

Are sustainable and innovative enterprises more equal in rewarding their women?

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ABSTRACT

The strategic importance of innovation and sustainability for business success is widely emphasized in the literature. To the best of our knowledge, no in-depth analyses have been developed to understand if there is a relationship between companies' engagement in innovative and sustainable projects and their attitudes towards implementing fair compensation and reward systems, given that this point is generally acknowledged to be critical, especially with regard to women. In this article, we pose the following research question: "Do sustainable and innovative companies reward their women equally, compared to men?" and test two hypotheses. The first recognizes the fact that innovation and R&D areas are still male-dominated, increasing the level of inequality in women's compensation, as measured by the gender pay gap (GPG), i.e., the average difference in pay between men and women, so we posit: "There is a positive relationship between innovation and the GPG". As for the second hypothesis, in line with the ongoing debate on sustainable human resource practices, we expect that companies with a sustainability agenda will reduce their GPG so that "There is a negative relationship between sustainability and GPG". We analyzed data from the Italian Business Census to test our hypotheses. The results show that the first hypothesis is confirmed, while the second is only partially confirmed. On this basis, policy implications and future research directions are identified.

1. Introduction

Attention to the gender pay gap (GPG), i.e., the average difference in pay between men and women, has grown in parallel with the increasing presence of women in the labor market and the search for appropriate and fair recognition of their contribution to organizational performance. The GPG is a global issue. According to Eurostat, the gender pay gap in the European Union was 14.1% in 2020, ranging from 1.4% in Luxembourg to 21.8% in Estonia. Despite evidence of a reduction in the GPG (Elkinawy and Stater, 2011), it is still claimed that women are paid less than their male colleagues (Perryman et al., 2016; Blau and Kahn, 2017; Bennedsen et al., 2022). Many explanations have been proposed for this situation, including, besides the remaining gaps in education and experience, an often-constrained labor market participation; also the fact that women often tend to spend fewer hours at work because they are engaged in other, essentially caring tasks (see, for example, Blau and Kahn, 2017). Even the adoption of gender equality programs and other

specific labor policies focusing on performance-related pay practices (Castilla and Benard, 2010; Elvira and Graham, 2002) do not always seem to succeed in closing the GPG, suggesting that these orientations are not yet deeply embedded in effective organizational practices or that a change in structures does not guarantee a change in processes (Eriksson-Zetterquist and Renemark, 2016). This long-lasting issue has become increasingly important as more women compete for jobs and present themselves as having skills and abilities that are valuable to industry and therefore deserving of sufficient recognition for their contributions. In addition, the importance of the GPG issue is growing due to recent and rapid changes in workplace conditions. For example, recent studies have shown that higher levels of robotization and automation in the workplace are associated with higher levels of GPG (Aksoy et al., 2021; Pavlenkova et al., 2021).

Starting from the significant work by Galor and Weil (1993) on the role of gender equality in general socio-economic development, the debate on the relationship between gender inequality and economic

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development at the macroeconomic level (e.g., Cuberes and Teignier, 2014) has become extremely lively. The concept of substantive equality is particularly suitable when discussing the GPG (McGregor and Davies, 2019), focusing on adequately valuing work so that remuneration is based on the value produced.

At the societal level, gender equality is seen as one of the influencing factors in the debate on the sustainable development of society, business, and ultimately nations. In this sense, gender inequality is assumed to be a pressing issue for society and sustainability, becoming a priority for policymakers (Torchia et al., 2018) and explicitly supported by the 2030 Agenda with one of the Sustainable Development Goals (SDGs) (SDG 5) (United Nations, 2015). Similarly, a steady increase in sustainable investment has been reported. In fact, since 1995, the size of sustainable investments in the US has increased more than 25 times (US SIF Foundation, 2020).

Sustainability is becoming a core issue for organizations and society, reaching the highest visibility in recent times and assuming a more and more pervasive role. Indeed, the pursuit of sustainability is considered “an integral part of the joint welfare function that boards are supposed to serve according to the law” (Eccles et al., 2014, p. 2838). The notion of organizational sustainability (Elkington, 1998, 2004) expresses the firm’s commitment, activities, and decisions towards three dimensions, i.e., social, economic, and environmental issues, while assuring organizational profitability. In this context, gender equality is also a core issue in the sustainability debate.

At the organizational level, identifying and eliminating any GPG among employees should be a key element of any organization’s social sustainability agenda.

In this sense, sustainability research studies - that demonstrate plausible causes of the GPG, its relevant factors, and policies to close the gap - can be positioned as an extension of a long tradition of theoretical development in feminist scholarship on behavior (through psychology and related fields), organizations (through feminist organization studies) and economics (through feminist economics) (Grosser et al., 2017).

