Toward performance measurement systems based on business models

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Abstract

Emerging research in the field of Management Control calls for abandoning outdated performance measurement systems (PMSs) to emphasize the value chain of companies' value creation. Business model (BM) concepts can help to highlight this causal chain and convince companies to reframe their PMSs. However, little is known about how BM information is entered and used in companies' accounting information systems (AISs). In this study, we investigate whether companies improve their AISs by institutionalizing BM information, and we look at ways in which they can combine this information into their PMSs. We statistically test the coercive, mimetic, and normative forces influencing the institutionalization of BM information and the changes in AISs using the content analysis of the corporate reports and websites of 86 listed firms. Our results show that firms adjusted their AISs to communicate BM information, resulting in AISs conducive to the replacement of traditional PMSs with new BM-based frameworks. Despite this change, we offer some reflections on whether and how these changes may happen in practice, and on ways in which combining BM information can give rise to new cognitive and accounting frameworks to reshape PMSs. This study enriches the theoretical research on the determinants shaping the institutionalization of new corporate information. It highlights the cognitive effects resulting from designing PMSs by advocating the need to consider cognitive and psychological aspects when capturing and portraying value creation in synoptic tools.

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1. Introduction

Management Control (MC) is traditionally conceived as "an internal process, internally managed, for internal purposes" (Marchi, 2011, p. 5). Over time, it becomes externally oriented, so providing information on firms' performance to protect the interests of various stakeholders (Capurro *et al.*, 2020). Through external reporting, stakeholders can assess and control the way firms create value - referring to both financial value and value to society (Greco and D'Onza, 2020). Thereby, external reporting contributed to revamping management control systems (MCSs) and their performance measures to support decision-making and satisfy stakeholders' information needs (Leotta *et al.*, 2020).

Despite their variety, the existing frameworks failed to capture and communicate a complete picture of how organisations create value (Capurro *et al.*, 2020). The academic and business communities have been interested in exploring how performance measurement frameworks (PMFs) can improve to measure and represent this process and its cause-effect dynamics (de Waal and Kourtit, 2013). The Balanced Scorecard (BSC) is one of the most recent and widespread PMFs highlighting the determinants of firms' value creation (Busco and Quattrone, 2015). However, many criticised the BSC, and other performance measurement systems (PMSs) because of their weaknesses and limitations – e.g., the dominance of financial metrics, weak cause-effect linkages and cognitive effects of visual maps on people' decision and judgement (Lucianetti, 2011; Cheng and Humpreys, 2012; Lau and Martin-Sardesai, 2012; Hoque, 2014). Emerging research claims that Business Model (BM)-based frameworks for performance measurement can help companies overcome these limits and replace previous PMFs, like the BSC (Nielsen *et al.*, 2017).

A BM explains how organisations create, deliver, and capture value (Osterwalder and Pigneur, 2010), and has become critical for both internal management and external disclosure (Holland, 2004). It offers insight into the logic that underlies the value creation process (Bini *et al.*, 2019). It provides an overview of firms' activities and the way they are carried out (Holland, 2004). Therefore, over the last decade, BM paved a way to reframe internal and external corporate information.

The academic literature and the professional bodies call for the need to disclose BM information for advancing corporate reporting due to its holistic conception and capability to explicit the tacit knowledge (Beattie and Smith, 2013; Bini *et al.*, 2016). Several studies contend an ever-increasing external relevance of internal MCSs to protect various stakeholders' interests

(Marchi, 2011; 2019). Specifically, the convergence of MCSs and external reporting aims to create value for both owners and stakeholder groups (Marchi and Trucco, 2017). Internal managers can respond to external stakeholders' demands by integrating BM information into MCSs (Hosoda, 2020). In turn, companies have likely reshaped their accounting information systems (AISs) for external reporting to provide new information about their BM. However, despite the claim for establishing new PMSs inspired by BM-based internal management frameworks, very little is known about how organisations have changed their AISs by including BM information.

This study aims to answer this call by investigating whether companies adjusted their AISs due to the institutionalising forces toward producing and reporting BM information and, in turn, how they can combine BM information into their PMSs. By positing that coercive, mimetic, and normative forces can change and diffuse AISs, we test the determinants explaining the institutionalisation of BM information in companies' AISs. Thereby, we examine if companies' AISs can help to reinvent their PMSs and foster the adoption of BM-based PMSs.

This article is structured as follows. Section 2 presents the previous literature and hypotheses development. Section 3 describes the research method. Our results are in Section 4. Last, section 5 contains our discussion and conclusion.

2. Literature and hypotheses development

2.1 Previous literature

MCS is conceptualised as a package of processes and mechanisms used by managers to direct employees' behaviour towards achieving objectives that are coherent with organisation's strategies (Malmi and Brown, 2008; Bedford and Malmi, 2015). MC can foster organisational learning and innovations processes (Davila *et al.*, 2009). It can enact psychological empowerment and creativity (Moulang, 2015). Behavioural research demonstrates the MC's effects on workplace and employee satisfaction and motivation (Lau and Martin-Sardesai, 2012; Lau and Roopnarain, 2014). These effects are explained by neurological mechanisms that can inhibit or activate individual behaviour toward achieving goals (Reichert and Woods, 2012). However, these consequences depend on the way managers measure, produce, present, and use the information for MC.

