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Effect of sustainability-oriented innovation practices on the overall organizational performance: An empirical examination

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Abstract

One major means to address corporate sustainability practices in organizations are sustainability-oriented innovation practices, which tend to result in significantly improved products, services, processes or even management systems. Prior research has widely discussed the relevant issues about integrating sustainability aspects into innovation process; however, little empirical research has been conducted to analyse the link between sustainability-oriented innovation practices and the overall organizational performance. This paper addresses this gap by exploring underlying structure of sustainability-oriented innovation practices as well as their effects on the particular performance dimensions (i.e., economic performance, quality performance, innovation performance, environmental performance and social performance). The large scale web-based survey yielded 266 usable responses encompassing both the manufacturing and service industries across five countries: Germany, Poland, Serbia, Slovenia and Spain. The results of the regression analysis demonstrate that sustainability-oriented innovation practices are positively related with the overall organizational performance. The empirical evidence suggests that when organizations strongly emphasize sustainability practices they can improve both economic and non-financial performance. From a practical perspective, the findings of the study may provide a clue regarding how organizations can embed sustainability aspects in their innovation processes with the aim of improving their performance.

Keywords: corporate sustainability, sustainability-oriented innovation, organizational performance, empirical study

Introduction

Debates relating to corporate sustainability (CS) are becoming important subjects of the wide range of the management literature, including those related to the corporate environmentalism (e.g. Kudłak, 2014), corporate social responsibility (CSR) (e.g. McWilliams and Siegel, 2000), the business case for sustainability (e.g. Dyllick and Hockerts, 2002) as well as literature related to other company specific sustainability initiatives (Lozano, 2012). Organizations are confronted with environmental and social issues in their decisions, not only to take into account moral and legal responsibility that need to be encouraged (Takala and Pallab, 2000), but also to ensure sustainable economic success (Koo et al., 2013; Wagner, 2010; Salzmann et al., 2005). Hence, the progress towards CS may be reflected in the capability of managers to look strategically at the organisation's long-term future in local and global communities (Dunphy et al., 2003). This is in line with Delai and Takahashi (2013), suggesting that sustainable development actions and initiatives have become vital aspects for any organization. Hence, a sustainable organization is one that contributes to sustainable development by delivering simultaneously economic, social, and environmental benefits—the so-called triple bottom line (Hart and Milstein, 2003).

Furthermore, over the past few years there has been growing interest in the literature to theoretically and empirically investigate the emerging topic of sustainability-oriented innovation (e.g. Klewitz and Hansen, 2013; Wagner, 2008; Hockerts, 2008). The latter brings to the fore a question about the sustainable value which can be created by pursuing sustainability-oriented innovation activities. From this context, the challenge for business is to develop innovation strategies in order to respond to needs and expectations of a wide array of stakeholders (Ayuso et al., 2006) and at the same time to justify economic rationale behind

these sustainability initiatives (Schaltegger and Wagner, 2006). Besides, van Kleef and Roome (2007) suggest that developing competencies that foster innovation for sustainable development can be perceived as the basis of competitiveness. For example, these competencies can enable organizations to offer products and services that create value for customers and to generate new products and services, and therefore adapting to rapidly changing environment faster than competitors (van Kleef and Roome, 2007).

Prior studies have empirically explored the links between sustainability-oriented innovations and sustainability performance (e.g. Wagner, 2008) as well as the links between eco-innovations and market performance (e.g. Pujari, 2006). Yet, the understanding of the relationship between sustainability-oriented innovation practices and broader aspects of organizational performance remains rather unclear. To fill this existing research gap, this research proposed a novel construct – sustainability-oriented innovation practices - and developed a research framework to further discuss the effect of these practices on the organizational performance. Hence, this study aims to broaden the understanding of performance implications of sustainability-oriented innovation practices and to increase the generalizability of prior research (Maletič et al., 2014) through a review of relevant literature, through the presentation of a theoretical framework of sustainability-oriented innovation practices, and by presenting and discussing the results of a large-scale empirical study. Therefore, this study adds to the emerging dialogue on CS by empirically investigating the performance benefits of business activities that are directed towards sustainability through innovation.

The paper is structured as follows: The subsequent section presents the theoretical background. The third section describes the research methodology; the fourth section presents the data analysis and the results obtained; the fifth section provides a discussion of the

findings and discusses theoretical and managerial implications as well as proposes future research directions.

Literature review

Corporate sustainability

Before discussing the literature review on the relationship between sustainability-related innovation and organizational performance, it is necessary to clarify what we mean by corporate sustainability (CS). Recently, the term CS has emerged as a concept which can be conceived as a prerequisite for achieving superior business performance (Dyllick and Hockerts, 2002; Chang and Kuo, 2008; Linnenluecke and Griffiths, 2013). From this perspective, CS can be defined as "the successful market-oriented realization and integration of ecological, social and economic challenges to a company" (Schaltegger et al., 2013). Essentially, the triple bottom line approach advocates that the long term success and profitability of an organization requires emphasis on all three dimensions of sustainability - economic, environmental, and social (e.g. Bansal, 2002, Dyllick and Hockerts, 2002). In an effort to extend the viewpoint of the interaction among the triple bottom line dimensions, Lozano (2008a) proposes a Two Tiered Sustainability Equilibria (TTSE). The TTSE incorporates the dynamic equilibria, not only among the triple bottom line dimensions, but also the dynamics of these dimensions over time, namely short and long term perspectives.

