances. Finally, together with organizational learning, routines are also considered an important factor to achieve an exploitation activity within the context of SMEs (Davidsson, 2004). Indeed, "competence exploitation embeds experience-led refinement and the selection and reuse of existing routines as core firm values" (Kyrgidou & Petridou, 2011, p.702).

The above discussion is particularly relevant for smaller knowledge-intensive firms. Indeed, in such context the processes of hiring, training, and managing people make allow to translate ideas into routines and social capital, converting tacit knowledge into explicit knowledge, and vice-versa (Filippini et al., 2012). Small knowledge-intensive firms particularly rely on organizational learning in order to adapt themselves to the changes of organization and environment through a quick learning of the employees (Starbuck, 1992). As claimed by Huggins and Weir (Purushothaman, 2015), the capability to take advantage of their peculiarities is the main source of competitive advantages for small knowledge-intensive firms.

On the basis of the above literature, the paper tests the following research hypotheses:

H.1 KM exploitation approach will be positively related to SMEs economic sustainability.

2.2.2. KM Exploration Approach in SMEs

According to Andriopoulos and Lewis (2009), smaller firms tend to follow exploration strategies, building their success on reputation and risk-taking approaches, while larger firms are typically engaged in exploitation activities (Gschwantner & Hiebl, 2016). Exploration seems to be the prevalent attitude in KM practices within the context of SMEs, because of a lack of resources which continuously fosters them to seek new ideas and assume an innovative approach in order to survive and develop (Shirokova et al., 2013). The authors find that entrepreneurship is a key in launching new ideas, becoming market-oriented, and supporting the growth and profits of smaller firms, thanks to their creativity. More specifically, the entrepreneurial orientation and culture are particularly relevant for "young growing companies that compete with large well-established companies, including multinationals, because it allows companies to achieve the necessary growth rates and the desired level of competitiveness" (Shirokova et al., 2013, p.178). Hence, entrepreneurial orientation and culture lead towards better firms' performance, represented by higher profits and greater firm's growth (Shirokova et al., 2013). Similarly, Jenssen & Aesheim (2010) underline the importance of entrepreneurship in enhancing the firm's profitability, market share, and sales growth. "Exploration suggests that organizations are categorized by search, discovery, experimentation, risk taking and innovation" (Severgnini et al., 2018, p.6), which is a feature often associated with SMEs (Bell & Young, 2004). Furthermore, Lubatkin et al. (2006) claim that SMEs are closer to the customers' change trend and as such are the first to feel the need to explore new sources of competitive advantages.

With specific reference to knowledge-intensive firms, Jenssen and Aasheim (2010) find that innovation, understood as product, market, or process changes, is fundamental to improve performance, despite the increasing level of risk. They stress the importance of leaders' awareness about explorative activities, underlying the role of informal management approaches that foster innovation. Bell et al. (2004) study shows the greater risk-taking inclination of knowledge-intensive firms with respect to traditional firms. Generalizing, they conclude that the degree of knowledge possessed by knowledge-intensive firms (e.g., managerial skills and expertise, supports received by external advisors and non-executive directors, external financial sources) enables them to achieve more aggressive business strategies.

On the basis of the above literature, the second hypothesis to test is the following:

H.2 KM exploration approach will be positively related to SMEs economic sustainability.

2.3. The Mediating Role of Performance Management Systems (PMSs) for KM and Economic Sustainability in SMEs

In the current business environment (Beijerse, 2000), everything quickly changes and requires companies to continuously readapt to face new challenges. In this context, performance management systems (PMSs) can support decision-makers with relevant and timely information, in order to assume the best possible decisions for successful strategies (Asiaei et al., 2018). Literature demonstrated how the importance of PMSs has expanded over time, though they are still "perceived as one of the most critical, yet most misunderstood and most complicated functions in management accounting and control systems" (Asiaei et al., 2018, p.296).

Performance management system (PMSs) can be defined as the set of "evolving formal and informal mechanisms, processes, systems, and networks used by organizations for conveying the key objectives and goals elicited by management, for assisting the strategic process and ongoing management through analysis, planning, measurement, control, rewarding, and broadly managing performance, and for supporting and facilitating organizational learning and change" (Ferreira & Otley, 2009, p.264).

Among the several theories and approaches developed during the last decades (Demartini, 2014), the contingency theory of management control (Otley, 1980) still represents the main theoretical reference for a large part of the research in the field (Chenhall, 2003; Otley, 2016). According to contingency theory there is no universally appropriate framework which is suitable to all organizations and all contextual conditions. Conversely, the design and the implementation of management control is influenced by a set of variables, such as environmental uncertainty, size and organizational structure, outsourcing relationships, environmental management (Perego & Hartmann, 2009), national cultures (Chenhall, 2003) and strategy (Chenhall, 2005; Langfield-Smith, 2008), consistently with which the control system needs to be customized (Demartini, 2014; Brignall & Ballantine, 2004).

This theory has been adopted to interpret the role and characteristics of management control in SMEs, often influenced by resource constraints (Massaro et al., 2016; Wong et al., 2015) and personal control approaches which can hinder PMS implementation (Lavia Lòpez & Hiebl, 2015). Garengo and Bititci (2007) systematized five contingency factors that influence the implementation and use of management control in SMEs: i) corporate governance structure; ii) management information system; iii) strategy; iv) organizational culture and management style; v) external environment.

One of the most relevant issues in a contingency perspective relate to PMS design and use (Bourne et al., 2000; Ferreira & Otley, 2009; Neely et al., 2000). Particularly, Neely et al. (2000) claim that the real challenge for managers refers to how the measures are

used in order to manage the business, as well as maintained over time. Moreover, in the context of SMEs, Kloviene and Speziale (2015) highlight that there is no general structure or framework for the usage of PMSs in the most effective and efficient manner in SMEs.

