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Impact of Green IS Practices on Organizational Benefits: The Perspective of SMEs Managers

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Abstract The presented study investigates the impact of Green information system (Green IS) practices on organizational performance benefits in the context of a small and medium-sized enterprise (SME). Three categories of Green IS practices, namely pollution prevention, product stewardship and sustainable development are taken into consideration. Furthermore, organizational benefits are considered to capture the extent to which SMEs achieve environmental and social performance. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to analyse survey data collected from 156 managers of SMEs. The results indicate, that Green IS for pollution prevention and sustainable development have a significant impact on environmental and social performance, while product stewardship is not an effective source of perceived organizational benefits in neither of the proposed aspects. To achieve a higher level of organizational benefits arising from Green IS practices, more focus should be given to the strategic orientation of using Green IS in SMEs. From an academic perspective, the paper enhances the current knowledge in investigating the link between Green IS practices and organizational benefits, particularly in the SMEs perspective.

Keywords: • Green IS practices • Organizational benefits • Environmental performance • Social performance • Green IS •

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1 Introduction

Recently, several environmental and sustainability studies have suggested that smart use of information technology (IT) and information systems (IS) can substantially help greening the planet (Chen, Boudreau, & Watson, 2008; Melville, 2010). The role of smart use of IT/IS in contributing to environmentally responsible human activity has been widely discussed in the literature, whereas the terms Green IT and Green IS have often been used interchangeably, synonymously, and/or without acknowledging the differences (Recker, 2016b). Among others, Loeser (2013) precisely distinguishes the scopes of Green IT and Green IS, describing the concepts as follows:

- The Green IT concept refers to measures and initiatives that lower the negative environmental impact of manufacturing, operations, and the disposal of IT equipment and infrastructure.
- The Green IS concept refers to practices which determine the investment in, deployment, use, and management of IS in order to minimize the negative environmental impacts of IS, business operations, and IS-enabled products and services.

This paper focuses on the concept of Green IS which is more far-reaching and wider concept than Green IT (Loeser, 2013). Due to the substantial possible benefits of applying Green IS initiatives, this area has attracted the attention of many authors. However, an in-depth literature review (see Baggia, Maletič, Žnidaršič, & Brezavšček, 2019) reveals a lack of research referring the implementation of Green IS by small and medium-sized enterprises (SMEs). We tried to mitigate this gap and we developed a conceptual model to investigate the drivers and outcomes of Green IS adoption in SMEs environment (Baggia et al., 2019). We based our model on the Belief Action Outcome (BAO) framework (Melville, 2010), while the viewpoint of SMEs management were taken into account. The main contribution of this model lies in establishing a link between personal attitudes, institutional mechanisms, internal environmental/sustainability initiatives, and performance implications towards Green IS in SMEs.

Among other results, the model presented in Baggia et al. (2019) enables a direct analysis of perceived organizational benefits due to implementation of different categories of Green IS practices: Green IS for pollution prevention, Green IS for product stewardship, and Green IS for sustainable development. The results obtained reveal that Green IS for preventing pollution and sustainable development can be treated as an effective source of perceived organizational benefits, while the impact of Green IS for product stewardship was not recorded to be significant. Within the present study, we want to continue our work and investigate these relationships in detail. For this purpose, we distinguished the organizational benefits due to Green IS practices implementation into two aspects: environmental performance and social performance. We analysed the perceived impact of a particular category of Green IS practices on each aspect. Similarly as in Baggia et al. (2019) the viewpoint of SMEs' managers was taken into account. Accordingly, this study's research objective is to fill in this gap in the literature by carrying out an empirical research among SMEs managers. Therefore, in response to identified conceptual and empirical dispersion, this paper intends to propose a framework to formulate the hypotheses that build on a premise of positive impact of Green IS practices on specific organizational performance dimensions.

2 Literature Review

2.1 From Green IS Initiatives through Green IS Practices to Organizational Benefits

Green IS represents any kind of IS that assists individuals and organizations in making environmentally sustainable decisions and establishing environmentally sustainable work practices rather than environmentally unsustainable ones (Recker, 2016a). The primary focus of Green IS initiatives is therefore on designing and implementing systems to support environmental management processes (Watson, Boudreau, Chen, & Huber, 2008). (Loeser, Recker, Brocke, Molla, & Zarnekow, 2017) understand Green IS initiatives as a wide range of IS-related environmental actions, including the formulation of Green IS strategies, which should be translated into sustainability actions through different Green IS practices.