As argued by prior literature (Lozano, 2012; Linnenluecke and Griffiths, 2010; Baumgartner, 2009), CS is gradually being better integrated into organization's activities and culture and should be understood as a holistic perspective which takes into account interactions between the economic, environmental, and social dimensions in the short and long term, as well as, between internal and external stakeholders (Lozano, 2015). Accordingly, it can be argued that CS is a multidimensional concept that includes diverse

types of sustainability practices, such as those related to the achievement of regulatory compliance to those related to the sustainability-oriented innovation and to the strategic level sustainability activities (Amini and Bienstock, 2014). The argument supporting the positive relationship between sustainability practices and organizational performance is also substantiated by several empirical studies. For instance, Fairfield et al. (2011) showed that external influential forces for sustainability and internal organizational commitment provide sufficient foundation for successful deployment of the sustainability practices, which ultimately lead to performance improvement.

Sustainable innovation and organizational performance

Researchers (Lopez-Valeiras et al., 2015; Kobayashi et al., 2011; Sánchez-Medina et al., 2011) and policymakers (e.g. OECD 2010) are becoming more and more interested in sustainable innovation and its link with organizational performance. Understanding and defining the notion of sustainable innovation and its dimensions is a complex task since this topic has been a subject of research in many different disciplines. However, one can adopt the definition proposed by Charter and Clark (2007): "Sustainable innovation as a process where sustainability considerations (environmental, social and economic) are integrated into company systems from idea generation through to research and development (R&D) and commercialisation. This applies to products, services and technologies, as well as new business and organisation models".

As stated by Klewitz and Hansen (2013), the debate on organizations that strive to achieve the goals of sustainable development through innovation was initially focused on eco-innovations. According to the literature (Carrillo-Hermosilla et al., 2010), eco-innovation can be conceptualized by utilizing the following dimensions: design dimensions, user dimensions, product service dimensions, governance dimensions and the engagement of key stakeholders

in the innovation process. The ultimate goal of putting efforts to eco-innovations is to provide new business opportunities and contribute to a transformation towards a sustainable society (Carrillo-Hermosilla et al., 2010). Generally, innovation can be defined as an idea, practice, or material artifact perceived as new by the relevant unit of adoption (Rogers, 1995). However, eco-innovations will be further elaborated within the three main categories (Rennings et al., 2006):

- *Process innovations* enable the production of a given amount of output (goods, services) with less input. The latter can be interpreted in terms of the eco-efficiency (Côté et al., 2006) which aims to reduce the material and energy intensity. Process innovations can be further subdivided into innovations in end-of-pipe technologies and innovation in integrated technologies categories (Rennings et al., 2006).
- *Product innovations* encompass the improvement of goods and services or the development of new goods categories (Rennings et al., 2006). It is suggested that most of the sustainability-oriented product/service innovations relate to incremental or evolutionary innovation (e.g. remanufactured products, recycled content, organic cotton-based clothing, and water-based paints) (Pujari, 2006).
- *Organizational innovations* include new forms of management systems. This could also include environmental management systems (Poksinska et al., 2003). More recently, the trend has moved towards holistic sustainability management system standards and guidelines (Maas and Reniers, 2013; Simon et al., 2013). In general, prior literature (Augusto et al., 2014) emphasises the importance of the organizational innovation fundamental role towards improving both process and product innovation, and consequently its effect on enhancing the organizational performance (Augusto et al., 2014). Hence, prior studies confirmed the inter-relationships of three eco-

innovation types and the synergetic mechanism that leads to improved business performance (Cheng et al., 2014).

Lately, the debate on sustainability and innovation has expanded its focus to include a wide range of themes such as sustainability-related innovation (e.g. Wagner, 2008; Klewitz and Hansen, 2013), sustainable innovation (Boons et al., 2013), CSR-driven innovation (e.g. Hockerts, 2008) as well as the discussion regarding the development of more sustainable management systems (Maas and Reniers, 2013). Even though these terms are often used interchangeably, eco-innovation only addresses environmental and economic dimensions while, for example, sustainable innovation embraces these as well as the broader social and ethical dimensions (Charter and Clark, 2007).

The effect of corporate sustainability on organizational performance has been extensively analysed in prior studies (e.g. Wagner, 2010; Siegel, 2009). In particular, several empirical studies have investigated this relationship by conceptualizing corporate sustainability as sustainable innovation (Wagner, 2009; Lopez-Valeiras et al., 2015). Further, it has been suggested (Maletič et al., 2014) that the relationship between sustainability-oriented innovation practices and organizational performance depends on contextual factors (e.g. environmental uncertainty, competitiveness) and institutional factors (e.g. country of origin). Whereas management literature suggests that sustainability-related innovation can be a source of competitive advantage for organizations, empirical results are not conclusive (Lopez-Valeiras et al., 2015). Accordingly, drawn upon several recent studies (Lopez-Valeiras et al., 2015; Rahman et al., 2015; Schrettle et al., 2014; Wagner, 2009; Hull and Rothenberg, 2008), one can identify a promising avenue for future research; in particular it is suggested that further research is needed to explore the link between sustainability-oriented innovation and organizational performance. Moreover, prior studies (Wagner and Llerena, 2008) have begun

to challenge the assumption of a unidirectional relationship between sustainability-oriented innovation and economic performance by introducing arguments for bidirectional causality.

