The Intangible Assets in the Green Transition of Firms: Empirical Insights from Italy

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Abstract

We empirically investigate the simultaneous relationship between the various types of intangible assets and their effects on eco-innovation adoption through a sample of Italian manufacturing firms.

The results highlight a positive influence of the intangibles on the likelihood to invest in eco-innovation. We observe, when focusing on the human capital, that while investments in only employee training only directly affect eco-innovation, the investments in management training for new business models indirectly influence eco-innovations by triggering the other intangible assets (R&D and intellectual property, Organizational capital, Open innovation).

Keywords: Intangible Assets; Human Capital; Green Transition; Eco-innovation; Global Competition

1. Intangible Assets and the Green Transition

Intangible assets are increasingly important for growth and competitiveness all over the world (OECD, 2011; Haskel & Westlake, 2018, 2022): "production in the second machine age depends less on physical equipment and structures, and more on the four categories of intangible assets: intellectual property, organizational capital, user-generated content, and human capital" (Brynjolfsson & McAfee, 2014). In some countries, the investments in intangible assets equal or surpass tangible ones such as building, equipment and machinery (OECD, 2011).

Literature has widely recognized the key role played by intangible assets for the growth of a firm and value creation (Lev, 2001; Brondoni, 2001, 2010; Vodák, 2011; Cucculelli & Bettinelli, 2015). Specifically, intangible assets are able to generate competitive advantage in the long-run since they are unique, rare and difficult for the

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competitors to imitate, also assuring cumulative effects (Heiens et al., 2007) and allowing to firm to generate increasing returns over time in contrast to physical assets that may be most characterized by diminishing marginal returns (Denicolai et al., 2015). These greater persistence of the returns over time is sustained also by the fact the intangible assets improve customer attainment and preservation strengthening the brand image of the company (OECD, 2008); this also because firm's success driven by the intangible assets is more believable in the global market (e.g., Montresor & Vezzani, 2016).

According to the Resource Based View (RBV) and the knowledge-view theory, the success of a company depends on intangible assets – with particular regard to the human capital – more than tangible ones.

In the new trajectories of competitiveness, environmental sustainability is an essential component (European Commission, 2019, 2020a, 2020b). President Ursula von der Leyen's underlined in her State of the Union speech (September, 2020) that the green transition is one of the key priorities of the European Commission, as determinant factor in supporting the European Union economically, environmentally and geopolitically (European Commission, 2020b). In this regard, the intangible assets, as factors supporting innovation (OECD, 2008), may be determinant in favoring the green transition via enhancing eco-innovations (Ricotti, 2022).

The change of the economic paradigm towards the sustainability growth (European Commission, 2019, 2020a, 2020b) requires firms to leave their "Conventional business models innovation praxis" (their comfort zone) to develop more green business models (Salvioni & Brondoni, 2020; Lindgren et al., 2021), along a stakeholder engagement (Salvioni & Almici, 2020), to reach a higher competitiveness level through eco-innovations. In the forefront, when focusing on human capital as one of the intangibles, the management skills play a much greater key role than when focusing on only the employee skills. This is because the paradigm change requires a new corporate culture possessing the competencies to adopt eco-innovations aimed at raising a firm's competitiveness through a recombining process of innovation at all levels by means of involving all the other types of intangibles.

Since the literature on eco-innovation determinants is widely developed (Horbach et al., 2012; for a review see, e.g., de Jesus Pacheco et al., 2017; Păcesilă & Ciocoiu, 2017), there is still a lack of empirical studies at a firm level simultaneously investigating the relationship between the various types of intangibles and their effects on eco-innovation adoption. More specifically, the role played by the diverse investments in human capital – by differentiating only employee training from management training for new business models – in raising the firm's competitiveness via eco-innovations.