To investigate PMS use, the most comprehensive view is addressed by Simons' framework (Simons, 1995; Simons, 2000), that provides four different types (or levers) of control: belief systems, boundary systems, feedback systems and measurement systems. These components can be used in two alternative ways:

- Diagnostic use: the PMS is used to set standards, monitor organizational outcomes and correct deviations. In this case, the systems provide "the traditional feedback role as MCSs are used on an exception basis to monitor and reward the achievement of pre-established goals" (Henri, 2006, p.531);
- Interactive use: the PMS is able to promote adaptability and strategic dynamic relying on informal and continuous dialogue at different levels of organization. In this case, the process of measurement is able to"…focus organizational attention, stimulate dialogue and support the emergence of new strategies" (Henri, 2006, p.531).

Particularly relevant for the current research is the effect of PMSs on KM (Märtensson, 2000). More specifically, Asiaei et al. (2018) demonstrate that a PMS can enable and encourage intellectual capital development and positively affect organizational performances. In a similar view, even though it does not specifically refer to PMS matters, Centobelli et al. (2018) discuss that suitable systems to support SMEs' managers (i.e., software) allow evaluation of KM processes and "increase the level of alignment between an enterprise's knowledge and its KM-Tools and the KM-Practices, improving the efficiency and effectiveness of the KMSs adopted and thus improving its overall knowledge management process" (Centobelli et al., 2018, p.123).

For the aim of this paper, we focus on the use of diagnostic and interactive PMSs which well match the exploitation and exploration KM activities (Severgnini et al., 2018). Indeed, an evident alignment between exploration/exploitation and interactive/diagnostic controls lead us to investigate the possible moderator effect played by PMSs within the KM-SME relationship for economic sustainability. This is especially consistent with knowledge-intensive firms' context, where the relationship between knowledge complexity and PMS is relevant (Ditillo, 2004) and the organizational tasks are characterized by a high degree of uncertainty (Ditillo, 2004).

Hence, for the aim of this paper, we focus on the use phase of PMSs within the context of SMEs; particularly, we want to be the first to launch a model which simultaneously takes into account KM, PMS use, and sustainability issues. SMEs need to translate their overall KM strategy into specific practices for each identified key performance area to assess the actual achievement of these practices (Kloviene, 2015). Thus, we investigate

the mediating effect of diagnostic and interactive PMS use, since they well match the exploitation and exploration KM approaches (Severgnini et al., 2018).

2.3.1. Diagnostic Use of PMS in KM Exploitation Approach

PMSs are traditionally perceived as systems to exploit existing resources (Gschwantener & Hiebl, 2016), using diagnostic tools that are able to monitor and check pre-set goals (Henri, 2006). Thus, managers are capable of checking their own strategies more efficiently and better exploit existing resources through a variance analysis (Raischi et al., 2009). Exploitation emphasises profits, a relevant customer orientation able to gain satisfaction and loyalty, and a relationship with employees based on discipline to provide them with rules and targets needed in order to attain speed and standardization useful for responding to customers' requests (Andriopoulos & Lewis, 2009). Hence, there exists a need for strictness, which can be achieved through structures and controls, that is, diagnostic controls (Fujino et al., 2014). Therefore, diagnostic tools well fit with exploitation requirements, since they have the effect of "enhancing the commitment of employees and focusing their actions on the desired outcomes" (Gschwantner & Hiebl, 2016, p.24). Severgnini et al. (2018) find that PMSs are able to align workers' behaviour on the business focus while performing exploitation activities. Similarly, Isobe et al. (2014) show that exploitation and diagnostic controls share the same goal, that is, operative efficiency (Henri, 2006). As Bedford (2015) says, if firms conduct exploitation activities and pay attention to diagnostic tools, they can gain positive performances. McCarthy and Gordon (2011) affirm the need to combine diagnostic controls and administrative controls, in order to limit employees' activities and, in so doing, facilitate their performance analysis. Feedback tools make the organization's performance and purposes transparent, thus "enhancing the commitment of employees and focusing their actions on the desired outcomes" (Gschwantner & Hiebl, 2016, p.22), supporting a more efficient exploitation of existing resources.

Moving towards the context of SMEs, we can show similar findings. Fujino et al.'s (2014) case study finds that the budget plays a key role in enabling managers to understand the needed productive capacity, in order to enhance small firm's efficiency. In contexts characterized by an internal-oriented culture (typically, smaller firms), efficiency acts as the main driver to seek cost advantages, entailing a need for economic-financial feedback tools (e.g., profit margins, variance analysis, turnover, ROI, etc.) (Miraglia, 2012). Jamil and Mohamed (2013) highlight a positive relationship between diagnostic controls and performance in the context of small-sized hotels.

As demonstrated for knowledge-intensive firms (Ditillo, 2004), when the organizational tasks are characterized by a low degree of newness the adoption of

authoritative, prescriptive, formal, and feedback tools is suitable to develop the enterprise knowledge. Similarly, Groen et al. (2012) highlight the important role of PMS in the knowledge transfer process in the small professional service firms, facilitating the staff collaboration, increasing their satisfaction and retention.

On the basis of the above discussion, the paper tests the following research hypothesis:

H.3 Diagnostic use of PMS will positively moderate the relationship between KM exploitation approach and SMEs economic sustainability.