Methods

Sample and data collection

The data used in this study are obtained from a research project conducted by a team of international researchers in the field of quality management. The target survey population consisted of international e-mail lists of executives and managers across a wide range of functions. Managers were chosen because they were considered to be familiar with the implementation of sustainability practices and performance indicators. Within the data collection process, a survey coordinator was appointed in each participating country to: (a) review the questionnaire from the content validity perspective and (b) conduct the process of collecting the data. The questionnaire with the cover letter indicating the purpose and significance of the study was emailed to target respondents. The e-mail lists of respondents were obtained via the universities' research databases. To ensure a reasonable response rate, the survey was sent in two waves.

In total, 266 usable responses were collected during the given time window. The questionnaire was responded by organizations that are located in Germany, Poland, Serbia, Slovenia and Spain, in portion of 14.7%, 21.4%, 7.5%, 43.6% and 12.8%, respectively. Primarily, the rationale for the selection of the particular countries was based on the sampling strategy to obtain a good spread of countries by geographic, economic, political and social criteria. In this regard, it is essential to recognize that within Europe there are some national differences in the approach that business takes towards sustainability related issues due to the institutional arrangements and characteristics of national business systems (Matten and Moon, 2008). However, it should be noted that the present study includes all countries in one sample,

rather to provide a cross country comparison. The profile of the organizations and respondents is provided in Table 1.

Table 1. Profile of the respondents in our sample

Sample distribution		**Percentage**
Respondent profile	Middle management	36.7
	Frontline management	22.7
	Top management	17
	Data not available	23.5
Organization profile (number of employees)	0–5	5.3
	5–50	27.1
	50–250	26.7
	250–500	8.6
	over 500	24.1
	Data not available	8.3
	Total	100 (N = 266)

In terms of organizational size, 5.3% of the sample was made up of micro-enterprises having five or fewer employees, 27.1% of the organizations belonged to small-sized organizations with 5 to less than 50 employees, 26.7% were medium-sized organizations with 50 to less than 250 employees, 8.6% organizations were with 250–500 employees and the rest (24.1%) were large organizations with more than 500 employees.

Measures

Independent variables: sustainability-oriented innovation practices

Recognizing the multi-dimensional nature of sustainability, a rapidly growing literature documents a wide range of specific sustainability practices being implemented by organizations (see for example, Hahn and Scheermesser, 2006; Maletič et al., 2011). Although our study mostly used multi-item scales that were verified through various analyses, appropriate scale for sustainability-oriented innovation practices was not available. Hence, the domains of construct were identified via a thorough review of the literature. Several items were operationalized in relation to eco-innovation activities in product development process (e.g. Pujari, 2006), stakeholder integration in product development process (e.g. Seuring and Gold, 2013) as well as in relation to business process improvements (e.g. Côté et al., 2006).

The items measuring sustainability oriented learning and the development of competencies supporting innovation were developed based on the literature review related to sustainability and organizational learning (e.g. Lozano, 2011; Siebenhuner and Anold, 2007; van Kleef and Roome, 2007).

Therefore, a diverse range of operationalizations has emerged for the sustainability-oriented innovation practices. The complete items of these scales are presented in Table 2.

Dependent variable: organizational performance

While recognising that performance is multi-dimensional concept (Chenhall and Langfield-Smith, 2007), we designed our survey instrument to capture the following five performance aspects: economic performance, quality performance, innovation performance, environmental performance and social performance. Based on the previous studies on this area (e.g. Kaynak, 2003; Martensen et al., 2007; Prajogo and Sohal, 2003; Wagner, 2010; Hutchins and Sutherland, 2008), we developed the above-mentioned scales for measuring the organizational

performance. A resulting four-item scale captures the extent to which organizations achieve business success. A four-item scale measures quality performance and captures the extent to which organizations have improved quality of their products and services during the last 3 years and meet customer satisfaction. A four-item scale measures innovation performance in terms of product and process innovation. A four-item scale measures environmental performance and captures the extent to which organizations achieve efficiency of material and energy consumption. Finally, a four-item scale measures social performance from the employee perspective (satisfaction, motivation and turnover ratio). The corresponding items for measuring the organizational performance are presented in Appendix A.

Analysis and Results

Measurement and validation of constructs

Sustainability-oriented innovation practices. The scales for measuring sustainability-oriented innovation practices were subjected to validity and reliability tests. The construct validity was assessed merely using exploratory factor analysis (EFA) based on oblique rotation (Direct Oblimin). The scale reliability was tested by calculating its Cronbach's alpha. Additionally, we performed corrected item-total correlations (CITCs) in order to strengthen validity and reliability results. The results of the validity and reliability test are presented in Table 2. The result of factor analysis supports the validity of the two sub-constructs as indicated by the amount of variance explained which exceeded 50%, and the loading factors of all items within each scale exceeded 0.5 (Hair et al., 2010).

