TYPES OF INTELLECTUAL CAPITAL EMPLOYED IN BIOECONOMIC PROJECTS – A LONGITUDINAL CASE STUDY

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Please cite this article as:
Săndulescu, M.S., Stoica, D.A., Albu, C.N. and Albu, N., 2018. Types of Intellectual Capital Employed in Bioeconomic Projects – A Longitudinal Case Study. *Amfiteatru Economic*, 20(49), pp. 667-683.

DOI: 10.24818/EA/2018/49/667

Article History
Received: 30 March 2018
Revised: 18 May 2018
Accepted:29 June 2018

Abstract
In this paper we investigate the existence and evolution of bioeconomic projects of OMV Group, a major global player in the oil and gas industry. We further study the intellectual capital components utilized by OMV Group in supporting these bioeconomic actions. We conduct a longitudinal case study over the 2010-2016 period and illustrate with the case of OMV Group how the oil and gas organizations mobilize various types of intellectual capital to engage in bioeconomic projects. Since the global importance of bioeconomy increased exponentially in the last years, we employ a theoretical framework recently proposed in the bioeconomic literature to ascertain the type of vision followed in the bioeconomic projects and its evolution. We find that the number of bioeconomic projects proposed by our case organization increased over time, and that the projects' focus evolved from bio-technology and bio-resources to bio-ecology, which has the potential of providing more long-term sustainable outcomes.

Key-words: bioeconomy, intellectual capital, innovation, sustainability, oil and gas industry

JEL Classification: Q57; L65; Q16; O34

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Introduction

The recent bioeconomy move originated in the interest manifested at the beginning of the 1970s for research on biotechnologies and the work on bioeconomics by, for example, Nicolae Georgescu-Roegen (Gowdy and Mesner, 1998; Mayumi, 2009; Birner, 2018), and got an important boost through the policies recently pursued by the Organization for Economic Cooperation and Development (OECD) and the European Commission (EC) (Mayumi, 2009; Birch and Tyfield, 2012). The analysis of the significance of the concept shows a shift from the perspective of resource substitution to the biotechnology innovation perspective (Birner, 2018). Despite some recent critiques, as exemplified by the "fetishization of all things *bio*" (Birch and Tyfield, 2013, p. 301), the international support of those concepts is currently overwhelming, and an increasing number of entities started complying to such international policies, agreements and recommendations (OECD, 2009; European Commission, 2012; Purkus, et al., 2018). Several current challenges of the twenty-first century, such as fossil resources and climate change, bio-based resources, planetary boundaries and limitation of natural resources, as well as population growth and food security are addressed by the bioeconomy, in its capacity of "sustainable and innovative use of biomass and biological knowledge to provide food, feed, industrial products, bioenergy and ecological and other services" (Lewandowski, et al., 2018, p. 14).

In this context, intellectual capital (IC) plays an important role in ensuring the development of bioeconomic projects. The extent and speed of innovation depend on an effective knowledge base and on the importance of IC in organizations. IC growth has the potential of contributing to developments in the bioeconomy field through increased innovation abilities developed as a result of intensified IC investments. Innovative capacities will result in opportunities to create new products, services or work practices (Van de Ven, 1986).

Given the importance of IC for bio-economy, we aim to investigate in this paper the existence and evolution of organizational bioeconomic practices of a company from the oil and gas industry, and to explore how IC is employed to support these actions. Following recommendations by current IC research (Dumay and Garanina, 2013), the emphasis is not on measuring IC, but on investigating its implications and importance within an organization. To that end, and as a contribution, we apply the theoretical lens proposed by Bugge, Hansen and Klitkou (2016) to uncover how the focus of bioeconomic projects may have evolved over time. The framework comprises three types of vision pertaining to sustainability projects: bio-technology, bio-resources and bio-ecology.

We mobilize for our analysis the case of OMV Group (hereafter referred to as either OMV or the Group), a major international player in the oil and gas industry, as an illustration of how global organizations respond to and develop projects in line with the bioeconomic global orientation. We perform a manual content analysis of seven Sustainability Reports (SR) issued by the Group between 2010 and 2016, and look specifically at nine bioeconomy projects launched over the period.

The remainder of this paper is organized as follows: Section 1 presents a review of the relevant literature on bioeconomy and IC, and the theoretical framework of our research. Section 2 details the research methodology and presents the case organization, while Section 3 presents our results and discussions ~~analysis~~. We finally conclude and present the paper's contributions to literature.

