Hardwiring sustainability into business practice through the use of management controls

A case study of Solvay Group

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Abstract

This is an exploration into how large companies, well placed in the sustainability field, embed sustainability in their corporate practice through the use of management controls. This was investigated empirically based on a case study of Solvay S.A. The framework by Crutzen et al. (2017), with its pattern approach to sustainability management controls, was employed in this study as a theoretical lens and as a tool for the evaluation of data output. Evidence indicates systemic and systematic deployment of formal management controls to direct the sustainability performance within the Group. Such technocratic institutionalization of sustainability through formal controls is topped by the application of informal cultural controls, concrete signals of which were identified in relation to sustainability. The paper concludes that the researched Group deploys a full package of formal and informal management control mechanisms for sustainability.

Keywords: Management controls, sustainable management controls, management control systems, corporate sustainability
Acknowledgements

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## Abbreviations

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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>BEL 20</td>
<td>Benchmark Stock Market Index of Euronext Brussels, 20 represents twenty listing companies</td>
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<td>BSC</td>
<td>Balanced Scorecard</td>
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<td>CAC 40</td>
<td>Cotation Assistée en Continu (in French Stock Market Index), 40 represents the most significant value among one hundred highest market caps on the Euronext Paris</td>
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<tr>
<td>CAPEX</td>
<td>Capital expenditure or capital expense</td>
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<td>CDP</td>
<td>Carbon Disclosure Project</td>
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<td>CEO</td>
<td>Chief Executive Officer</td>
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<tr>
<td>CFROI</td>
<td>Cash Flow of Return on Investment</td>
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<td>COP21</td>
<td>(COP) is Conference of the Parties and this is the 21st such conference</td>
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<td>DJSI</td>
<td>Dow Jones Sustainability Index</td>
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<tr>
<td>Underlining</td>
<td>Underling Earnings Before Interest and Taxes, Depreciation and Amortization</td>
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<td>EBITDA</td>
<td>Financial Reporting Guide</td>
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<td>FRG</td>
<td>The Financial Times Stock Exchange 100 Index</td>
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<td>FTSE</td>
<td>Human Resources</td>
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<td>IFRS</td>
<td>International Financial Reporting Standards</td>
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<td>ISO</td>
<td>International Organization for Standardization</td>
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<td>KPIs</td>
<td>Key Performance Indicators</td>
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<td>LCA</td>
<td>Life cycle assessment</td>
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<td>LTI</td>
<td>Long-term Incentives</td>
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<td>M&amp;A</td>
<td>Mergers and Acquisitions</td>
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<td>MCs</td>
<td>Management Controls</td>
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<td>MTAR</td>
<td>Medical Treatment Accident Rate</td>
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<td>NGOs</td>
<td>Non-governmental organization</td>
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<tr>
<td>NYSE</td>
<td>New York Stock Exchange</td>
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<td>OHSAS</td>
<td>Occupational Health and Safety Assessment Series</td>
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<tr>
<td>PMS</td>
<td>Performance Measurement System</td>
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<td>R&amp;I</td>
<td>Risk &amp; Innovation</td>
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<tr>
<td>REBITDA</td>
<td>Results Before Earnings Before Interest, Taxes, Depreciation and Amortization</td>
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<tr>
<td>S.A.</td>
<td>Société Anonyme</td>
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<td>SCs</td>
<td>Sustainability Controls</td>
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<td>SMCs</td>
<td>Sustainable Management Controls</td>
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<td>SPM</td>
<td>Sustainable Portfolio Management</td>
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<td>STI</td>
<td>Short-term Incentives</td>
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<td>TBL</td>
<td>Triple Bottom Line</td>
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<td>TFS</td>
<td>Together For Sustainability</td>
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1 INTRODUCTION

This part is concerned with introducing the topic of management controls and sustainability, with delineating the research gap in this area, and with explaining the scope of the current research.

1.1 Problem specification

A survey of 300 companies by Bain & Company (2016) reveals that 2 percent of sustainability programs reach success in achieving their goals. Of the remaining 98 percent, 81 percent achieve diluted results while 16 percent fail. Why such a low rate of success? What separates achievers from the poor performers on this front?

Some of the key factors determining success or failure are found inside the companies. Results are achieved by companies that, in addition to focusing on external pressure and reporting, hardwire sustainability into their internal processes, accountability systems and incentives (Bain & Company, 2016). Public sustainability commitments and CEOs’ enthusiasm are important but they are delivered only through internal change (Bain & Company, 2016). A recent survey by McKinsey & Company (2017) covering 2422 corporate respondents comes to support such conclusions. Its findings indicate that limited integration of sustainability in the fabric of the organizations and their systems – notably those relating to finance, information technology and human resources (HR) – impede companies to close the gap between their sustainability commitments/reasons, on the one hand, and actual actions and performance, on the other.

Research points that, to embed sustainability principles in practice, companies need to make full use of control systems that regularly monitor whether and how the business performs against its sustainability targets (Bonacchi and Rinaldi, 2007; Gond et al. 2012). Adequate planning and control systems are required as they support translation of specific goals (corporate sustainability, in this case) into business activities (Pojasek, 2012). More precisely, these controls are meant to support the quantification of sustainability, the analysis of factors that contribute to it, the management of such agenda, and the diffusion of sustainability principles within a company (Bonacchi and Rinaldi, 2007). As underlined by Ditillo and Lisi (2014), Management Controls (MCs) are critical in this regard as, in organizations, “the objectives that are pursued and the actions that are implemented are those for which managers are responsible and upon which they are evaluated and rewarded” (p. 27) – a task that falls under MCs. Unless sustainability is meaningfully integrated in the MCs, it is at a constant risk of remaining a rhetorical commitment and/or a
marginal concern largely non-quantified and un-captured in terms of costs and value it generates for companies (McKinsey & Company, 2017).

Building on the aforementioned premises, this study aims to explore how large companies, well placed in the sustainability field, hardwire sustainability into their practice with the help of MCs. Such work will be conducted using the framework by Crutzen et al. (2017) with its scenario/pattern approach to Sustainable Management Controls (SMCs). In this generally under-researched area, Crutzen et al. (2017) put forward the most recent and comprehensive MCs and SMCs framework. These are the factors that inform the use of this particular framework as the key analytical tool in the current thesis. Given that at the basis of Crutzen’s work lies Malmi and Brown (2008) “package” approach to MCs, this research also follows it, structuring its investigation around the five packages of controls in (i) planning, (ii) cybernetic, (iii) reward and compensation, (iv) administrative, and (v) cultural areas.

1.2 Research gap and research question

Although management control for sustainability is increasingly attracting academic attention, empirical research is limited when it comes to the specific issue of whether and how large companies employ management control to achieve their sustainability objectives in practice (Crutzen et al. 2017). This study falls under this under-researched area, aiming to investigate the specific question of:

How companies pursue their sustainability objectives by integrating them into practice through the use of MCs?

The decision to focus on large companies is informed by the fact that within such organizations all MCs packages are expected to be found and developed, making the analysis as to if and how sustainability is integrated within these packages more meaningful (Riccaboni and Leone, 2010). The choice to focus on companies that are well placed in the area of sustainability, as assessed by international rankings (such as DJSI), stems from the expectation that sustainability is present in their MCs and that research into their practices would yield richer data and knowledge on the otherwise under-researched subject (Crutzen et al. 2017) of this study. Moreover, their public commitments to sustainability, as well as efforts to gain/strengthen reputation and external image in this area make them potentially valuable case studies of how these are reflected in internal practices.
1.3 Overview of methodology

This is an exploratory study that relies on a single case study design with embedded units of analysis, where the MCs packages – i.e., those of (i) planning, (ii) cybernetic, (iii) reward and compensation, (iv) administrative, and (v) cultural (Malmi and Brown, 2008) – are treated as distinct units. Data for the case study is collected through primary research involving documentary and archival analysis, semi-structured in-depth interview and written communication with the company. Secondary data is equally used in the research.

The researched company is Solvay S.A. (hereafter interchangeably referred to as Solvay, the Group, the company).

1.4 Audience

The primary audience of this study is business managers in search for data in this area. The findings of this research are meant to assist businesses to examine – in particular using the pattern/scenario approach – and to manage the integration of sustainability into business functions and practice with the help of MCs. However, it should be noted that the scale of this thesis is limited to one Group, its findings coming to support and/or deepen existing research in the field of MCs rather than to alter the available body of literature.

The literature analysis of existing systems and frameworks and their respective criteria could equally serve researchers and/or consulting firms who searching for ways to connect theoretical knowledge to practice for more effective results in the field of sustainability integration. The framework analysis could also inspire new research in the direction of intra-organizational pursuit of sustainability.

1.5 Structure

This rest of this paper is structured around four key parts. Following the current part, Chapter two presents an analysis of existing literature in the field of MCs and sustainability, as well as introduces the theoretical and analytical frameworks of Malmi and Brown (2008) and Crutzen (2017) employed in this research. Chapter three focuses on the methodological choices behind this research. Chapter four details the case study with its key empirical results. In Chapter five the findings are analyzed against the aforementioned theoretical frameworks. The final Chapter six presents the conclusions and recommendations generated by this research.
2 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

This Chapter discusses previous research into both MCs and SMCs, the limitations of the latter, and the two theoretical frameworks by Malmi and Brown (2008) and by Crutzen et al. (2017) that guide the current study.

2.1 Literature review

2.1.1 Management controls

Research has been focusing on MCs for more than 30 years (Otley, 1980). The field of MCs is, however, an evolving one. Having started as a tool of numerical evaluation of the financial and the material to support decision-making, the MCs now include a much broader toolbox (Chenhall, 2003). This has fuelled the interest of the academia to redefine the MCs and conceptualize the field (see for e.g., Lowe, 1971; Otley, 1999; Chenhall, 2003; Merchant and Van der Stede, 2007; Malmi and Brown, 2008).

At a general level, the MCs are seen as “means of gathering and using information to aid and coordinate the process of making planning and control decisions throughout the organisation and to guide employee behaviour” (Bhimani, et al. 2008, p. 615). Traditionally, these were seen through the prism of formal controls (Anthony, 1965; Otley, 1999; Malmi and Brown, 2008; Langfield-Smith, 1997) deployed to put in place and work toward the implementation in practice of a given strategy (Chenhall, 2003). Such a “formal” take on the MCs has been lately revised and supplemented with informal controls that shape the organizational culture (Chenhall, 2003; Malmi and Brown, 2008; Hosoda and Suzuki, 2015). The understanding now is, therefore, that MCs include all these mechanisms which managers use to ensure both formally and informally that the employees’ behaviour is aligned with company’s objectives and strategies (Herath, 2007; Otley, 1999; Chenhall, 2003; Malmi and Brown, 2008).