Table 2. Scale validity and reliability

Factor	Items	Factor loading	CITC

SOPPD	The organization makes improvements to radically reduce environmental impacts of products and services' life-cycles.	.933	.781
	Preliminary market assessments are made to obtain customers' view of green product ideas.	.832	.714
	Multiple departments (such as marketing, manufacturing, and purchasing) are working together on sustainability related initiatives.	.822	.702
	We consider sustainability as an opportunity for product/service differentiation.	.771	.702
	The organization undertakes regularly business process reengineering with a focus on green perspectives.	.756	.747
	The organization involves key non-market stakeholders issues (such as local communities, general public, governments and NGOs) early in the product/service design and development stage.	.641	.577
	We acquire innovative environmental-friendly technologies and processes.	.550	.623
	*We search for external sources (e.g. partners, customers, research institutions) of knowledge in our search for innovative ideas related to sustainability.	.498	.601
SOICD	We develop new competencies supporting innovation in the organization.	.927	.725
	We continuously try to strengthen innovation skills in key areas where we have no prior experiences.	.901	.719
	The organization is constantly exploring new/different ways to understand the expectations and requirements of key stakeholders.	.705	.675
	The organization involves key market stakeholders (customers,	.610	.568

suppliers) early in the product/service design and development stage.		
The business processes are flexible allowing us to achieve high levels of responsiveness towards key stakeholder needs and demands.	.529	.522
*The organization is characterised by a learning culture stimulating innovation for sustainability.	.510	.688

*Excluded from further analysis

SOPPD - sustainability-oriented process and product deployment

SOICD - sustainability-oriented innovation competencies deployment

As shown in Table 2, the results show two factors with eigenvalues greater than one, accounting for 59.516 % of the variance (Kaiser-Meyer-Olkin statistic 0.928; Bartlett statistic 2104.340; significance 0.000). Thus, a model with two factors may be adequate to represent the data. To ensure a convergent validity a cut-off value of 0.5 is considered in this study. The first factor shows the variables having a common underlying dimension of 'sustainability-oriented process and product deployment (SOPPD)'. The main variables, which load heavily on this factor, are related to the integration of sustainability aspects into product or process development. The second factor, named 'sustainability-oriented innovation competencies deployment (SOICD)', includes the variables related to developing and deploying new knowledge and skills aiming to foster sustainability-related innovations as well as to deploying stakeholder competencies.

The alpha coefficients have the acceptable value ranging from 0.86 to 0.89, with the lowest value for the variable SOICD and the highest value for the variable SOPPD. Therefore, the alpha value for each construct was well above the recommended value of 0.70, which is considered satisfactory for exploratory research (Hair et al., 2010). As shown in Table 2, the

corrected item-total correlation scores range from 0.52 to 0.78. The rules of thumb suggest that the item-to-total correlations should exceed 0.5 (Hair et al., 2010).

Organizational performance. Organizational performance measures were assessed via responses to the question 'Please select the number (on a 5-point Likert-type scale) that accurately reflects the extent of your organization's overall performance over the last three years on each of the following'. The following dimensions of organizational performance were included in the questionnaire: economic performance, quality performance, innovation performance, environmental performance and social performance.

In order to confirm the latent factor structure for measured variables, an exploratory factor analysis (EFA) was performed using the principal components analysis (PCA) with the Varimax rotation method. The results show five factors with eigenvalues greater than one, accounting for 69.094% of the variance (K-M-O statistic 0.883; Bartlett statistic 2392.687; significance 0.000). In order to guarantee the convergent and discriminant validity, the low loading items (< 0.5) were excluded from the subsequent data analysis. Hence, in the iterative process of purifying the scales, two items were excluded from further analysis cross-loading (i.e., loading of > 0.3 on three factors), or due to low loading (i.e., loading < 0.5). Factor loading of organizational performance items are presented in Appendix A.

Descriptive statistics

Prior to further statistical analysis, we first investigated the descriptive statistics for study variables. Means, standard deviations, and bivariate correlations are presented in Table 3. Observing the overall sub-constructs, we can see that the highest mean value corresponds to the quality performance (3.88), while the lowest value corresponds to the economic performance (3.24). As shown by the results, respondents' organizations appeared to be

implementing sustainability-oriented innovation practices to a relatively strong extent (means of 3.57 and 3.84, respectively).

As expected, the results revealed positive and significant correlations between sustainability-oriented innovation practices and all organizational performance dimensions, with correlations coefficients ranging from 0.26 to 0.46 ($p < 0.01$). Furthermore, SOPPD shows the strongest correlation with the overall organizational performance ($r = 0.512$, $p < 0.01$), and the lowest correlation with the economic performance ($r = 0.258$, $p < 0.01$). Regarding the SOICD, the strongest correlation was observed in the case of overall organizational performance ($r = 0.508$, $p < 0.01$), while the lowest value was found in the correlation between SOICD and environmental performance ($r = 0.308$, $p < 0.01$).