1. Review of the scientific literature

1.1. What is bioeconomy?

Recent concerns in the bioeconomics sphere have crystallized in the second half of the 20th century, an important precursor of the movement being Nicolae Georgescu-Roegen (Gowdy and Mesner, 1998; Mayumi, 2009; Birner, 2018). Since then, becoming a sustainable and equitable society has become a major concern for governments, public institutions, businesses and individuals (Heijman, 2016). This need has been fueled by the growing effects of globalization, population growth and concerns about climate and environmental change (Aquilani, et al., 2018).

Globalization has had, over the past decades, an extensive impact over countries, institutions, business and individuals and it has led to the development of new technologies and processes (Pop and Valeriu, 2015; Lehtonen and Okkonen, 2016). Moreover, given the impact that globalization has on the environment, sustainability concerns were raised. Thus, the sustainability concept has become one of the most pressing challenges of our century, being a keyword in the global research and political agendas for decades (D'Amato, et al., 2017). There are many movements in the area of sustainability, such as circular economy, green economy and bioeconomy.

The European Commission defines bioeconomy as an "economy that encompasses the production of renewable biological resources and their conversion into food, bio-based products and bio-energy. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries" (European Commission, 2012, p. 5). Other definitions of bioeconomy exist in various sectors (i.e. bio-fuels – Scarlat, et al., 2015; bio-technologies – OECD, 2009; reduced emissions and the use of fossil fuels – Philip, 2015). Bioeconomy is a branch of green economy that the European Commission has included at the core of its long-term strategy towards 2050. The concept is centered on the usage of renewable raw materials and application of research, development and innovation, and industrial biotechnology (Scarlat, et al., 2015). It also allows the use of available biological resources more effectively than before by innovative methods and to supplement their fields of application on the basis of new scientific knowledge and findings. Industrial applications include the use of biotechnological processes to produce chemicals, plastics, and enzymes, environmental applications such as bioremediation and biosensors, methods to reduce the environmental effects or costs of resource extraction, and the production of biofuels (OECD, 2009).

The academic literature followed this trend, and a significant number of studies on bioeconomic issues were conducted to better explain the various aspects of this concept, ranging from social sciences to chemistry, from international and national economy to commodity science (Heijman, 2016; Aquilani, et al., 2018). There is however scope in expanding this literature given the political importance of this concept and its emerging nature over time. For example, more studies are needed to reflect on how organizations in various domains respond to this global trend.

1.2. How can intellectual capital mediate the outcome of bioeconomy practices?

IC entails a set of knowledge resources used by companies in order to create corporate value (Roos and Roos, 1997; Abhayawansa and Guthrie, 2010; IIRC, 2013) and gain competitive

advantage (Nahapiet and Ghoshal, 1998; Youndt, Subramaniam and Snell, 2004; Subramaniam and Youndt, 2005; IIRC, 2013). The relationship between IC and a company's ability to innovate has also been widely investigated (Ahuja, 2000; Subramaniam and Venkatraman, 2001; McAdam, 2002; Subramaniam and Youndt, 2005). A causal relationship has been established between the two concepts, as innovation entails the identification of potential opportunities to create new products, services or work practices (Van de Ven, 1986) while IC facilitates the achievement of these objectives (Ahuja, 2000; Subramaniam and Venkatraman, 2001; Subramaniam and Youndt, 2005). In this view, for companies involved in research and development (R&D) and innovation activities, it becomes relevant to use the SR and other corporate channels to report on IC as a sign of their innovative actions and a signal of the future development of the organization.

The existing literature identified three IC components namely, the human, the organizational and the social capital (Nahapiet and Ghoshal, 1998; Youndt, Subramaniam and Snell, 2004; Subramaniam and Youndt, 2005). Recent studies (Dumay, 2009; Dumay and Garanina, 2013; Cuozzo, et al., 2017) show that, although there are dozens of classifications of IC components in literature, this tripartite analysis (that is, human, organizational and social capital) is widely accepted. Furthermore, these studies recommend a more in-depth analysis of IC and its components in organizations. The primary source of human capital are the employees with their associated knowledge, skills, abilities and motivations to innovate (Subramaniam and Youndt, 2005; Beattie and Smith, 2013; IIRC, 2013; Melloni, 2015; IIRC, 2013). The organizational capital includes elements such as manuals, databases, patents, copyrights, software, structures, systems, procedures and protocols (Youndt, Subramaniam and Snell, 2004; Subramaniam and Youndt, 2005; Cabrita and Vaz, 2006; Melloni, 2015; Subramaniam and Youndt, 2005; Beattie and Smith, 2013; IIRC, 2013; Melloni, 2015). In turn, the social capital comprises the knowledge resources linked to interactions among individuals such as customers, suppliers or R&D partners (Nahapiet and Ghoshal, 1998; Subramaniam and Youndt, 2005; Beattie and Smith, 2013; Melloni, 2015; Subramaniam and Youndt, 2005) and the trust and loyalty resulted from these relationships (IIRC, 2013).

