

## Does Green Intellectual Capital Affect Green Performance? The Mediation of Green Innovation

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### Abstract:

Nowadays, wineries have to cope with the many challenges that threaten their survival. In this context, environmental management and the development of intangible assets are two decisive elements for their survival. The following three research questions can be answered through this study: (1) does Green Intellectual Capital (GIC) influence Green Performance (GP)? (2) does Green Innovation (GI) influence the GIC-GP relationship? and (3) what measures can companies take to improve their GI? The results of the study show that there is a positive and significant relationship between GIC and GP, with this relationship being partially measured by the GI variable.

**Keywords:** Green Intellectual Capital, Green Performance, Green Innovation, Environmental Management.

### 1. INTRODUCTION

At present, there are several problems that highlight the excessive growth from an economic standpoint, such as global warming, pollution and deforestation. These problems threaten the survival of the human species on earth, which has led to a heated debate on the imperative need to achieve sustainability (Hsueh, 2019).

Historically, activities aimed at caring for and respecting the environment have been in conflict with obtaining economic rents. On the one hand, the classical current of research argues that profit maximization should be the priority objective for managers (Friedman, 1962). On the other hand, the current stream of publications indicates that companies should take into account social and environmental variables (Stewart and Niero, 2018). In this last current of thought, Green Innovation (GI), plays a fundamental role, given that it allows balancing the economic performance-environmental management dichotomy. In fact, the growing concern for environmental care has generated great business opportunities for the development of environmentally friendly products and processes (Singh et al., 2020; Zameer et al., 2020).

There are two main reasons why organizations are developing their environmental management programs: (1) increasing customer awareness of environmental issues and (2) the tightening of environmental regulations. These factors act as catalysts for the development of GIs, as well as for the implementation of environmental programs (Chen & Chang, 2013).

However, despite the current trend whereby organizations are developing sustainable practices, there is still ambiguity in identifying the drivers of GI that, in turn, improve Green Performance

(GP) (Soewarno et al., 2019). From the perspective of the Natural Resource-Based View (NRBV), intangible assets are fundamental to represent key elements for a correct environmental management and, consequently, for obtaining a superior competitive position vis-à-vis competitors, since under this approach competitive advantage is linked to the development of environmentally friendly activities by the organization.

Organizational intangibles linked to the protection of the environment in which organizations operate, therefore, can be conceived of as a surplus of organizational capabilities, such as environmental management and performance. In order to achieve these intangible assets, organizations can choose to develop three types of Intellectual Capital (IC): human, structural and relational capital (Davenport and Prusak, 1998). In this sense, the IC that includes concern for the environment, i.e., Green Intellectual Capital (GIC), has emerged as an emerging field of study at present (Yong et al., 2019), being a widely used variable to analyse the effect of the organization's environmental intangibles and other organizational variables (Marco-Lajara et al., 2021a; Marco-Lajara et al., 2021b).

The present investigation analyses the GIC-GP link, as well as the mediating role of GI in this link. There are three reasons that motivated the study. First, there is a lack of scientific literature on the relationship in question. Secondly, there is no previous research that has analysed the relationship in the wine industry. Third, GIC is an emerging field of study that needs constant stimulation in the field of IC and environmental management.

The present study aims to advance our knowledge of the GIC construct. To this end, GI has been conceived as a mediating variable and GP as the dependent variable to be analysed. Therefore, the study provides clarity in the study of GIC, as well as contributing to the debate on the need or not of environmental management in organizations. In particular, the study aims to answer the following two research questions: (1) does GIC positively and significantly affect the GP, and (2) does GI mediate this link?

To achieve the proposed research objectives, the study is structured as follows. Section 1 reflects on the research gap to be filled, Section 2 presents the research hypotheses to be countered. Section 3 presents the set of steps to achieve the proposed objectives, Section 4 the results and finally Section 5 the main conclusions, limitations and future lines of research.

### **The mediating effect of green innovation on the Green Intellectual Capital-Green Performance relationship.**

The NRBV provides insight into the increased awareness on the part of organizations to develop environmentally friendly organizational capabilities, such as GIC and GI. The origin of this theory can be traced back to the work of Hart (1995) who introduced a new approach within the Resource Based View (RBV) in order to emphasize the importance of environmental management as a strategic element. The NRBV was a revolution in the study of business management, since it argued that environmental intangibles could become barriers to entry against new competitors (Hart & Dowell, 2011).