According to Chen, Watson, & Karahanna (2009) or Gholami, Sulaiman, Ramayah, & Molla (2013) the Green IS practices can be classified into three categories: Green IS practice with a focus on pollution prevention, Green IS practice with a focus on product stewardship, and Green IS practice with a focus on sustainable development. Green IS practices focusing on pollution prevention refer to the innovation and use of information systems (such as enterprise carbon and energy management systems) to reduce pollution generated by business operations. Green IS practices focusing on product stewardship refer to the innovation and use of IS (such as enterprise digital platforms and communication and collaboration systems) that enhance the environmental friendliness of upstream and downstream supply chains (Chen et al., 2009; Gholami et al., 2013). Moreover, Green IS practices focusing on sustainable development refer to the innovation and use of IS that transform business operations (Gholami et al., 2013; Ijab, Molla, & Cooper, 2012).

The implementation of Green IS practices leading from Green IS initiatives can bring many positive outcomes to organization. For example, Loeser et al. (2017) reported that Green IS initiatives **can generate at least three types of benefits:**

- reduce costs by increasing the resource efficiency of IT infrastructure resources and organization-wide business processes;
- enhance corporate reputation by shrinking the organization's environmental footprint while providing tools for tracking and reporting environmental performance; and
- facilitate and improve organizational capabilities for green product and process innovations, which can result in long-term organizational advantages.

2.2 Green IT/IS Initiatives in SMEs

Since SMEs make up for approximately 99% of all enterprises and two-thirds of employment in the OECD area (OECD, 2015), they account for a significant share of pollution. According to Miller, Neubauer, Varma, & Williams (2011), SMEs account for approximately 64% of industrial pollution in Europe. Walker, Redmond, Sheridan, Wang, & Goeft (2008) also asserted that SMEs are more 'pollution-intensive' than 'big business', with some estimates suggesting that the contribution of SMEs may be as high as 60-70% of global environmental pollution. This statements are in accordance with findings of Shah, Ganji, & Hasan (2016) who reported that SMEs share 70% of global pollution, with the majority of manufacturing sector. Therefore, reducing the environmental impact of SMEs in both manufacturing and services is a key factor in successfully greening the economy (OECD, 2015). A systematic overview of the abundant literature on sustainability initiatives in SMEs found several studies addressing the general green practices for improving SME business in a sustainable way (e.g. Hernandez-Pardo, Bhamra, & Bhamra, 2013; Kerr, 2006; Verdolini, Bak, Ruet, & Venkatachalam, 2018), while some authors (e.g. Álvarez Jaramillo, Zartha Sossa, & Orozco Mendoza, 2018) analysed the barriers faced by SMEs when implementing initiatives for sustainable development. Some studies also investigate the importance and drivers to environmental, green, or sustainable SMEs' innovations in a specific environment (e.g. the food and beverage sector (Cuerva, Triguero-Cano, & Córcoles, 2014); French SMEs (Pinget, Bocquet, & Mothe, 2015); European SMEs (Cecere & Mazzanti, 2017); Ecuador SMEs (Sarango-Lalangui, Álvarez-García, & Del Río-Rama, 2018); Malaysia SMEs (Moorthy, Yacob, Chelliah, & Arokiasamy, 2012; Musa & Mohamad, 2018; Yacob & Moorthy, 2012); Southern Brazil (Schmidt, Zanini, & Junior, 2018)) while Masocha & Fatoki (2018) discuss the impact of coercive pressure on sustainability practices of SMEs.

However, although the SMEs are important drivers of global sustainability, they are not addressed sufficiently in the Green IT/IS literature. SMEs differ from larger companies, since they generally face size-related resource constrains, skill deficit and knowledge limitations (OECD, 2015). They also express different behaviour when adopting new technologies (Gäre & Melin, 2011). Therefore, the existing research based on large companies cannot be directly transferred to SMEs. We found only a few papers which examined the drivers of Green IT adoption in SMEs in different countries all over the world (e.g. Czech (Buchalcevova & Gala, 2012, 2013), Philippines (Hernandez, 2018), Indonesia (Muafi, 2015), New Zealand (Coffey, Tate, & Toland, 2013)). Ramayah, Siew, Ahmad, Halim, & Lo (2013) developed a structured questionnaire to explore the views and issues of SMEs, who have already implemented Green IT practices, while the research of Daggag (2014) points at increasing awareness regarding the advantages and limitations on Green IT provides guidelines for its utilization. In addition, Foogooa & Dookhitram (2014) proposed a useful Green IT maturity assessment tool for SMEs.

The literature review reveals again that the area of Green IS adoption and/or the outcomes of Green IS evaluation in the SME environment remain rather unexplored. Unfortunately, with the exception of our studies (Baggia et al., 2016) and recently published (Baggia et al., 2019) we were unable to find any paper concerning Green IS adoption and/or the outcomes of Green IS initiatives and practices in the SME environment.