AISs support managers' MC by capturing and providing "information about economic events that decision-makers use for planning, monitoring and controlling their organisations" (O'Donnell and David, 2000, p. 180). However, AISs are often considered as an aggregated measurement that cannot represent the complexity of organisational life since AISs may ignore some strategic and individual factors (Granlund, 2011). Traditional financial measures in AISs have a backwards-looking view, ignore the firms' intangible assets and do not ensure goal congruence between staff decisions and actions (Nørreklit, 2000). Therefore, there is a long-standing need to combine non-financial measures with financial ones in PMFs.

Performance measurement and management systems should be balanced and dynamic to support decision-making by elaborating and analysing information (Neely *et al.*, 2002). They can make explicit the relationships and methods that firms will use to implement their strategic intents (Otley, 1999). They aim to improve and direct decision-making processes towards strategy implementation and stimulate motivation and learning processes (Castellano, 2011). To be effective, these systems should use different measures and perspectives (Kaplan and Norton, 1996) and adapt to external changes rapidly (Chau, 2008; Cocca and Alberti, 2010). Hence, as performance management and measurement tools are essential to gain competitive advantage, companies use them to translate their business strategy goals into a set of performance measures (de Waal and Kourtit 2013).

The BSC is widely known and adopted performance management and measurement framework (de Waal and Kourtit, 2013). It was born to overcome the historical and backwards-looking financial measures of accounting metrics (Nørreklit, 2003). It integrates financial and non-financial performance measures, so bringing a breakthrough innovation in management accounting practices (Busco and Quattrone, 2015). The BSC attempts to measure performance drivers and outcomes linked by cause-effect relationships across four perspectives – i.e., financial, customers, internal processes, and learning and growth (Nørreklit, 2000). Each business unit in an organisation can develop its own BSC to portray its goals and strategy and turn them into metrics (Lipe and Salterio, 2000).

The BSC gained great interest internationally (Nørreklit, 2003), and was used to help managers to make decisions, receive feedback, and communicate information (Wiersma, 2009). It represents a value-added management system to survive in a complex business system (De Geuser *et al.*, 2009). Its popularity is due to its malleability to adapt to different uses (Jazeri and

Scapens, 2008). BSC can align personal goals with company strategy, support operational decisions, and provide reliable feedback for learning and performance evaluation (Nørreklit, 2000; Malina and Selto, 2001).

Initially, it was a PMF to integrate financial and non-financial performance (Malmi, 2001; Busco and Quattrone, 2015). Then, Kaplan and Norton proposed the strategy maps to provide visual support in understanding the relationships between the four perspectives of the BSC and the firms' strategy (Vedovato and Bagnoli, 2014). The BSC strategy maps generated a constant process of interrogation and reinvention of the strategic vision and involved users' engagement (Vedovato and Bagnoli, 2014; Busco and Quattrone, 2015). Therefore, the BSC became a strategic management system to capture, communicate and implement a business strategy (Wiersma, 2009). Recently, Nielsen *et al*. (2017) argued that the BSC could be used for internal and external disclosure. However, despite its diverse uses and diffusion among firms (Lipe and Salterio 2000; Malmi 2001), the BSC was criticised for not delivering on its promises (Hoque, 2014; Busco and Quattrone, 2015).

In practice, the BSC's usage unveiled several limitations. Hoque (2014) reviewed the gaps of the BSC found in the academic literature, so highlighting that its primary aims were actually challenged. The BSC is not 'balanced' as it emphasises financial information (de Waal and Kourtit, 2013); it is not a 'scorecard' in the conventional accounting sense (Atkinson *et al*., 1997). The many performance indicators do not help identify the performance drivers influencing the financial outcomes and provide a few strategic information (Ittner *et al*., 2003). The use of strategy maps posits that the relationships between the different perspectives are known and effectively articulated in a model (Vedovato and Bagnoli, 2014). Thereby, the BSC's capability of being a strategic tool highlighting causality among the four dimensions was questioned (Nørreklit, 2000).

The BSC and other PMFs are characterised by a high level of complexity and abstraction (Nielsen *et al*., 2017). Abstractness acts both as a maieutic machine sustaining innovations and as a rhetorical machine articulating the accounting inscription for fostering innovations (Busco and Quattrone, 2015). This abstractness lies in the cause-effect relationships of the BSC, which attempt to link firms' value creation drivers. The many performance measures also posed some cognitive challenges for decision making, as there is a lack of guidance about the relative weights for the BSC measures and little training of the human resources involved (Otley, 1999; Tayler, 2010; Lucianetti, 2011). Nonetheless, there was a lack of understanding of how individual actions contribute to the overall strategy (Ferreira and Otley,

2009). Therefore, the BSC can cause cognitive limitations and affect managers mental model (Lipe and Salterio, 2000; Hall, 2011).

The BSC's inherent complexity creates difficulties in communicating and understanding its underlying logic, which impedes its implementation and use (Banker *et al*., 2011). As a result, managers systematically overweight financial measures at the cost of non-financial measures (Ittner *et al*., 2003). In sum, the BSC failed to portray a holistic view of the organisation' value creation and the connectivity among its drivers.