2.3.2. Interactive Use of PMS in KM Exploitation Approach

Exploration may be evolved and supported by interactive control tools (Henri, 2006), able to foster better dialogue, communication and ideas, giving more space to employees' creativity and leading to the exploration of new knowledge processes (Gschwanter & Hiebl, 2016). Several contributions (Haddara & Zach, 2011; Fink & Ploder, 2009) address the relevance of soft and social methods in smaller firms to exchange knowledge among the workers (e.g., mind-mapping, brainstorming, knowledge networking, storytelling). Metaxiotis (2009) highlights the importance of lessons-learned systems and technological networks, combined with face-to-face discussions and meetings for knowledge sharing, as well as discussion lists, groupware, and work-flow systems. In short, the existing literature shows the relevance of critical factors, such as technology/information systems (e.g., databases), document management systems, e-mail, data mining (Gresty, 2013), culture, networks, external consultants, employees' learning and experience, public institutions (e.g., university), and management best practices (Alvarez et al., 2012; Haddara & Zach, 2011) for effective exploration execution within the context of SMEs.

Differently from the previous hypothesis, when organizational tasks present a high degree of newness (for example technology and market are not known), Ditillo's study (2004) demonstrates the need to support interaction, cooperation and information sharing with informal tools. Similarly, Jenssen and Aasheim (Jenssen & Aashein, 2010) underlie the importance for small knowledge-intensive firms of "strong, innovative and informal management approaches that encourage innovation". Groen et al. (2012) point out PMS are very important for knowledge creation process in the small professional service firms if developed together with employees.

Therefore, on the basis of the above literature, we test the following research hypothesis:

H.4 Interactive use of PMS will positively moderate the relationship between KM exploration approach and SMEs economic sustainability.

Figure 3.1 summarizes the research hypothesizes above discussed.

Figure 3.1 – *Research framework*
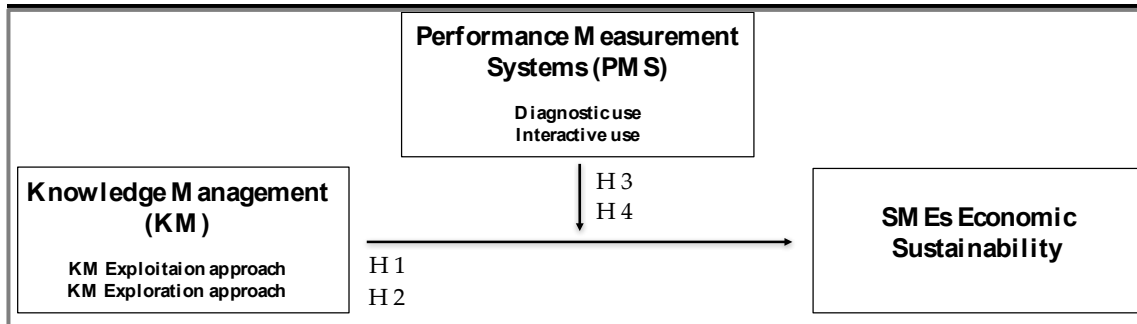
Source: The Authors.

3. Materials and Methods

The study of the relationships between KM approaches, economic sustainability and the use of PMS is conducted by adopting quantitative research techniques. In order to test research hypotheses, a statistical analysis on a survey submitted during the year 2017 by Italian Medium firms operating in knowledge-intensive industries is performed.

The following paragraphs provide a description of the steps, methodology and analysis of the research.

3.1. Sample Strategy

The population companies are represented by medium firms headquartered in Italy and operating in knowledge-intensive industries. The dimensional classification of Recommendation 2003/361/CE of the European Commission has been taken as reference to identify medium-sized companies; this guide constitutes the only authentic reference relating to the dimensional qualification of SMEs (Recommendation 2003/361/CE). Consequently, medium companies can be defined as those that have: a number of employees between 50 and 250; an annual turnover value of over 10 million and less than 50 million euros or an annual value of total assets of over 10 million and less than 43 million euros. Medium companies represent the most suitable target for this research because in this sample the implementation of PMSs is likely to be found. At the same time, they do not have the typical distortions of large corporations (e.g. quotation).

The geographical region is represented by the Italian country. The reason for this geographical choice is based on the fact that the firms located within this area were more

easily accessible and knowable by researchers. This has allowed contact with the firms during the survey phase.

Finally, the third criterion of the sample strategy implies the choice of the economic activity sectors. In order to ensure the reliability of the main independent variables – knowledge exploitation approach and knowledge exploration approach – this analysis has been focused only on the knowledge-intensive industry sectors, according to the specific segments defined by OECD (see Appendix A).

The sample strategy was performed with the use of Amadeus, a Bureau Van Dijk comprehensive database of 14 million companies across Europe that combines data from over 35 sources, with software for searching and analysis. Steps of the sample strategy are summarized in Table 3.1.

Table 3.1 - *Steps of the sample strategy*

Sample steps	Criteria	Number of identified firms
1. Medium companies in Italy	50< number of employees<250; 10 million < annual value of turnover < 50 million or 10 million < annual value of total assets < 43 million	11.293
2. Italian Firms	Firms headquartered in Italy	1.239.971
3. Knowledge Intensive Firms	NACE Rev. 2 codes: 50; 51; 58; 59; 60; 61; 62; 63; 64; 65; 66; 69; 70; 71; 72; 73; 74; 75; 78; 80; 84; 85; 86; 87; 88; 90; 91; 92; 93	207.509
Total		**1.603**

Source: The Authors.

Intersection of the three criteria used in the Amadeus research strategy – Medium companies headquartered in Italy and which main activities is related to Knowledge Intensive sectors – has allowed to identify a final sample represented by 1.603 firms.