Given the relevance of intangible assets under this approach, the particularities of intangible assets has attracted the interest of different scholars focused on the study of environmental management (Marco-Lajara et al., 2022a; Marco-Lajara et al., 2022b; Marco-Lajara et al., 2022c; Marco-Lajara et al., 2022d; Marco-Lajara et al., 2022e; Marco-Lajara et al., 2022f; Marco-Lajara et al., 2022g; Marco-Lajara et al., 2022h). Thus, authors such as Russo & Fouts (1997) and Aragón-Correa & Sharma (2003) point out that the success of environmental

management derives from the adequate generation of organizational capabilities. In this same line of thought, recent authors such as Yusoff et al. (2019) and Yong et al. (2019) have analyzed the effect of organizational sustainable intangibles on organizational performance. To conduct this research, the authors have also relied on the Intellectual Capital-Based View (ICBV), which argues that the set of intangibles of a human, structural and relational nature can lead to competitive advantage. This theory overcomes the limitations of the RBV in terms of its explanatory capacity for obtaining a competitive advantage, which is why it has been used, together with the NRBV, to explain the relations raised (Andreeva et al., 2021).

Currently, the ICBV approach is linked to the environmental management literature through the GIC construct (Malik et al., 2020; Wang, 2022). This set of environmental intangibles enables organizations to meet the environmental demands of stakeholders as well as to implement stringent environmental regulations, which is why they have a priority role in meeting the Sustainable Development Goals (Yadiati et al., 2019). Indeed, GIC provides a better understanding of the functioning of GI, understood as the ability to develop environmentally responsive product and process innovations (Anik and Sulistyono, 2021). Through the present study, the NRBV approach is linked to the ICBV to understand the relationships between GIC, GI and GP. Therefore, based on these theories, the following hypotheses are formulated:

- H1. GIC has a positive effect on GP.
- H2. GIC has a positive effect on GI.
- H3. GI has a positive effect on GP
- H4. GI mediates the relationship between GIC and GP.

### **Methodology**

The study has been contextualised in the Spanish wine industry for several reasons. Firstly, this sector is of utmost importance for social and environmental development of Spain, being a benchmark in terms of vineyard surface and export volume. Secondly, knowledge is increasingly important to compete in the global wine sector (Cassi et al., 2012). Thirdly, no previous research has analysed the relationships raised in the wine sector, which represents a research opportunity to further advance the study of the variables analysed.

The population, on the other hand, is made up of all those companies belonging to the National Code of Economic Activities (CNAE, by its acronym in Spanish) 1102. After carrying out a search through the database of the Iberian Balance Sheet Analysis System (SABI, by its acronym in Spanish), it was found that this code was made up of a total of 4,373 companies, this being the population under study. A structured online questionnaire was used to obtain the sample. Firstly, a pre-test was carried out to determine the degree of understanding of the selected validated scales and, subsequently, it was distributed through the Qualtrics application in the last four months of the year 2021. A total of 2016 were obtained after the collection process. However, after filtering them, 202 observations were considered valid, and this became the final sample.

To ensure the reliability of the variables employed, validated scales were used. For the measurement of GI, the scale designed by Chen (2008b) was used, which considers this variable as a multidimensional construct consisting of green product innovation (4 items) and green process innovation (4 items). The scale used by Zaragoza-Sáez et al. (2020) was used to measure GIC, which is conceived as a first-order construct. The GP scale, on the other hand,

was conceived as a first-order variable, using the scale developed by Paillé et al. (2014). Finally, age and age were introduced as control variables.

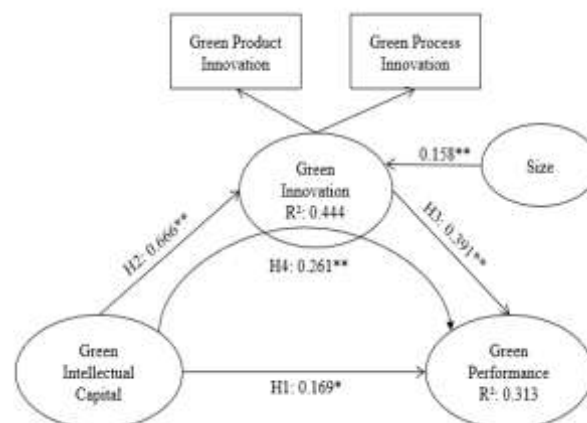
The analysis technique used to carry out the hypothesis testing was partial least squares structural equation modelling (PLS-SEM), using the software SmartPLS v. 3.3.3. This technique allows us to analyse a set of relationships between latent variables, and is therefore suitable for studies in the social sciences (Roldán & Cepeda, 2017). There are different reasons that justify the suitability of the technique for carrying out this research. Firstly, direct and indirect relationships between the constructs analysed are considered, and PLS-SEM is an appropriate technique for these cases. Secondly, the research exceeds the minimum sample size for using this technique, which is 100 observations. Thirdly, there are multidimensional variables in the research, and PLS-SEM is an effective technique for analysing this type of constructs.