According to Nielsen *et al*. (2017), BM-based frameworks can help companies overcome these limitations and replace previous PMSs like the BSC. Being able to portray a corporate value-creation story, BM is acknowledged as an adaptive and flexible mechanism to measure and report firm's activities to create and deliver value (Holland, 2004; Seddon *et al*., 2004). Furthermore, it is a holistic, multi-level concept with the ability to explicit the tacit knowledge and refocuses on the conceptual links between intellectual capital and value creation (Beattie and Smith, 2013; Bini *et al*., 2016). Nielsen and Roslender (2015) see the BM concept and its frameworks as a means for visualising value creation within organisations. Hence, emerging research claims that BM can enhance financial reporting because it can make firms' value creation evident (see, e.g., Page, 2014; Michalak *et al*., 2017).

The demand for external information on how value is created is increasing (Nielsen, 2014). Several reporting frameworks and guidelines stressed the need for reporting BM information (International Integrated Reporting Council (IIRC), 2010; Global Reporting Initiative (GRI), 2013). However, AISs cannot always capture the multifaceted organisational life (Granlund, 2011). External and internal pressures might lead companies to change and enrich their AISs to disseminate information (Muhammad *et al*., 2019). Therefore, relying on the initiatives requiring BM information, companies might have likely reshaped their AIS for communicating BM information externally.

This paper investigates whether companies have enriched their AISs due to the institutional pressures to produce and report BM information and, in turn, can combine that information into their PMSs. We test the isomorphic forces that contribute most to institutionalising BM information in AISs. By this, we reveal the determinants that can contribute to AISs enrichment.

2.2 Research questions

We tested the institutionalisation of BM information by embracing the

institutional theory. Institutional theory postulates that powerful forces led different organisations in the same business line to become more similar (DiMaggio and Powell, 1983). Isomorphism is a process explaining the homogenisation of organisational forms and practices.

BM information is presented and disseminated via different media (e.g., Annual reports, Integrated Reports, Strategic reports) (Giunta *et al.*, 2013; Bini *et al.*, 2016; Melloni *et al.*, 2016; Mechelli *et al.*, 2017; Tweedie *et al.*, 2018). However, each corporate medium has its own rules, purposes, and characteristics. The financial report is a traditional medium focusing on the users of accounting information. Instead, in a broader sense, non-financial reporting encompasses many non-financial reports targeted to multiple stakeholders with social and environmental interests (Lodhia, 2018; Capurro *et al.*, 2020). Meanwhile, corporate websites allow for greater flexibility and visibility in disseminating information to a global audience instantaneously (Isenmann *et al.*, 2007; Everaert *et al.*, 2019).

Stakeholders use external reporting to monitor the value created by the firm from the financial and sustainability perspective (Greco and D'Onza, 2020). Previous research demonstrated that the firms' choice of "where" to report corporate information results from external pressures and the firms' attempt to influence external stakeholders and the capital market (see, e.g., de Villiers and van Staden, 2011). Therefore, we analyse the BM information disclosed in the three corporate media to examine whether companies have enriched their AISs through BM information's institutionalisation. Hence, our first research question is:

RQ1: Have companies enriched their AISs due to the institutionalisation of BM information?

Since we are interested in understanding the factors affecting the institutionalisation of BM information in AISs, our second research question is:

RQ2: What are the determinants of BM information institutionalisation?

We develop the hypotheses to answer this second research question in the following subsection.

2.3 Hypotheses development

The logic of change in MCS is diffused within the companies through

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three isomorphic institutional changes - i.e., coercive, mimetic, and normative forces (Berry *et al*., 2009). These three isomorphic forces "can and, generally do, operate simultaneously" (Tuttle and Dillard, 2007, p. 392).

Coercive isomorphism results from formal and informal pressures exerted on companies by other organisations on which they depend. Coercive pressures, which drive companies to homogenise their practices, can be measured by several variables (Judge *et al*., 2010; de Villiers and Alexander, 2014). In this study, we consider accounting standards, regulation, and stock exchange rules as coercive factors forcing companies to report BM information.

Accounting standards can incentivise managers to represent how organisations create value (Lassini *et al*., 2016). Early references to BM are included in some international accounting standards, such as IAS 2, IAS 40 and IFRS 9, so representing a base for measurement standards and narrative reporting (EFRAG *et al*., 2013). Furthermore, regulations (i.e., UK Corporate Governance Code; EU Directive 2014/95) can foster the production of BM information (Dumitru *et al*., 2017; Di Tullio *et al*., 2019) by affecting the enrichment of AISs (Dumitru *et al*., 2017; Di Tullio *et al*., 2019). Last, empirical studies support a significant relationship between disclosure and firms' listing status (see, e.g., Singhvi and Desai, 1971; Hossain *et al.*, 1994). They demonstrate that companies react to stock exchange regulatory requirements by reporting greater amounts of mandatory and voluntary information (Ahmed and Courtis, 1999). Accordingly, we expect that increasing exposure to regulated financial markets results in greater pressure to produce value creation information. This prediction aligns with the literature claiming BM's role to meet the needs of investors and analyst (Nielsen, 2014).