So, if one of the main goals of sustainability research is precisely to understand and close the GPG, what actually happens on the ground? Do sustainable companies really reduce gender pay disparities among their employees?

In recent years, a lively debate has emerged in the discussion surrounding environmental preservation and cleaner production on the relationship between sustainability and innovation, also highlighting contrasting evidence (e.g., Kuzma et al., 2020); as reported in the following paragraph, innovation is considered a classic and constantly evolving issue for companies (Klarin, 2019). However, a few studies have investigated GPG in innovative firms, and rarely innovation and gender have been analyzed together (Pecis, 2016). Quite a good number of contributions in the managerial domain recognize that due to historical and cultural factors, areas of innovation (such as R&D departments) are frequently dominated by men. So, what can we expect to see on the ground? Do innovative companies really reduce the gender pay disparities among their employees?

Starting from these premises, our research interest tries to bring these two questions together. To the best of our knowledge, no in-depth analyses have been developed to understand whether companies engaged in innovative and sustainable projects have a stronger attitude towards more equitable pay and reward models. As we will discuss in detail in the following sections, there are only studies that look at these variables separately. Here, we evaluate innovation and sustainability as organizational levers, recognizing that organizations typically have to deal with both, sometimes even simultaneously (Kuzma et al., 2020), considering the need for research on these two important areas of study. In addition, this study, which seeks to find a balance between these two key areas and investigate their impact on the GPG, highlights the need for a holistic approach: organizations have to understand them as complementary and interrelated. Therefore, we pose the following

research question: “Do sustainable and innovative companies reward their women equally compared to men?”

We examine the question focusing on the Italian context. Italy is one of the main European countries where innovation, sustainability, and the GPG are well represented in the economic and social debate. The Italian GPG has been analyzed in detail by Zizza (2013), and its evolution during the 2008–2012 economic crisis has been studied by Pizzalunga and Di Tommaso (2019). Moreover, several phenomena related to the Italian GPG have been analyzed, such as job mobility (Del Bono and Vuri, 2011), education (Mussida and Picchio, 2014), occupational choice, and family responsibilities (Cuttillo and Centra, 2017).

The paper is organized as follows. In sections 2 and 3, we present the theoretical background for investigating our research question and formulating related hypotheses. In section 2, we show how innovation and sustainability are closely related phenomena, motivating a joint investigation of their relationship with the GPG. In section 3, we develop two research hypotheses on how innovation and sustainability might be related to the GPG.

In section 4, after introducing the methodology, the data sets are analyzed using linear regression, and the hypotheses are tested. The discussion of the results is presented in section 5. Finally, in the concluding sections 6–8, after evidencing contribution and implications, we suggest avenues for interpreting limitations, suggesting research extensions, and future work.

2. Theoretical background: innovation-sustainability debate

The concept of sustainability has a long tradition, with its roots in the literature on CSR and sustainable development: Dyllick and Hockerts (2002) trace the evolution of the concept of sustainable development over the last three decades and show how it can be applied at the firm level. The analysis converges with the triple-bottom-line perspective (Elkington, 1998, 2004) by identifying three types of capital relevant to the concept of corporate sustainability: economic, natural, and social capital. In Salzmann et al. (2005), a comprehensive review of theoretical frameworks, studies, and tools is presented to provide a rationale for sustainability strategies within organizations.

Recalling the relevance of organizations pursuing sustainability, it was stated almost three decades ago that “sustainability requires a balance between the three legs of the stool of environmental, social and economic concerns in decision making” (Dovers et al., 1996: 1143). Corporate sustainability is understood here as the organizational ability to commit, act and make decisions that generate resources, taking into account the dimensions of the triple bottom line (Elkington, 1998, 2004).

The question of why companies practice corporate social responsibility (CSR) has gripped academics and practitioners over the last two decades (Pope and Lim, 2022). Two opposite sustainability motives have emerged as dominant: the instrumental or the compliance one and the purpose or moral one. The former posits that the main stakeholders to be concerned about are shareholders (Friedman, 1970). From this perspective, firms engage in sustainability practices only if a mere instrumental return is expected, such as increasing competitiveness or avoiding bad publicity (Paulraj et al., 2017; Smith, 2003). On the other hand, purpose motivations are driven by the belief that sustainable practices should be implemented because of their intrinsic value and independently of profitability (Davis et al., 1997; Lloret, 2016). Recently, some authors have demonstrated that nowadays, CSR initiatives are increasingly driven by purpose and societal issues rather than mere business motives (Wickert, 2021; Čater et al., 2023).