There is a difference between formal and informal controls (Hosoda and Suzuki, 2015; Otley, 1980; Langfield-Smith, 1997). Formal controls include operating procedures, approaches and practices used by managers to communicate the company’s goals with their employees (Anthony and Govindarajan, 2007; Langfield-Smith, 2003; Merchant and Van der Stede, 2007; Simons, 1994), as well as to set the limits and the rules that need to be respected (Simons, 1994). Such formal controls can be financial and non-financial in nature (Chenhall, 2003; Goold and Quinn 1990).
Informal controls, on the other hand, do not control behaviours through unequivocal measures (Crutzen et al. 2017). They cover “a set of beliefs that define basic values, purpose and direction” (Simons, 1994, p. 172). Employees adhere these values and traditions through repetitive “signals” relayed by managers (Crutzen et al. 2017; Hosoda and Suzuki, 2015). These signals correspond to informal structures and symbols (Hosoda and Suzuki, 2015). Informal controls, therefore, can be characterized as a framework that fosters an organizational climate that is aligned with the values of the company and the shared beliefs of managers and employees (Hosoda and Suzuki, 2015).

2.1.2 Sustainability controls and limitations

Driven by a growing interest in corporate sustainability, a body of literature on MCs for sustainability has emerged (Ditillo and Lisi, 2014; de Villiers, Rouse and Kerr, 2016; Guenther, Endrikat and Guenther, 2016; Durden, 2008). The key lines of enquiry is the “intra-organizational impact of sustainability” (Ditillo and Lisi, 2014) and, in particular, the extent at which MCs can be used to direct and support corporate performance in said area (Gond et al. 2012; Bonacchi & Rinaldi, 2007).

The use of MCs for sustainability is seen, to an extent, as a procedure to counterbalance externally driven sustainability reportings, and to counteract the risk of greenwashing, as it is tied to internal control mechanisms and management accounting (Ditillo and Lisi, 2014). The set of mechanisms and frameworks used in the aforementioned task is defined as SCs. More specifically, Wijethilake (2017) underlines that SCs are meant to “support strategic decision making in responding to sustainability challenges” (p. 572), to connect such objectives, and to achieve better monitoring of the organizational performance in the said area (Wijethilake, 2017). Furthermore, SCs can be used as a “communication system” in terms of dispersing sustainability's values by setting the minimum risk in strategic plans that are associated with sustainability strategies (Gond et al. 2012).

Despite the growing interest, there is a lack of empirical research around the SCs (Caputo et al. 2017; Crutzen et al. 2017; Gond et al. 2012; Durden, 2008). This shortage is connected to the fact that MCs are aligned with the more classical structures of a company (Merchant and Van der Stede, 2007) and with the traditional economic and organizational behaviour and change. However, non-classical forms of control over business operations are gathering a growing interest. For instance, the increasing use Results Controls, which describes the employee's behaviour, are applied in many hierarchical levels in the companies (Merchant and Van der Stede, 2007). These controls are as important as the “classical” forms of MCs. These non-classical forms are contributing to the development of the control systems that a company could use to align their societal and environmental
responsibilities (Ditillo and Lisi, 2014; Battaglia et al. 2016). In the same vein, Guenther et al. (2016) underlined that these systems give a chance to incorporate sustainability aspects in organization systems and to adjust corporate procedures and exercises.

Finally, a gap exists in the degree of the implementation between SCs and MCs. The main idea behind this gap is that MCs are considered far more important and more fundamental factors than SCs for the businesses to achieve their objectives (Ditillo and Lisi, 2014). Under this light, it is vital that the role of SCs must be re-evaluated and investigated more, in order to become a functional tool that could incorporate sustainability into the core of business models and future strategies (Weaver, Trevino and Cochran, 1999).

2.2 Theoretical frameworks

2.2.1 Package approach to management controls

Within the research field of MCs the idea of a package approach is a well-standing one (Otley and Berry, 1980). However, among researchers there is no consensus on what is the definition of MCs (Fisher, 1998), what MCs comprise and how they should be grouped. The lack of a common understanding of MCs spurred the appearance of several frameworks (Simons, 1995; Merchant and Van der Stede, 2007; Malmi and Brown, 2008). Their application in practice remains to be, however, somehow reduced. According to Malmi and Granlund (2009), this is because there is a need for more practice-focused frameworks that examine the application of MCs in real-life settings. Malmi and Brown (2008) is one of such frameworks considered appropriate for analysis of corporate practices (Malmi and Granlund, 2009).

Building on level of control by Simons (1995) and object of control by Merchant and Van der Stede (2007), Malmi and Brown (2008) have developed a conceptual framework that facilitates studies of MCs as a package. The framework goes beyond the definition by Simons (1995) and expands it by stating that “[MCs] include all the devices and systems managers use to ensure that behaviours and decisions of their employees are consistent with the organisation’s objectives and strategies but exclude pure decision-support systems” (pp. 290-291). Such a take highlights a clear distinction between decision-support systems that are focused on taking or recommending actions and management control systems that are generally responsible for understanding, translating and applying those decisions (Taylor, 2012).
Malmi and Brown (2008) equally recognize that MCs should not operate or be analysed in isolation. Every individual component of control inevitably sits under a broader control system and analyses should recognize the links or risk erroneous conclusions (Fisher, 1998; Chenhall, 2003 as quoted in Malmi and Brown, 2008). A typical system that acts alone is characterized as predefined and is not typically connected to other systems, acting in isolation and addressing specific/targeted challenges within the company (Merchant and Van der Stede, 2007). The framework by Malmi and Brown (2008) goes beyond analysing each individual control system in isolation. Rather, it sees MCs as packages consisting of different systems instead of each system acting individually. A central idea is the relationships and interplays between different elements of the MCs. According to Malmi and Brown (2008), “the strength of [such] typology lies in the broad scope of the controls in the management control system as a package, rather than the depth of its discussion of individual systems” (p.291).

Importantly, the discussed framework is inclusive and encompasses not only well known, by accounting researchers, formal systems but also recognizes and integrates administrative and cultural control systems as equal parts. As the Malmi and Brown (2008) explain, “while much management accounting research has studied accounting-based controls and this is typically focused on formal systems, there is still limited understanding of the impact of other types of control (such as administrative or cultural) and whether/how they complement or substitute for each other in different contexts’” (p. 288).

Ditillo and Lisi (2014) highlight the potential of the aforementioned framework, with its unique structure, its package approach and, importantly, its equal focus on formal and informal controls, to foster research into MCs and sustainability (or, as they are often referred to SCs). The latter feature is key in the context of sustainability diffusion where there is no clarity on how formal or informal systems assist or influence integration of sustainability into practice (Ditillo and Lisi (2014). Indeed, emerging and new research into the subject matter (e.g., Crutzen et al. 2017; Ditillo and Lisi, 2014) is based on Malmi and Brown (2008).

In this is a typological framework of five separate groups of systems, when combined, form a package of control systems. These are: (i) planning, (ii) cybernetic, (iii) reward and compensation, (iv) administrative, and (v) cultural controls. Each system group is further divided into subcategories and will be presented separately in the following paragraphs (Malmi and Brown, 2008).

In the paragraphs that follow the MCs packages, one by one, are shortly explained as described in Malmi and Brown (2008). The core of the framework is also summed up in the Figure 1.
Planning controls

An ex-ante form of control, planning is the process through which a company directs efforts and behaviour by setting time-bound and measurable goals in the key functional areas of the organization. In Malmi and Brown (2008), planning has two subcategories, namely long-range planning and action planning. Long-range planning extends over a medium-to-long period of time, being more strategic in its focus and nature. It is framing company's strategic priorities and initiatives, thereby is considered effective in controlling activities of its members to make these are in line with the pre-set and desired organizational outcomes.

In contrast, action planning is about short-term goals set for a period equal or less than 12 months. As such, action planning has a tactical focus oriented to address immediate needs of the company.

Administrative controls

The administrative controls focus on directing the behaviour of the company's employees. They do so by organizing individuals, by monitoring behaviour and monitoring accountability, and by concretizing ways in which tasks and behaviours ought to be performed or not to be performed. Based on this framework, administrative controls are divided in three different groups: (i) organization design, (ii) governance structures and (iii) policies and procedures.

Governance structure includes few essential elements, namely board structure, board configuration, various management, and projects teams. The governance...
structure is a system that comprises and includes both formal lines of authority and accountability, as well as control systems with explicit coordination duties on horizontal and vertical axes within the company. Meetings, schedules, policies, and procedures are few examples of such forms of control. In the context of sustainability, governance structure could play an important role by giving companies necessary structures to reach set goals and objectives in this area (Chvatalová, Kocmanová and Dočekalová, 2011).

The discussed framework goes beyond the traditional understanding of organizational control. It expands our view of administrative controls to include governance and organizational structure as equally important mechanisms. They state that these systems are capable of organizing individuals' and direct employees' behaviour. Also, the authors believe that organizational design is something that managers can change, and not something imposed to them, making it a useful and practical instrument in achieving proposed objectives. This is even more critical in the context of implementing sustainability. Formal structures must be well defined and flexible in order to facilitate interaction of sustainability managers/specialists with other departments. The work of decision makers on coordination of highly interdependent activities is facilitated by the existence of such structure (Gond et al. 2012).

**Reward and compensation controls**

The reward and compensation controls are closely associated and linked with cybernetic controls but form a separate package used to motivate and boost performance of individuals and groups, and to align their goals and activities – be they financial or sustainability-related – with those of the company. These controls often focus on effort/task correlation that impacts performance in three key ways: effort direction, effort duration, and effort intensity. In order to increase the effort/task correlation, companies use or monetary incentives or bonus payment as a common component of their reward system.

**Cybernetic controls**

Green and Welsh (1988) see cybernetic controls as “a process in which a feedback loop is represented by using standards of performance, measuring system performance, comparing that performance to standards, feeding back information about unwanted variances in the systems, and modifying the system’s comportment” (p.289). Cybernetic controls (i) enable quantification and tracking of a phenomenon/activity/system within the organization; (ii) set standards of performance and targets; (iii) allow for feedback on actual performance against the
set standard; (iv) enable variance analysis; and (v) allow for modification and/or redress of the system’s behaviour (Malmi and Brown, 2008).

These controls are divided into four systems/subcategories: (i) budgets, (ii) financial measures, (iii) non-financial measures and (iv) hybrids, which contain both financial and non-financial measurement controls.

Budgeting is a common and a well-known control tool through which employees are held accountable for specific financial measures. As a management control system, the primary goal of the budget is to set an acceptable level of behaviour for employees and to evaluate their performance against the set indicators. As a financial instrument, it is used to plan and set financial targets, in short and long runs, covering all planned expenses and revenues of the company for the determined period.

In contrast, financial performance measurement is a more technical instrument meant for very narrow use, guiding or holding employees accountable for a specific established target/measurement. It measures company's financial performance, for instance return on investment or profit margins. Non-financial measurements come to support and compliment financial measurements by identifying performance drivers.

The last group is that of hybrid measurement systems. These are sets of financial and non-financial measurement, or a mix of them, that have been used to establish and monitor the achievement of set objectives. An example of such tool is Balanced Scorecard and more recently Sustainability Scorecard (Anthony and Govindarajan, 2007).