These argumentations on coercive isomorphism bring us to the following research hypotheses:

H1: Accounting standards affect the enrichment and institutionalisation of BM information in firms' AISs
H2: EU regulation affects the enrichment and institutionalisation of BM information in firms' AISs
H3: Stock exchange rules affect the enrichment and institutionalisation of BM information in firms' AISs

Mimetic isomorphism occurs when organisations model themselves based on "what others are doing" (Carruthers, 1995, p. 317). Companies tend to imitate those organisations occupying a similar position within the same industry as they are more likely to have similar BMs and resources' usage compared to companies in other industries (the Sustainability Accounting

Standards Board (SASB), 2017). Furthermore, shareholders can require companies to produce and report BM information. Empirical studies demonstrate a significative influence of companies' ownership on corporate reporting practices (e.g., Cormier *et al.*, 2005). Considering the number of shareholders as a proxy for ownership structure, we expect that the greater the number of shareholders, the greater the pressure to producing BM information.

Therefore, the following research hypotheses refer to mimetic isomorphism forces:

H4: Industrial sectors affect the enrichment and institutionalisation of BM information in firms' AISs

H5: Ownership affects the enrichment and institutionalisation of BM information in firms' AISs

Normative isomorphism takes place when standards, norms and values established by professions shape homogeneous practices. The involvement in professional networks influences how professional personnel undertake their activities within an organisation (Carruthers, 1995). Accordingly, normative pressures further explain how companies shape their practices through peer development and communication and common socialisation experiences (Tuttle and Dillard, 2007). We test two professional factors related to the normative isomorphism: voluntary adoption of professional reporting frameworks; and the auditors.

Many frameworks and guidelines for non-financial information were developed by professional organisations, such as GRI, IIRC, and SASB, among others. Their reporting frameworks often embrace and acknowledge the BM as one of the main elements to be reported (IIRC, 2010; GRI, 2013; SASB, 2017). Empirical evidence indicates that using the Integrated Reporting Framework positively influences the reporting practices of BM information (Dumitru *et al.*, 2017). Therefore, we expect that BM information is produced mostly by the companies adopting those reporting frameworks.

Auditors can also influence institutionalisation as they embody the prevalent reporting norms. They professionalise corporate reporting practices in the process of normative isomorphism (de Villiers *et al.*, 2014). Wallace and Naser (1995) suggest that big independent audit firms are more prone to demand more details in their clients' annual reports. Empirical studies demonstrate a positive relationship between audit firm size and disclosure levels (Singhvi and Desai, 1971; Hossain *et al.*, 1994). Furthermore, the role of audit firms in providing assurance services also influences the content of

non-financial reports (O'Dwyer *et al.*, 2011). Hence, we expect that corporate reports audited by the biggest professional auditors (i.e., the so-called "Big4") provide more BM information, especially when rules and accounting standards require it. Thereby, we develop the following research hypotheses representing the normative isomorphism:

H6: Professional frameworks and guidelines affect the enrichment and institutionalisation of BM information in firms' AISs

H7: Auditors affect the enrichment and institutionalisation of BM information in firms' AISs

In this study, we also analyse the content of corporate websites, which represent a non-binding communication medium for firms. We expect that firms providing more BM information in their corporate reports are encouraged to transfer that information on their corporate websites. Companies produce certain voluntary information to improve their digital reputation and visibility, by taking advantage of the flexibility allowed by the web-based solutions. Accordingly, that information may be incorporated into corporate reports to comply with new requirements or improve their corporate image through a more traditional medium. This leads us to the last research hypothesis on the mutual interaction between media:

H8: BM information in corporate reports influence BM information in firms' corporate websites and vice versa

The analysis of the isomorphic factors that shape the institutionalisation of BM information allows us to understand if current companies' AISs are able to support the reinvention of BM-based PMSs into organisations.

3. Research method

From the first quartile of most capitalised global publicly-listed companies in the 2016 OSIRIS database (9.680), we selected a sample of 96 firms spread across industrial sectors and geographic areas. We used the Neyman optimal allocation formula[1] to choose the best sample size. As ten companies did not have both financial and non-financial reports and an available corporate web page, the final sample was reduced to 86 firms (see Table 1).

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[1] Corbetta, P. (2003), La ricerca sociale: metodologia e tecniche. IV. *L'analisi dei dati*, Bologna, il Mulino.

Tab. 1 – Sample composition

			N
By industrial sector	*N*	*By geographic area*	*N*
Consumer discretionary	19	Africa	2
Consumer staples	6	Asia	32
Energy	3	Central and South America	3
Financials	7	Europe	23
Health care	5	North America	25
Industrial	23	Oceania	1
Information technology	10		
Materials	7		
Real estates	3		
Utilities	3		
TOT	86		86

We performed a computer-assisted content analysis of their corporate reports and websites to analyse their BM information and answer the research questions. Content analysis still plays an important role in exploring and understanding emerging reporting practices (Dumay and Cai, 2014). It is based on textual coding, defined as a process of transcribing, recording, categorising or interpreting units of analysis in terms of a data language so that they can be compared and analysed (Krippendorff, 2013).

We employed the Business Model Canvas (BMC) (Osterwalder and Pigneur, 2010) as our coding schema. The BMC is a visual tool designed to represent the BM elements and their potential interconnections and impacts on value creation. It "marked a turning point for the field of business models because it convened academic insights with practitioner needs" (Nielsen *et al.,* 2019, p. XII). Furthermore, the BMC provides us with a more detailed list of the elements that make up the BM, allowing for better comparison across media. The BMC's components, named "building blocks", represent the items of our conceptual framework and coding schema: key partners; key activities; key resources; value propositions; customer relationships; channels; customer segments; cost structure; revenue streams.