3 Research Model

As proposed in work of Baggia et al. (2019), the meaningful organizational benefits arising from Green IS initiatives are: lower waste and emissions (Bokolo, 2016; Gholami et al., 2013; Loeser, 2013; Melville, 2010), reduced energy consumption (Bokolo, 2016; Gholami et al., 2013), a higher level of social responsibility (Cuerva et al., 2014; Deng & Ji, 2015), a greater level of employees' environmental awareness (Brooks, Wang, & Sarker, 2012), and an improved company image (Gholami et al., 2013; Loeser et al., 2017). We also assumed that these benefits can be achieved through implementation of different categories of Green IS practices (see Section 2.1):

- **Green IS for pollution prevention** which includes the use of software to reduce overall emissions, waste and hazardous materials,
- **Green IS for product stewardship** which enhanced the use of software to enable environmentally friendly material sourcing and acquisition, product/service development, distribution and delivery,
- **Green IS for sustainable development**, which promotes the adoption of software to transform business.

In order to analyse the perceived organizational benefits due to implementation of different categories of Green IS practices more in detail we distinguished the construct "Organizational Benefits" from the model presented in Baggia et al. (2019) in two separated constructs as follows:

- **Environmental performance**, which may result in reduction of waste, reduction of emissions and/or energy consumption,
- **Social performance**, which can express in better company image, higher level of social responsibility as well as environmental awareness.

To investigate whether the SMEs' managers actually perceive the positive impact of Green IS practices on both aspects of organizational performance the following hypotheses are proposed:

H_{1a}: Green IS for pollution prevention is positively associated with environmental performance.
H_{1b}: Green IS for pollution prevention is positively associated with social performance.
H_{2a}: Green IS for product stewardship is positively associated with environmental performance.
H_{2b}: Green IS for product stewardship is positively associated with social performance.
H_{3a}: Green IS for sustainable development is positively associated with environmental performance.
H_{3b}: Green IS for sustainable development is positively associated with social performance.

The corresponding research model is shown in Figure 1.

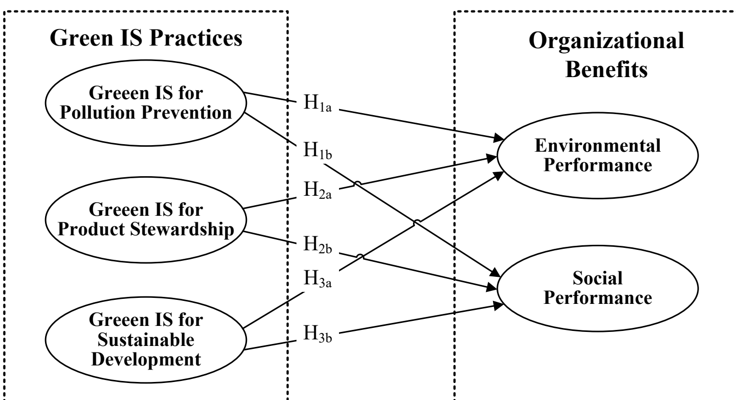

Figure 1: The research model

4 Results

4.1 Data Collection and Statistical Methods

To evaluate the model presented in Figure 1, we developed a questionnaire (Baggia et al., 2019) where every model construct was represented by several indicators (i.e., questions). The list of measured indicators used in this study is given in Table 1. All of them were measured on a 5-point, Likert-type scale of agreement, with 1 meaning strongly disagree, and 5 strongly agree.

In the survey, 156 Slovenian SMEs participated. They come from different areas (classified according to Eurostat (2008)), where the major portion of them (14.1%) are from Other Service Activities, 11.4% from Information and Communication, and 8.7% from Manufacturing. Regarding the respondents' position, 20.8% of them were CEOs, 20.1% heads of departments, 13.2% CIOs, 4.2% external IS consultants, while 41.7% of the respondents listed another job position.

The model from Figure 1 was evaluated using the PLS-SEM approach with R package plspm (Chin, 2010; Henseler & Sarstedt, 2013; Sanchez, 2013). The analysis was performed using the standard two-stage approach, where firstly the measurement model and, secondly, the structural model were evaluated (Sanchez, 2013). The PLS-SEM results are presented with the values of the path coefficient (representing the relationships between the model constructs) together with the values of *t*-statistics and the significance level. Besides, for the endogenous latent variables a coefficient of determination (R^2) was calculated, representing the percentage of the variance explained by the set of the variable predictors.

4.2 Descriptive statistics

The results of descriptive statistics for the model constructs and corresponding indicators are given in Table 1.