Although intangible assets remain a concept still difficult to define and to measure, we adopt the approach defined by Brynjolfsson and McAfee (2014) identifying four types of intangibles: i) R&D and intellectual property; ii) organizational capital; iii) user-generated content (that we broadened to the concept of open innovation); and iv) human capital. Applying a mediation analysis, we simultaneously analyzed the

relationship between these different types of intangible assets and their effects on a firm's decision to plan eco-innovations. We deepen the effects of human capital in adopting eco-innovations estimating the direct effect, on one hand, and the indirect effect via influencing the other three intangibles, on the other. All this tested by using two types of human capital: i) investments in only employee training, that we call "Human Capital operational" (*HC operational*); and ii) investments in management training for new business models besides employee training, that we call "Human Capital managerial" (*HC managerial*).

To do this, we use a survey carried out by the Centro Studi Guglielmo Tagliacarne (Italian Research Centre of the Chambers of Commerce) and Unioncamere (Italian Union of the Chambers of Commerce) in 2022 on 3,000 Italian manufacturing firms having between 5 and 499 employees.

2. Literature Review and Research Hypotheses

2.1 Intangible Assets and Eco-Innovations

From a theoretical point of view, this paper combines the strand of literature on intangible assets with those of eco-innovation determinants.

Literature has widely recognized the key role played by the intangible assets for a firm's growth, success, and value creation (Brondoni, 2001, 2010; Lev, 2001; Perrini & Vurro, 2010; Vodák, 2011; Seo & Kim, 2020). Intangible assets are a determinant factor supporting innovation (OECD, 2008) involving the adoption of new business models. Brynjolfsson and McAfee (2014) identified intangible assets in four typologies: i) intellectual property (including also R&D); ii) organizational capital; iii) user-generated content; and iv) human capital. This is our reference classification since it looks at the concept on intangible assets in a broader manner taking into account also the innovation ecosystem (i.e. the firm's relationship with external actors).

From the 1990s, the resource-based view theory (RBV) and the knowledge-view theory stated that the success of a company depends on intangible assets more than tangible ones, especially focusing on the role of human capital. According to the RBV theory, human capital is the resource (valuable, rare, and not imitable) that generates a competitive advantage for the firm (Barney, 1991), because it enhances the quality of outputs and the efficiency of the operations, on one hand, and it is heterogeneously distributed among firms, on the other. Since eco-innovation is strictly related to a firm's competitive advantage (for a review see Hojnik & Ruzzier, 2016 and Jové-Llopis & Segarra-Blasco, 2018), under the well-known question: "Does it pay to be green?" (Ambec & Lanoie, 2008), human capital becomes a key factor increasing also the firm's propensity to invest in the environmental field (Portillo-Tarragona et al., 2018): the adoption of proactive environmental strategies requires high commitment human resource practices, such as specific training activities (Perrini & Vurro, 2010). Particularly, the literature on eco-innovations determinants considers knowledge

resources, capabilities, and human skills as important drivers of eco-innovation as technology push factors (Horbach, 2008: Horbach et al., 2012).

Within human capital, management plays a key role since the new managerial approaches adopted by an organization-wide sensitivity to the natural environment generate important competitive gains (Perrini & Vurro, 2010). The increasing effects of climate change and the growing attention to the role of the business in the society push the firms to face a "Transformative Development" (Brondoni & Ricotti, 2022) involving a switch towards green business models (Sommer, 2012; Lindgren et al., 2021; Bigliardi & Filippelli, 2021) with innovations that combine the firm's strategy with environmental value creation (Hart & Milstein, 2003; Pavez et al., 2021). Namely, to obtain the greatest benefits through the best management system from their environmental investments (Janahi et al., 2021). Indeed, this transformation towards green business models requires managers to study how the business can offer, create and capture environmental value in their processes, products and services (Boons & Lüdeke-Freund, 2013; Bocken et al., 2014; Quintás et al., 2018). This calls for the need for the managers to understand how to pursue a sustainable growth by implementing the best innovations towards the environmental sustainability (Bossle et al., 2016; Luqmani et al. 2017).

In addition to human capital, the improvement of knowledge capital depends on R&D activities too, because they trigger eco-innovations by enhancing technological capabilities (Horbach, 2008; Horbach et al., 2012).