BMC has been widely applied and tested worldwide (Eppler *et al*., 2011; Wrigley *et al*., 2016) and is used in large and well-known companies (Antoldi *et al*., 2016). Its widespread adoption is likely due to its easy-to-use template (Lund and Nielsen, 2014). BMC has become a de-facto reference standard and the most used frameworks representing BM (Joyce and Paquin, 2016). Thus, it provides us with a reasonable degree of external validity.

We analysed the entire corporate reports and websites, for the amount of 258 sources, to code and count the sentences explaining each BMC's building block. For each item, we calculate how many times each component was coded in each medium. Such a measurement approach considers the "volume" of information – in terms of sentences or words count – to measure the importance that managers place on the information (de Villiers and van Staden, 2011). As a sentence may contain information about more than one BMC's component, the categories were not mutually exclusive in our coding process. Furthermore, each table (or graph) providing information about a component was counted as one sentence. The same rules were applied to analyse the corporate websites – accessed in May-June, 2018. Yet, to analyse the web pages, we excluded the following elements of any pages (Castelo Branco and Lima Rodrigues, 2006): online copies of corporate reports; links to external sources (e.g., press releases); and links to other publications (e.g., newsletters, podcasts).

We performed a pilot coding on 20 companies' websites and reports. Then, we shared and discussed the results with all the authors to ensure internal validity (i.e., the correspondence between conceptual definitions and coding measures) and semantic validity (i.e., the extent to which the content in the same category has the same meaning) (Beattie *et al*., 2004). Accordingly, two junior researchers manually coded the remaining sources.

The content analysis resulted in a dataset with the frequency for each component occurring in the three medium. To answer the research questions, we first analysed the BM information distribution in terms of mean values and dispersions by BMC's building blocks across the three media. This allowed us to assess the extent of enrichment of companies' AISs about BM information and the common practices among companies. Then, we performed a multiple regression analysis to examine the determinants of BM information institutionalisation.

4. Results

4.1 Enrichment of companies' AISs

Table 2 shows the results of our analysis of the BM information across the three media analysed. Overall, the financial report is the most informative medium compared to the websites and non-financial reports. Yet, corporate websites provide more information than non-financial reports. Prior research demonstrates that the website is a flexible and dynamic medium for reporting

non-financial information (see, e.g., Frost *et al.*, 2005). Thereby, the corporate website is a dominant medium that fostered companies to produce strategic information about their markets, customers, and resources. As a result, while the "black box" of BM seems to be concealed in non-financial reporting (Dumay *et al.*, 2019), it starts to be revealed in other corporate communication media, like the websites, and this contributed to enriching companies' AISs.

Tab. 2 – Extent of BM information across media

	Financial reports	*Non-financial reports*	*Corporate websites*
Mean	42.535	17.616	26.314
Maximum	122.000	137.000	169.000
Minimum	3.000	0.000	3.000
Std. deviation	26.652	22.274	24.759