However, these aspects of IC are not independent and they should be assessed according to their inherent characteristics. While the individual knowledge associated with human capital can change as a result of employees' mobility, the organizational capital is static, being preserved within the company (Subramaniam and Youndt, 2005). In a similar vein, the social capital, which includes a network of individuals cannot be easily impacted by the changes in specific individual actors (Bourdieu, 1985). Moreover, while organizational knowledge is generally bounded within a set of rules and procedures that tend to follow a predetermined pattern, social capital entails a flexible exchange of knowledge (Kostova and Roth, 2003; Subramaniam and Youndt, 2005). As a result, these intangible resources are dynamic and tend to complement each other: the human capital facilitates knowledge creation by giving rise to unique ideas, the organizational capital facilitates the storage and dissemination of knowledge resources throughout the company (Subramaniam and Youndt, 2005; Cabrita and Vaz, 2006) and the social capital enhances the abovementioned roles by facilitating the collaboration of individuals both within and between organizations (Subramaniam and Youndt, 2005; Melloni, 2015).

Dumay (2009), Dumay and Garanina (2013) and Cuozzo, et al. (2017) show that many of the IC studies are aimed at identifying and measuring its components, while the current interest lies in understanding how IC interacts with organizational practices and how IC is mobilized

for various projects. This study thus extends previous research by investigating the extent to which organizations utilize their IC abilities and blend its various components to develop bioeconomic projects.

1.3. Theoretical framework

Following a literature review of 453 papers on bioeconomy published between 2005 and 2014, Bugge, Hansen and Klitkou (2016) identify three ideal visions of bioeconomy, namely the bio-technology vision, the bio-resource vision and the bio-ecology vision. The key characteristics of the three bioeconomy visions are presented bellow (table no. 1).

Table no. 1. Key characteristics of the bioeconomy visions

	The Bio-Technology Vision	**The Bio-Resource Vision**	**The Bio-Ecology Vision**
Aims & objectives	Economic growth & job creation	Economic growth & sustainability	Sustainability, biodiversity, conservation of ecosystems, avoiding soil degradation
Value creation	Application of biotechnology, commercialization of research & technology	Conversion and upgrading of bio-resources (process oriented)	Development of integrated production systems and high-quality products with territorial identity
Drivers & mediators of innovation	R&D, patents, Technology Transfer Offices, Research councils and funders (Science push, linear model)	Interdisciplinary, optimization of land use, include degraded land in the production of biofuels, use and availability of bio-resources, waste management, engineering, science & market (Interactive & networked production mode)	Identification of favorable organic agro-ecological practices, ethics, risk, transdisciplinary sustainability, ecological interactions, re-use & recycling of waste, land use, (Circular and self-sustained production mode)
Spatial focus	Global clusters/ Central regions	Rural/Peripheral regions	Rural/Peripheral regions

Source: Bugge, Hansen and Klitkou, 2016, p. 10

As explained in Bugge, Hansen and Klitkou (2016), the bio-technology vision clearly privileges economic growth and job creation, assuming positive effects on climate change and environmental aspects. Investments in research and innovation are fundamental in this vision, resulting in the production of scientific knowledge from a linear model of innovation, concentrated in a limited number of regions globally. More sustainability concerns are addressed in the bio-resource vision of bioeconomy, as capitalizing on bio-resources would drive economic growth. This vision highlights the processing and conversion of bio-resources into new products. Research and innovation are also important to this vision, but result from collaboration of partners with dissimilar competences and across sectors. Finally, the bio-ecology vision is primarily directed to achieving sustainability, promotes biodiversity, conservation of ecosystems and prevention of soil degradation. These visions are not mutually exclusive and can overlap (Devaney and Henchion, 2018).