**Cultural controls**

The last package – that of cultural controls - is more informal in nature. It encompasses the set of (i) values, (ii) symbols and (iii) social norms within “clans” that are being viewed as controls that influence and regulate thoughts and actions of company's employees (Clegg et al. 2005).

Value-based controls are sets of beliefs used by senior management to communicate and support desired direction, value and purpose for the company (Simons, 1995 as quoted in Malmi and Brown, 2008). Clan controls are sets of social norms, acquired, in the form of skills or values, by individuals after being exposed to specific subcultures within the company. It becomes a management control when it is used
to establish value, rituals or beliefs within a group of employees (Ouchi, 1979 as quoted in Malmi and Brown, 2008). Finally, symbol-based controls refer to specific elements, mechanisms and utilities, such as dress code or workplace design that could be used to develop and implement specific culture among employees. All culture controls are considered to enclose and direct other controls in the company (Lueg and Radlach, 2016).

2.2.2 Sustainability management controls - pattern framework

Building on Malmi and Brown (2008), Crutzen et al. (2017) aims to “[...] gain an improved understanding of the existence and the patterns of [SMC], and to draw conclusions on the strengths and deficiencies of current corporate practice” (p. 1292). Based on an empirical study of 17 large Western European firms, Crutzen et al. (2017) develop a scenario-type framework of SMCs. The framework consists of 4 key patterns. The following paragraphs are a short explanation of the aforementioned patterns, as described by Crutzen et al. (2017). These patterns are further summed up in Figure 2.

Figure 2. Sustainability management control patterns in the 17 examined companies

Source: Sustainability and management control. Exploring and theorizing control patterns in large European firms (Crutzen et al. 2017, p.1298)
Pattern A - Basic management control

This first Pattern is associated with the deployment of limited formal and informal control systems for sustainability. Three possible explanations of the pattern are: (i) management has limited awareness of the relevance of deploying MCs for sustainability objectives; (ii) management is unwilling to design strong control mechanisms in this way; and (iii) companies have only recently committed to such practices and are still confronting technical, organization and/or cognitive barriers.

Pattern B - Behavior-based management control

The Pattern B is the most common scenario. It is characterized by the deployment of predominately informal controls for sustainability. This is common in companies where top management makes use of informal controls to motivate and involve employees in following the desired course of action. One advantage of this approach is that it comes with a high level of awareness/ownership over the sustainability agenda within the organization. Moreover, due to the fact that informal controls are subtler, they are deemed to face less internal resistance. The pattern is deemed to happen when managers target more sustainability mindful employees amongst newer generation and assume that the key to internal change is motivating people; once the employees are motivated through informal controls they are more likely to follow up and chance formal structures and systems. Pattern B is seen as an initial step to be followed by the introduction of more robust and formalized approaches to MCs and sustainability.

The first limitation of Pattern B is, however, that managers may find it harder to pursue sustainability relaying only on informal schemes that are not reflected in the formal once and that may even come in conflict with the more conventional and economically-driven formal MCs. Moreover, following the reinforcement theory, an important mean of enforcing and boosting the frequency of behavior – pursuit of sustainability, in this case – is to reward it. This is hard to attain, however, under Pattern B.

Pattern C – Advanced formal management control

The third Pattern relies on a more formalized take on MCs for sustainability. It consists of dedicated and well-developed formal control systems such as organizational structures, responsibilities and objectives, and resources reinforced by budgeting and planning. In such a configuration, there is an expectation of a good performance of formal controls that are considered to be sufficient for reaching the
set sustainability objectives. However, companies belonging to Pattern C ignore or avoid informal MCs. Heavy reliance on formal controls, not backed by informal, may limit implementation of company’s sustainability objectives in areas that are difficult to capture, measure and control through formal approaches.

**Pattern D – Full management control package**

This last Pattern features both strong formal and informal MCs for sustainability. This configuration is rarely found in practice and none of the examined companies deployed such level of controls. It is generally considered that strong formal controls eventually lead to the appearance of informal ones. The data suggest, however, that this does not seem to be the case. Instead, informal controls may have to be designed and aligned just as deliberately and targeted as the formal ones.

### 2.3 Employment of frameworks

The framework by Crutzen *et al.* (2017) is employed in this research not as an assessment but as a theoretical tool to guide both the collection and the subsequent analysis of data output. More specifically, the criteria for the analysis of individual packages of MCs for sustainability were derived from the aforementioned framework and further employed for collecting and structuring the empirical data in the current research. The patterns of the framework are used at the final stage of the research guide and support the analysis of data and the theoritization of such. The patterns are approach here as ideal-type constructs (Weber, 1904) and a continuum rather than definite and/or clear-cut scenarios.

Malmi and Brown (2008) package approach to MCs, which also lies at the basis of Crutzen *et al.* (2017), inform the underlying understanding and structuring of this investigation around the five packages of (i) planning, (ii) cybernetic, (iii) reward and compensation, (iv) administrative, and (v) cultural areas.
3 METHODOLOGY

The current Chapter is concerned with presenting the methods employed in this study and with explaining the reasoning behind such choices. It does so by detailing the overall research purpose, its strategy, as well as techniques employed for data collection and analysis within the framework of this study.

3.1 Research purpose

Although management control for sustainability is increasingly attracting academic attention, empirical research is limited when it comes to the specific issue of whether and how large companies employ management control to achieve their sustainability objectives in practice (Crutzen et al. 2017). This thesis falls under this under-researched area and is, at its core, an exploratory research. As such, the purpose of this research is exploration that does not start with set propositions but is rather concerned with fine-tuning and expanding the understanding of the subject matter (Yin, 2003; Robson, 2002) of MCs and sustainability and exploring the practice of it. In other words, the thesis is set to explore the empirical, the practical and the real-life set up. Given this purpose, the research is inherently flexible (Adams and Schvaneveldt, 1991 as quoted in Saunders et al. 2009) and will adapt its strategy and techniques if and as required in the course of the work.

3.2 Research strategy

This study relies upon an embedded single case study strategy. Such a choice is informed by both substantive – i.e., subject matter-related – and methodological arguments explained below.

With specific reference to MCs-related research, many scholars (e.g. Epstein and Wisner, 2005; Gond et al. 2012; Maas et al. 2016) called for further employment of case and field studies or, in other words, for research more engaged with practice. Adams and Larrinaga-González (2007, p. 333) found that the "extant literature on sustainability accounting and reporting, in contrast to management accounting and management, has largely ignored practice within organizations". Malmi and Granlund (2009) equally call for more practice-oriented works in the area of MCs and sustainability. By relying on a case study strategy, this thesis follows such calls.

Methodologically speaking, this study addresses the question of “how” and looks at the current practices of and by the business. Both the question and the temporal
Parameter are fully in line with research criteria that call for/can adopt a case study strategy (Robson, 2002 as quoted in Saunders et al. 2009; Yin, 2003). Moreover, since MCs adopt a contingent approach (Fisher, 1998), this research seeks a richer understanding of the context and processes at play in the business’s pursuit of sustainability through MCs. Case study, again, is an appropriate fit in terms of research strategy when such goals are followed (Morris and Wood, 1991 as quoted in Saunders et al. 2009).

Furthermore, this is an embedded single case study. The focus on a single company is both a feasible and a methodologically grounded decision. This study seeks to contribute to a broader understanding of MCs and their role in sustainability using well-formulated theories, mainly those by Malmi and Brown (2008) and Crutzen et al. (2017). Single case studies are suitable when it comes to tasks such as the above of confirming or expanding a well-formulated theory (Yin, 2003). Moreover, a single case study is well placed to capture the unusual, critical and/or revelatory (Yin, 2003) data and findings that could contribute to the aforementioned research goal.

Although this study deals with a single case study, it will be an embedded one, meaning that it will involve more than one unit of analysis within the selected company (Yin, 2003). The individual MCs packages – i.e., those of (i) planning, (ii) cybernetic, (iii) reward and compensation, (iv) administrative, and (v) cultural (Malmi and Brown, 2008) – are treated as distinct units of analysis. On top of this layer, the interaction(s) between the packages at the company-wide level is an additional dimension and unit of analysis.

Whilst an exploratory single case study with embedded units of analysis is a suitable strategy, as argumented above, for exploring and addressing the research question under scrutiny, the generalizability of this study is limited (Merriam and Tisdell, 2009). Hence, the current study and its findings may or may not lend themselves to generalization to different jurisdictions and company contexts. Furthermore, an embedded case study combines multiple methods for data generation (Scholz and Tietje, 2002), having the potential of generating rich description and analysis of a phenomenon (Merriam and Tisdell, 2009). The risk, however, is overanalyzing or overdetailing that may be an obstacle for the reader to follow and use (Merriam and Tisdell, 2009). The last pitfall may occurs when the case study concentrates just on the subunit level and neglects to come back to the bigger unit of examination (Yin, 1994; 2009). By doing so, there is the risk of shifting the original purpose of the study and hence, the subject of interest is converted to the context of the study rather than the target of the study (Yin, 1994; 2009).
3.3 Choice of company

This research aims to explore how large companies, well placed in the sustainability field, hardwire sustainability into their practice with the help of MCs. The focus on large companies is informed by the fact that within such organizations all MCs packages are expected to be found and developed, making the analysis as to if and how sustainability is integrated within these packages more meaningful (Riccaboni and Leone, 2010).

The focus on companies that are well placed in the area of sustainability is grounded in the expectation that sustainability is present in their MCs and that research into their practices would yield richer data and knowledge on the otherwise under-researched subject (Crutzen et al. 2017) of this study. The DJSI can be seen as an indicator of sustainability performance, with an expectation of an above average performance in favorably ranked companies (Crutzen et al. 2017).

By means of random selection, 45 companies that satisfied the aforementioned criteria were contacted to enquire on the possibility and interest to be included in this research. This was done through an open call addressed to the publicly stated contact point(s) within the Sustainability Departments and/or the External Relations Departments. All were provided with a full research brief containing information on the justification, scope and methods of this study. Three large companies expressed interest, of which one had to be selected. Solvay Group – an international chemical group that is among 30 worldwide biggest chemical companies based on revenue (Solvay, 2017) – was deemed to be the best suited candidate in terms of the industry, sustainability practice, and availability (to suit the limited timeframe of this study).

3.4 Techniques and procedures

This is a cross-sectional study (Saunders et al. 2009), meaning that it researches a particular phenomenon at a particular time and in a particular context, that relies on a multi-method approach. The techniques and procedures employed for data collection and analysis result from such parameters.

3.4.1 Literature review and analytical framework

Literature analysis is used to investigate whether and how companies integrate and enforce their sustainability objectives through the use of MCs. In pursuing this main line of inquiry, the review seeks to:
(i) identify and analyze the emergence of MCs beyond accounting literature and their role in gathering information and evaluating the performance of organizational resources and also the organization as a whole towards its set strategies, in particular those pertaining to sustainability;

(ii) analyze SMCs as a relatively new field with its promises and limitations;

(iii) examine the use of “package” approach to MCs and sustainability; and

(iv) identify and use, as appropriate in this study, existing analytical and/or operational frameworks to evaluate and guide companies efforts to integrate and pursue sustainability through MCs.