Table 1: Descriptive statistics for the model constructs and corresponding indicators

Model construct	Indicator	*M*	*SD*
Pollution Prevention (PP) ***M*=3.835** ***SD*=0.792**	***Our company promotes the use of software for:***		
	reduction of emissions (PP1)	3.776	0.913
	reduction of waste (PP2)	3.885	0.894
	reduction of dangerous and toxic materials (PP3)	3.846	0.903
Product Stewardship (PS) ***M*=3.697** ***SD*=0.788**	***Our company promotes the use of software to enable environmentally friendly:***		
	material sourcing and acquisition (PS1)	3.679	0.872
	product development (PS2)	3.718	0.818
	product/service development process (PS3)	3.731	0.904
	distribution and delivery (PS4)	3.660	0.861
Sustainable Development (SD) ***M*=3.325** ***SD*=0.778**	***Our company promotes:***		
	the use usage of online collaboration tools to reduce travelling (SD1)	3.917	0.908
	employee teleworking (SD2)	2.878	1.177
	transformation of business processes to paperless (SD3)	3.667	0.946
	the use of tools to measure and follow environmental impact (SD4)	2.840	1.013
Environmental Performance (EP) ***M*=3.462** ***SD*=0.646**	***The perceived environmental performance due to Green IS practices implementation is:***		
	reduction of waste (EP1)	3.532	0.731
	reduction of emissions (EP2)	3.397	0.768
	reduction of energy consumption (EP3)	3.455	0.721
Social Performance (SP) ***M*=3.404** ***SD*=0.692**	***The perceived social performance due to Green IS practices implementation is:***		
	improved company image (SP1)	3.212	0.771
	higher level of social responsibility (SP2)	3.500	0.766
	higher level of environmental awareness of employees (SP3)	3.500	0.783

4.3 Evaluation of the Measurement Model

The measurement model can be evaluated in terms of the unidimensionality of the latent variables, convergent validity, and discriminant validity (Ravand & Baghaei, 2016). Results of measurement models evaluation are listed in Tables 2-4.

The unidimensionality of latent variables is assessed by Cronbach's alpha, composite reliability through Dillon–Goldstein's rho (both indices should exceed 0.7), and principal component analysis by examining the first two eigenvalues where the first one should be larger than 1 while the second one should be below 1. It can be seen from Table 2 that all the indices easily satisfy the threshold criterion and therefore the measurement model's unidimensionality can be proved.

The measurement model's convergent validity is achieved when the average variance extracted (*AVE*) (measuring the amount of variance captured by the model construct relative to the amount of variance attributable to measurement error) of each construct exceeds 0.5 (Fornell & Larcker, 1981) and the factor loadings of its indicators are above 0.7 (Ravand & Baghaei, 2016). Table 3 reveals that all the factor loadings are larger than 0.7. Moreover, Table 4 shows the values of *AVE* for all constructs exceed 0.5 (the smallest is for *SD* 0.580), indicating the model has high convergent validity.

The model's discriminant validity is examined in two ways: first, by analysis of the indicators' loadings and cross-loadings and, second, by comparing the value of the square root of *AVE* of each construct with the correlations between other constructs. To prove discriminant validity, the loadings of the indicators of a particular construct must be greater than the corresponding cross-loadings. It may be seen from Table 3 that this condition is fulfilled. Furthermore, the values of the square root of *AVE* for a particular construct must be greater than the corresponding correlations between other constructs (Fornell & Larcker, 1981). The correlations between the model's constructs are shown in the right panel of Table 4, while the values of the square root of *AVE* are given in the diagonal elements in the correlation matrix. It is evident from Table 4 that the values of the square root of *AVE* for a particular model construct are all greater than the interconstruct correlations. Therefore, also discriminant validity of all model constructs can be approved.

Table 2: Evaluation of the unidimensionality of latent variables

Latent variable	No. of indicators	Cronbach's alpha	Dillon-Goldstein's rho	1st eigenvalue	2nd eigenvalue
PP	3	0.850	0.909	2.310	0.455
PS	4	0.932	0.952	3.326	0.327
SD	4	0.768	0.852	2.363	0.653
EP	3	0.845	0.907	2.292	0.471
SP	3	0.875	0.925	2.415	0.512

Table 3: Loadings (in bold) and cross-loadings of the model constructs and their indicators

Model construct	Indicator	PP	PS	SD	EP	SP
PP	**PP1**	**0.895**	0.625	0.472	0.356	0.423
	PP2	**0.922**	0.623	0.439	0.358	0.368
	PP3	**0.809**	0.651	0.443	0.270	0.286
PS	**PS1**	0.619	**0.894**	0.474	0.311	0.347
	PS2	0.685	**0.930**	0.529	0.293	0.353
	PS3	0.649	**0.937**	0.532	0.262	0.302
	PS4	0.657	**0.885**	0.484	0.252	0.314
SD	**SD1**	0.355	0.421	**0.772**	0.323	0.361