## 2. RESULTS AND DISCUSSION

The two-stage model has been used as a consequence of the existence of multidimensional variables in the model (Hu and Bentler, 1998). The first stage consisted of calculating the latent variable scores. Subsequently, we (1) evaluated the global model fit, (2) the fit of the measurement model and (3) the fit of the structural model.

Regarding the first type of fit, it should be noted that the model has an adequate overall model fit, since the standardized root mean square residual is less than 0.08, also fulfilling the requirement of Byrne (2008), who considers that this indicator should be less than 0.05. Likewise, the unweighted least squares discrepancy ( $d_{ULS}$ ) and the geodesic discrepancy ( $d_G$ ) are within the confidence range after analyzing the bootstrapping technique (Hair et al., 2019). With regard to the second type of adjustment, it is important to point out that the indicators meet the reliability criteria, since the loadings are greater than 0.707 (Carmines and Zeller, 1979). Secondly, the constructs analyzed meet the internal consistency criteria, with Cronbach's alpha being above 0.8. Thirdly, the variables also meet the requirement of convergent validity, so that the AVE values are greater than 0.5 (Fornell and Larcker, 1981). Fourth, the constructs meet the criteria of discriminant validity, so that each construct captures realities different from the others. Once the overall model fit and measurement fit had been analyzed, the structural model was evaluated, i.e., the relationships between variables were analyzed.

**Figure 1. Theoretical model with R-squared, path coefficients ( $\beta$ ) and significance.**



\*  $p < 0.05$ . \*\*  $p < 0.001$   
Source: own elaboration

Figure 1 shows the results related to the evaluation of the structural model and Table 1 shows the analysis of the direct and indirect effects between the proposed relationships. There is a positive and significant total effect of the ICM on the GP, and the indirect effects are also positive and significant. This allows us to confirm the four hypotheses. To analyze the quality of the model, the Geisser test was used, with predictive relevance given that the Q2 values were greater than 0.25 (Hair et al., 2019). Regarding the control variables, only the size variable showed a positive and significant effect.

**Table 1. Results of the structural model for the mediation model**

Direct Effects	Path Coefficient	t-Value	p-Value	95% BCCI	Hypothesis
GI -> GP	0.391	3.635	0.00**	[0.195; 0.551]	H3 supported
GIC -> GI	0.666	13.437	0.00**	[0.583; 0.748]	H2 supported
GIC -> GP	0.169	1.737	0.042*	[0.069; 0.231]	H1 supported
Indirect Effects	Path Coefficient	t-Value	p-Value	95% BCCI	Hypothesis
GIC -> GI -> GP	0.261	3.572	0.00**	[0.134; 0.379]	H4 supported

Notes: BCCI: bias corrected confidence intervals; \*  $p < 0.05$ . \*\*  $p < 0.001$ .  
Source: own elaboration

### 3. CONCLUSIONS AND IMPLICATIONS

Wineries are confronted with various exogenous and endogenous threats to the long-term viability of the sector. As far as exogenous factors are concerned, rising energy prices or water scarcity are two clear examples. As for endogenous factors, the knowledge of winemakers can be a key driver for the adoption of environmentally friendly practices. It is for this reason that the research is of utmost relevance, as it empirically demonstrates the GIC-GP link.

A series of theoretical and operational implications are drawn from the results of the study. On the theoretical side, the results contribute to generate new knowledge in the literature on IC and environmental management, given that, to our knowledge, there are no previous studies that have contextualised the relationships raised in the Spanish wine sector. These findings are consistent with recent research such as Wang & Jou (2021). However, there is still a notorious paucity of literature on the subject. In terms of practical implications, the study can be very useful for making environmental decisions in Spanish wineries. From a Green Human Capital (GHC) point of view, codes of good practice can be developed or environmental sessions can be organized to improve the green knowledge of employees. From the point of view of Green Structural Capital (GSC), circular economy programs or water management systems can be developed to improve organizational capacities aimed at preserving the environment. From the point of view of Green Relational Capital (GRC), the environmental demands of stakeholders must be effectively managed through, among other means, environmental management.

The study suffers from certain limitations despite its important contributions. The relevance of the subject makes it necessary to broaden the geographical scope of the research in order to establish differences between the New World and the Old World. Likewise, the effect of size on the green yield of Spanish wineries could be further analysed. Therefore, we intend, as a future line of study, to conduct a multi-group analysis to identify the differences in environmental management according to the size of the wineries.

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