2. Research methodology

An important number of international, regional and national governmental and policy organizations have developed bioeconomy strategies in the past decade. For example, OECD and the European Commission have both produced key strategy documents (OECD, 2009; European Commission, 2012), and several European countries (including Austria, Denmark, France and the Netherlands) have developed national policy strategies for the bioeconomy.

We thus investigate the application of those policies in the case of OMV, a listed Austrian group acting in the oil and gas industry. We select OMV first because it is based in a European country equipped with a national strategy for the bioeconomy (i.e. Austria). Second, the oil and gas industry where our case organization acts, is one of the appropriate fields for having projects and initiatives pertaining to bioeconomy. Third, given the nature of its activity, the Group's activities have an environmental impact, and is therefore expected to be committed to sustainability policies.

Therefore, the general approach of our research is to construct a case study, since we have proposed a "comprehensive description of an event or social unit" (Şandor, 2013, p. 22). Cassell and Symon (1994) show that the dynamic analysis of organizational phenomena is an important area of research and that case studies allow for a detailed analysis of the change. The case study as a research strategy is specific to qualitative research, which in turn involves inductive analysis, the use of some theories to understand the phenomenon and the factors that influence each other, as well as a design of context-dependent research continuously adapted along the way (Şandor, 2013, p. 22).

Case studies can be based on different types of data, depending on the researcher's access to data (Şandor, 2013). Given the limited access to the Group's activities, as well as previous research in the IC field (Guthrie, Petty and Yongvanich, 2004), we utilize the corporate reports issued by OMV. Previous studies in the IC area show that the analysis of corporate disclosures is a common method of research (Guthrie, Petty and Yongvanich, 2004; Dumay and Cai, 2015). "Annual reports are highly useful sources of information, because managers of companies commonly signal what is important through the reporting mechanism" (Guthrie, Petty and Yongvanich, 2004, p. 287). They are therefore an important means of communicating with the stakeholders the main achievements and strategic projects of the companies.

We thus select for our study the seven most recent SR that address the OMV's bioeconomic actions and policies, starting with the year 2010. We excluded prior reports from the analysis because it was after 2010 that most such initiatives in the area of bioeconomy have emerged and developed in OMV. We performed a manual content analysis of the corporate reports, following prior literature (Guthrie, Petty and Yongvanich, 2004; Melloni, 2015). This research method is predominant in IC studies (Dumay and Cai, 2015), and its limits are primarily related to the quantitative analysis employed sometimes. We have not, however, attempted to measure IC but to investigate its effects, and thus circumvent such criticism.

This approach facilitated the in-depth analysis of corporate narratives. The content analysis was carried out in a qualitative manner (Şandor, 2013, pp. 172-178), where the coding is not aimed at the statistical analysis of trends and causality, but it is a theoretical one (Krippendorff, 2013). Particularly, the analysis was performed through a process of close reading of the documents, while also comparing their content in order to assess the evolution of the messages. The first procedure entailed the identification of statements devoted to IC

disclosures with a focus on (but not limited to) a specific section of the SR (i.e. the section in which the company discloses information about innovation). We also considered other statements in the reports that highlighted the company's perspective on innovation. The second procedure concerned the classification of statements into one of the three IC categories, namely human, organizational and social capital. Thus, from a methodological point of view, coding was both open (text analysis and code attachment) and selective (the identification of the phenomena and aspects related to the subject investigated) (Strauss and Corbin, 1998). Finally, we have analyzed nine bioeconomy projects launched by OMV post-2010 and considered their characteristics. Coding of these characteristics was made independently by two team members, thus ensuring the validity of the approach. Based on this analysis, we employed the theoretical framework and its three visions to organize the codified material. We presented our results in accordance with the methodological recommendations for qualitative content analysis (Şandor, 2013, pp. 177-178), in a narrative style (with quotes from the reports), in a quantitative style (highlighting the trends – for example, the evolution of expenses), and in a tabular and graphical style.

2.1. The OMV Group as case organization

OMV is one of the most important listed entities in Austria, with a workforce of 20,700 employees and an important international representation. The Group is active in Refining and Marketing in 13 countries and in Exploration and Production in 17, on four continents. The Austrian government holds a significant participation in the Group (31.5%) and IPIC Abu Dhabi holds 24.9% of the shares; the rest (43.3%) represents free float, shares being mainly held by investors from Austria, UK and USA, and own shares (0.3%).