The firms' e-mail addresses were manually extracted from each website. The survey was sent in January 2017. Three mailings were carried out in the period between January and June 2017; each of these was followed by specific contact, in order to verify completion of the survey. Our final sample is composed of 219 surveys collected after this procedure. The response rate (13,6%) is consistent with the range of responses found in previous studies that used mail surveys sent to SMEs (Newby et al., 2003).

3.2. Variables Description

3.2.1. Dependent Variable – Firm Performance

The dependent variable of this study is represented by the firm financial performance. The last question of the survey is related to the collection of necessary information for measuring this variable. Each responding company has indicated the exact amount of the Net Operating Profit After Tax (NOPAT) and Invested Capital (IC) – included in the last financial statements. These two values are necessary for the measurement of corporate profitability, the percentage that investors in a company are earning from their invested capital.

This profitability measure allowed us to analyze the firms' financial strengths, weakness, opportunities and threats (Jacobson, 1987). It is also a powerful measure of corporate financial performance, able to sterilize the common problem of performance measurement (Chen & Dodd, 1997). Based on these, the Return On Capital Invested (ROI) has become the central measure of firms' performance, able to reduce the level of subjectivity normally expressed by the common measures used in the survey (Stewart, 1996). ROI is an objective measure of financial performance, without any managerial valuation.

As widely argued, ROI can describe the efficiency of the use of invested capital (Figge & Hahn, 2012). While economists and analysts may rely on other alternatives to assess profitability, Dale et al. (2013) suggested ROI as economic sustainability indicator because of its practicality and ease of use. ROI is a paramount indicator of profitability that is highly recognized in economic theory (Dale et al., 2013). Although we recognize that other measures of firm performance have been used in the literature, it is more practical, for measurement and operational reasons, to measure the concepts of economic sustainability using this standard measure (i.e., ROI).

3.2.2. Independent Variable – Knowledge Strategies

The independent variables of this study are represented by two knowledge strategy types: Knowledge exploitation strategy and Knowledge exploration strategy.

Scales validated in prior work were adapted and combined specifically for this study. All items of this study were measured on five-point Likert scales (Likert, 1932), where a score of 1 means strongly disagree and 5 means strongly agree.

The expectation of this study – connected to the first and second hypothesis, is related to the positive effects on firms' performance that arise from the adoption of Knowledge strategies.

Knowledge exploitation. As previously illustrated, knowledge exploitation is defined as the use and further development of existing competencies (March, 1991; Liu, 2006).

Basically, exploitation refers to the processes of adopting, adapting and applying existing knowledge (Liu, 2006; March, 1999). This level of existing knowledge and experience is essential for adopting incremental knowledge actions (Marengo, 1991, 1993). Consequently, measures of knowledge exploitation strategy were adapted from Kohli, et al. (1993) and He and Wong (2004). The exploitation items were created for measuring the importance for a firm to improve the existent offer of product or to explore the implemented processes or to enhance the research in old product or to exploit the reference product market (e.g. improve the research activities in the actual offers of products; maintain the existent market position; exploit the reference market). Collectively, the expectation is that these items capture the process of exploitation of existent knowledge. Therefore, the eight items of our exploitation scale (Cronbach Alpha = 0.78) is related to the firms' knowledge activities and practices like the use of existing knowledge repositories, the pursuit of efficiency in performing activities and the emphasis on incremental improvement of R&D processes.

Knowledge exploration. On the opposite side, knowledge exploration is related to the pursuit of new competencies (March, 1991); learning activities linked with the process of new resource addition. Exploration reflect the firms' ability to acquire new knowledge rather than use the existing level of knowledge and experience (Liu, 2006). For these reasons, measurements of the knowledge exploration strategy were adapted from the same sources (Kohli et al., 1993; He & Wong, 2004). Therefore, the eight items of our exploration scale (Cronbach Alpha = 0.75) is focused on the firms' knowledge activities and practices, such as the systematic use of teamwork practices, the interaction with external knowledge sources and the recognition of opportunities including not just product and process innovations, but also new markets and organizational structures. The expected result is related to the capability of the items to measure the importance for a firm of pursuing knowledge exploration activities and practices. Conversely, the employed items were related the importance of explore new process or to focus the research in new product or to explore new market (e.g. focus the research activities in new product; change the process technology; explore new market with new product). Cronbach Alpha values of this scale are reported in Table 3.2.

Cronbach alpha is an internal consistency reliability index (Cronbach, 1970). It measures the proportion of variance in the scores that is attributable to the true score variance. For this reason, the Cronbach Alpha is a measure of the strength of the factor. In this analysis, the Cronbach Alpha of the two independent variables is higher than .70, that indicates a higher degree of coherence between the items that are part of the same scale.

Table 3.2 – *Cronbach Alpha for KM approaches measurement*

Variables	Items	Cronbach Alpha
KM exploitation approach	ET_1 ET_2 ET_3 ET_4 ET_5 ET_6 ET_7 ET_8	0.78
KM exploration approach	EX_1 EX_2 EX_3 EX_4 EX_5 EX_6 EX_7 EX_8	0.75

Source: The Authors.

3.2.3. Moderating Variable – Performance Measurement Systems Adoption

The moderating variable of this study is represented by the use of PMSs by distinguishing between diagnostic control systems and interactive control systems. The role of this variable is to interact with the fundamental relationship between firm performance (dependent variable) and knowledge strategy approaches (independent variable). For the analysis of the types of PMSs, previous scales were specifically adapted and combined. All items of this study were measured on five-point Likert scales (Likert, 1932), where a score of 1 means strongly disagree and 5 means strongly agree.