Furthermore, organizational capital is also recognized as an important factor. According to the literature on the eco-innovation determinants, organizational capabilities can drive eco-innovation (Horbach, 2008; Horbach et al., 2012). According to Porter and van der Linde (1995), organizational and coordination problems can impede the realization of eco-innovations. This is strictly related to the importance of management, because "innovation and environmental sustainability become central concepts and both should be well assimilated in a company's management and coordination activities" (Bossle et al., 2016, p. 862).

With regards to the fourth type of intangible asset, user-generated content, in this study we broadened the concept to open innovation since nowadays co-innovation regards not only users, but also many other actors. The open innovation concept emphasizes the fact that firms take competitive advantages not only from internal knowledge but, increasingly, from several external actors involving managed inflows and outflows of knowledge across organizational boundaries (Chesbrough, 2003; Chesbrough & Bogers, 2014). Thus, intangible assets also generate competitive advantages through the relationship between organizations (Silvestrelli, 2010; Cassetta et al., 2022). The complexity of the adoption of the environmental innovations requires information and knowledge – new or complementary – from the outside of the firm's boundaries (Ghisetti et al., 2015; Casalegno et al., 2020; Valdez-Juárez et al., 2020; Pichlak & Szromek, 2021; Sanchez & Pavez, 2021), involving also a high level of green management practices inside the firm (Naruetharadhol et al, 2021). Indeed, several studies found a positive effect of open innovation – or specific external relationships – on eco-innovation (Ghisetti et al., 2015; Doran &

Ryan, 2016; Triguero et al., 2018; Leitão et al., 2020; Valdez-Juárez et al., 2020; Naruetharadhol et al., 2021; Sanchez & Pavez, 2021). In the light of this positive connection, new terms such as "open green innovation mode", "open eco-innovation mode," and "open environmental innovation mode" – that are interchangeable in use – were introduced in the literature (Ghisetti et al., 2015; Naruetharadhol et al., 2021).

2.2 Hypotheses Development

All in the light of the points reported above, we posit the following hypotheses:

Hp1. Firms investing in R&D and Intellectual property are more likely to adopt eco-innovations

Hp2. Firms investing in Organizational capital are more likely to adopt eco-innovations

Hp3. Firms investing in Open innovation are more likely to adopt eco-innovations

Hp4a Firms investing in Human capital through employee training are more likely to adopt eco-innovations

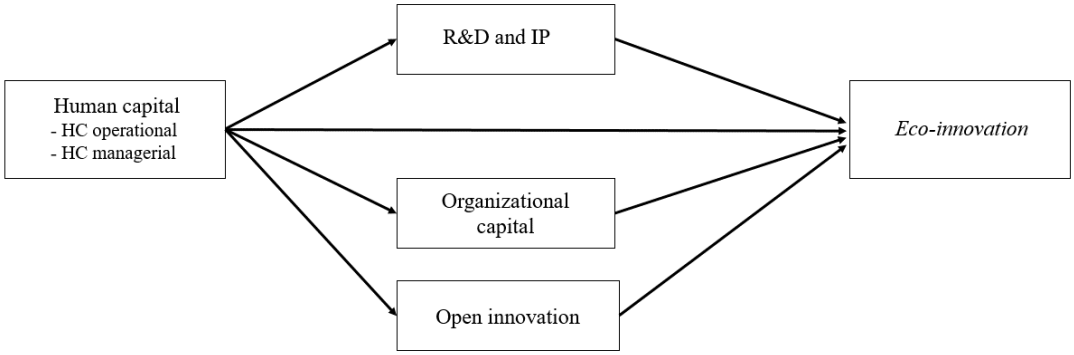
Hp4b Firms investing in Human capital, also including management training for new business models, are more likely to adopt eco-innovations than firms investing only in employee training

Hp4c Firms investing in Human capital, also including management training for new business models, are more likely to adopt eco-innovations driven by competitiveness motivations than firms investing only in employee training

These hypotheses develop on the basis of a framework (Figure 1) that: i) adopts the definition of intangible assets according to Brynjolfsson and McAfee (2014); and ii) considers human capital an input of the innovation (Nelson & Phelps, 1966; Romer, 1990) – corresponding, in our case, to R&D and Intellectual property (*R&D and IP*), *Organization capital*, *Open innovation*, besides eco-innovation – hence, potentially able to influence a firm's decision of investing in eco-innovation both directly and indirectly via its influence on the other three types of intangible assets.