Table 3. Means, standard deviations and correlations

	Mean	**SD**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
(1) *SOPPD*	3.57	.89							
(2) *SOICD*	3.84	.78	.684**						
(3) *Organizational performance*	3.49	.66	.512**	.508**					
(4) *Economic performance*	3.24	.95	.258**	.322**	.705**				
(5) *Quality performance*	3.88	.81	.316**	.453**	.687**	.336**			
(6) *Innovation performance*	3.50	.92	.459**	.455**	.801**	.515**	.511**		
(7) *Environmental performance*	3.44	.95	.448**	.308**	.684**	.318**	.293**	.415**	

(8) *Social performance*	3.37	.96	.362**	.337**	.740**	.355**	.426**	.451**	.409**

**Correlation is significant at the 0.01 level (2-tailed).

Regression analysis

In the first step, mean scores were calculated from the scale's items to generate the composite scores for the organizational performance. This newly created composite variable was subsequently used in the regression analysis. Furthermore, the normality of the composite score was checked and the result indicated no major violation, with skewness and kurtosis values well within the accepted range (± 1 and <3, respectively). Additionally, the Kolmogorov-Smirnov test of normality supports the aforementioned arguments (K-S = 0.053, p = 0.093).

Table 4 summarises the regression results for the effects of sustainability-oriented innovation practices on the organizational performance.

Table 4. Results of regression analysis: SOPPD, SOICD, and organizational performance

Dependent variable: Organizational performance	
	Model
SOPPD	0.310**
SOICD	0.296**
R^2	0.309
Adjusted R^2	0.303
F	54.356
P-value of overall model	0.000

**P < 0.01

The results in Table 4 show that the overall regression model is significant with an F value of 54.356 (P = 0.000). Furthermore, to examine multi-collinearity, we calculated variance inflation factors (VIF) for the regression equation. The VIF for the regression model was 1.87, which is well below the rule-of-thumb cut-off of 10 (Field, 2005).

As shown in Table 4, the results of the regression analysis suggest that both sub-constructs of sustainability-oriented innovation practices (SOPPD and SOICD) have a significant relationship with organizational performance ($\beta = 0.310$, $p < 0.01$; $\beta = 0.296$, $p < 0.01$ respectively). R square shows that 31% of the variation in organizational performance is explained by the sustainability-oriented innovation practices. Thus, the basic premise which suggests a positive relationship between sustainability practices and organizational performance is supported.

As observed in the above presented results, we found a positive and significant relationship between sustainability-oriented innovation practices and organizational performance. However, the question remains whether the both sub-constructs of sustainability-oriented innovation practices can be identified as statistically significant predictors of all organizational performance dimensions. Such a detailed analysis shall contribute towards providing more meaningful research implications. Results presented in the Table 5 indicate that only SOICD significantly and positively influence the economic performance (EcoP) ($\beta = 0.273$, $p < 0.01$) as well as the quality performance (QP) ($\beta = 0.446$, $p < 0.01$). Regarding the effects on innovation performance (IP), the results indicate that both SOPPD and SOICD are statistically significantly related to the innovation performance ($\beta = 0.277$, $p < 0.01$; $\beta = 0.265$, $p < 0.01$, respectively).

Table 5. Results of regression analysis: SOPPD, SOICD, economic performance (EcoP), quality performance (QP), and innovation performance (IP)

	Dependent variable		
	EcoP	**QP**	**IP**
SOPPD	0.071	0.011	0.277**
SOICD	0.273**	0.446**	0.265**
R^2	0.106	0.206	0.248
Adjusted R^2	0.099	0.199	0.241
F	13.896	31.070	38.689
P-value of overall model	0.000	0.000	0.000

*P < 0.05, **P < 0.01

Furthermore, the results (Table 6) indicate that SOPPD significantly explains the environmental performance ($\beta = 0.446$, $p < 0.01$), while the coefficient for SOICD is not significant ($p > 0.05$).

Table 6. Results of regression analysis: SOPPD, SOICD, environmental performance (EP), social performance (SP)

	Dependent variable	
	EP	**SP**
SOPPD	0.446**	0.248**
SOICD	0.003	0.167*
R^2	0.201	0.146
Adjusted R^2	0.194	0.139

F	29.554	20.289
P-value of overall model	0.000	0.000

*P < 0.05, **P < 0.01

Moreover, regression analysis was applied to examine the effects of the SOPPD and SOICD on the social performance (SP). The results show (Table 6) that both coefficients are positive and significant performance ($\beta = 0.248$, $p < 0.01$; $\beta = 0.167$, $p < 0.05$, respectively), thereby indicating that both SOPPD and SOICD predict the social performance.

MANOVA – Effect of sustainability-oriented innovation practices on organizational performance

The purpose of this section is to explore whether the dimensions of organizational performance when considered collectively (as examined by MANOVA) and individually (as examined by ANOVA), significantly differ for high and low levels of the sustainability-oriented innovation practices. A score above 4 (i.e. 4 and 5) was treated as high, and a score of 3 or below was treated as low, for defining the two categories high and low. Therefore, the main aim is to examine whether there are significant mean differences in organizational performance (as measured by the economic performance, quality performance, innovation performance, environmental performance and social performance) for low and high levels of sustainability-oriented innovation practices (as measured by SOPPD and SOICD).