	SD2	0.249	0.292	**0.761**	0.209	0.240
	SD3	0.406	0.429	**0.772**	0.314	0.255
	SD4	0.507	0.503	**0.754**	0.349	0.373
EP	**EP1**	0.381	0.305	0.275	**0.833**	0.736
	EP2	0.313	0.264	0.371	**0.879**	0.668
	EP3	0.296	0.238	0.408	**0.908**	0.745
SP	**SP1**	0.320	0.248	0.271	0.618	**0.771**
	SP2	0.376	0.342	0.413	0.791	**0.945**
	SP3	0.418	0.373	0.414	0.784	**0.962**

Table 4: Average Variance Extracted (*AVE*), square root of *AVE* (on the diagonal) and correlations among the model constructs

Model constr.	*AVE*	**Correlations**				
		PP	**PS**	**SD**	**EP**	**SP**
PP	0.769	**0.877**				
PS	0.831	0.716	**0.912**			
SD	0.585	0.513	0.554	**0.765**		
EP	0.764	0.378	0.308	0.402	**0.874**	
SP	0.805	0.416	0.363	0.415	0.820	**0.897**

4.4 Evaluation of the Structural Model and Hypotheses Testing

The structural model from Figure 1 was evaluated by estimating paths between the model constructs. Results from Table 5 show that 4 out of 6 hypotheses were supported, while 2 were rejected.

Table 5: Results of the structural model evaluation and hypotheses testing

Hypothesis	Path	Path coefficient	*t*-statistics	p-value	Hyp. supported	Sig. level
H_{1a}	PP → EP	0.253	2.388	0.0182	Yes	*
H_{1b}	PP → SP	0.257	2.464	0.0149	Yes	*
H_{2a}	PS → EP	-0.034	-0.308	0.7587	No	n.s.
H_{2b}	PS → SP	0.032	0.300	0.7644	No	n.s.
H_{3a}	SD → EP	0.290	3.269	0.0013	Yes	**
H_{3b}	SD → SP	0.265	3.037	0.0028	Yes	**

*$p<0.05$; **$p<0.01$; ***$p<0.001$

Figure 2 shows the evaluated structural model with significant and non significant path. The coefficient of determination R^2 is also calculated for both endogenous latent variables. This coefficient determines the model's predictive capability if its value is greater than 0.1 (Escobar-Rodriguez & Monge-Lozano, 2012). It can be seen from Figure 2 that in our case this requirement is fulfilled.

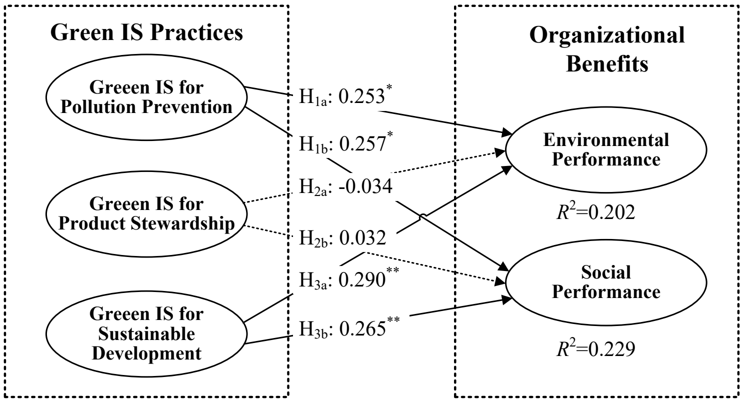

Figure 2: The evaluated relationships among the structural model constructs

5 Discussion & Conclusions

The key factor in greening the economy is the reduction of environmental impact of SMEs (OECD, 2015). Even though the majority of SMEs is struggling for survival on the competitive market, their environmental impact must not be overseen. Green IS are an appropriate tool to enable SMEs a smooth transition to sustainable practices. The findings of our study show the importance of Green IS practices adoption to general organizational benefits, as seen by managers. In addition to the multiplicity of factors influencing the perceived organizational benefits of Green IS usage in SMEs (Baggia et al., 2019), this paper extends the study with the detailed examination of relationships of Green IS practices and perceived organizational benefits. Aligned with this goal, perceived organizational benefits were categorized into two groups, namely benefits in environmental performance and benefits in social performance of the SME.

The proposed model was evaluated with PLS-SEM approach. The evaluation of the measurement model showed that the latent variables are unidimensional, the model has high convergent validity and the discriminant validity of all model construct is approved. According to the results, hypotheses H1a, H1b, H3a and H3b can be confirmed. Green IS for pollution prevention and Green IS for sustainable development have a significant impact on environmental, as well as social performance of an SME. Even though, it was anticipated that Green IS for product stewardship will affect at least a part of perceived organizational benefits, this is not the case. Similar as in Baggia et al. (2019), Green IS for product stewardship does not significantly impact perceived organizational benefits in environmental performance, nor in social performance. According to (Gholami et al., 2013), a short term orientation focuses on using IS for pollution prevention, and a strategic orientation focuses on using IS for product stewardship and sustainable development. Although we could not confirm the impact of Green IS for product stewardship on perceived environmental or social performance, it is evident from the model that SMEs do not focus only on short term orientation, but tend to extend their Green IS Practices also to the strategic orientation using Green IS for sustainable development. This shows a high potential that SMEs have in performing Green IS practices and further on in other sustainable practices.