The expectation of this study (third and fourth hypothesis) is related to the enhancing effect on Knowledge strategy performance. Directly connected to the positive relationship between the specific characteristics of the two types of PMS and of the two types of KM approach, we expect that: knowledge exploitation firms' economic sustainability is higher for Diagnostic PMS adopters; and knowledge exploration firms' performance effect is enhanced for Interactive PMS adopters.

Diagnostic control systems. Diagnostic control systems are used to monitor and reward the achievement of specific goals through the analysis of critical performance variables (Bisbe & Otley, 2004). They provide a powerful guide for deliberate strategies, but they

are not very useful in the search for emergence strategies (Simons, 2000). Thus, this type of system is correlated with conservative strategies, based on existing resources and experience. Indeed, the research expectation has to do with the moderating role of this PMS type in the relationship between the KM exploitation approach and economic sustainability.

Interactive control systems. On the opposite side, interactive control systems are related to informal information systems used regularly by managers for discussing the implementation of the strategy and for fostering the organizational debate (Bisbe & Malagueño, 2009). Consequently, interactive control systems provide a guide in the search for emergent strategies, and are directly connected to the implementation of innovative strategies (Simons, 2000). For this reason, this research investigated the moderating role of this type of PMS in the relationship between Knowledge exploration strategies and firm performance.

The measurement of these two types of PMS use were done by adapting the Vandenbosch's (1999) items scale to the scope of this work. These items were developed with the main goal of understand the orientation of the PMS use. Diagnostic control systems represent the traditional ways of monitoring the performance with a focus on the difference between set and achieved goals. Consequently, the use of this systems is measured by the importance for the firms to carry out the corrective actions or a consistent financial reporting or a robust measurement system (e.g. relevance of the measurement process; importance of the measurement process; significance of the formalized procedure). On the opposite side, Interactive control systems is focused on the interaction between the different organizational levels. This use of PMS is based on the interactive processes and on the process of knowledge sharing. Therefore, the aim of the employed items was to measure the use of the PMS as an interactive system or the importance of the informative dialog or the relevance of problem solving and new ideas development (e.g. importance of the meeting and interaction; relevance of the formalized process and routine; significance of the interrelated decision making). Cronbach Alpha values are reported in Table 3.3.

As for the previous variable, we employed the Cronbach Alpha to evaluate the internal validity of the considered multi-item scales. Values of Cronbach alpha for the two moderating variables are higher than .80, indicating a higher degree of coherence between the items that are part of the same scale.

Table 3.3 – *Cronbach Alpha for PMS use measurement*

Variables	Items	Cronbach Alpha
Diagnostic PMS	DIA_1 DIA_2 DIA_3 DIA_4 DIA_5 DIA_6 DIA_7 DIA_8	0.85
Interactive PMS	INT_1 INT_2 INT_3 INT_4 INT_5 INT_6 INT_7 INT_8	0.88

Source: The Authors.

3.2.4. Control Variable

The regression model includes some control variables to account for the specific effects of the observational framework that can influence the statistical relationships. To measure the effects of the firm's size in the relationship between KM approaches and firm economic sustainability in the analysis the natural logarithm of the net sales – sales, has been employed. The role of this variable is to take into account the size effect on the firm's performance. Medium companies should achieve higher performance than others for many clear factors, e.g. economies of scale.

The last part of the survey concerns the collection of the necessary information for controlling the main hypotheses. Responding companies have indicated the exact amount of operating sales - included in the last financial statements. This variable represents the control variable of the statistical regression.

3.3. Statistical Analysis and Methodology

Quantitative data analysis was employed in this study, including principal component analysis (PCA) and the OLS regression method. Statistical analysis was performed using STATA 16.

In the first step, PCA analysis has allowed us to identify specific factor for each independent and moderating variable (KM exploitation approach, Knowledge exploration approach, Diagnostic PMS; Interactive PMS), assuming a number of principal components that represents at least 75% of the total variance. Jolliffe (1972) suggested 0.70 of total variance as the minimum level to take into account for retaining the factor. After the selection of the factor, the factor score was calculated by the single score of the retained principal component, weighted for the % of the total variance retained by each single component.

The four factors scores are used to identify the value of each independent and moderating variable.

After the process of factor calculation, in order to test the research hypothesis, four different OLS regression models were used. All variables were standardized to conform to a standard normal distribution, in observance of the requirements of regression analysis (Heise, 1969).

Model 1:

$$Performance = \alpha + \beta_1\,Knowledge\ Exploitation + \beta_2\,Logsales + \varepsilon. \tag{1}$$

Model 2:

$$Performance = \alpha + \beta_1\,Knowledge\ Exploration + \beta_2\,Logsales + \varepsilon. \tag{2}$$

Model 3:

$$Performance = \alpha + \beta_1\,Knowledge\ Exploitation + \beta_2\,Diagnostic\ PMS + \beta_3\,Knowledge\ Exploitation * Diagnostic\ PMS + \beta_4\,Logsales + \varepsilon. \tag{3}$$

Model 4:

$$Performance = \alpha + \beta_1\,Knowledge\ Exploration + \beta_2\,Interactive\ PMS + \beta_3\,Knowledge\ Exploration * Interactive\ PMS + \beta_4\,Logsales + \varepsilon \tag{4}$$

4. Results

The correlations of the variables are provided in Table 3.4. The matrix indicates a positive correlation between the independent variables and the dependent variable of the model. The correlation between the control variable (net sales) and firm performance is non-significant, then excluding the firm's size effect.