3.4.2 Data collection

Primary data under this study was generated through semi-structured interview and documentary/archival research.

Employing semi-structured interviews as source of primary data in a case study is a recommended technique (Yin, 2014), especially when the purpose is to investigate complex issues within a given setting/organization (Denscombe, 2014). The semi-structured form of the interview allows the discussion and the research to tap into unforeseen angles and cover concerns that might have not been reflected in the original design of this research and the associated questioners (Justesen and Mik-Meyer, 2011) – a key consideration given the exploratory character of this study.

In approaching the company, the initial contact was made with the Sustainability Department. It is this service that was expected to have an overview of the company’s work in the area of sustainability. In the case of Solvay, the contact was with the Deputy Chief Sustainability Officer responsible for sustainability reporting and answering questionnaires of rating agencies, investors, and global customers, who represented the company throughout the research and served as the primary interviewee. In negotiating access, it was mutually agreed that, if required, the Sustainability Department would initiate contact between the research team and the rest of the company. It was, however, not deemed to be the case by the responsible Officer as the Department was in position to offer the required data.

The semi-structured in-depth interview took place on 16th of April 2018. Conducted over Skype, the interview was with the Deputy Chief Sustainability Officer (hereinafter referred to as the interviewee or Washer, 2018) and lasted 84.14 minutes. It is to be underlined that this interview was preceded and followed by email communication with requests for clarifications and/or further information.
These complemented and generated additional data to that of the interview. As such, they are filed in the database of this case study under interview results.

The interview questionnaire consisted of two distinctive components. First part addresses the overall view on the company sustainability strategy and its development over time. Questions were designed to understand the level and nature of commitment to sustainability, the set measurable goals and objectives – as articulated and prioritized by the company, key opportunities and constrains in this area – as assessed by the company. The second, rather large, part explored whether the control mechanisms exist and if/how they are employed to manage the company's sustainability performance and to integrate it into practice. Package-by-package questions were developed for this part of the questionnaire. It is to be noted that the semi-structured interview and the email exchange with the company was used to both generate data but also to cross-check and fill possible gaps in information obtained through documentary and archival research. The interview questionnaire reflects this. See Appendix 2 for detailed interview questions.

Documentary and archival research, considered to comprise a wide range of materials from corporate press releases to annuals reports on behalf of companies, can (Fischer and Parmentier, 2010) and indeed served here as a second resource of primary data. In the case of the current study, the list of such materials included minutes of shareholder meetings, scorecards, policies relating to rewards and compensation or code of conduct, planning documentation, annual reports, sustainability reports, press material, statements, commitments, etc. These were not processed by a third-party and, as such, constitute primary sources (O’Reilly and Kiyimba, 2015). They amounted to approximately 2400 pages of documentation.

To improve the quality of research and to allow for triangulation (Saunders et al. 2009), complementary secondary data was collected prior and in parallel with the primary research. Such work focused on publicly available and third-party processed information (e.g., assessments and ranking by international entities). The analysis provided a fuller descriptive background for this study.

### 3.4.3 Data analysis process

The data analysis process began after the selection of the company and the completion of negations with the Group. The interview and the written communication with the company representative was preceded and followed by primary and secondary data analysis. The outcomes of the interview were linked and processed with the rest of the data immediately upon its completion. The data provided by email was analysed as it was emerging. All data was structured my MCs packages and processed package by package and against the two theoretical
frameworks by Malmi and Brown (2008) and Crutzen et al. (2017). The framework by Crutzen et al. (2017) was used for the evaluation of data output.

For greater triangulation (Saunders et al. 2009), both the primary and the secondary data were analysed by the two researchers. Also, both researchers analysed the transcribed materials.

The data that was collected but deemed not relevant in the context of the current study and its research question was processed and kept in the case study database. It was, however, removed at the stage of the analysis as to not dilute attention from the relevant information (Miles and Huberman, 1994).

### 3.5 Quality of research design

This is an empirical social science research and, as such, it was subjected to the four commonly used tests of quality research design (i.e., construct validity, internal validity, external validity and reliability) as contextualized and recommended for the specific application to case studies by Yin (2014).

The first step followed was to construct validity. This is a particularly critiqued test when it comes to case studies due to the concern of subjective judgment of the researcher(s) in the process of data collection. Hence, this research followed two key tactics recommended to increase construct validity in case studies (Yin, 2014). First, the use of multiple sources of evidence was ensured through inclusion in the research of the company's written communication, public statements, reports, internal systems of monitoring and data gathering, and data generated through a first hand interview process. Second, the recommended a chain of evidence (Yin, 2014) was constructed by ensuring that all data was catalogued and maintained in a database with all written documentation, transcriptions and audio files present.

The test of internal validity, which is meant to establish a causal relationship applies to explanatory or causal studies (Yin, 2014), hence was not followed in the case of this exploratory case study.

The third test is that of external validity. According to Yin (2013), there is an erroneous argument that single cases provide scarce basis for generalizing. It stems from the misguided comparison of surveys to case studies. Survey samples are readily generalized and extrapolated to the universe. But this analogy to sample and universe does not apply to the case studies. Surveys are grounded in statistical generalizations, while case studies are grounded in analytical generalization. In such
analytical generalization, the key is the analysis and generalization of results to a broader theory (Yin, 2014). This is indeed what the current research is set to do – the findings of this single case study are generalized to the theoretical framework of SMC patterns.

The final test of reliability was followed through the two recommended tactics of using a case study protocol and maintaining a case study database (Yin, 2014), as discussed above. Moreover, having a team of two researchers also limits of one-person bias, allowing for better triangulation (Saunders et al. 2009) and “auditing” (Yin, 2014) of each others processing and results throughout data collection and analysis.

3.6 Ethical considerations

In negotiating access and participation this study, anonymity was offered to the entity as a whole and to respondents (Saunders et al. 2009). Solvay, however, did not take up the offer. Prior to the initiation of research, the company was provided with a comprehensive written research brief containing the justification, the scope and the methodology of this study. A presentation on the purpose and the mechanics of the research (Saunders et al. 2009) was also offered prior to the interview process.
4 EMPIRICS

4.1 Short history of Solvay

Headquartered in Brussels, Belgium, Solvay S.A. is a company founded in 1863 as a start up that produced sodium carbonate based on a patented Solvay process. Since then, the company became a leading international chemical group that is among 30 worldwide biggest chemical companies based on revenue (Solvay, 2017). In 2017, Solvay's consolidated net sales stood at 10.1 billion Euro and 2.230 billion Euro of REBITDA. With 160 sites around the world, Solvay has approximately 24,500 full-time employees and a presence in 61 countries across continents (Solvay, 2017). Solvay is a publicly traded company. First time the company was listed on stock exchange market on Euronext Brussels and part of BEL20 index under the symbol “SOLB”. Since 2012, the new, transformed Solvay was listed of NYSE Euronext in Paris, where it is part of CAC 40 index replacing PSA Peugeot Citroen (Solvay, 2016b).

Solvay's activities expand across different areas and sectors. It was actively involved in pharmaceutical business until the selling of the entire division, Pharma, to Abbott Labs in 2010 (Solvay, 2015). In 2012, the company announced and commenced the implementation its transformational plan that aimed to refocus the group activities and make it a pure specialized chemical company (Solvay, 2015). Solvay's Committee of Executive Members reorganized its priorities around five major directions: Consumer Chemicals, Advanced Materials, Performance Chemicals, Functional Polymers and Corporate & Business Services. In an effort to strengthen Solvay's capacity, through acquisitions and diversifications, the Group launched the initiatives to acquire few chemical specialized companies (Solvay, 2015). Several bold-on acquisitions have been added to the Group’s portfolio, such as Rhodia (2011), Chemlogics (2013) and Cytec Industries Inc (2015). Since its launch, the Solvay's transformational plan focused on the integration of lately acquired business units in order to create and pursue excellence initiatives that could create shareholders value (Solvay, 2015).

4.2 Sustainability emergence within Solvay

As mentioned earlier, at the basis of the Group lies the Ernest Solvay's technological and environmental breakthrough with the ammonia-soda process, known as the Solvay process (Bertrams et al. 2013). This process, used until today, replaced at the time the Leblanc process that was both expensive economically and taxing environmentally by using polluting byproducts (Bertrams, et al. 2013). In early 1900s, Solvay became one of the biggest multinational companies in the world having a social model that assured workers with houses, as well as instituted health
and safety measures on its sites (Bertrams et al. 2013; Clamadieu, 2013, Solvay, 2015a). With the emergence of the environment agenda globally in the 1970s, the Group started to follow industry trends increasingly becoming aware and factoring in its footprint (Bertrams et al. 2013; Solvay, 2017a). In 2004, Solvay explicitly referred for the first time to its commitment to sustainable development and made it a part of its strategy by partnering with Solar Impulse (Solvay, 2017a). In 2012, the company acquired Rhodia, a French producer specialized in fine chemistry, synthetic fibers and polymers (Rhodia, 2012), and changed its sustainability goal to that of becoming a leader in sustainable chemistry. In the same year, the company started to implement its transformational plan meant to serve the aforementioned goal (Solvay, 2017; Solvay, 2017a).

The new vision under the transformational plan is “asking more from chemistry”, encompassing the desire to ensure economic growth while acting responsibly and with respect to humankind and the environment (Solvay, 2011). The vision spans from the Group’s logic that responsible chemistry is the answer to worldwide challenges as complex as global warming, the growing population, scarcity of resources, and poor social conditions.

The Group delivers against this vision through its reformed business model, which is geared towards higher growth, higher profit margin and less cyclical business (Solvay, 2018, 2018f). Under this model, the value creation attempts to align growth, earning and returns, with a focus on sustainability (Solvay, 2018) as one of the primary and intrinsic drivers of growth (Solvay, 2017). The model is grounded in the Group’s approach to environmental challenges as a chance to shift to a low-carbon world but also to take it as an economic opportunity (Solvay, 2017; 2018, 2018f).

Solvay’s new strategy is to create and develop a new model of chemistry. It has a two-fold focus on: (i) addressing society’s sustainable challenges by creating operations that work with nature and not against it, and (ii) offering clients innovative solutions that will raise their performance and quality of society’s life (Solvay, 2011). In this regard, the Group’s strategy is to fight climate change both through reducing its own footprint as well as through developing sustainable products and solutions for its costumers (Solvay, 2015d). On its manufacturing facilities Solvay decide to reduce the CO2 intensity on their activities by 40 percent until 2025 (Solvay, 2015d). To achieve this target Solvay committed in developing energy efficient programmes such as SolWatt, as well as increasing the use and share of renewable energy and developing clean technologies (Solvay, 2015d). Also, the Group set an internal price on CO2 of 25 Euro a tonne to account for climate issues and to influence its investment decisions (Solvay, 2015d).
As a world player in the field of chemistry, the Group commits itself to developing and offering solutions to global sustainability challenges through both its own actions and by chain reaction initiated among partners and stakeholders (Solvay, 2011). In this regard, the Group positions itself as a corporate ambassador of change and of putting innovative capabilities at the service of low-carbon economy (Solvay, 2015c). In 2015, Solvay made public commitments to tackle climate change and was among the first signatories of the Business Proposals for the 2015 International Climate Change Agreement of COP 21 in Paris. As stated by Jean-Pierre Clamadieu, the Chairman of the Executive Committee and CEO of Solvay, “[b]usiness has a critical role to play in implementing the Paris Agreement. By joining forces with clients, leading brand owners, governments and civil society, we will be able to accelerate the energy transition to match the Paris Agreement (Solvay, 2015e)”.