The concept of innovation (Baregheh et al., 2009) is a central tenet of strategic management theories. The seminal work of Tushman and Nadler (1986) recognizes the strategic role of innovation as the basis for the ability to generate competitive advantage and support development and growth. Early studies distinguish between product and process innovation (Abernathy and Utterback, 1978), opening an important

stream discussed retrospectively in Klarin (2019), who systematically maps three decades of product and service innovation research to provide a typology of eight primary product and service innovation types.

The role of innovation in sustainability has long been debated and researched especially in the last decade. A typical question is: how can innovation initiatives contribute to sustainability impacts along the three dimensions of economic, social and environmental value creation? (Coffay et al., 2022).

However, the focus of the innovation-sustainability debate tends to be on the broader environmental and social impacts of innovation. Some studies do not separate innovation and sustainability at all. For example, when discussing the determinants of corporate environmental innovation (Murillo-Luna and Hernandez-Trasobares, 2022) or the drivers of eco-innovation (Rhaïem and Doloreux, 2022). Again, it has been pointed out that the definition of new value creation and what is sustainably valuable must involve and be supported by societal actors and downstream businesses if new opportunities (e.g., performance benefits and environmental impact reduction) are to be exploited (Iles and Martin, 2013).

This interplay between societal expectations and corporate practices becomes particularly crucial in the context of sustainability, as over the last decades, companies' instrumental use of green and social claims has become a central topic in the public debate about CSR. In this context, an increasing number of organizations have been accused of "not walking the talk," which means their CSR claims on environmental or social issues have not been followed or supported by actual corporate activities (Gatti et al., 2019; Walker and Wan, 2012). Such divergence between socially responsible communication and practices is commonly known as greenwashing.

Innovation and sustainability are critical issues in today's business and economic debates. Innovation is recognized as "the main driver of industrial growth on the planet", as suggested by Kuzma et al. (2020: 1) At the same time, the same authors suggest that it is the main cause of social and environmental disruption due to the pollution and resource consumption inherent in production processes.

Authors in the extant literature support the relevance of a positive relationship between innovation and sustainability. In particular, it is suggested that innovation should generate positive economic, social, and environmental outcomes (De et al., 2020). In this sense, a recent study suggests that innovation generates sustainability performance in all three domains of economic, social, and environmental sustainability (Kuzma et al., 2020). In another study, Yang et al. (2019), focusing their analysis on the impact of institutional pressures on organizational behavior, demonstrated that managers' perceptions of institutional pressures are related to their focus on a proactive environmental strategy, affecting the firm's ability to innovate.

Additionally, when exploring the motivations behind initiatives for innovation and sustainability, it is essential to consider the instrumental versus the purpose-driven approaches (Čater et al., 2023; Wickert, 2021; Wijen, 2014). These approaches can influence the extent to which innovation is aligned with sustainability goals and the actual commitment of organizations to sustainability principles. An instrumental approach may lead companies to adopt innovation practices primarily to achieve specific economic gains or to comply with regulations and standards. In contrast, a purpose-driven approach places intrinsic value on sustainable practices, independently of immediate economic returns, driven by a genuine commitment to sustainability and its broader societal impact. Understanding the interplay between these different motivations can provide valuable insights into the true drivers of sustainability-oriented innovation and its potential to address the challenges of economic, social, and environmental value creation.

3. Hypothesis development

This section is dedicated to the theory-based development of the two main research hypotheses, stating the expected relationships between innovation and sustainability and the GPG.

3.1. Relationship between innovation and gender pay gap

Studies on the impact of innovation initiatives on gender pay equity are still scarce and present many contrasting elements.

It has been shown that organizations with a higher proportion of women on the board of directors invest more in innovation, are more successful in implementing innovation projects and are more likely to be cited in patents. The hypothesis that female directors enhance incentives to innovate by increasing oversight of managers is supported by the fact that the positive relationship between female board presence and innovation is stronger when product market competition is less intense and managers have a more established position (Chen et al., 2018). Further results have recently been advanced for the positive impact of female leaders on innovative green firms (Moreno-Ureba et al., 2022), CSR activities (Yarram and Adapa, 2021), sustainability performance (Naciti, 2019), corporate sustainability practices (Nadeem et al., 2017) and frugal innovation business models (Levänen et al., 2022). Recent studies based on token theory and critical mass theory also show that token representation of women on boards is not associated with the positive effects of diversity when a critical mass is reached (Yarram and Adapa, 2021).