To capture the potential effect of training on management skills for new business models, in comparison to only on employee skills, we measured human capital in two different ways: i) the firm investing in only employee training (*HC operational*); and ii) the firm investing also in management training for new business models besides employee training (*HC managerial*).

Figure 1: *Conceptual Framework*



3. Data and Empirical Strategy

3.1 Data

The data used come from a survey carried out by Centro Studi Tagliacarne-Unioncamere (Italian Union of Chambers of Commerce) in early 2022 on a representative sample of 3,000 Italian manufacturing firms with a number of employees between 5 and 499. These fresh data allows us to study firms' future strategies.

The sample corresponds to 2.3% of the whole Italian population in terms of firms and 4.8% in terms of employees. Specifically, the sampling procedure ensured the statistically representativeness of the data following both exhaustive and random sampling criteria. The stratification considered three dimensions of firm: i) industry (24 divisions of the section C manufacturing sector of the Nace Rev.2 classification); ii) size class in terms of employees (5-9, 10-49, 50-249, 250-499); iii) geographical location (North-West, North-East, Center, South). The maximum sampling error is small (e=1.8%; α=0.95%) indicating that the final sample is representative of the population. The survey was conducted by CATI (Computer-Assisted Telephone Interviewing) method by a professional contractor with the aim of gathering both qualitative and quantitative information on the firm; several preliminary briefings have been held with the contractor aiming at explaining to interviewers the exact meaning of specific critical issues.

3.2 Empirical Strategy

We conducted a mediation analysis (Hayes, 2018) to measure simultaneously the relationship between the intangible assets and their influence on firm's eco-innovation adoption. Considering the human capital as input factor of the other three intangible assets, we measure the effect of the human capital (Table 1) by conducting two types of analyses: one considering as key variable *HC operational* (binary: 1 = if the firm invests in training activities only for the employees), and the other considering as key variable *HC managerial* (binary: 1 = if the firm invests in management training for new business models besides employee training) on investment decision in eco-innovation (dependent variable *Eco-innovation*, binary: 1 = if the firm has planned to

invest in the eco-innovation in the period 2022-24) by decomposing the direct effect from the indirect effect via three mediators capturing the firms investing in the other three intangible assets: i) R&D and intellectual property (*R&D and IP*, binary: 1 = if the firm invests in R&D and in achieving intellectual property rights, i.e. patents, trademarks or designs), ii) *Organizational capital* (binary: 1 = if the firm invests in organizational innovation); iii) *Open innovation* (binary: 1 = if the firm carries out co-innovation with customers, universities, and supply chain firms).

Table 1: *The Effects of Human Capital on Eco-innovation*

Type of effect	Description
DIRECT EFFECT HC operational → Eco-innovation	The direct effect of the investment in training activities only for the employees on the Eco-innovation
INDIRECT EFFECT HC operational → Eco-innovation	The effect of the investment in training activities only for the employees on the Eco-innovation via its influence on the other intangibles (R&D; organizational capital, Open innovation)
DIRECT EFFECT HC managerial → Eco-innovation	The direct effect of the investment in management training for new business models besides employee training on the Eco-innovation
INDIRECT EFFECT HC managerial → Eco-innovation	The effect of the investment in management training for new business models besides employee training on the Eco-innovation via its influence on the other intangibles (R&D; organizational capital, Open innovation)

We applied the structural equation modelling[1] (StataCorp, 2021) (command *sem* in STATA).