Table 7 demonstrates the means and standard deviations of the dependent variables (organizational performance based on: economic performance, quality performance, innovation performance, environmental performance and social performance), by high and low categories/levels of sustainability-oriented innovation practices.

Table 7. Means and standard deviations for organizational performance dimensions by sustainability-oriented innovation practices (SOPPD and SOICD)

		SOPPD		SOICD	
DV	Group	Mean	s.d.	Mean	s.d.
Economic	Low level	2.91	1.07	2.71	.96
performance	High level	3.46	.91	3.51	.87
Quality	Low level	3.60	.97	3.29	1.02
performance	High level	4.14	.69	4.16	.69
Innovation	Low level	2.97	.97	2.75	1.09
performance	High level	3.88	.83	3.81	.79
Environmental	Low level	2.88	.91	3.02	.88
performance	High level	3.85	.78	3.66	.93
Social	Low level	2.87	1.04	2.70	.97
performance	High level	3.62	.82	3.57	.91

Taking into account the unequal sample sizes, we used both Pillai's Trace statistic and Wilks' Lambda in terms of test power and robustness. Considering the unequal sample sizes, we perform MANOVA by using both Type 3 sums of squares and Type 1 sums of squares. However, no significant difference between the two options was observed. Hence, the results of using Type 3 sums of squares are presented.

The multivariate tests indicate that there is a significant effect of the independent variable (i.e. level of the SOPPD) on all dependent variables (DVs), considered as a group. In this case, all statistics are significant ($p < 0.01$), so we can conclude that level of sustainability-oriented innovation practices have a significant effect on all of the performance variables. Therefore, the results indicate that the organizational performance, in terms of economic

performance, quality performance, innovation performance, environmental performance and social performance, significantly differs for high and low levels of SOPPD (Pillai's Trace = 0.311, Wilks' $\lambda = 0.689$, $F(12.820)$, $p < 0.01$). Likewise, the multivariate tests show that there is a significant effect also in the case of low and high levels of SOICD as well (Pillai's Trace = 0.269, Wilks' $\lambda = 0.731$, $F(10.991)$, $p < 0.01$).

Since the multivariate test was significant, we examined the ANOVA results (i.e. univariate tests of individual DVs). The ANOVA results indicate that the organizational performance based on economic performance ($F = 11.169$, $p < 0.01$, partial $\eta^2 = 0.071$), quality performance ($F = 15.867$, $p < 0.01$, partial $\eta^2 = 0.098$), innovation performance ($F = 37.540$, $p < 0.01$, partial $\eta 2 = 0.205$), environmental performance ($F = 48.806$, $p < 0.01$, partial $\eta^2 = 0.251$) and social performance ($F = 23.909$, $p < 0.01$, partial $\eta^2 = 0.141$), significantly differs for high and low levels of SOPPD. Although significant group differences were found for all DVs, the effect size is small in the case of economic performance as well as in the case of quality performance ($\eta 2 = 0.071$; $\eta^2 = 0.098$, respectively), indicating that a small proportion of variance in the dependent variables is predictable from the independent variable.

Similarly, the results imply that the organizational performance based on economic performance ($F = 22.150$, $p < 0.01$, partial $\eta^2 = 0.126$), quality performance ($F = 34.764$, $p < 0.01$, partial $\eta^2 = 0.185$), innovation performance ($F = 41.337$, $p < 0.01$, partial $\eta^2 = 0.213$), environmental performance ($F = 13.464$, $p < 0.01$, partial $\eta^2 = 0.081$) and social performance ($F = 24.868$, $p < 0.01$, partial $\eta^2 = 0.140$), significantly differs for high and low levels of SOICD. Based on the comparison between the above two groups of results, one can conclude that a larger proportion of variance in the dependent variables (i.e. economic performance and quality performance) is predictable from the SOICD ($\eta^2 = 0.126$; $\eta^2 = 0.185$, respectively).

Whenever Levene's test for homogeneity of variance was significant at the $p < 0.05$ level, nonparametric statistics (Kruskal-Wallis) were used to confirm the effects obtained by the ANOVA. At the $\alpha = 0.05$ level of significance, there exists enough evidence to conclude that there is a difference in the mean scores of organizational performance dimensions among the two categories (i.e. levels of SOPPD or levels of SOICD).

Discussion and conclusions

The analysis reveals a number of significant associations of sustainability-oriented innovation practices with the different organizational performance dimensions. The results of the regression analysis as well as the results of the multivariate analysis of variance (MANOVA) have confirmed the premise that sustainability practices positively influence the organizational performance. As such, the study provides empirical evidence indicating that organization can benefit by developing and deploying sustainability-oriented innovation practices. These findings underpin previous assertions that organizations can achieve competitive advantage from pursuing sustainability (e.g. Schaltegger and Wagner, 2006; Wagner, 2010). For example, Forsman (2013) found that there is a strong positive relationship between environmental innovations and the market-related competitive advantage.