Solvay’s performance on both financial and extra-financial indexes is externally recognized by rating agencies. Recent recognition includes ranking by RobecoSAM Dow Jones Sustainability Index (DJSI) in 2017 where Solvay has re-joined DJSI World Index being ranked 11th for its progress and robustness on materiality analysis, human rights policy, impact measurement and valuation (Solvay, 2017; RobecoSAM AG, 2018). Oekom Research rated Solvay as a “Prime” company that places the Group among the leaders in the chemical sector for its management of environmental issues though the usage of eco-efficiency practices and governance criteria (Finvex, 2018; Solvay, 2017). The Group has equally recorded an absolute score of 3.8 on FTSE’s ethical investment index; such a score places Solvay in the top 10 percent of “super-sector” companies (Solvay, 2017). For its work toward the creation of sustainable value among its supply chain, EcoVadis supplier sustainability ratings ranks Solvay with Gold, with a score of 77/100 (Solvay, 2017). Other rankings that place Solvay high include the Euronext Vigeo World Index, the Euronext 100 index, the Ethibel Sustainability Index, the Carbon Disclosure Project (Solvay, 2017). Solvay’s shares are incorporated in numerous other weighted stock market indexes, including the STOXX family (DJ Stoxx and DJ Euro Stoxx), the FTSE 300, and the MSCI index (Solvay, 2017).

4.3 Integration of sustainability into Solvay’s management controls

4.3.1 Planning controls

The planning package was the first to be examined. From this package, the current research covered long-range and action planning. The data gathering and the subsequent analysis focused on four key considerations, namely (i) the integration of sustainability in long-range planning; (ii) the integration of sustainability in short-term action, (iii) the translation of sustainability objectives from the long- to
the short-range planning, and (iv) the range of sustainability issues covered by the company in the afore-mentioned planning processes.

Solvay exercises long-term planning in relation to sustainability. The Group’s strategy comprises a total of eight strategic objectives, two of which are concerned with its environmental performance and three dedicated to social issues (Solvay, 2015; 2015f; 2016; 2017). The five sustainability objectives are time bound – to be delivered by the cut off date of 2025 – and accompanied by quantitative targets against which the Group reports on a regular basis (Solvay, 2015; 2015f; 2016; 2016e; 2017).

The long-range sustainability objectives are subsequently translated into short-term action through the Group’s sustainability approach – the Solvay Way – and its Sustainable Portfolio Management (SPM) methodology. Aligned with ISO 26000, the Solvay Way aims at making the “connection between [...] the financial and extra-financial value [Solvay] creates” (Solvay, 2017, p. 37) and at operationalizing sustainability by articulating actions and assigning responsibilities across Group’s business units (Solvay, 2015; 2015f; 2016; 2017). Three aspects of the Solvay Way are to be emphasized in this discussion. First, the approach articulates 23 commitments to six major stakeholders - namely, customers, employees, investors, suppliers, communities, and the planet – that are further translated into and operationalized through 49 practices. Second, such commitments are generated through a process of stakeholder consultation, being subsequently approved by the Board and the CEO. Third, the approach intentionally allows for its contextualization, to regional and country needs taking into consideration local legal frameworks and priorities (Solvay, 2015), and for self-assessment by each entity and/or site against the Solvay Way targets with a subsequent articulation, if required, of redress actions. The action plans under the Solvay Way are entirely local with a high degree of autonomy (Washer, 2018). However, while allowing such autonomy for entities and/or sites, the plans and the self-assessment under the Solvay Way are “checked by internal audit and by external audit” (Washer, 2018, p. 6).

SPM is the second tool employed by Solvay in the operationalization of its strategic sustainability objectives (Solvay, 2015; 2016; 2017; Washer, 2018). As part of its one-year outlook, the SPM is used to assess “current products (portfolio and processes) and future spending (innovation, acquisitions)” (Solvay, 2016, p.26). This is followed by an audit of the elements. SPM is further used as part of the year business plan to challenge priorities, agree on priorities and allocate resources in the area of sustainability (Solvay, 2015f; 2016).
Integration of sustainability with and into Solvay's core strategic and management processes is also observed. Sustainability is an explicit consideration mainstreamed into corporate strategy and action (Solvay, 2017) rather than approached through separate sustainability vision, policy and report. Since 2016, the Group produces an integrated annual report.

The Group's planning processes cover both social and environmental dimensions (Solvay, 2015f; 2016), with a heavier but an exclusive focus on the latter. This is observed in the long-term as well as short-term planning (Solvay, 2015f; 2016).

### 4.3.2 Administrative controls

The administrative MCs was the second package under scrutiny. The package was considered in terms of (i) organizational structure and (ii) organizational policies relating to sustainability.

The Group has a multi-layered and formalized structure with regard to its sustainability agenda (Figure 3). As stated by Solvay, the goal of such organization is to mobilize employees at all levels towards the achievement of the set sustainability objectives and targets (Solvay, 2017).

The Board of Directors Executive Committee is the highest governance structure at Solvay in terms of sustainability, being tasked with setting the strategic directions in this area and with monitoring their execution (Solvay 2013; 2015; 2016; 2017; Washer, 2018). The Board of Directors dedicates at least one of its meeting each year to worldwide issues of sustainability and their relation to/impact on the Group (Solvay, 2015f; 2016a; Washer, 2018). More concretely, the workings of such meetings are structured around (i) “the main strengths and weaknesses of the Group, identified by the Solvay Way self-evaluation and the evaluation made by financial rating agencies; and (ii) the priority societal and environmental targets of the Group and the performance achieved by the group with respect to Group priority targets” (Solvay, 2015f; 2016a). The choice of all-Board regular meeting, as opposed to the creation of an ad hoc committee on sustainability, is informed by the fact that this arrangement allows for a stronger involvement of the entire Board in the chosen strategy (Solvay, 2014, 2015f; 2016a, Washer, 2018). Within the Executive Committee, the Climate Supervisor – a function first added in 2017 – is tasked with ensuring that climate issues are factored into every decision taken by the Group (Solvay, 2017).

The Group's second link in its sustainability structure is the Corporate Sustainable Development. This shared-service Department is charged with the supervision of the Group's approach and sustainability work in response to the expectations and the commitment to stakeholders, and with the consolidation of
the self-assessment under the Solvay Way followed by the reporting of the results to the Board of Directors and the Executive Committee (Solvay, 2015f; 2018; Washer, 2018). The line of reporting from this Department is directly to the Solvay’s CEO.

The third layer is that of the Group’s Sustainability Champions and Correspondents. The primary focus here is on the deployment of the Solvay Way on the ground and its implementation through day-to-day practice in 100 percent of Solvay’s sites (Solvay, 2016a, Washer, 2018). The Group has a network of more than 200 champions and correspondents in this regard (Solvay, 2016a; Washer, 2018). These are, in essence, focal point for sustainability operating at Businesses and Functions level, industrial sites, R&I laboratories and business units. Their activities are coordinated and supervised by the Corporate Sustainable Development Team (Solvay, 2017; Washer, 2018).

The concluding component of the chain are the Group’s employee. Theirs is the role of day-to-day action and implementation of the Solvay Way (Solvay, 2016a; Washer, 2018). Currently, 44 percent of Group’s employees are involved in the self-assessment or action plans falling under the Solvay Way (Washer, 2018). Despite such employee involvement, the challenge is ensuring consistency in the understanding of sustainability amongst those participants/employees. “The most sceptical may still consider that this [...] exercise is about communicating environmental footprint, [while] the most knowledgeable [...] are fully aware that this is more [a story of] value creation” (Washer, 2018, p.10).

The existence of a set of policies and procedures with regard to sustainability is observed in Solvay’s case. These are broadly grouped into those relating to people model and those relating to management model. The former group comprises Group’s policies and procedure in (i) ethics, including Solvay’s Code of Conduct and Ethics Helpline that contain sections dedicated to respect for responsible practices towards the Group’s stakeholders and the environment (Solvay, 2016a, 2017, 2018); and in (ii) HR, including a component in the Solvay Way and the Group’s Management Book (Solvay, 2016a, 2017, 2018) with an emphasis on gaining employees’ commitment to the Group’s new culture and its sustainability objectives (Solvay, 2016a, 2018).
A number of measures are being undertaken to ensure the application of the Code of Conduct. These include training programs at different hierarchical levels of the Group in the application of the Code and, in case of violations, application of sanctions (Solvay, 2017, 2018, Washer, 2018). The Ethics and Compliance Department is in charge of providing annual training to all employees at the managerial level (Solvay, 2018). Management, in a cascading mode, is responsible for training their respective teams. Web-based ethics and compliance platform are also used in this regard. The training is done on selected topics for the old employees. For example, anti-bribery, anti-corruption, anti-competition, human rights in business policy were topics covered in 2017 (Solvay, 2017). The training on the entire Code is provided only to new employees (Solvay, 2016a). In 2017, such training covered 80 percent of all employees of the Group (Solvay, 2017). The execution of the Code within different zones where the Group is active is performed by Compliance Officers (Solvay, 2018). They are assisted by an entrusted group of experienced employees who act as auditors/mentors pursuing a culture based on ethics and in compliance with the Solvay values and its Code of Conduct (Solvay, 2018).

The group of policies and procedures relating to management model includes those in the areas of (i) purchasing, including principles of sustainability in Solvay Way with a methodology of selection applicable to suppliers in all geographical areas and the “Together for Sustainability” (TFS) initiative with audits and assessments of suppliers responsible practices (Annual Integrated Report, 2016); (ii) production, which is implemented through Health Safety Environment management system in alignment with ISO 14001 and OHSAS 18001 standards (Solvay 2015; 2016; 2016a;
2017), as well as the Solvay Way requirements to “measure annually maturity in managing operator safety and health, product safety and controlling environmental footprint” (Solvay 2013b, p.9; 2015; 2016; 2016a; 2017); and (iii) innovation, which is implemented through the application of Solvay’s SPM for the evaluation of projects’ environmental footprint and societal acceptance throughout the development process (Solvay 2015; 2016; 2016a; 2017).

4.3.3 Reward and compensation controls

The third package of MCs – that of reward and compensation – was considered in terms of (i) the existence of such schemes for sustainability performance and (ii) their coverage.