This paper contribution is twofold: From an academic perspective, it enhances the current knowledge by investigating the performance implications of Green IS practices, especially by taking into account the SMEs perspective. From the managerial point of view, it is necessary to recognize the sustainable value creation as a result of behaviours and actions of an organization directed towards Green IS. As such, the results of our study demonstrate that SMEs could benefit from using IS to manage green and sustainable aspects. Therefore, the results of our study demonstrate that SMEs would benefit from efforts to create and maintain Green IS practices. Well-established techniques and strategies that help foster sustainable principles include product stewardship that aims to take responsibility for minimizing the product's environmental impact throughout all stages of the products' life cycle. The use of Green IS has a potential to stimulate the practitioners in SMEs to proactively focus on pollution prevention initiatives to reduce overall emissions, waste and hazardous materials, to reduce costs by using collaborating tools as well as to improve environmental friendliness of SMEs' processes. Although not directly addressed by the results of our study, it is necessary to emphasize the importance of stimulating the pro-environmental behaviour of employees in SMEs. Thus, managers in organizations should be aware of the important role they play in creating the climate that promotes employee green behaviours (Norton, Zacher, & Ashkanasy, 2014).

Limitations and Future directions

The Green IS topic has mainly gained attention among the research sector. Further research on Green IS should follow specific methodology (i.e. Action design research, Design Science Research) to enable the extension and promotion of research results to the economy sector. In addition, this research was focused to Slovenian SMEs, therefore it would be valuable to extend the research to other countries and compare results. It would also be useful to upgrade this cross-sectional study to a longitudinal study, to gain insights into the changes of behaviour caused by diverse activities, calls and actual data exposing the problem of climate change and general sustainability issues.

References

Álvarez Jaramillo, J., Zartha Sossa, J. W., & Orozco Mendoza, G. L. (2018). Barriers to sustainability for small and medium enterprises in the framework of sustainable development—Literature review. Business Strategy and the Environment, 1–13. https://doi.org/10.1002/bse.2261

Baggia, A., Brezavšček, A., Maletič, M., Šparl, P., Raharjo, H., & Žnidaršič, A. (2016). Awareness and Attitude Towards Green IS in Slovenian Enterprises. Organizacija, 49(1), 15–27.

Baggia, A., Maletič, M., Žnidaršič, A., & Brezavšček, A. (2019). Drivers and Outcomes of Green IS Adoption in Small and Medium-Sized Enterprises. Sustainability (Switzerland), 11(1575). https://doi.org/10.3390/su11061575

Bokolo, T. (2016). Green Information Systems Integration in Information Technology Based Organizations: An Academic Literature Review. Journal of Soft Computing and Decision Support Systems, 3(6), 45–66. Retrieved from http://jscdss.com/index.php/files/article/view/117/pdf_142

Brooks, S., Wang, X., & Sarker, S. (2012). Unpacking Green IS: A Review of the Existing Literature and Directions for the Future. In J. vom Brocke, S. Seidel, & J. Recker (Eds.), Green Business Process Management: Towards the Sustainable Enterprise (pp. 15–37). Berlin, Heidelberg: Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-27488-6_2

Buchalcevova, A., & Gala, L. (2012). Green ICT Adoption Survey Focused on ICT Lifecycle from the Consumer's Perspective (SMEs). Journal of Competitiveness, 4(4), 109–122. https://doi.org/10.7441/joc.2012.04.08

Buchalcevova, A., & Gala, L. (2013). Green ICT drivers and inhibitors perceived by the Czech SMEs. Journal of Systems Integration, 4(2), 43–49. Retrieved from http://www.si-journal.org/index.php/JSI/article/viewFile/151/118

Cecere, G., & Mazzanti, M. (2017). Green jobs, innovation and environmentally oriented strategies in European SMEs. Resource and Energy Economics. https://doi.org/10.1016/j.reseneeco.2017.03.003

Chen, A. J. W., Boudreau, M.-C., & Watson, R. T. (2008). Information systems and ecological sustainability. Journal of Systems and Information Technology, 10(3), 186–201. https://doi.org/10.1108/13287260810916907

Chen, A. J., Watson, R. T., & Karahanna, E. (2009). Organizational Adoption of Green IS & IT: An Institutional Perspective. In ICIS 2009 Proceedings (pp. 1–17). Retrieved from https://aisel.aisnet.org/icis2009/142/?utm_source=aisel.aisnet.org%2Ficis2009%2F142&utm_medium=PDF&utm_campaign=PDFCoverPages

Chin, W. W. (2010). How to Write Up and Report PLS Analyses. In V. Espozito Vinci, W. W. Chin, J. Henseler, & H. Wang (Eds.), Handbook on Partial Least Squares (pp. 655–689). Berlin Heidelberg: Springer-Verlag. https://doi.org/10.1007/978-3-540-32827-8

Coffey, P., Tate, M., & Toland, J. (2013). Small business in a small country: Attitudes to "Green" IT. Information Systems Frontiers, 15(5), 761–778.