Table 3.4 - *Correlation matrix*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) ROI	1.00							
(2) ET	0.22	1.00						
(3) EX	0.34	0.34	1.00					
(4) DIA	0.07	0.23	0.36	1.00				
(5) INT	0.15	0.22	0.33	0.77	1.00			
(6) DIA*ET	0.39	0.19	-0.01	0.04	0.07	1.00		
(7) INT*EX	0.60	0.07	0.08	-0.11	-0.03	0.32	1.00	
(8) Sales	0.02	-0.07	0.11	-0.02	0.00	-0.11	-0.03	1.00

Source: The Authors.

Table 3.5 - *Results of regression*

Independent variable	Model 1 (1)	Model 2 (2)	Model 3 (3)	Model 4 (4)
ET	**0.2272*** (0.0664)**		0.1553* (0.0649)	
EX		**0.3444*** (0.0643)**		0.2638*** (0.0541)
DIA			0.0192 (0.0636)	
INT				0.0855 (0.0535)
DIA*ET			**0.3653*** (0.0634)**	
INT*EX				**0.5849*** (0.0507)**
Cons	-0.0247 (0.0661)	-0.0331 (0.0637)	-0.0274 (0.0618)	-0.0288 (0.0502)
Sales	0.0361 (0.0664)	-0.0200 (0.0643)	0.0721 (0.0624)	0.0043 (0.0508)
Observation	219	219	219	219
R^2	0.0517**	0.1174***	0.1793***	0.4569***
F	5.89	14.37	11.69	45.01

***, **, * indicates value of P-value equal or less than 0.001, 0.01 and 0.05. Standard error in parentheses. The four hypotheses (ET, EX, DIA*ET, INT*EX) are reported in bold.

Source: The Authors.

Table 3.5 displays the results of the four OLS regression models. Each theoretical hypothesis corresponds to a specific statistical model. The results of the model application are displayed in columns; each line indicates the reference value for the key variable. The next paragraphs analyze the statistical implication of each hypothesis.

First hypothesis, KM exploitation effect. The OLS regression of the 219 surveys received from Medium firms headquartered in Italy that operate in Knowledge-Intensive Sectors, confirm the first expectation. Firms that pursue a Knowledge exploitation strategy achieve a higher performance than the others. Model 1 (1) shows the positive effect derived from the Knowledge exploitation strategy, even if this influence is not particularly relevant and, in general, the model explains the performance dynamic to a very limited extent. In fact, the R2 for Model 1 (1) is very low (0.0517), though statistically significant ($p \leq 0.01$). Positive correlation between this variable and the firm's performance is also confirmed by the correlation matrix (0.22).

Second hypothesis, KM Exploration effect. Model 2 (2) confirms also the second theoretical hypothesis. Firms that pursue KM exploration approaches achieve a higher performance in terms of economic sustainability. Model 2 (2) confirms this positive effect on firm performance. We have a higher positive correlation (0.34), very significant ($p \leq 0.001$). The R2 for Model 2 (2) is 0.1174 and significant ($p \leq 0.001$). In this case, the positive effect on the firm's performance is higher for the KM explorative firms than the KM exploitative firms. This result is confirmed by the degree of the correlation index – also confirmed by the correlation matrix.

Third hypothesis, KM exploitation, economic sustainability and the moderating role of the Diagnostic PMS. Model 3 (3) tests the moderating role of Diagnostic PMS use. Firms that pursue KM exploitation and at the same time use the PMS as a Diagnostic system achieve higher performance. The correlation index of the moderating variable is positive and higher (0.39) than the independent variable. The R2 for Model 3 (3) is 0.1793 and significant ($p \leq 0.001$). This relation is very significant ($p \leq 0.001$). The moderating effect of this variable is also confirmed by the value of R2. A significant change in R2 in Model 3 (3) indicates a pure moderator role. In this model, by adding the moderating variable, R2 increases to 0.1793. This change of 0.1276 confirms once more this moderating relationship.

Fourth hypothesis, KM exploration, economic sustainability and the moderating role of the Interactive PMS. Testing of the moderating role of Interactive PMS use confirms the fourth hypothesis of this research. Firms that pursue KM exploration approaches and use PMSs as Interactive systems achieve higher performance. The correlation index of the moderating variable is higher (0.60) than the dependent variable. The value of R2 for Model 4 (4) is 0.4569 and significant ($p \leq 0.001$). The relation between the moderating

variable and the firm's economic sustainability is very significant (p≤ 0.001). In this case, as in the previous model, the role of the moderating variable is confirmed by the increase in the value of R2. The change of 0.3395 indicates the role of the variable as a pure moderator.

Control variable. The natural logarithm of net sales is employed for controlling the effect of the firm's size. In the four regression models, the relationship between this variable and the firm's performance is not significant. Based on this, it is possible to exclude the effect of the firm's size on corporate performance.

In the four models, a maximum VIF value – harmful collinearity (Mason & Perreault, 1991) of 1.1 is reached, indicating that there is no serious multicollinearity between variables. Consequently, the data is normally analyzed.

Finally, we performed further research to assess the adequacy of the R2, highlighting that social sciences have reveled over the time a particular level of strengthens in the relation between an independent and dependent variable. As a matter of fact, Falk and Miller (1992) recommended a level of R2 equal or greater than 0.10. Cohen (1988) suggested a level of R2 higher than 0.02 for demonstrating a statistical relation. In the same vein, some recent empirical studies support their hypotheses with low values of R2. For example, Ali et al. (2019) confirm their hypotheses with statistical model fitted at level of R2 between 0.118 to 0.401. Alda (2019) supports the hypotheses formulated with statistical model that showing low level of R2 (0.0756; 0.1577). Suzuki, Ando and Nishikawa (2019) discuss their hypotheses with level of R2 around 0.10. Finally, Cha, Adebe, Dadanlar (2019) demonstrate their evidence with similar level of R2. For these reasons, we consider our level of R2 coherent with the recent empirical literature and able to support our discussion and conclusion.