Some authors suggest that research on innovation is still gender blind, meaning that "the implementation and formulation of innovation policies and innovation research are often designed as if innovation is gender neutral" (Nählinger et al., 2012, citing van Acker et al., 2018).

However, men are expected to be more involved than women in innovation processes (Cooper, 2012; Ranga and Etzkowitz, 2010) due to the (unfounded) link between innovation and technology and the assumption that men have superior mathematical and technical skills. In addition, employers may have incomplete information about the skills of their employees. Thus, they may base their assessments on gendered averages, such that women's lower average math skills may affect GPG (Hanushek et al., 2015; Altonji and Blank, 1999). It is recognized that mathematics skills are particularly relevant for R&D and technology-led firms, and women's lower average analytical skills are considered to be a source of discrimination in these contexts (Brussevich et al., 2019). It is also suggested that this discrimination may lead women to invest less in these skills and to apply less frequently for jobs that require them (Maso and Vahter, 2020).

On the other hand, recent studies show that women have a higher potential to demonstrate "individual dynamic capabilities" that promote innovation in sustainability areas. Managers' individual dynamic capabilities help them to identify market changes earlier and promote greater social and environmental commitment (Buil-Fabregà et al., 2017).

Most studies on the relationship between the gender gap and innovation focus mainly on highly technical and male-dominated sectors. It has also been demonstrated that even in industries where women outnumber men, such as the public sector, "women still feel less encouraged in the innovation process compared to men" (van Acker et al., 2018: 175). In this sense, women's lower level of encouragement in the innovation process may reduce the value they produce and, in turn, their average compensation. From this perspective, women's difficult access to innovation processes can be seen as a kind of "glass ceiling" or "sticky floor". Recent research in this area shows that, on average, "glass ceilings" (typically related to the motherhood penalty)

account for about 60% of the gender pay gap, while “sticky floors” (related to social norms, gender stereotypes, and discrimination) account for about 40% of the GPG (Ciminelli et al., 2021; see also, among others, Adams and Funk, 2012; Lewellyn and Muller-Kahle, 2020).

However, interest in “traditional” factors to explain the GPG, such as education and various individual-level characteristics, has gradually declined over time (Bertrand et al., 2010; Blau and Kahn, 2017; Goldin, 2014). Recent contributions in labor economics have increasingly emphasized the firm-specific wage premium and heterogeneity as a determinant of the GPG. In particular, recent research has shown that firm productivity matters for the GPG, with men and women sorting into high-productivity firms to different extents and also receiving different wages within these firms once hired (Card et al., 2016; Coudin et al., 2018). For example, Card et al. (2016) showed that sorting and bargaining effects together explain about one-fifth of the gender wage gap in Portugal. Furthermore, another study showed that between-firm (sorting) and within-firm heterogeneity (bargaining) explain 35 percent of the GPG in the case of France (Coudin et al., 2018).

Some recent studies have looked closely at the relationship between innovation and GPG. Dahlin et al. (2023) suggest that innovation may reproduce or even exacerbate gender inequality. A study among workers in France shows that R&D investment has a positive impact on GPG (Dugardin and Ginglinger, 2019). In a study among Estonian workers, Pavlenkova et al. (2021) show that the introduction of automation has a higher impact on the wages of male workers than female workers.

Masso and Vahter (2020), in another study conducted in Estonia, showed that technological (product and process) and non-technological (organizational and marketing) innovation, investment in R&D, and innovation-related partnerships are associated with higher GPG in the firm. The same study also showed that the GPG is stronger at both the top and the bottom of the wage distribution.

Therefore, the first hypothesis is:

H1. There is a positive relationship between innovation and GPG.

3.2. Relationship between sustainability and gender pay gap

The GPG discourse is situated within the debate on equity, which is seen as one of the central themes of sustainability. As such, it is expected that remuneration decisions will be subject to detailed ethical and environmental considerations (Welford, 2005), thus linking remuneration decisions and corporate sustainability systems.

To our knowledge, no studies have directly examined the relationship between sustainability practices and GPG. More generally, attention to the relationship between sustainability and gender equality is relatively recent. Gender equality has long been a priority for the European Union (EU). It is also an integral part of its sustainability strategy, as stated in the European Commission's Gender Equality Strategy 2020–2025 (2020). Indeed, there is general agreement among economists that greater income inequality can lead to environmental, social, and economic problems (e.g., Gómez-Bezares et al., 2019).

Sustainability is a broad concept (Purvis et al., 2019). It is conceptualized in three primary and interrelated pillars: social, economic, and environmental (e.g., Basiago, 1999; Boyer et al., 2016; Du Pisani, 2006; Lozano, 2008).