The box plots in the figures below provide us with the insights to answer our first research question about the enrichment and institutionalisation of Business model information (BMI)[2]. Figure 1a shows that there is little variance in most of the BM building blocks. There is a moderate spread of the distribution for the most established and traditional information, such as *Value proposition* and *Revenue streams*. This means that these elements are less institutionalised than the others. Yet, although there is a small quantity of information for some blocks (e.g., Channels, Customer relationship), companies' practices are very close to the average values. The top whiskers are substantially longer than the bottom ones, thus indicating that just a few companies provide more information on some topics. Therefore, companies enriched their AISs with more, even though few, BM information, without minimal divergences in companies' practices.
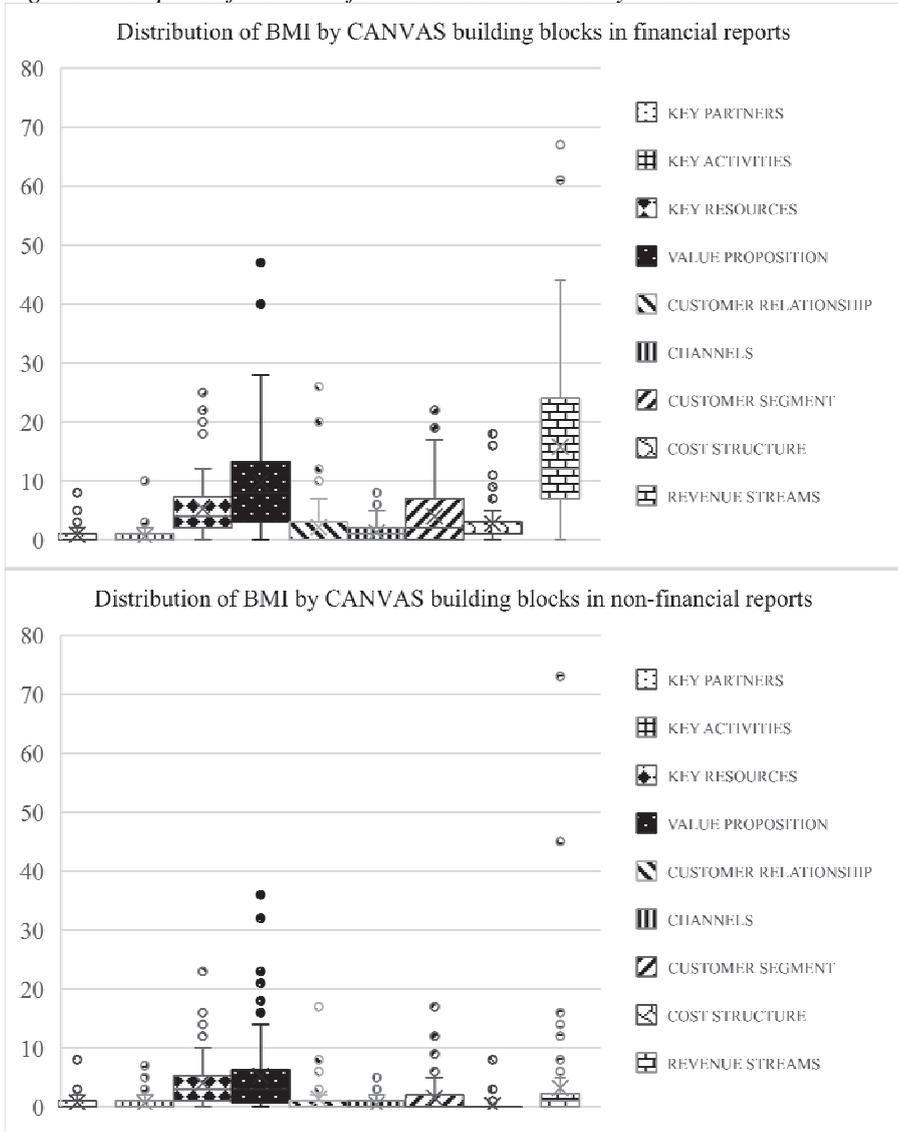
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[2] Each rectangular box in the figures represents the middle 50% of the distribution of BM information, between the first and third quartiles, while the small circles are outliers. The standard deviation represented in the boxes provides us with information about the divergence in companies' practices of producing their BM information. Thus, the larger the box (i.e., the distribution), the greater is the divergence in companies' practices.
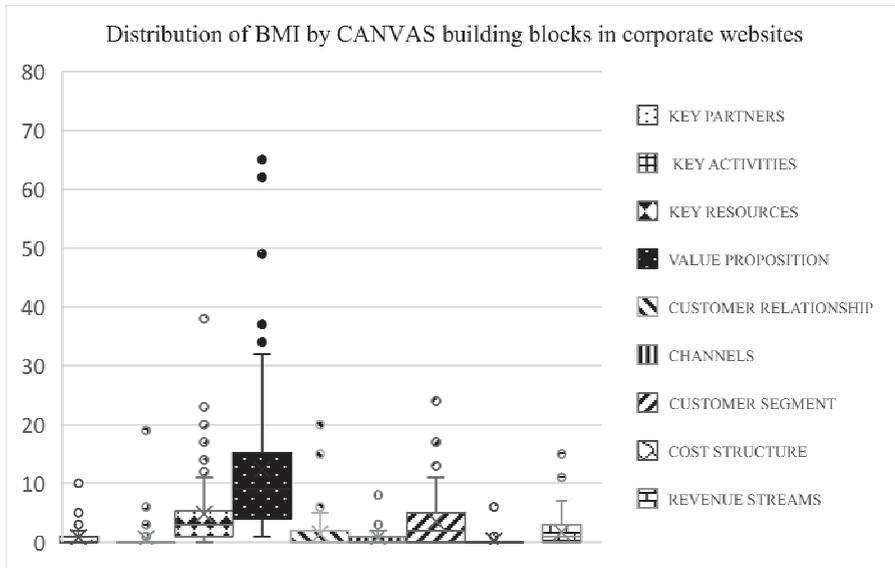
Fig.1a – Box plot of the overall BM information distribution

Distribution of total BMI by CANVAS building blocks
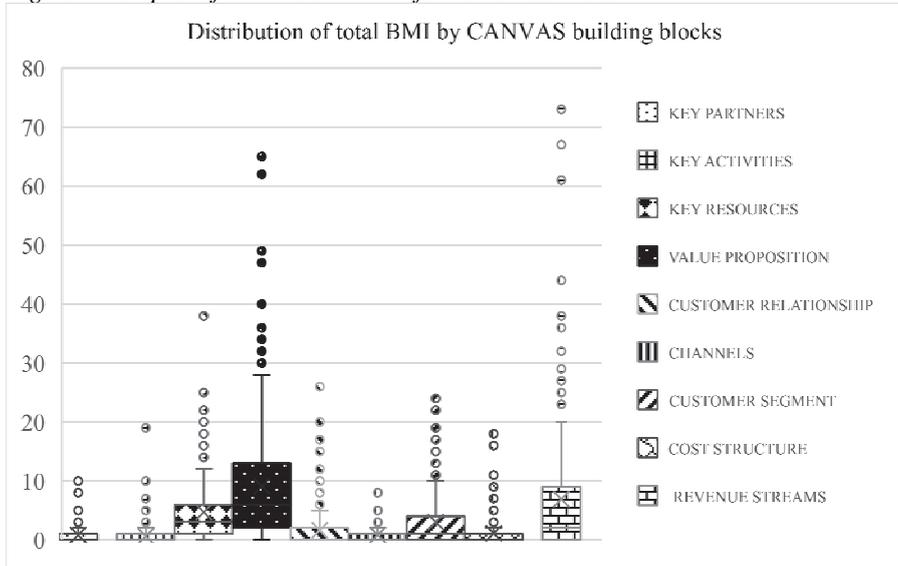
We find similar distributions when we consider the BMI by media (see Fig. 1b). *Value proposition* and *Revenue streams* are still the elements with the highest dispersion (except for websites), followed to a lesser extent by *Key resources*, *Customer segment* and *Customer relationship*. However, some outliers on the top tiers of the distributions, indicating more information by a few companies, influence most such dispersion. All the remaining topics present similar overlapping areas, so confirming a certain degree of homogenisation in the companies' practices of enriching their AISs. Therefore, our evidence suggests that firms have enriched their AISs through institutionalised BM information even though with some minor differences. The following subsection presents our results on the determinants and isomorphic pressures explaining this institutionalisation.