5. Discussion and Conclusions

The findings of this study contribute to the existing literature in a number of ways.

First, the paper provides empirical evidence on the positive impact of KM on SMEs economic sustainability. Building on the premise that the pursue of economic profitability is relevant for the long-term survival of SMEs (Lizano et al., 2019) this empirical research demonstrates that the design and implementation of an adequate KM approach is important for the economic sustainability of SMEs. Given that SMEs typically suffer from resource constraints (Wong et al., 2015; Massaro et al., 2016), our results show that the adoption of exploitation or exploration KM approach supports SMEs profitability. Even if the existing literature has usually referred these evidences to large companies (Lavie et al., 2010), often emphasizing the role of ambidexterity (Lubatkin et al., 2006;

Andriopoulos & Lewis, 2009; Raischi et al., 2009), our study demonstrates that managing knowledge is a process that generates value also for SMEs when adopting a coherent KM approach. This is in line with previous studies that have recognized the importance of KM, which allow entrepreneurs to identify and exploit opportunities (Acs et al., 2009), to enhance entrepreneurial orientation (Politis, 2005) and to reinforce organizational learning (Cardoni et al., 2018).

Second, the study provides empirical evidence about the impact of explorative innovation activities on SMEs economic sustainability. Data analysis demonstrates that the effect on performance is much stronger for SMEs that adopt KM exploration approach rather than for SMEs adopting KM exploitation approach. First of all, this finding is consistent with the study of Garcia-Alvarez (2015), and Gaziullusoy et al. (2013) and demonstrates the importance for SMEs to build on the positive interaction between KM and innovation. In other words, innovative capabilities that originate from KM activities can play an essential role for SMEs sustainability (Sanders Jones & Linderman, 2014). Consequently, this study provides empirical evidence on the importance of adopting business models that are able to integrate KM and innovation. When this occurs, SMEs are able to reach sustainable competitive advantage and superior performance. This is coherent with the Lopes et al (2017) research and extend their theoretical implications to SMEs. The Lopes et al. research (2017) shows that absorptive capacity (Zahra & George, 2002) plays a very important role in this interplay. Since absorptive capacity has not been investigated in our research, understanding the relevance of absorptive capacity for SMEs innovation and economic sustainability could be the main focus of a next research project. Secondly, the important role of KM exploration is also consistent with the features of the knowledge intensive industries. Managing valuable processes in those sectors tends to be more difficult, as firms have to carry out activities characterized by uncertainty, asymmetries and scares observability (Austin & Larkey, 2002; Ditillo, 2006). The uncertainty is linked to a greater level of innovation and problem solving activities, arising critical issues that evolve dynamically (Ekstedt, 1989). The asymmetries mainly concern the relationship between managers and staff, since managers and experts possess different information. Observability is linked to the very intangible nature of the KM processes. From the knowledge based-view perspective (Grant, 1996), exploration activities act as cross-learning mechanisms that are able to integrate specialized knowledge to deal with uncertainty, asymmetries and scares observability. Conversely, exploitation activities are more effective in contexts of less uncertainty and greater standardization as in traditional manufacturing companies, where knowledge codification and transfer are performed more effectively. Finally, our study shows that KM

exploration, despite increasing uncertainty and the risk exposure, is able to perform a better impact on economic performance than KM exploitation.

Third, this study examines the moderating role of PMS between KM and SMEs performance, making our evidences consistent with some seminal works in PMS literature. Firstly, empirical results confirm that PMS, both as a diagnostic and interactive systems, are a necessary tool for successful management (Widener, 2007). These findings are consistent with the knowledge based-view of the firm which demonstrates the ability of organizations to reach higher performance when the intangible resources, especially the knowledge, are managed strategically. Consistently with Simons perspective (Simons, 2000) and Kaplan and Norton (1996) analysis, PMS can play a powerful lever to monitor the critical success factors and develop a sustainable competitive advantage. Our paper shows that SMEs supporting a consistent KM strategy with a coherent use of PMS report a positive impact on sustainability. This is consistent with arguments that explain the scarce economic sustainability of SMEs with the poor quality of managerial decisions (Schlierer et al., 2012). The implementation of a consistent KM strategy, both KM exploitation strategy and KM exploration strategy, is greatly amplified by the use of coherent PMS since the quality of decision-making increases. This is especially true for SMEs whose decision-making activities is largely influenced by the entrepreneurial decision styles and for family firms with limited professionalization on business administration (Choi et al., 2018). This raises a managerial issue for SMEs and family businesses (Cardoni, 2018) since our findings demonstrate that the use of PMS allows SMEs to reach a higher level of economic sustainability and encourage to increase the level of professionalization in management.

Fourth, the study enriches the existing literature that investigates the role of PMS for innovation and KM exploration strategies (Bedford, 2015; Lövstål & Jontoft, 2017; Asiaei 2018). The study shows that PMS is a mechanism that leverages KM exploration strategies for SMEs that operate in knowledge-intensive industries and it confirms the effectiveness of interactive controls in supporting innovation processes (Bisbe & Malagueño, 2009). This is consistent with the theoretical propositions of the knowledge-based theory of the firm and the contingency theory of PMS. The use of interactive controls facilitates the integration of different knowledge bundles in a systematic way when SMEs competitive action is deployed in turbulent environments that require fast and innovative responses (Scott & Tiessen, 1999). Indeed, the uncertainty that is intrinsic in exploration strategies is one of the most relevant contingency factors that affects PMS design and use (Chenhall, 2003). As stated by Ditillo (2006), interactive control mechanisms reinforce knowledge integration processes and sustain performance of firms in the knowledge intensive sectors.