OMV has taken a stance towards a more sustainable environment by signing the United Nations Global Compact, the world's largest initiative to encourage companies to adopt sustainable practices and report on their implementation. This position is further illustrated in the Group's strategy: "We aim to provide energy for a better life. We are producing and marketing oil & gas, innovative energy and high-end petrochemical solutions – in a responsible way" (www.omv.com). In its SR OMV recognizes the dangers of climate change and has committed to significantly reduce greenhouse gas emissions. The Group has also adopted a comprehensive code of conduct and a business ethics directive.

OMV publishes a SR simultaneously with its annual report. The SR focuses on managing sustainability along the entire value chain. SRs also provide detailed information on stakeholder relationships, human resources, health and safety, human rights, security, environmental management, climate change, renewable and future energies and R&D. The focus of the Group is on combining economic prosperity, social cohesion and environmental protection. Consequently, these actions are oriented towards creating long-term sustainability. Moreover, OMV has initiatives and projects in the area of bioeconomy, which we further analyze in terms of innovative effort and the bioeconomy vision.

3. Results and discussion

OMV's commitment to sustainability is visible through its reporting. As a first step, the results of the qualitative analysis of open and selective coding data (Strauss and Corbin, 1998; Şandor, 2013) are narratively presented (Şandor, 2013).

The company's reports show how OMV integrates social, environmental and economic considerations into its business, by developing strategies in the areas of health, safety, security and environmental management as well as human resources support to sustainability management. Moreover, the evolution reported over time is a first indication of the innovation efforts that OMV is pursuing in the area of sustainability. This evolution is sizeable in two directions: the form of the disclosure and the initiatives disclosed. The form of disclosure and assurance indicates, first, the plurality of disclosure standards (Albu, et al., 2013). OMV SRs for the period 2010-2013 meet the requirements of the A+ application level of the GRI G3 framework, with assurance provided by Deloitte. Since 2014, the company follows the G4 Guidelines which will be superseded with the GRI Sustainability Reporting Standards starting with the 1st of January 2018.

Second, the sustainability efforts intensify during the period investigated. As such, the reports indicate that OMV engaged in consultations with the external stakeholders of the company. The Group identified 18 distinctive areas of interest and classified them on three levels of importance:

- High importance: health and safety; oil spills; security; business ethics and corruption; energy efficiency; regulatory environment; employee attraction, retention and training; impacts of climate change; governance; community engagement; diversity; human rights;
- Moderate importance: water management; renewable energy; supply chain management; R&D;
- Low importance: unconventional energy sources; biodiversity.

Safety, security, environment, health, community and stakeholder relationships and socio-economic affairs are reported to be at the core of OMVs vision for attaining long term sustainability. The Group reports to be involved in developing new technologies and by applying the best practices OMV strives to act in a responsible manner and promote sustainable growth for all its stakeholders and interested parties.

Starting with 2010, two areas of interest – People and Planet – have been highlighted at the management level. In the first year, over 3,600 sustainability goals were defined by managers, with 53% related to health and safety, 30% in the area of CO2 emissions reduction, and 17% targeting diversity issues (OMV SR, 2010, p. 8). The Group set the goal of reducing the CO2 emissions generated from its activities by 80% by 2050, a target agreed by European Union and G8 leaders in 2009. This goal may require 95% decarbonization of the road transportation sector.

In this respect, we have noted slight improvement over the time period we investigated, from 12.2 million tones CO2 equivalent in 2010 to 11 million tones CO2 equivalent in 2016 (which is a decrease by almost 10% of these emissions). Such improvements are achievable mainly as a result of sustainability projects focused on more ecological activities and biofuels, projects sustained by innovation.

A significant part of the innovation in the area of sustainability pertains to bioeconomy projects. OMV's engagement in bioeconomy projects has emerged starting in 2010. The content analysis of about 500 pages of OMV's reports and the open and selective coding (Strauss and Corbin, 1998; Şandor, 2013) have led us to the identification of bioeconomic

projects. Next we present an overview of the projects in which the company is currently being involved (table no. 2).