The path explained in Figure 1 is estimated through the following four equations:

$$M_{1i} = i_{M_1} + a_1 X_i + d_1 C_i + \varepsilon_{M_1} \quad (1)$$

$$M_{2i} = i_{M_2} + a_2 X_i + d_2 C_i + \varepsilon_{M_2} \quad (2)$$

$$M_{3i} = i_{M_3} + a_3 X_i + d_3 C_i + \varepsilon_{M_3} \quad (3)$$

$$Y_i = i_Y + c' X_i + b_1 M_{1i} + b_2 M_{2i} + b_3 M_{3i} + d_4 C_i + \varepsilon_Y \quad (4)$$

where M_1, M_2 and M_3 are the mediators (respectively, *R&D and IP, ii) Organizational capital; iii) Open innovation*), Y is the response variable *Eco-innovation*, X is the key variable (for each analysis: *HC operational; HC managerial*), and C is the vector including all control variables:

- age (discrete: Number of years since inception);
- size (discrete: Number of employees);
- high-tech (binary; 1 = if the firm operates in high/medium-high technology intensive sector; 0 = if the firm operates in low/medium-low technology intensive sector);

– tertiary (continuous: share of employees with tertiary degree);
– geographical location (North-West, North-East, Center, South).

Finally, ε is the random error term; i_{M_1}, i_{M_2}, i_{M_3}, i_y are the regression constants. Collinearity problem does not emerge since the values of Variance Inflation Factor are below of the critical threshold of 10 (Yoo et al., 2014)[2].

In Equations 1, 2 and 3 the coefficients a_1, a_2 and a_3 are the effects of the key variable X on each mediator (M_1, M_2, M_3). In Equation 4 the coefficient c' is the direct effect (that is unmediated) of the key variable X on the response variable Y when adjusted for the mediators; coefficients b_1, b_2, b_3 are the effects of each mediator M_1, M_2, M_3 on Y when adjusted for X.

The indirect effect measures the effects of X on Y that are explained (mediated) by the mediators. Specifically, in presence of three mediators (M_1, M_2, M_3) we have three indirect effects: one related to *R&D and IP* (a_1b_1); one related to *Organizational capital* (a_2b_2); one related to *Open innovation* (a_3b_3): the sum of these three effects constitutes the total indirect effect. Thus, the total effect (c) of X on Y corresponds to the sum of the direct effect (c') and the total indirect effects ($a_1b_1 + a_2b_2 + a_3b_3$): analytically, $c = c' + (a_1b_1 + a_2b_2 + a_3b_3)$. Stata version 15 was used for all the estimates. Table 2 displays summary statistics.

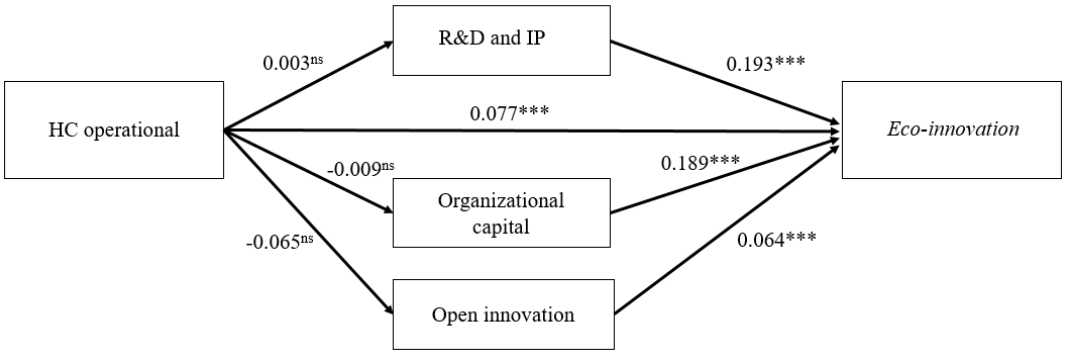
Table 2: *Summary Statistics*

	Mean	Std. Dev.	Min	Max
Eco-innovation	0.528	0.499	0	1
HC operational	0.406	0.491	0	1
HC managerial	0.339	0.473	0	1
R&D and IP	0.591	0.492	0	1
Organizational capital	0.513	0.500	0	1
Open innovation	0.317	0.465	0	1
Age	32.108	16.500	3	135
Size	43.873	71.167	5	497
High-tech	0.184	0.388	0	1
Tertiary	9.785	14.815	0	100
North-West	0.317	0.465	0	1
North-East	0.315	0.465	0	1
Center	0.202	0.402	0	1
South	0.166	0.372	0	1