In particular, the results of this study indicate that organizations can benefit from integrating sustainability aspects in their products and processes, as reflected by the positive and significant effect of SOPPD on the organizational performance. These findings are somewhat supporting the argument that incorporating sustainability activities in product and process development can provide tools and mechanisms to organizations to enhance their economic benefits without affecting environment and communities (Pujari, 2006; Schrettle et al., 2014). In this regard, stakeholder dialogue and stakeholder knowledge integration can be regarded as the capabilities necessary to capture stakeholder's requirements and transform

them into innovative solutions (i.e. products, services, processes or strategies) (Ayuso et al., 2006). Therefore, our study leads us to suggest that organizations should built sustainability aspects into tangible and intangible product/process quality characteristics, through a constant focus on stakeholders' wants and needs, and on the basis of principles of continuous improvement. However, one can argue that organizations are confronted with creating value by identifying an overlap between customer benefits and clearly defined (prioritized) sustainability goals, i.e., translating sustainability goals into product features that contribute to the customer value (Keskin et al., 2013). Owing to the above-explained complexities in managing sustainability, recent studies (e.g. Kuei and Lu, 2013) emphasise the integration of quality management and sustainability, thereby enhancing the value and competitive position of organizations as well as contributing to the sustainable development. The latter also brings the debate on the relationship between integrated management systems and sustainable development to the forefront (Mežinska et al., 2013).

Furthermore, the results of this study also suggest that innovation-oriented competencies are an important co-determinant of the organizational performance. These finding can be substantiated by a number of previous studies (e.g. Lozano, 2011; Siebenhuner and Anold, 2007) that have pointed out the importance of the sustainability-oriented learning in terms of fostering innovation and making an effective shift towards sustainability.

Concerning the effects of sustainability-oriented innovation practices on the particular sub-constructs of organizational performance, our study indicates that both SOPPPD and SOICD are positively and significantly associated with innovation and social performance, while there are some discrepancies in the case of economic performance, quality performance, and environmental performance.

Regarding the effect of sustainability-oriented innovation practices on the innovation performance, our study contributes to prior literature suggesting that engagement in

sustainability drives innovations (Hockerts, 2008). Moreover, as proposed by Ayuso et al. (2011), organization's innovativeness can be affected by stakeholders' engagement which could be considered as an important organizational capability. The latter is also to some extent captured by our findings, since the scales for measuring sustainability-oriented innovation practices include stakeholders' engagement activities as well. Encouragingly, our results also suggest that sustainability-oriented innovation practices appear to be beneficial in terms of social performance, which supports the previous debates on the positive influence of sustainability-related activities on job satisfaction, and negative influence on turnover intentions (Gond et al., 2010).

Regarding the quality performance, our study indicates that SOICD is strongly and positively associated with quality performance, but it fails to confirm the significant effect of SOPPD on quality performance. However, ANOVA results further indicate that quality performance differs significantly in respect of the independent variable (i.e. low and high level of SOPPD). These results provide some additional arguments to support the contribution of sustainability-oriented innovation practices to the quality performance. The findings of our study needs to be interpreted form the stakeholders' perspective, suggesting that the inclusion of stakeholders and the integration of their respective demands (Seuring and Gold, 2013) is considered crucial for driving performance (Asif et al., 2011) and achieving competitive advantage (Delmas, 2001). Based on the quality standpoint, it can be argued that organizations need to yield value for one or more stakeholders, which is ultimately reflected in performance benefits.

Regarding the environmental performance, results of the regression analysis show significant effect of the SOPPD on the environmental performance, while there is no evidence from regression analysis to support the significant effect of SOICD on the environmental performance. In addition, results of the separate univariate ANOVAs indicate that there is

significant mean difference in environmental performance with regard to the level of the sustainability-oriented innovation practices (i.e. low and high levels of SOPPD and SOICD). Hence, the results contribute to a better understanding of the theoretically justifiable interplay between sustainability-oriented innovation practices and environmental performance (Klewitz and Hansen, 2013). Above indicated arguments can be substantiated with the findings of the prior studies (e.g. Weng et al., 2015) that have provided some empirical evidence that adopting of green innovation practices is essentially an effective way of improving the environmental performance and consequently enhancing the overall organizational performance.

Regarding the economic performance, our study provides some evidence to support the business case for CS (Schaltegger, and Wagner, 2006; Dyllick and Hockerts, 2002; Siegel, 2009) by merely focusing on the effects of sustainability-oriented innovation practices. Specifically, our findings indicate that organizations are able to achieve success in the market place and gain economic benefits by building innovation capabilities (van Kleef and Roome, 2007) and by focusing on the interactions with stakeholders (Polonsky and Ottman, 1998). From a somewhat different perspective, the findings should also be interpreted in the light of a potential trade-off between sustainability practices and economic performance. For instance, focusing merely on the economic bottom line would lead to the economic viability of the organization, but not necessarily to sustainability in terms of environmental and social aspects (Lozano, 2008).

Theoretical contributions and managerial implications

The main theoretical implication of this study is the development of an empirically based and testable framework of sustainability-oriented innovation practices, which integrates the literature on sustainability-related innovations (e.g. Wagner, 2008; Klewitz and Hansen,

2013) with that of organizational performance (Antony and Bhattacharyya, 2010). The development of the scales for measuring sustainability-oriented innovation is deemed important for the further development of the corporate sustainability research. In recent years, however, there has been a proliferation of approaches to performance measurement across a range of disciplines (Chenhall and Langfield-Smith, 2007), which can also be considered to be one of the causes of ambiguity in establishing the scale of measurement of overall organizational performance. In this regard, the study adds to the dialogue on how overall organizational performance is or should be measured.