Table no. 2. Bioeconomy projects initiated by OMV since 2010

No.	Project title	Brief description	Inception year	Individual or partnered
1	Hydrogen mobility-Germany	Building a hydrogen fueling infrastructure in Germany	Prior to 2010	Partnership
2	Hydrogen mobility-Austria	Building a hydrogen fueling infrastructure in Austria	2012	Individual
3	AUFWIND	Production of alternative aviation fuel	2013	Partnership
4	Wind2hydrogen	Production of renewable hydrogen.	2014	Partnership
5	Synthesis Gas	Production of a renewable and CO2 neutral fuel	2014	Partnership
6	Feedstock recovery	The use of plastic waste to produce synthetic crude	2016	Individual
7	Electro-mobility	Develop the charging network for battery powered electrical vehicles	2016	Partnership
8	Co-Processing of renewable feedstocks	Increase the quality and stability of fuels with biogenic components	2016	Individual
9	Direct conversion of CO2 to hydrocarbons	Conversion of CO2 and biomass to alcohols, which can be added to gasoline.	2016	Partnership

All the projects described above have produced positive outcomes, thus none of the projects has been discontinued by the Group and their respective partners. In addition, figure no. 1 highlights the increasing importance ascribed by the company to such activities over time, as the number of projects increased year to year (from one project in 2010 to nine projects in 2016). The innovation effort reflected by the R&D expenditure followed a similar pattern. In particular, the 2010 R&D expense amounted to EUR 15.8 million, while in 2016 the amount amounted to EUR 28.4 million, which represents an 80% increase.

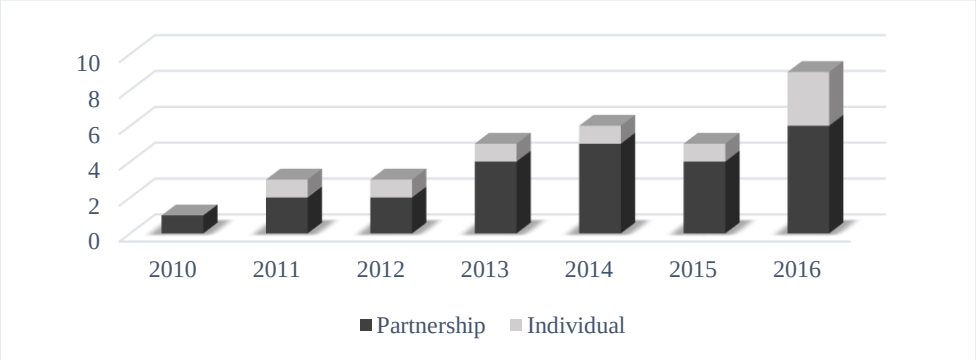

Figure no. 1. Time-evolution of the bioeconomy projects initiated by OMV

We first analyze in more depth the innovation efforts of the Group and the components of the IC mobilized. The most visible component of the IC is the social capital, as also indicated in figure no. 1. The vast majority of the Group's projects are developed in partnerships. The following quotes are used to further illustrate the abovementioned tendency and to underline the role of the social capital in OMV's innovation process. More precisely, the company highlights in its SRs the close cooperation with other organizations from within the industry, but also with universities and research institutes, with a view of creating new energy sources and technologies.

- "Together with our five partners in the H2 Mobility initiative, we have agreed on a specific action plan for the construction of a nationwide hydrogen-refueling network for fuel cell powered electric vehicles." (OMV, 2013, p. 16)

- "In Germany, we are part of a consortium, under the leadership of the research center Jülich, which aims to demonstrate that microalgae for the economically viable production of alternative aviation fuel can be cultivated in Germany." (OMV, 2014, p. 10)

- "Another innovation area is the direct conversion of CO2 to hydrocarbons like alcohols. Together with the Technical University of Vienna, Austria, OMV started the investigation under laboratory conditions to convert CO2 and biomass enzymatically to alcohols, which can be added to gasoline." (OMV, 2016, p. 47)

We noted in OMV's discourse the words utilized to reflect the partnerships and hence the importance of the social capital for the company. These statements indicate the company's "ability to share information to enhance individual and collective well-being" (IIRC, 2013, p. 15). Our analysis supports previous research finding that IC disclosures are generally focused on social capital (Guthrie and Petty, 2000; Bozzolan, Favotto and Ricceri, 2003; Davey, Schneider and Davey, 2009; Melloni, 2015).