4. Results and Discussion

The results of the entire study are reported in Figures 2-5 and in Tables 3-6. Monitoring several of the firm's characteristics (age, size, sector, graduate employees, geographical location), we see that intangible assets positively influence the firm's eco-innovation. Specifically, the coefficients of *R&D and IP*, *Organizational capital*, and *Open innovation* are positive and statistically significant ($p<0.01$) (Figures 2 and 3). Thus, Hypotheses 1, 2 and 3 are accepted.

Figure 2: *Effects of HC Operational and Other Intangible Assets on Eco-innovation*

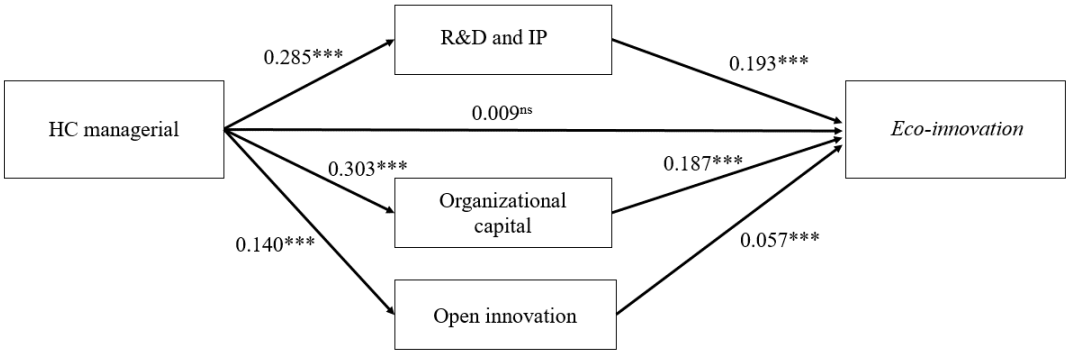


*Note: The figure reports the coefficients of the structural equation model including the control variables. *** p<0.01; ** p<0.05; p<0.1; ns: not significant.*

Overall, our findings underline that the intangibles are the assets on which to focus for fostering the green transition, calling for the need to support both internal intangibles of the business (R&D and intellectual property, and organizational capital) and the external ones favoring a multi-stakeholder approach for innovation where firms, universities, suppliers, and customers work together. Specifically, the results confirm that eco-innovation is complex such as to require the implementation of important technological capabilities through R&D activities (Horbach, 2008; Horbach et al., 2012), innovative organizational models able to generate innovation advantages (Bigliardi & Filippelli, 2021), as well as the combination of internal and external knowledge that are important for removing inefficiencies (including technological ones), joining complementary expertise and skills, reducing the risk-aversion, and leveraging the capabilities (of all actors) of generating innovation advantages (Chesbrough, 2003). Nevertheless, looking at the magnitude of the coefficients, it is worth highlighting that the internal intangibles (*R&D and IP*, and *Organization capital*) have a higher effect (coefficients are, respectively, 0.193 and 0.189) than the external ones (coefficient *Open innovation*: 0.064).

Moreover, human capital from the employee training perspective has a positive influence on a firm's decision to invest in eco-innovation: the total effect of *HC operational* is highly statistically significant (p<0.01). Thus, Hypothesis 4a is accepted. The strength of human capital increases when we consider management training besides the employee training: the magnitude of the total effect of *HC managerial* is nearly double than those of *HC operational* (0.129 vs 0.072, both p<0.01, Table 3 and 4). Thus, Hypothesis 4b is accepted. Moreover, *HC managerial* positively affects the three other intangibles (Figure 3), in contrast to *HC operational* (Figure 2).