Group’s senior management is covered by systems of Short-term Incentives (STI) and Long-term Incentives (LTI). Both are currently linked to sustainability performance. Since 2015, the STI for senior management consists of three components, of which 30 percent are linked to the individual performance as measured against a set of pre-determined objectives; 60 percent are linked to the actual performance achieved towards a combination of annual pre-set collective Group economic performance objectives; and 10 percent are related to Group Sustainable Development indicator (Solvay 2016; 2016d; 2017; 2018; Washer, 2018). Starting with January 2017, 20 percent of LTI for senior executives are also driven by improvement in the Group’s greenhouse gas intensity (Solvay, 2017; Washer, 2018).

Initially covering the senior management, the reward for sustainability performance was extended in 2017 to the rest Solvay’s management ranks. As such, the Group’s compensation policy now links 10 percent of the variable remuneration for all managers to Solvay Way – the previously discussed sustainability approach – assessment results (Solvay, 2017; Washer, 2018).

In a further attempt to link reward to sustainability performance for all employees, Solvay introduced in 2015, following an agreement with its global social dialogue body – the Solvay Global Forum, a “blanket” profit-sharing plan based on Group performance (Solvay 2015; 2016; 2017; Washer, 2018). The plan allows for “all employees worldwide to benefit from a profit-sharing […] indexed to the Group’s financial and sustainable development performance for 2015 and 2016” (Solvay, 2015b). Such a plan is based on both quantitative and qualitative criteria with 80 percent linked to financial and 20 percent to the sustainability targets (Solvay 2015b, 2016; 2017; Washer, 2018). According Cécile Tandeau de Marsac, Group General Manager HR at Solvay, such an approach “[…] raise[s] the awareness of
Solvay employees throughout the world, whether blue-collar or white-collar employees, to the Group’s economic and societal performance” (Solvay, 2015b). Albert Kruft, coordinator of Solvay Global Forum, equally links Group’s reward policy to sustainability, saying that the above illustrates the Group’s commitment ‘[...] to remunerate [...] employees in a fair manner, in line with Solvay Way, our sustainable development policy” (Solvay, 2015b, p.30).

The initial testing of the plan took place in 2015 with an original allocation of € 10 million for all Group employees, exempt senior executives and French employees already covered by a similar plan (Solvay, 2015). Based on the results of the pilot testing, the plan was extended (Solvay, 2016; 2017; Washer, 2018).

Such reward schemes are seen by the Group to be effective in motivating its employees with regards to sustainability performance. In certain jurisdictions and sites, for example, the attitude of the managers towards sustainability may be skeptical but they are interested in securing the “maximum bonus for [their] entity” which, as explained above, is linked to sustainability assessment under the Solvay Way (Washer, 2018). The scheme, therefore, pursues the managers to work on topics (sustainability, in this case) that may not be otherwise material to them (Washer, 2018).

4.3.4 Cybernetic controls

In the examination of the Group’s cybernetic MCs package, the emphasis was placed on (i) the employment/usage of cybernetic controls – financial, non-financial and/or hybrid measurement systems – for sustainability; (ii) the range of sustainability issues covered by cybernetic controls; (iii) the link, through cybernetic MCs, of economic performance to social and environmental; and (iv) the complexity of the applied cybernetic control.

The Group has dedicated systems that measure financial and socio-environmental performance (Solvay, 2015; 2016; 2017; 2017c; Washer, 2018). At each level of the Group – i.e., corporate, Shared Service platforms and GBUs – a given manager operating the process is responsible for controlling execution consisting of the implementation, tracking, measurement and delivery of targets related to economic, social and environmental performance (Washer, 2018). The generated data are consolidated monthly and analysed at every level of responsibility, namely the Solvay Business Services, the Finance Director of the given entity, the Group Accounting and Reporting services, and the Executive Committee. Elements are analysed following internal and external rules, using various methods, such as a variance analysis, plausibility and consistency checks, ratio analysis, and
comparison with forecasts (Solvay, 2017c; 2018). Besides monthly reporting analysis described above, each GBU performance is analysed quarterly by the Group controlling teams in the context of business forecast reviews (Solvay, 2017; 2018).

For economic targets, the Group uses more traditional instruments – such as budgets, Key Performance Indicators, financial measurements and targets – to plan, monitor, measure and report on progress according to preset short- and long-term objectives (Solvay, 2018; Washer 2018). The main financial performance indicators the Group measures and tracks are Cash Flow of Return on Investment, Underling Earnings Before Interest and Taxes, Depreciation and Amortization (Underlining EBITDA) and Free Cash Flow (Solvay, 2018). Using traditional accounting systems, financial data are collected on all Solvay industrial plants, including production sites and R&I centers, and for each business separately in the case of multi-business sites. After a full validation process at the local and regional level, data are systematised and prepared using Group accounting policy, which is in accordance with European Regulation (EC) 1606/2002 on the application of international accounting standards dated July 19, 2002 (Solvay, 2018). The outcomes are consolidated at the Group level in accordance with International Financial Reporting Standards and presented to the Board of Directors and CEO for further use. Furthermore, an online Financial Reporting Guide is deployed to explain how the International Financial Reporting Standards rules should be applied throughout the Group. Using the FSG, the control and monitoring activities are defined for all employees in the a number of domains – i.e., management control, financing and cash flow, financial control, financial communication, tax, and insurance policies – and cross-Group projects, like acquisitions and divestitures (Solvay, 2018).

In the case of its extra-financial performance, the Group makes use of a fairly diversified set of systems. Some of these systems are simple in the sense that they are meant to be used for monitoring one given indicator of one set of themed indicators. Such are the system attached to the Group’s Health Safety & Environment department for carrying out health and safety audits, or the system that accompany the Group’s Ethics and Compliance Department investigations into the potential infringements of the Code of Conduct (Solvay, 2016a). Yet other cybernetic systems are complex and encompass multiple indicators, with different origin and range of use. This is the case of the SPM - the Group’s primary methodology and cybernetic system when it comes sustainability-related, with a particular focus on environment, performance.

SPM is implemented globally to assess the Group’s sustainable development profile through cradle to gates LCA of its products/solutions (Solvay, 2016d; 2018e; Washer, 2018). SPM is considered by the Group as “[...] probably [being] among the best in the industry” (Washer, 2018) as “not many companies are equipped with a
tool that enables them to measure the impact of sustainability in business terms of every decision they make” (Solvay, 2017b, p.32).

SPM is a matrix (Figure 4) that has the capacity to simultaneously assess and combine data on:

(i) Environmental footprint of manufacturing process with operations vulnerability presented on vertical axis, comprising calculation of a product’s ecoprofile, monetization of negative impact, and financial risk of negative impacts/externalities (Solvay, 2016d; Washer, 2018);

(ii) Market threats and opportunities with market alignment presented on horizontal axis, comprising market alignment profiling (via questionnaire) and market alignment categorization (via positioning of the product on a scale of 1 to 5) (Solvay, 2016d; Washer, 2018); and

(iii) Sales volume, which is presented in the matrix in “darker shading representing the revenue at stake” (Solvay, 2016d, p.7).

Figure 4. Sustainable Management Portfolio mapping matrix

Source: Sustainability Portfolio Management Guide, Driving long-term sustainability growth, (Solvay 2016d, p.7)
Such SPM-generated data provides the Group’s users, at strategic and operational level, with the following ready-to-use outputs:

(i) Detailed analysis of business planning that considers environmental footprint within product portfolio planning (Solvay, 2016d);

(ii) Monetization of both the risk related to environmental impact and the “shadow costs” of manufacturing of given product(s)/solution(s) (Solvay, 2016d);

(iii) Degree and range to which the product(s)/solution(s) produced by the Group are an integral part of the solutions that the market and the consumers are seeking to address their own sustainable development challenges (Solvay, 2016d); and

(iv) Strategic project-related decisions in key divisions of the portfolio management, more specifically in Research and Innovation, capital expenditures, and Mergers and Acquisitions (Solvay, 2016d).

SPM is an independent system at the “entry and display” level (Washer, 2018). However, it is linked at the later stage, when the data generated through it is combined for decision-making purposes and strategic discussions strategic discussions between each of GBUs of the Group and Executive Committee (Solvay, 2018; Washer, 2018). For example, in decisions related to investments, top management looks at and includes sustainability assessments by using SPM analysis of the planned investment alongside the financial assessments (Solvay 2016; 2016d; 2017; 2018; Washer, 2018), and accountability for such decisions is based on the combined data generated by the systems tracking both financial indicators and the SPM (Washer, 2018). The choice to have SPM as a separate system stems from the attempt to increase the clarity/the usability and the absorption of data by decision-making managers (Washer, 2018).

Last but not least, the Group deploys hybrid cybernetic systems, comprising financial and extra-financial performance, in the form of scorecards. Such scorecards are applied to both the Group’s internal performance (Solvay, 2017, Washer, 2018) and the performance of its suppliers (Solvay, 2013c).

4.3.5 Cultural controls

The last part explored the existence and employment of cultural controls to shape and reinforce the organizational culture and environment in relation to sustainability within Solvay. The focus was on identifying signals of cultural controls.
When it comes to shared values, the Code of Conduct is the cornerstone of ethics and compliance within the Group (Solvay, 2013a; 2015f; 2016a). The document represents a set of rules on doing business and interacting with stakeholders in accordance and in compliance with the Group’s ethical norms (Solvay, 2013a; 2015f; 2016a). The Code is not covering all possible situations that the employees could face; it rather highlights the guiding principles that connect the employees to the Group’s values that are historically at the basis of its organizational culture (Solvay, 2013a; 2015f; 2016a). As discussed in the administrative MCs package, the Code contains sections dedicated to responsible practices towards the Group’s stakeholders and the environment (Solvay, 2016). Training and guidance are provided in order to facilitate the understating and ensure the application of the Code (Solvay, 2016; 2017; Washer, 2018).

Solvay’s organizational culture in the area of sustainability expands beyond its borders with its suppliers - 39,400 worldwide - being frequently evaluated on different issues, such as human rights, safety and health conditions at working place, conflict-free minerals, and certified sources of raw materials (Solvay, 2017). In 2016, Solvay adopted its Responsible Purchasing and Sustainable Supply Chain Statement that merges and aligns all existing guidelines to Solvay’s ethical and value norms (Solvay, 2017). According to the document, each supplier or sub-supplier needs to be accountable for respecting these rules if they want to maintain business relation with Solvay (Solvay, 2016c). Furthermore, the Group develops external partnerships with international organization and NGOs to foster sustainability enforcement across the supply chain. These partnerships are geared towards the provision of training on compliance with international regulations and laws, sharing of technologies and knowledge spillover, as well as auditing and monitoring of practice across the supply chain (Solvay, 2015f; 2016; 2016c; 2017).

Internal platforms for sustainability discussion are present within the Group. These are meant to encourage social dialogue among employees and management on different topics, including sustainability (Solvay, 2010). Since 2007 the Group has an internal platform, developed as a cross-hierarchical forum, on sustainable development (Solvay, 2010). This forum aim is to initiate discussions and provide support, locally, to sustainability-related projects (Solvay, 2010). Additionally, the Group develops an online platform that will help to guide different its representatives in their work on sustainability within Solvay and with external partners (Solvay, 2017; Washer, 2018). The need to be met but this platform is that of educating the employees in sustainability matters with “commercial people [wanting or needing] a sustainability toolbox […] they can use in their day-to-day issues with their customers” (Washer, 2018, p.10). The new platform is expected to cover the discrepancy between different types of training at different levels, as well as to become a universal source of knowledge that could respond and tackle
specific/needed topics on sustainability issues (Solvay, 2017; Washer, 2018). The platform will become functional at the end of 2018 (Washer, 2018).