Cuerva, M. C., Triguero-Cano, Á., & Córcoles, D. (2014). Drivers of green and non-green innovation: Empirical evidence in Low-Tech SMEs. Journal of Cleaner Production, 68, 104–113. https://doi.org/10.1016/j.jclepro.2013.10.049

Daggag, A. H. (2014). Greening Information Communication Technologies in Small-Medium Sized Companies. In Zone I Student Papers Proceedings. Retrieved from https://www.asee.org/documents/zones/zone1/2014/Student/PDFs/108.pdf

Deng, Q., & Ji, S. (2015). Organizational green IT adoption: Concept and evidence. Sustainability (Switzerland), 7(12), 16737–16755. https://doi.org/10.3390/su71215843

Escobar-Rodriguez, T., & Monge-Lozano, P. (2012). The acceptance of Moodle technology by business administration students. Computers & Education, 58(4), 1085–1093. https://doi.org/10.1016/j.compedu.2011.11.012

Eurostat. (2008). Statistical classification of economic activities in the European Community. NACE Rev. 2. https://doi.org/KS-RA-07-015-EN-N

Foogooa, R., & Dookhitram, K. (2014). A self green ICT maturity assessment tool for SMEs. 2014 IST-Africa Conference and Exhibition, IST-Africa 2014, (May). https://doi.org/10.1109/ISTAFRICA.2014.6880671

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. Journal of Marketing Research, 18(1), 39–50. https://doi.org/10.2307/3151312

Gäre, K., & Melin, U. (2011). SMEs need formative infrastructure for business transformation. Journal of Enterprise Information Management, 24(6), 520–533. https://doi.org/10.1108/17410391111166558

Gholami, R., Sulaiman, A. B., Ramayah, T., & Molla, A. (2013). Senior managers' perception on green information systems (IS) adoption and environmental performance: Results from a field survey. Information & Management, 50(7), 431–438. https://doi.org/10.1016/j.im.2013.01.004

Henseler, J., & Sarstedt, M. (2013). Goodness-of-fit indices for partial least squares path modeling. Computational Statistics, 28(2), 565–580. https://doi.org/10.1007/s00180-012-0317-1

Hernandez-Pardo, R. J., Bhamra, T., & Bhamra, R. (2013). Exploring SME perceptions of sustainable product service systems. IEEE Transactions on Engineering Management, 60(3), 483–495. https://doi.org/10.1109/TEM.2012.2215961

Hernandez, A. A. (2018). Exploring the Factors to Green IT Adoption in SMEs in the Philippines. In IST-Africa 2014 Conference Proceedings (Vol. 20, pp. 49–66). https://doi.org/10.4018/JCIT.2018040104

Ijab, M. T., Molla, A., & Cooper, V. (2012). Green Information Systems (Green IS) Practice in Organisation: Tracing its Emergence and Recurrent Use. In AMCIS 2012 Proceedings (p. 6). Retrieved from https://aisel.aisnet.org/amcis2012/proceedings/GreenIS/6

Kerr, I. R. (2006). Leadership strategies for sustainable SME operation. Business Strategy and the Environment, 15(1), 30–39. https://doi.org/10.1002/bse.451

Loeser, F. (2013). Green IT and Green IS: Definition of Constructs and Overview of Current Practices. In Proceedings of the Nineteenth Americas Conference on Information Systems. https://doi.org/10.13140/2.1.3065.6962

Loeser, F., Recker, J., Brocke, J. vom, Molla, A., & Zarnekow, R. (2017). How IT executives create organizational benefits by translating environmental strategies into Green IS initiatives. Information Systems Journal, 27(4), 503–553. https://doi.org/10.1111/isj.12136

Masocha, R., & Fatoki, O. (2018). The Impact of Coercive Pressures on Sustainability Practices of Small Businesses in South Africa. Sustainability (Switzerland), 10(3032). https://doi.org/10.3390/su10093032

Melville, N. P. (2010). Information Systems Innovation for Environmental Sustainability. MIS Quarterly, 34(1), 1–21. Retrieved from https://misq.org/downloadable/download/linkSample/link_id/838/