Figure 3: *Effects of HC Strategic and Other Intangible Assets on Eco-innovation*



Note: The figure reports the coefficients of the structural equation model including the control variables. *** p<0.01; ** p<0.05; p<0.1; ns: not significant.

Table 3: *Direct, Indirect, and Total Effects of HC Operational on Eco-innovation*

	Coefficient	**Std error**
DIRECT EFFECT HC operational → Eco-innovation	0.077***	0.017
INDIRECT EFFECT HC operational → Eco-innovation	-0.005	0.005
TOTAL EFFECT HC operational → Eco-innovation	0.072***	0.018

*Control variables included. *** p<0.01; ** p<0.05; * p<0.1*

Table 4: *Direct, Indirect, and Total Effects of HC Managerial on Eco-innovation*

	Coefficient	**Std error**
DIRECT EFFECT HC managerial → Eco-innovation	0.009	0.019
INDIRECT EFFECT HC managerial → Eco-innovation	0.119***	0.008

TOTAL EFFECT HC managerial → Eco-innovation	0.129***	0.019

*Control variables included. *** p<0.01; ** p<0.05; * p<0.1*

Nonetheless, the total effect of human capital is the sum of direct and indirect effects: according to our framework analysis (Figure 1), human capital can influence a firm's eco-innovation both: i) directly; and ii) indirectly via influencing the other three types of assets (*R&D and IP*, *Organizational capital*, *Open innovation*) which in turn raise the firm's eco-innovation. By exploring this issue, we discover that *HC operational* exerts a significant effect on the firm's decision to invest in eco-innovation only directly (direct effect: 0.077, p<0.01, Table 3, Figure 2), while *HC managerial* only indirectly (indirect effect: 0.119, p<0.01, Table 3; direct effect not significant, Figure 3). In this latter case, the total effect is almost totally explained by the indirect effect: exactly 92% as the share of indirect effect (0.119) on the total effect (0.129) (Table 4). This confirms the key role of management training for new business models in increasing the likelihood of adopting eco-innovation via renewing the entire business system, fostering R&D and intellectual property, new organizational models (organizational capital), and collaborations with external actors (open innovation) to further increase innovative power. Thus, by triggering all intangible assets in supporting eco-innovation, the investments in human capital, including also management skills for new business models, (*HC managerial*) may lead to a higher impact of eco-innovation on the firm's competitiveness. In this regard, further analyses seem to confirm this reasoning: when we consider as outcome the variable (*Eco-innovation competitiveness*) taking value 1 if the firm invests in eco-innovation specifically driven by motivations related to the competitiveness upgrading (e.g., improvement of product quality, of branding, enlargement to new markets), we found a positive and significant influence of *HC managerial* on this outcome (total effect: 0.078, p<0.01, Table 6) in contrast to *HC operational* for which any significant effect emerges (Table 5). Thus, Hypothesis 4c is accepted.

Table 5: *Direct, Indirect, and Total Effects of HC Operational on Eco-innovation Competitiveness-driven*

	Coefficient	**Std error**
DIRECT EFFECT	0.023	0.015

HC operational → Eco-innovation competitiveness-driven		
INDIRECT EFFECT HC operational → Eco-innovation competitiveness-driven	-0.004	0.003
TOTAL EFFECT HC operational → Eco-innovation competitiveness-driven	0.019	0.015

Note: Control variables included. *** p<0.01; ** p<0.05; * p<0.1

Table 6: *Direct, Indirect, and Total Effects of HC Strategic on Eco-innovation Competitiveness-driven*

	Coefficient	**Std error**
DIRECT EFFECT HC managerial → Eco-innovation competitiveness-driven	0.016	0.017
INDIRECT EFFECT HC managerial → Eco-innovation competitiveness-driven	0.062***	0.006
TOTAL EFFECT HC managerial → Eco-innovation competitiveness-driven	0.078***	0.016

*Note: Control variables included. *** p<0.01; ** p<0.05; * p<0.1*

5. Conclusion and Emerging Issues

In the present study, adopting the definition of intangible assets given by Brynjolfsson and McAfee (2014), we empirically investigate the effects of each intangible asset (R&D and intellectual property, organizational capital, user-generated content that we broadened to the concept of open innovation) on a firm's eco-innovation by analyzing at the same time the relationship between the different types of intangibles. Furthermore, we deepen the role of human capital by differentiating the investments only in employee training (*HC operational*) from those also including management training for new business models besides employee training (*HC managerial*).