Since 2016, the Group reports annually on its financial and non-financial, including sustainability, performance in a unified manner. This is done through its Annual Integrated Reports (see Solvay 2016, 2017). As explained by the Group, “it is more and more difficult to dissociate sustainability from normal operations and it is precisely that message that we drive through the company and that you can see through the [Integrated] Annual Report” (Washer, 2018, p.11)

A number of events/projects that involve employees in volunteering were identified. Examples include the rehabilitating of coral reefs with PVC piping in Thailand (Solvay, 2018a), the worldwide GLEE Project (Solvay, 2018b), the Young Alchemy in Latin America (Solvay, 2018c) and the Centre de Ressources Medico-Social in France (Solvay, 2018d).

Cultural sustainability symbols are equally present within the Group. An example include the Solar Impulse Project - a partnership initiate in 2004 between Solvay and the Solar Impulse on the “first airplane to fly solely on solar energy, demonstrating that chemistry contributes to constructing sustainable solutions for the planet” (Solvay, 2013b, p.94). Internally, this is considered one of the key symbols or Solvay’s efforts in sustainability (Washer, 2018).
5 DISCUSSION OF RESULTS

This chapter is concerned with the analysis and discussion of the data. The discussion is guided by the two theoretical frameworks by Malmi and Brown (2008) and by Crutzen et al. (2017) presented in part 2.3.

5.1 Results by individual management controls packages

Planning controls

Taking the framework by Crutzen et al. (2017) further, we propose to analyze the planning controls in terms of both the breadth and the depth of sustainability integration in this package. Depth, in this case, refers to the integration of sustainability in the long-range planning, the action planning/short-term action, and the alignment of the two. Breadth of the sustainability planning refers to the dimensions/the range of issues covered by the company.

The analysis of the planning controls within Solvay reveals that sustainability is integrated in both the Group’s long-range planning and action planning. These objectives are time bound and measurable (Malmi and Brown, 2008). Importantly, the long-term sustainability objectives find themselves translated and operationalized at the lower levels of action planning. The aforementioned processes cover, in addition to the evident economic dimension, the social and environmental sides of sustainability. A heavier focus, especially at the level of the action planning, is placed on environmental aspects. As such, the planning package satisfies both the criteria of depth and breadth of sustainability integration (Figure 5).

**Figure 5. Breadth and depth of sustainability planning, Solvay results**

<table>
<thead>
<tr>
<th>Breadth</th>
<th>Social dimension</th>
<th>Environmental dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-range planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action/short-range planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Translation from long- to the short-range planning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own development
Such results indicate that sustainability is systemically and systematically pursued through the planning controls within the Group. Moreover, sustainability is not approached as an ad-on to the core economic and financial objectives. Rather, it is what the vision of the company is geared towards, trickling down to the rest of the planning processes.

**Cybernetic controls**

The existence of cybernetic systems does not automatically indicate their use as MCs. According to Malmi and Brown (2008), “cybernetic system can either be an information system or control system” (p. 292). When used for information and decision supporting functions, these are considered information systems; however, when the cybernetic system links behaviour/performance to targets to accountability for variations, it is classified as a MC (Malmi and Brown, 2008). As expected, Solvay has in place and employees cybernetic systems for sustainability. The underlying question is, however, whether these are used as information systems or as MCs. Findings reveal that the latter is the case. SPM is the Group’s primary cybernetic system for sustainability, with a focus on environmental performance, and it is found to establish the behaviour/performance-targets-accountability links. In addition, the system includes in this chain the redress/corrective action, when such is required, feeding it back into the performance loop. Such a use takes the SPM from an information system to a cybernetic management control for sustainability.

A second key point refers to separate vs hybrid cybernetic systems for sustainability (Crutzen et al. 2017). The essence of such (desired) integration of systems lies in the possible marginalization/crowding out of sustainability-related systems when/if they stand alone. Solvay’s SPM is a separate as a system at the “entry” and display level. It is, however, integrated with the systems of financial performance at the decision making, including investment and resource allocation, levels. Findings of this study indicate that Solvay’s choice to have separate systems is informed by the user-friendliness and by the concern for a higher absorption/usage of sustainability data by the managers rather than its marginalization in the process of weighing factors and trade-offs in the decision-making processes. Furthermore, hybrid systems are further used in the company in the form of scorecards (Ittner and Larcker, 1998; Kaplan and Norton, 2001) for its own sustainability performance and that of its suppliers.

Last but not least, such cybernetic systems within Solvay are “fairly complex [and] interrelate” (Crutzen et al. 2017, p. 1296) a host of indicators and uses of such, as discussed earlier.
**Reward and compensation controls**

As recommended by Malmi and Brown (2008), the reward and compensation were approached here separately, rather than as a part of the cybernetic controls. The question guiding the analysis is whether and how these controls are being deployed to boost individual and group performance by aligning their goals and efforts with the organisational targets (Bonner and Sprinkle, 2002) in a given area.

The findings reveal the existence of a number of reward and compensation schemes linked to and contingent of the sustainability performance within Solvay. These are monetary in nature and broad in coverage.

The focus on contingent monetary incentives for sustainability within the Group is justified, as these are generally found to boost performance by focusing efforts on a task (Bonner and Sprinkle, 2002) and to improve sustainability performance (Bain & Company, 2016). In particular, monetary incentives are deemed: (i) to cause individuals to follow goals they would not follow in absence of the monetary incentivization; and (ii) to result in stronger commitment to goal(s) and, therefore, more intense effort “than non-contingent incentives or no incentives” (Locke et al. 1981, as quoted in Bonner and Sprinkle, 2002). Indeed, the findings from Solvay show that the possible non-adherence to or lower buy-in of sustainability-related values of the Group is overcome/compensated by the motivation to secure bonuses. However, monetary incentives have their limits. An important one being the lack of skill(s) that is found to “attenuate the effort–performance relation because, while monetary incentives may induce higher levels of effort, the performance of individuals who lack requisite skills is not sensitive to these effort increases” (Bonner and Sprinkle, 2002, p. 337). Therefore, alongside monetary incentivization, individual skills acquisition and development in the field of sustainability may deserve increased attention.

The coverage of the reward schemes for sustainability is another key point when it comes to SMCs. Such coverage was found, by previous empirical research, to be generally limited to senior managers and, in few cases, extended to middle managers (Crutzen et al. 2017). Findings from the current study show, however, that Solvay’s scheme have a more comprehensive coverage than that, with all employees with a variable compensation having 10 percent of their incentives linked to sustainability targets and with all employees without a variable compensation entitled to a profit-sharing plan indexed to both the Group’s financial and sustainable development performance. Moreover, employees with LTI have their scheme linked to the Group’s greenhouse gas emissions reduction targets. The reward schemes for sustainability are, therefore, found to be wide both hierarchically and temporally-speaking. Such results indicate an explicit and
targeted alignment of the reward and compensation controls with the organizational sustainability agenda.

**Administrative controls**

The administrative controls were considered on the accounts organizational structure and organizational policies/procedures.

In the analysis of the organizational structure in relation to sustainability, attention is paid to the formalization of structures and the line of reporting (Crutzen *et al.*, 2017). Findings from Solvay reveal a multi-layered and formalized sustainability structure, comprising Board of Directors Executive Committee, a shared service sustainability department, and a multi-site and multi-functional core group of Sustainability Champions and Correspondents. The line of reporting is strong going to the CEO and the Board. The existence and the place of the Sustainability Champions and Correspondents is to be underlined as they are deemed to “ground” and “broaden” the sustainability function at the level of the employees. These Champions and Correspondents are found to have, in essence, an implementation function. More specifically, through their own performance and by catalyzing colleagues, Champions and Correspondents work on the realization/application of existing sustainability programs/plans. There may be space to further explore their role and that of the employees, and to structure accordingly, for generating more bottom-up sustainability projects within the company. Such bottom-up approach may increase legitimacy, ownership and employee engagement with the company's sustainability agenda (Lamach, 2017).

Results also reveal that sustainability is translated into the Group's policy and procedure frameworks at all level of action controls - i.e., those dealing with “behavioural constraints, pre-action reviews, and action accountability” (Merchant and Van der Stede, 2007, as quoted in Malmi and Brown, 2008). Two points are to be underlined here. First, sustainability is integrated into both the Group's policies and procedures centering on people (i.e., ethics and HR) and those relating to management model (i.e., purchasing, production, and innovation). To enable/support the understanding and the internal application of “more abstract codes of conduct” (Crutzen *et al.* 2017, p.1296) and related policies, the company has put on place guidelines and training for its employees. Second, the Group has dedicated policies and procedure applicable, in addition to its own performance, to those of its suppliers.
**Cultural controls**

In line with Crutzen *et al.* (2017), the focus was placed on the detection of the signals of cultural controls in relation to sustainability.

Results from Solvay indicate the presence of the following groups of signals: (i) instilling and enforcement of shared values (e.g., Code of Conduct, management book), (ii) development of dedicated platforms (e.g., cross-hierarchical forum, online sustainability platform), (iii) Integrated Annual Report since 2016, (iv) volunteering projects by and with employees, and (v) symbols (e.g., the Solar Impulse Project, CEO statements).

It is to be pointed out that the analysis here focused on the number of signals rather than their assessment (for example, the concern was how the Group pursues sustainability through shared values rather than how well the employees share these values). This may be seen as a challenge as both theoretical frameworks employed in this research – i.e., Malmi and Brown or Crutzen – emphasise the role of informal cultural controls in creating a deeper shared culture, related to sustainability in this case, within a company. However, while stressing the importance, the aforementioned frameworks do not provide sufficient analytical tools or reference points as to what constitutes “shared”, what depth of adherence is expected and/or how this can be examined beyond identification of signals of cultural controls.

### 5.2 Sustainability management controls – pattern analysis

When it comes to the analysis of the formal MCs for sustainability, the Group displays all signals of the “full package” approach (Crutzen *et al.* 2017). This approach indicates that the Group has developed a complete set of formal controls in view of directing sustainability performance within the company and of delivering against its objectives in the said area. Such an employment of MCs also suggests a more active management of sustainability performance (Crutzen *et al.* 2017) and a technocratic institutionalization of sustainability within Solvay.