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Fig. 1b – Box plots of the BM information distributions by media

Distribution of BMI by CANVAS building blocks in financial reports

Distribution of BMI by CANVAS building blocks in non-financial reports

Distribution of BMI by CANVAS building blocks in corporate websites

4.2 Determinants of the BM information institutionalisation

We use Ordinary Least Squares (OLS) regression analysis to answer the second research question and empirically test our research hypotheses. Accordingly, the general regression model for testing the institutional isomorphisms is defined as follows:

$$BMI = α + β1\ AccountingStandards + β2EU + β3MarketCap + β4Industry + β5Ownership + β6ProfFrameworks + β7Big4 + ε$$

We also added the extent of BMI retrieved in financial reports (BMIfr), non-financial reports (BMInfr) and corporate websites (BMIws) to test the potential interaction among these media, as established in our hypothesis n. 8. The aim is to assess if their mutual interaction contributes to enriching the AISs. Table 3 presents the significant results of the regressions run for each medium.

Tab. 3 – Regression estimations across media[3]

		BMI_{fr}	BMI_{fr}	BMI_{fr}	BMI_{nfr}	BMI_{ws}
	C	2.259218	1.220509	2.014619	1.963664	1.997126
Coercive	IFRS	0.458181***	0.329848*			
	LocalGAAP			-0.526303***		
	EU				0.546406*	0.406598**
	LOG(MCAP)		0.101558***	0.070644**		
Mimetic	ENERGY					0.882965**
	SHAREH	0.006656***				
Normative	IR				1.617305***	
	Big4					
Media interaction	BMI_{fr}					0.240657**
	BMI_{nfr}					
	BMI_{ws}	0.234211**	0.205750*	0.202560**		
	R^2	0.243746	0.242581	0.288984	0.209638	0.185634
	Adj R^2	0.216078	0.214871	0.262971	0.189879	0.155840
	Prob(F)	0.000040	0.000042	0.000003	0.000082	0.000728

The first three hypotheses represent the association between coercive pressures and BM information institutionalisation. The regression models confirm these hypotheses for each medium. Yet, the IFRS and LOG(MCAP) variables positively affect the information in the financial reports, confirming the significant pressure from accounting standards and stock exchange rules in fostering BM information production. We also included the Local-GAAP variable to perform an additional test finding a negative correlation with the dependent variable. USGAAP influence was not significant. On the other hand, belonging to the European Union (EU variable) represents the coercive force for non-financial reports and corporate websites. Therefore, hypotheses 1, 2 and 3 are accepted in all the communication media.

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[3] * coefficient statistically significant at the 10% level; ** coefficient statistically significant at the 5% level; *** coefficient statistically significant at the 1% level.

Diagnostic tests were performed to check the absence of normality, heteroskedasticity and multicollinearity problems in each model.

Variables definition:

Coercive isomorphism: IFRS (1 if the company adopts the IFRS; 0 if not); USGAAP (1 if the company adopts the US-GAAP; 0 if not) LocalGAAP (1 if the company adopts neither the IFRS either the US-GAAP; 0 if not); EU (1 if the company is subject to EU regulation; 0 if not)

Mimetic isomorphism: LOG(MCAP) = Market capitalisation in logarithmic form; ENERGY (1 if the company belong to the energy sector;0 if not)

Normative isomorphism: SHAREH = number of shareholders; IR (1 if the company adopts the IIRC Framework; 0 if not); GRI (1 if the company adopts the GRI Framework; 0 if not); SASB (1 if the company adopts the SASB Framework; 0 if not); Big4 (1 if the report is audited by one of the "Big Four"; 0 if not).

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The second set of hypotheses predict the influence of the mimetic forces on the institutionalisation of BM information. This influence is confirmed for financial reports and corporate websites. Specifically, the former is affected by SHAREH, while the latter is affected by the ENERGY industrial sector. Hence, we can accept hypotheses 4 and 5 about the mimetic pressures, confirming a positive influence on BM information in financial reports and corporate websites.

Hypotheses 6 and 7 concern the impact of professional frameworks and type of auditors. Only the IR (Integrated reporting framework) variable supports hypothesis 6 but only for non-financial reports. We found no significant influence from the adoption of GRI framework, SASB framework and Big4 audit service. Accordingly, the tests of normative pressures reveal that hypothesis 6 is partially confirmed while hypothesis 7 is not empirically supported.