Miller, K., Neubauer, A., Varma, A., & Williams, E. (2011). First assessment of the Environmental Compliance Assistance Programme for SMEs (ECAP). Retrieved from http://ec.europa.eu/environment/archives/sme/pdf/First assessemnt of the ECAP for SMEs.pdf

Moorthy, M. K., Yacob, P., Chelliah, M. K., & Arokiasamy, L. (2012). Drivers for Malaysian SMEs to Go Green. International Journal of Academic Research in Business and Social Science, 2(9), 74–86. Retrieved from https://core.ac.uk/download/pdf/25777543.pdf

Muafi, M. (2015). Green IT empowerment, social capital, creativity and innovation: A case study of creative city, Bantul, Yogyakarta, Indonesia. Journal of Industrial Engineering and Management, 8(3), 719–737. https://doi.org/10.3926/jiem.1341

Musa, M. H., & Mohamad, M. N. (2018). Importance of Green Innovation in Malaysian SMEs: Advantages and Future Research. International Academic Journal of Business Management, 5(4), 64–73. Retrieved from http://iaiest.com/dl/journals/2- IAJ of Business Management/v5-i4-oct-dec2018/paper6.pdf

Norton, T. A., Zacher, H., & Ashkanasy, N. M. (2014). Organisational sustainability policies and employee green behaviour: The mediating role of work climate perceptions. Journal of Environmental Psychology, 38, 49–54. https://doi.org/10.1016/j.jenvp.2013.12.008

OECD. (2015). Environmental Policy Toolkit for Greening SMEs in the EU Eastern Partnership countries. https://doi.org/10.1787/9789264293199-en

Pinget, A., Bocquet, R., & Mothe, C. (2015). Barriers to Environmental Innovation in SMEs: Empirical Evidence from French Firms. M@n@gement, 18(2), 132. https://doi.org/10.3917/mana.182.0132

Ramayah, T., Siew, K. K., Ahmad, N. H., Halim, H. A., & Lo, M.-C. (2013). An Exploratory Study of Green IT Adoption Issues among SMEs. Life Science Journal, 10(12s), 246–255.

Ravand, H., & Baghaei, P. (2016). Partial Least Squares Structural Equation Modeling with R. Practical Assessment, Research & Evaluation, 21(11), 1–16. Retrieved from https://pareonline.net/pdf/v21n11.pdf

Recker, J. (2016a). Toward a design theory for green information systems. Proceedings of the Annual Hawaii International Conference on System Sciences, 2016–March, 4474–4483. https://doi.org/10.1109/HICSS.2016.556

Recker, J. (2016b). Tutorial Green Information Systems. Retrieved from http://siggreen.wikispaces.com/file/view/AMCIS2016_GreenIS_Tutorial_slides.pdf

Sanchez, G. (2013). PLS Path Modeling with R. Retrieved from http://www.gastonsanchez.com/PLS_Path_Modeling_with_R.pdf

Sarango-Lalangui, P., Álvarez-García, J., & Del Río-Rama, M. D. C. (2018). Sustainable Practices in Small and Medium-Sized Enterprises in Ecuador. Sustainability (Switzerland)2, 10(6), 1–15. https://doi.org/10.3390/su10062105

Schmidt, F. C., Zanini, R. R., & Junior, R. S. (2018). Evaluation of Sustainability Practices in Small and Medium-Sized Manufacturing Enterprises in Southern Brazil. Sustainability (Switzerland), 10(2460). https://doi.org/10.3390/su10072460

Shah, S., Ganji, E. N., & Hasan, S. (2016). An Analysis of Environmental Management and Sustainability in SMEs. WSEAS Transactions on Environment and Development, 12, 353–365.

Verdolini, E., Bak, C., Ruet, J., & Venkatachalam, A. (2018). Innovative Green-technology SMEs as an Opportunity to Promote Financial de-risking. Economics, 12(14), 1–12A. https://doi.org/10.5018/economics-ejournal.ja.2018-14

Walker, B., Redmond, J., Sheridan, L., Wang, C., & Goeft, U. (2008). Small and medium enterprises and the environment: barriers, drivers , innovation and best practice. A review of the literature. Perth, Western Australia School. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.475.6016&rep=rep1&type=pdf

Watson, R. T., Boudreau, M.-C., Chen, A. J., & Huber, M. (2008). Green IS: Building Sustainable Business Practices. Information Systems Journal, 76, 1–15. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.567.2008&rep=rep1&type=pdf

Yacob, P., & Moorthy, M. K. (2012). Green Practices: Perception of Malaysian SME Owners/Managers. International Journal of Academic Research in Economics and Management Science, 1(3), 103–111. Retrieved from https://pdfs.semanticscholar.org/084f/28fb64157b771f5055de048a9c4f710f0690.pdf