It to be stressed that, as stated by Crutzen *et al.* (2017), the “full package” approach reveals the availability of the controls and not the extent of their application nor the effectiveness of such a process. This latter point is beyond the scope of the current study and, indeed, the SMCs Pattern framework in general.
Table 1. Full package of formal MCs for sustainability in Solvay

<table>
<thead>
<tr>
<th>Formal controls included</th>
<th>Administrative</th>
<th>Cybernetic controls</th>
<th>Planning</th>
<th>Reward and compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Structure</td>
<td>Policies</td>
<td>Budget</td>
<td>Perf. meas.</td>
</tr>
<tr>
<td>Full package</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

Source: Own adaptation, based on Crutzen et al. (2017)

After adding the second layer of analysis – that of informal cultural controls – to the "full package" of formal controls, Solvay is concluded to fall under the Pattern D of the SMCs Pattern framework (Crutzen et al. 2017). Pattern D stands for full management control for sustainability, indicating development and employment of MCs for sustainability in the areas of planning, advanced cybernetic controls, reward and compensation, structure, and culture. The latter package of informal cultural controls is the key to the SMCs Patterns framework. They are instrumental in enforcing other controls as the culture controls enclose and direct the formal ones (Lueg and Radlach, 2016). More specifically, strong formal controls may fail at the implementation stage if not backed by informal controls that help create internal legitimacy (Aragón-Correa, Marcus and Hurtado-Torres, 2016) and nurture an organizational culture supportive of and conducive to sustainability.

Two points are to be stressed out in the categorization of Solvay under the SMCs Pattern D. First, whilst the SMCs Patterns by Crutzen et al. (2017) do not include policies and procedures, the current study did. This does not affect the current Pattern analysis, however, as Solvay displays a high degree of employment of these MCs for sustainability and would not score lower on this account. Second, given that the difference between the Pattern C and Pattern D (Crutzen et al. 2017) lies in the informal cultural controls and, specifically, in the number of signals displayed by the company (i.e., 4 or fewer indicate Pattern C; 4 or more indicate Pattern D), this study focused on the identification of such signals but not on their evaluation. Challenges of investigating cultural controls (Crutzen et al. 2017), given their informal and hard-to-capture nature (Marschan, Welch and Welch, 1996), were indeed encountered in the current research and may be a pitfall in the aforementioned categorization.
5.3 Analytical limitations and reflections

The initial research by Crutzen et al. (2017) doesn’t classify any of the 17 researched companies under Pattern D, suggesting how scarce are the cases of deployment of both formal and informal controls for sustainability. This study is mindful of the aforementioned fact. However, as mentioned earlier, the framework by Crutzen et al. (2017) provides no reference points as to what is the difference between Patterns C and D beyond the identification of the number of cultural control signals, and as to how these signals can be assessed. This is considered a limitation of the said framework and, by association, of the current study.

Taking further the framework by Crutzen et al. (2017), this study makes a difference between institutionalization and internalization of sustainability within a company through MCs. Institutionalization is proposed to refer to the technocratic deployment of formal controls for sustainability and corresponds to the full package category as proposed by Crutzen et al. (2017). Internalization, on the other hand, is suggested to denote a complex hardwiring of sustainability into the corporate fabric through both formal and informal controls, likely corresponding to Patterns C and D as proposed by Crutzen et al. (2017).
6 CONCLUSION

This was an exploration of how large companies, well placed in the field of sustainability, embed sustainability in their business practice through the use of MCs. In particular, the research focused on a package-by-package analysis of MCs and the integration of sustainability in those.

The study is based on the case of a large corporation Solvay S.A, analyzing the Group’s internal MCs on (i) planning (namely, long-term planning and action planning), (ii) cybernetics, (iii) reward and compensation (namely, monetary incentives); (iv) administrative (namely, structure, policies and procedures), and (v) culture. The framework by Crutzen et al. (2017), with its pattern approach to sustainability MCs (SMCs), was employed in this study as a theoretical lens and as a tool for the evaluation of data output.

Findings indicate systemic and systematic deployment of formal MCs to direct the sustainability performance within the Group. Such actions are not accidental. Rather, they trickle down from the overall strategy and business model of the Group – anchored in and taking sustainability as an economic opportunity – and priority setting level to the management control packages covered by this study.

The Group is found to displays all signals of the “full package” approach to SMCs. This indicates the development of a complete set of formal controls and a technocratic institutionalization of sustainability within Solvay. Moreover, the Group is concluded to fall under the Pattern D of the SMCs Pattern framework with the employment of informal cultural controls on top of the formal ones to internalize sustainability.

It is to be stressed out that such results reveal the availability of the controls – formal and informal – and not the extent of their application and/or their effectiveness. This was beyond the scope of the current research and the framework guiding it (i.e., Crutzen et al. 2017).

In this under-researched area, future investigations are suggested to increasingly focus on the practice, the empirical and the real-world application of the MCs for sustainability. While theoretical material is available, research into business practice is scarce. Moreover, the frameworks employed here and, indeed, the current study itself, investigated the availability but not the performance of MCs for sustainability within companies. Analytical frameworks and tools in this latter area may also be necessary.
NOTES

1 Management Control Systems and Management Controls are used interchangeably in literature. The latter avoids the confusion of the word "system" as denoting informational systems and is used in more recent literature on the subject. This research, therefore, uses the term of Management Controls.
REFERENCES


**CORPORATE PUBLICATIONS/INTERNAL DOCUMENTS/VIDEO/INTERVIEWS/PRESS RELEASES**


Washer, M. (2018). Deputy Chief Sustainability Officer at Solvay, Management Controls at Solvay. Interview with the author, 16 April. Personal communication. (Interview)
APPENDICES

Appendix 1: Company name: Enquire on the use of it as a case study in research into sustainability and management control systems

Dear (persons name),

We write to you to enquire on the possibility of taking (company’s name) as a case study in our research into the issue of sustainability and management control systems within large firms. This research is being conducted within the framework of the MSc Programme in Sustainable Management at the Uppsala University, Sweden.

The specific issue the research focuses on is how companies pursue their sustainability objectives and hardwire them into practice through the use of management control systems. The emphasis is on practice, hence our work will rely on case studies of large firms - leaders in the field of sustainability - and their real-life experience.

Given (company's name) practice in the area of sustainability and your ranking in Dow Jones Sustainability Index, we would like to use it as the key case study in our research. This would entail analyzing existing reports and conducting limited interviews with relevant representatives of the company working on its sustainability agenda. (Company’s name), in turn, will be provided with data gathered through the research and the findings. The name of the company could be made public or, if you prefer, remain anonymous. Would such a course of action be possible and of interest to you?

The attached brief document provides more information on our research, which we stand ready to discuss further. Should you have any questions and/or require additional details, please let us know. We are happy to meet in person and/or Skype at your earliest convenience.

We look forward to your response and to the possibility of cooperating on this research project.

Best regards,

Alexandru Buftic and Dimitrios Karafylloudis
Appendix 2: Interview Guide

The below interview questions is a representative piece of the questions asked at the interview. The questions concern the five types of MCs that are structured as follows: (i) Administrative Controls, (ii) Cybernetic Controls, (iii) Reward and Compensation, (iv) Cultural, and (v) Planning.

Administrative controls

The first set of questions refers to administrative controls. Here we wanted to discuss the organizational structure and the main policies relating to sustainability.

1. Could you please explain more on how these structures work: how and who coordinates their work towards common sustainability objectives?
2. How the work is organized to ensure accountability and reporting on the established sustainability objectives and targets?
3. How would you assess the performance of this structure? Do you see a need for it to be revised or is this seen as an optimal organization of your sustainability work?
4. To what extent senior management use policies, procedures and rules to control and promote sustainability strategies? For example, what is the place of sustainability in policies such as your code of conduct and your management book?
5. Are there guidelines to accompany and help the employees understand and follow the sustainability-related parts of the Group’s code of conduct and your management book?
6. How, in general, are the employees and the management helped to understand and developed their skills in the area of sustainability?

Cybernetic controls

The second set of questions is about Cybernetic controls, which cover all financial, non-financial and hybrid systems of the company. Here we wanted to discuss how such systems cover sustainability in Solvay and how they generally operate.

1. How does your company track, measure and evaluate the performance toward sustainability objectives? Which systems of reporting does your company use? Is
reporting done in one or many systems, using separate or consolidated financial and non-financial data?

2. In brief, what is Sustainable Portfolio Management (SPM)? Is SPM a third party validated system?

3. Could you please explain more if and how SPM is integrated with other company’s systems and budget?

4. If and how SPM is linked to Solvay Way. If they are linked, through which systems and how it works?

5. How is the data generated through SPM or Solvay Way monetized and integrated in your budget and financial performance indicators?

6. Do you have other tools used for sustainability, for example balanced scorecards and such?

**Reward and compensation**

The third set of questions refers to your reward and compensation schemes and how these integrate sustainability.

We see that your company is using reward systems to motivate your employees in the area of sustainability; we have several questions regarding the coverage of this scheme and their performance

1. Very briefly, what are the MAIN schemes you are using?

2. What is the coverage of these schemes: do they cover only senior and middle management levels or are they covering all the employees and hierarchical echelons levels? How many people?

3. We see that in 2015 you have allocated 10 million for reward schemes linked to sustainability, was this budget maintained after 2015? At what levels the budget stayed?

4. We see that in 2015, (was extended for 2016-2017) you had a group reward profit sharing plan with 20 percent is linked to sustainability development targets, did this scheme work well? Did you decide to extend and make the scheme permanent tor not?

5. We see that 10 percent of your STI are linked to Group Sustainable Development indicator. Is LTI linked in similar ways to sustainability?

6. On a general level, do you think that your reward schemes motivate well/effectively your employees in pursuing sustainability? Do you see any areas as particularly strong or needing improvement?
Cultural

In this package we were interested in your organizational culture and the place of sustainability in it. We seek to understand how the sustainability agenda and commitments are articulated, how it is communicated inside the company and how it is owned by the employees.

1. How are your sustainability vision and objectives communicated to managers and employees?
2. Do you think sustainability is a shared value in your company? How do you build ownership of sustainability and its values inside the company and in all employees?
3. What are the specific platforms (online and otherwise) that you have to bring employees around the topics of sustainability?
4. Do you have flagship programs/initiatives that bring employees around sustainability? Do these programs emerge from top to bottom or is there a space for the employees to generate sustainability solutions and to bring them to upper levels?
5. What is the role of the company's leadership and family in committing to sustainability and bringing the employees around this agenda?

Planning

The last set of questions refers to planning management control systems. In this package we seek to understand how sustainability is integrated in long-term planning in Solvay and how this is translated into short-term action.

1. How many long-term objectives of your company pertain to sustainability? Are these a part of the company's main long-term plan or does sustainability have its separate plan?
2. How are sustainability objectives translated into short-term actions? And how many of the long-term objectives are found in short term actions?
3. Do you have separate short action plans for sustainability or is sustainability mainstreamed/integrated into the main plans and management processes of the company?
4. How are sustainability objectives being operationalized at different levels? Are they being integrated in plans by all Members of the Group? How about levels – are they being integrated in your international and country plans?
Appendix 3: Database summary

The table below aims to present accumulated all the information that was used in the discussion of the thesis that touched upon the research question, the research process and the conclusions. The main objective of this effort is to make the documents easily retrievable for later scrutiny (Yin, 2009).

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<td>Washer, M.</td>
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