In sum, this study provides empirical evidence on how a specific KM approach supports economic sustainability of SMEs and how a consistent implementation and use of PMS leverage the link between KM and ES. It addresses some literature gaps and claims for an extension of the relevant stream of research on the use of PMS by providing some theoretical and managerial implications.

As for the theoretical insights, our research framework put together the concepts of sustainability, knowledge management and PMS making an innovative contribution to the existing literature. The study is addressed to solve some research gaps that concerns the effects of KM and PMS use for SMEs sustainability. In this sense, our results confirm that the quality of decision-making process and the effects of KM strategies on firm performance are enhanced when the alignment of the PMS use with the KM strategy is verified. Therefore, results contribute to find the mechanisms of economic sustainability for SMEs survival.

As for managerial implications, there are several lessons for practice. First, the findings encourage SMEs entrepreneurs and managers to design and implement a coherent KM approach and to explicitly adopt a strategic and operative focus on the economic value embedded in the relevant knowledge that entrepreneur, employees and key external stakeholders possess. The unleashing of relevant knowledge in the firm operative processes is the key for the development of a sustainable competitive advantage. Second, the study stimulates SMEs to take advantage from exploration and innovation activities. This is true especially for SMEs operating in knowledge intensive industries. The search for new markets and the involvement of suppliers, customers and employees for the deployment of a more articulated value propositions to the market emerge as the two relevant drivers for the achievement of two goals: the absorption of knowledge that is relevant for the competitive action and the firm long-term profitability. Third, results show that PMS is nowadays a fundamental tool to facilitate decision-making and support KM activities. Then, the alignment of the design and use of PMS with the KM strategy and other contextual factors is an excellent managerial practice that SMEs entrepreneurs and managers have to take seriously into consideration. To gain a full advantage of the positive effects of KM on economic sustainability, managers and accountants are encouraged to strategically align and integrate KM, innovation and PMS design and use. The study demonstrates that these three managerial actions are relevant for SMEs sustainability.

This study is subject to several limitations that represent opportunities for further research. Data were obtained from a survey potentially affected by some biases. In order to restrict the bias effects, first we have paid great attention to the research method by performing a preliminary test of the questionnaire and a pilot implementation of the

survey. Moreover, we have conducted diagnostic tests which confirmed that there were no significant statistical errors. Application of the traditional statistical regression method (OLS) unexplained part of the variation in performance, the noise of the model. The data should be further analyzed for investigating other specific factor that could also influence the adoption of different Knowledge strategies or the use of different PMS approach. Another issue related to the OLS regression model regards the reverse causality and the simultaneously. Other statistical method as GMM, could aim to solve these problems by the use of instrumental variable estimation. Given the cross-sectional nature of the study, the findings on exploration and exploitation strategies are fixed at a certain point in time, assuming that the KM approach adopted by a SME is relatively stable over time. Although some respondents may have implemented a strategic shift in the period between the questionnaire release and the analysis of collected data, we can assume that the number of transitions is relatively low in the short term. The distinction between the two KM approaches refers to the different nature of some KM activities, thus it does not consider in a structured way all the KM activities that could be conceptually associated with the two approaches. Even the way of conceptualizing the use of the PMS is mainly based on prevailing managerial accounting practices, therefore it might be interesting to analyze a narrower whole of PMS, like strategic performance management system (SPMS) or value based management system (VBMS). Another limitation concerns the measurement of SMEs sustainability since we refer to economic sustainability by selecting ROI as main indicator of profitability. To this end, other profitability indicators and further dimensions of SMEs sustainability might be considered in future research with the aim to analyze the multiple interrelation between KM and PMS for SMEs long-term profitability.

Furthermore, the use of quantitative methodology is not able to provide rich answers to "why" and "how" the linkages among KM, PMS and ES work. Future research may perform qualitative methodologies to gain a better understanding of the effects that organizational and environmental structures generate on KM and PMS, also by adopting a longitudinal study for the analysis of the key variables that explain in more fine details the link among KM, PMS and SMEs sustainability.

Appendix A

Knowledge intensive industries according to OECD classification with NACE Rev.2 codes between brackets (OECD, 2006):

- Motion picture, video and television programme production, sound recording and music publishing activities (59);
- Programming and broadcasting activities (60);

- Telecommunications (61);
- Computer programming, consultancy and related activities (62);
- Information service activities (63);
- Scientific research and development (72);
- Water transport (50); Air transport (51);
- Legal and accounting activities (69);
- Activities of head offices; management consultancy activities (70);
- Architectural and engineering activities; technical testing and analysis (71);
- Advertising and market research (73);
- Other professional, scientific and technical activities (74);
- Employment activities (78);
- Security and investigation activities (80);
- Financial service activities, except insurance and pension funding (64);
- Insurance, reinsurance and pension funding, except compulsory social security (65);
- Activities auxiliary to financial services and insurance activities (66);
- Publishing activities (58); Veterinary activities (75);
- Public administration and defence; compulsory social security (84);
- Education (85);
- Human health activities (86); Residential care activities (87);
- Social work activities without accommodation (88);
- Creative, arts and entertainment activities (90);
- Libraries, archives, museums and other cultural activities (91);
- Gambling and betting activities (92);
- Sports activities and amusement and recreation activities (93).

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