While drawing on earlier work on performance implications of sustainability management activities (e.g. Wagner, 2008), this research contributes to the literature by focusing on the link between sustainability-oriented innovation practices and organizational performance. Although prior literature has discussed the link between sustainability practices and economic performance (e.g. Wagner, 2010), this study further explores the effect of sustainability-oriented innovation practices on several organizational performance dimensions. This is significant because so far there are only a few empirically based studies that investigate sustainability-oriented innovation and its link to the overall organizational performance. Although our study focuses on exploration activities rather than on exploitation activities within organizations, it may still provide useful insights into the discussion on green/sustainable organizational ambidexterity (Chen et al., 2014; Maletič et al., 2014). Our study clearly suggests that the exploration activities which are embodied in SOPPD and SOICD variables are crucial in achieving superior performance. Additionally, our study also advances green/sustainable organizational ambidexterity literature by offering insights into how to measure exploration activities in empirical studies.

In addition, our results have also significant managerial implications based on judgements of managers in five European countries. First, it is valuable to suggest that

executive management needs to focus on building the innovation capability which can be considered as a key mechanism required for realizing and maximizing the effects of sustainability initiatives on the organizational performance. In this regard, the capability of an organization to create innovative and sustainable solutions (i.e. process innovations, product innovations and service innovations) can be viewed as organizational resource. Therefore, managers should establish an efficient mechanism to sustain this asset and effectively use it to enhance performance and gain competitive advantages. Accordingly, managers should strive to achieve sustainable innovation excellence in terms of developing innovative new products or services in a way which both in the short term and in the long run satisfies the customers and other stakeholders, such as employees, suppliers and society, in a balanced way (Dahlgaard-Park and Dahlgaard, 2010). Thus, managers who focus on long-term value creation may be well advised to direct resources towards increasing both sustainability performance and innovativeness.

Limitations and future research directions

As with all empirical studies, there are a number of limitations and directions for future research. One limitation is that although the measurement scales used in the paper are developed based on a comprehensive literature review, they capture only limited dimensions of sustainability-oriented innovation practices. Therefore, the scales developed in this study advance further research opportunities in the field. One research opportunity is to examine the factors (i.e. antecedents) that drive or hinder the sustainability-oriented innovation practices deployment. Further, the relationship between sustainability-oriented innovation practices and organizational performance may be moderated by factors that encompass innovation attributes and organizational characteristics (e.g. entrepreneurship orientation). Moderating effects were not examined here and would need to be explored in the future. We acknowledge that there

are possible sources of bias concerning the sample distribution. Certainly, the survey population is a crucial as it determines the set of entities from which the sample can be drawn and affects both the internal and external validity of the study results (Harzing et al., 2013). Future studies could increase the generalisability of the results by taking caution in controlling for possible extraneous variation. Using a stratified random sample one can mitigate this risk, for example by ensuring relative and homogenous representation of respondents across different research settings.

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Appendix A

Measurement items – organizational performance	
Economic performance (10.2 % of variance)	*Factor loadings*
PERF1. Return on investment (ROI) has increased above industry average during the last 3 years	.771
PERF2. Sales growth has increased above industry average during the last 3 years	.865
PERF3. Profit growth rate has increased above industry average during the last 3 years	.871
PERF4. Market share has increased during the last 3 years	.656
Quality performance (37.4 % of variance)	
PERF5. The quality of our products and services has been improved during the last 3 years	.736
PERF6. Customer satisfaction has increased during the last 3 years	.752
PERF7. Customer complaints has decreased during the last 3 years	.829
PERF8. The cost of poor quality has decreased during the last 3 years	.792
Innovation performance (6.5 % of variance)	

PERF9. The organization has introduced more innovative products and services than our main competitors during the last 3 years	.697
PERF10. Our new products and services are perceived by our customers as innovative	.821
PERF11. The speed of adoption of new technology is faster than at our main competitors	.713
PERF 12. The number of innovations that provide the organization with a sustainable competitive advantage has increased during the last 3 years	.732
Environmental performance (9.6 % of variance)	
PERF13. The efficiency of the consumption of raw materials has improved during the last 3 years	.715
PERF14. The resource consumption (thermal energy, electricity, water) has decreased (e.g. per unit of income, per unit of production, …) during the last 3 years	.720
PERF15. The percentage of recycled materials has increased during the last 3 years	.779
PERF16. The waste ratio (e.g. kg per unit of product, kg per employee per year) has decreased during the last 3 years	.784
Social performance (5.4 % of variance)	
*PERF17. The turnover ratio has decreased during the last 3 years	.612
PERF18. The employees' satisfaction has increased during the last 3 years	.734
PERF19. The employees' motivation has increased during the last 3 years	.805
PERF 20. Health and safety performance has improved during the last 3 years	.796
*PERF 21. Employee education and training (man-days per employee per year) have increased during the last 3 years	.486

*Excluded from further analysis