The last hypothesis aims to find further explanations beyond the institutional pressures. Specifically, it tests the mutual interaction across media in enriching the AISs. The results are mixed, as the variable BMI_{ws} is significantly and positively associated with the quantity of BM information in the financial reports, while the variable BMI_{fr} is significantly and positively associated with corporate websites. As a result, we can partially confirm hypothesis 8.

5. Discussion and conclusion

This study is motivated by the call for abandoning outdated PMFs and renewing internal management disclosure to improve decision making and create PMSs in capturing contemporary conceptions of value creation (Nielsen *et al*., 2017). Prior research revealed the cognitive and behavioural bias caused by the limitations of PMFs to capture the determinants of a firm's value creation and their linkage (Reichert and Woods, 2012) and also demonstrates that performance measurement affects managers' mental models (Hall, 2011).

PMS-based decision-making involves profound psychological implications (Tayler, 2010). In turn, human factors, like leadership style, can influence MC design and its outcome (Abernethy *et al*., 2010). The causal chains in strategy maps, like BSC, are frequently interpreted and used by managers to confirm their preferences in the decision-making process (Tayler, 2010). Even though the incompleteness of their visual elements (like the BSC strategy map) can stimulate engagement, interrogation, and innovation (Busco

and Quattrone, 2015), the visual presentation of performance measures and their linkages also influence managers' judgement (Cheng and Humphreys, 2012).

The BM concept can pave a way to reframe PMSs and how the companies' value chains are visually framed and measured to capture value creation (Nielsen *et al.*, 2017). In this paper, we investigate how companies have enriched their AISs by producing and reporting BM information to pursue the reframing of their PMSs. Thereby, we provide evidence on the institutionalisation of BM information and its determinants. By considering the content of corporate reports and websites as a proxy for firms' AISs, our study provides us with an overall picture of the companies' AISs enrichment with BM information and their readiness to support the design of BM-based PMSs.

In answering our first research question ("*Have companies enriched their AISs due to the institutionalisation of BM information?*"), we find evidence supporting a positive answer. By producing BM information for external reporting and disclosure, companies enriched their AISs. The minimal divergence (variance) among the companies' practices suggests their homogenisation and an early institutionalisation of BM information in their AISs. Even though there are some BM blocks with little information (e.g., Channels and Customer relations), their statistical distribution is very close to the average values. The differences we find in the corporate media suggest that the multitude of media (financial reports, non-financial reports, and websites) fostered companies to enrich their AISs with BM information. Websites represent a flexible and dynamic media for reporting information voluntarily, without any constraints coming from law, accounting standards, and reporting frameworks.

Regarding the second research question ("*What are the determinants of the institutionalisation of BM information?*"), our results show that coercive, mimetic, and normative forces influence the BM information's institutionalisation in AISs differently. The coercive forces from regulations, accounting standards, and stock exchange rules contributed most to institutionalising BM information. This result is in line with the previous research recognising the great impact of these forces on reporting BM information (Nielsen, 2014; Lassini *et al.*, 2016; Di Tullio *et al.*, 2019). Mimetic behaviour also influences it because of the ownership structure, as companies tend to reproduce the practices of their competitors in the same industry. Meanwhile, we find a minor contribution to institutionalisation from professional initiatives and pressures. The adoption of the Integrated Reporting Framework only influences the institutionalisation of BM information but that was to be expected given that BM is a core concept of integrated reporting.

Our study demonstrates that firms have adjusted their AISs to communicate BM information. Thus, we conclude that this empowerment of AISs may make companies able to reshape their traditional PMSs though BM-based frameworks. However, we question whether and how this can happen in practice. As MC is seen as a package of systems, PMS and AIS only represent a piece of the cybernetic systems in this package (Malmi and Brown, 2008; Bedford and Malmi, 2015). Thus, the capability of BM information to redesign companies' PMSs and MC depends on how much companies will be able and prone to couple these elements with the other systems of the MC package (Malmi and Brown, 2008).

Our study has practical motivation and implications. However, it also contributes to advancing the theory on the determinants of information institutionalisation in corporate information systems (Berry *et al.*, 2009). Furthermore, our findings contend that AISs provide different types of information according to diverse stakeholders' interests. By demonstrating how the institutionalising forces have contributed to reshaping companies' AISs to produce BM information, we advocate that companies may have the basis for reinventing their PMSs around BM. As such, BM information can help define new cognitive and accounting frameworks to redesign PMSs. Considering the cognitive and behavioural bias caused by the existing PMSs, emerging synoptic tools need to consider the cognitive and psychological aspects to make the value chain and value creation more evident.

This study has some limitations but also opens up some future research opportunities. Even though our sample spreads across different geographic areas, we do not consider the cultural variables that may explain the commonalities and divergences in companies' practices. Also, we selected listed companies with higher market capitalisation, excluding the Small and Medium-sized Enterprises (SMEs). SMEs have different characteristics and peculiarities and represent another particular research area in MCSs (Castellano, 2011; Leotta *et al.*, 2020).

This research considers the external reports as a proxy for firms' AISs and analyses them by employing regression analysis. Other research methods, such as surveys, can provide further insights into organisations' experiences with PMSs and the degree of enrichment of their AISs. Furthermore, we analysed information provided in corporate reports and websites over a single year. A longitudinal analysis may help reveal a trend in reshaping traditional PMSs through BM-based frameworks over time. Last, another area of interest for future research concerns the way new synoptic tools can make the value chain and value creation more evident for decision-making.

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