We also identify in the Group's reports several disclosures which made reference to the organizational capital. As the company also develops individual projects, the role of this IC component in the process of innovation was emphasized:

- "OMV leverages synergies of exploration, production and power plant know-how and will analyze the potential in this area with the aim of investing in a geothermal power plant." (OMV, 2011, p. 74)

- "This research project is using biogenic material unfit for human consumption – such as woodchips and straw – to produce energy and draws on our refining know-how and the existing facilities at Schwechat." (OMV, 2012, p. 16)

Statements associated with the role of the human capital were also identified. Moreover, the corporate narratives included quantitative disclosures in order to underline employees' contribution to knowledge creation:

- "Innovative ideas from our employees saved us EUR 8,774,380 in 2012." (OMV, 2012, p. 60)

- "We have the skills, the international presence and the commitment to make a real difference to how the world consumes energy." (OMV, 2013, p. 17)

In summary, the analysis suggests that OMV's innovation efforts in the area of bioeconomy rely on all the components of IC. The employees' skills and motivations to innovate (i.e.

human capital), together with the elements that entail the organizational capital, represent essential components for the company's innovation strategies. In addition, the social capital builds on these elements by complementing and enhancing their importance. These findings are consistent with previous literature on IC (Ahuja, 2000; Subramaniam and Venkatraman, 2001; Subramaniam and Youndt, 2005). Given the prevalence of the corporate disclosures associated with the social capital component of the IC, our analysis suggests that in the context of bioeconomy, social capital is the most important facilitator of the OMV's ability to innovate. As such, partnerships seem to represent the most important way in which the company intends to deliver sustainable benefits to its stakeholders, while at the same time pursuing its future growth and revenue generation. In turn, a sustainable behavior also provides the corporate license to operate in the society, which represents the necessary condition to maintain "the social acceptance of our operations" (OMV, 2016, p. 3).

Next, we turn to the type of vision encapsulated by the projects pertaining to bioeconomy. We carefully analyze their description in the corporate reports in order to identify the types of vision associated. The coding and classification was independently performed by two researchers, to limit the subjectivity of the analysis (Krippendorff, 2013) and it entailed the identification of the relationship between the text of the reports and the theoretical framework proposed by Bugge, Hansen and Klitkou (2016) by means of keywords (open, axial, and selective coding according to Şandor, 2013, p. 175).

Table no. 3: Bioeconomy vision of OMV's projects

No.	Project title	Details	Bioeconomy vision
1	Hydrogen mobility-Germany	The consortium (17 companies – car manufacturers, oil and gas companies and utilities companies) developed a joint entity business model to develop an infrastructure for hydrogen in Germany	Technology
2	Hydrogen mobility-Austria	Focus on hydrogen fuel cells as an alternative to traditional means of transport, while simultaneously reducing CO2	Technology
3	AUFWIND	Production of alternative aviation fuel	Resource
4	Wind2hydrogen	Establish the conditions needed to produce renewable hydrogen	Resource
5	Synthesis Gas	SynGas can be transformed into liquid fuel such as petrol or diesel and is widely used as a chemical feedstock	Resource
6	Feedstock recovery	The project uses plastic waste to produce synthetic crude in a pyrolysis process. This recycled crude can be processed into any desired refinery product, while reducing the dependence on fossil resources and improving carbon intensity	Ecology
7	Electro-mobility	The innovative partnership supports the transformation process on the energy market. OMV will take a 40% stake in SMATRICS (a provider for all services related to electro-mobility and the first to offer a complete, high-performance charging network throughout Austria)	Technology

No.	Project title	Details	Bioeconomy vision
8	Co-Processing of renewable feedstocks	Co-Processing introduces the biogenic additive already in the production process. Innovative refinery integrated biomass-to-liquid concepts to produce gasoline and diesel from biogenic feedstock are the basis on which OMV develops next generation fuels	Ecology
9	Direct conversion of CO2 to hydrocarbons	Conversion of CO2 and biomass to alcohols, which can be added to gasoline	Resource

With regard to our theoretical lenses, we note that most early projects tend to result in the creation of bio-technologies through innovation and research activities. For example, regarding Project no. 1, the Group states that:

"The H2 Mobility initiative was founded in September 2009 as a public-private partnership between Germany's National Organisation for Hydrogen and Fuel Cell Technology (NOW) and eight industry stakeholders, including OMV. Its aim is to build a hydrogen fueling infrastructure by 2015 and successfully introduce fuel cell vehicles into the German market." (OMV, 2010, p. 19)

The project thus assumes that developing this infrastructure will benefit the host country of Germany by finally introducing cell vehicles on the respective market. It also obviously creates jobs for builders of this infrastructure, and mobilizes important research and innovation resources resulting in new technology. It thus exemplifies the bio-technology vision of bioeconomy.