Empirical results show that the intangible assets positively affect the firm's decision to adopt eco-innovations. Focusing on human capital, we find that the investments in *HC managerial* has a higher effect (than those *HC operational*) on the likelihood of adopting eco-innovations, and it influences eco-innovation activities indirectly by triggering the other three types of intangibles; while the investments in *HC operational* exert only a direct effect without activating other intangibles. Moreover, the *HC managerial*, in contrast to the *HC operational*, is a determinant factor triggering the eco-innovations driven by motivations of competitiveness upgrading.

Several policy implications would be drawn by our results. Firstly, more in general, green policies should be designed to improve not only the single implementation of eco-friendly innovation but also the entire transformation towards new business models by also promoting the diffusion of sustainable practices (Fornasari & Neri, 2022). Thus, secondly, and more specifically, green policies should concentrate not only on the physical investments (e.g., equipment, machinery), but they should be able to trigger the investments on all types of intangible assets leading to new business models – more green and more competitiveness driven. This is of worth especially for human capital investments. In this regard, it is determinant to support a firm's investments on the management skills to improve the competencies to develop: i) "value creation", corresponding to the ability to raise the value added of the goods by investing in Key processes (renewing of the processes) and in Key resources (e.g., brand, knowledge, technology, partnership with external actors); and ii) "value capture", by investing in the uniqueness of the goods produced (Green value proposition) together by intercepting new customer segments (Targeting group). In doing so, from a policy perspective, it is essential to work on the managerial culture – and entrepreneurial, considering that for the vast majority of enterprises in Italy owner and manager are the same person – besides the specific skills upgrading. This because the only incentives for eco-innovation adoption risks to have short-term effects mainly involving only the tangible assets and with low impact on competitiveness. Thirdly, the effectiveness of all these indications calls for a presence of a strong support of public institutions (the benchmark could be "One-Stop-Shops" operating at the local level providing services of information, evaluation, advisory, technical assistance, and training on eco-innovation activities) especially for small firms – often corresponding also to family firms – where the managerial and entrepreneurial culture growth paths are more complex, due to for example barriers to innovation, higher risk aversion, and scarce open-mindedness. These directions contribute to achieve an "Institutionally sustainable" process (Esposito & Musso, 2016) capable of self-feeding in the future without intervention from the outside. Indeed, the final goal would be the transition from an "antagonistic" competitiveness model to that of sustainable development (Brondoni et al., 2021).

The neo-institutional approach has highlighted how institutions represent an important factor in national and regional development, because their quality and density promote the efficiency of production systems and cooperation between economic and social actors (Acemoglu & Robinson, 2012; Rodrigues-Pose, 2013).

The real change of a theoretical perspective in recent years is that of the transition from the "antagonistic" competitiveness model to that of sustainable development, thus proposing a new vision of bottom-up planning that affects all levels, from the local one to the European Union.

Our paper is clearly not immune from limitations. Firstly, the cross-sectional analysis impedes to investigate the dynamics of the relationship, also hindering a full causal interpretation of our results. Secondly, the analysis did not measure the intensity and the typology of eco-innovations. Thirdly, our analysis only focused on

the manufacturing sector of one country – Italy. Future research addressing all these issues could be useful.

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Notes

[1] The result of the Breusch-Pagan test of independence (677.694, $p>0.01$ for the model in Figure 2; 502.006, $p<0.01$ for the model in Figure 3) rejects the hypothesis that the error terms for the different equations are independent, so indicating that the SEM estimate is preferred.

[2] The mean VIF is 1.21. Further details are available upon request.