Project no. 3 has a however rather different scope. Initiated in 2013 and coordinated by the Jülich research canter, one of the largest interdisciplinary research centers in Europe, the project aims at producing alternative aviation fuels:

"The AUFWIND project involves twelve partners from research and industry, with Jülich researchers investigating the suitability of biomass made from microalgae as a basis for the production of kerosene. This innovative undertaking will optimize the production of algae oil by assessing different photo bioreactor technologies and adapting them to Central European conditions. The project is evaluating whether the process is economically and ecologically feasible." (OMV, 2014, p. 10)

As a result, bio-resources are processed and converted into new products through research and innovation activities, thus being characteristic of a bio-resource vision on bioeconomy (Bugge, Hansen and Klitkou, 2016).

In addition, starting with 2016, OMV initiated Project no. 6, which uses plastic waste to produce a synthetic crude that reduces the amount of fossil resources needed in plastics production. The following excerpt further denotes the manner in which the bio-ecology vision was adopted:

"Circular economy and urban mining are two important topics at OMV. Recycling used plastics instead of burning it as waste is one important way to make better use of a valuable resource. However, the quality of recycled plastics is often not very high. Feedstock recovery

is an innovative OMV research project which uses old plastics to produce synthetic refinery feedstock." (OMV, 2016, p. 45)

Thus, as exemplified in our analyses, OMV's bioeconomy activities fall in all three visions of bioeconomy identified in Bugge, Hansen and Klitkou (2016). However, these activities seem to gradually shift their focus over time from creating bio-technologies to that of bio-resources, and finally by being focused on bio-ecology. As indicated by Bugge, Hansen and Klitkou (2016), these visions thus coexist in practice and may be used at different phases of bioeconomy projects. The more complex nature of ecology-related project seems to defer their beginning after the commencement of projects in the other two visions. Additionally, our analyses also portray the joint existence of projects classified in all three visions at the same time, depending on their focus. 2016 thus corresponds to launching four new projects, one creating technology, one focused on bio-resources and two bio-ecological ones. This also testifies for the increasing scope of OMV's bioeconomy projects, as successful projects have caught on. As two out of the four new projects are developed in close collaboration with universities and other industry partners, we also observe the increased role played by the social capital in this process. Furthermore, the relevance of the other two IC components is also emphasized, as both bio-ecological projects are individual one, reflecting the inherent contribution of both human and organizational capital.

Conclusions

In this paper we have investigated the existence and evolution of organizational bioeconomic practices of OMV, a major international player in the oil and gas industry, and explored how IC is employed to support these actions. To respond to the proposed research objective, we have used a qualitative approach consisting of a case study and a qualitative content analysis. To develop our analyses, we have employed the strategies outlined by Miles and Huberman (1995, pp. 245-246): identifying themes, grouping, using comparison and identifying relationships between items through theory. Additionally, we have used the theoretical lens proposed by Bugge, Hansen and Klitkou (2016) to uncover how the focus of bioeconomic projects may have evolved over time.

First, we find that the number of bioeconomic projects in which OMV engaged increases over time, along with the innovation efforts in this area. Second, we illustrate how OMV blends all components of IC in its bioeconomic efforts, with a stronger emphasis on the social capital component, pertaining to partnerships and collaborative learning. Third, we find that OMV's bioeconomic projects pertain to all three types of visions identified by Bugge, Hansen and Klitkou (2016), thus confirming their prediction that these ideal visions do not manifest exclusive of one another. In addition, we also note an evolution of these projects' focus over time, starting from bio-technological ones, through bio-resources ones, and ending with bio-ecological ones. This suggests that, as individual entities embark on the way to bioeconomy practices, these tend to be first oriented toward economic growth and job creation, and then to sustainability and biodiversity concerns. We finally show how OMV mobilizes all components of IC to achieve successful both individual and partnered bioeconomic projects.

We thus contribute to the literature on bioeconomy first by the in-depth investigation of the bioeconomic projects of a major international organization, and by showing how various components of IC contribute to the bioeconomy. Second, we are among the first to apply the

theoretical framework proposed by Bugge, Hansen and Klitkou (2016) to investigate organizational practices and to explore how an organization expands its bioeconomic actions over time.

Future literature may expand our analyses of bioeconomic projects to larger time horizons, similar organizations acting in the same industry, or to organizations acting in other industries. Thus, cross-sectional comparisons could be envisaged to figure out patterns in the way organizations are able to engage in bioeconomic projects. Similarly, the bioeconomic practices of organizations situated in other geographic areas might be investigated. For example, companies in countries that do not have a national policy for bioeconomy might engage in different bioeconomic projects, and some light may be shed on the effectiveness of such policies.

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