The environmental dimension of sustainability is addressed, among others, by management studies that examine the benefits associated with women's participation in corporate governance. Evidence from these studies shows that a higher proportion of women in top management positions has a positive impact on the environmental sustainability of organizations (Lu and Herremans, 2019).

The social dimension of sustainability includes gender equality

(Haynes and Murray, 2015), which has been shown to be a critical component in achieving the goal of overall sustainability (Alarcón and Cole, 2019) and a driving force in the development of innovation and its implementation in organizations (Kiron et al., 2013; Shin et al., 2018).

Overall, sustainability -along with CSR- is becoming increasingly important in the strategic agenda of contemporary organizations. Existing research suggests that sustainability policies can lead to long-term benefits and organizational resilience (Ortiz-de-Mandojana & Bansal, 2016). In times of crisis, such long-term motives reinforce the obvious drivers of reputation, compliance, and institutional pressures. A recent integrative literature review (Podgorodnichenko et al., 2021), which considers both academic and practical literature, convincingly illustrates how sustainability agendas are translated into action and performance through human resource management (HRM) practices. This analysis is particularly useful in shedding light on the relationship between a sustainability agenda and the effective implementation of gender equality as a responsible and sustainable HRM practice. According to Podgorodnichenko and colleagues (2021, p. 8), “both literatures are underpinned by the premise that it is sustainable HRM (responsible practices towards employees [...]) that positively impacts organizational performance (e.g., economic outcomes, reputation, employee productivity, innovativeness)”. Furthermore, in their study the authors suggest that a sustainability agenda needs to be implemented through HRM with several concurrent mechanisms in different functional areas to be translated into performance (Podgorodnichenko et al., 2021; Pham et al., 2020). More specifically, academic literature and practitioners show broad agreement that employee-oriented practices (such as work flexibility, organizational justice, equality, and diversity management) enhance individual and organizational performance (Buciuniene and Kazlauskaitė, 2012; Jiraporn et al., 2019; Lee, 2019; Rodríguez-Sánchez et al., 2021). Current studies provide strong evidence for the positive relationship between sustainable HRM and organizational performance. Furthermore, they suggest possible mechanisms for translating the sustainable development agenda and sustainable HRM into performance. These are motivation and organizational commitment (Longoni et al., 2018) and organizational identity (Newman et al., 2016; Shen and Benson, 2016).

From this perspective, HRM practices aimed at analyzing and closing the gap fall into the broader category of responsible and sustainable HRM. These practices are concrete HRM tools that companies can use to translate a sustainability agenda into organizational performance.

We can therefore assume that the adoption of a sustainability agenda and its actual implementation would imply a significant effort to reduce the GPG, thus implying a negative relationship between sustainability and GPG. Moreover, the belief in the existence of a positive link between the implementation of sustainable practices and the reduction of GPG is consistent with the recent scientific evidence suggesting that purpose motives increasingly outweigh purely instrumental motives (Wickert, 2021; Čater et al., 2023), indicating that stakeholders extend beyond shareholders to include employees and other relevant parties.

To be more precise, a negative relationship between GPG and the measures taken by companies to promote sustainability would mean that as the measures to promote sustainability increase, GPG decreases.

Therefore, we posit that:

H2. There is a negative relationship between sustainability and GPG.

4. Methodology and analysis

4.1. Data sources

For our research, we were able to use two sets of data (available as

supplementary material). The first is a new dataset recently made available by the Italian Statistics Institute (ISTAT), namely the Permanent “Business Census” (*Censimento permanente delle imprese, ISTAT, 2020*¹). It is a periodic survey on a wide range of strategic initiatives and projects of Italian companies, based on a representative sample of the entire population of Italian companies, designed and carried out by ISTAT. On the one hand, this is a guarantee of scientific quality and integration into the European framework of statistical registers. On the other hand, the researchers had no direct control over the design and management of the survey.

The second is the periodic ISTAT “Labor and wages” dataset,² from which our GPG estimate is based.

The study proposed here is one of the first analyses to take advantage of the recent release of the ISTAT permanent business census, which will be published for the first time by ISTAT in 2020. Its aim is to provide a detailed picture of the Italian economic system regularly, by collecting information on emerging issues such as business organization, competitiveness, and environmental sustainability. In order to increase the quantity and quality of the information provided while reducing the response burden on enterprises, the strategy of the permanent census is based on the use of the National Statistical Register of Enterprises, which integrates several administrative and statistical sources, as well as a sample survey that collects mainly qualitative information.

These two main data collections have been used to create a comprehensive database containing data on 1,033,662 organizations grouped into 75 NACE divisions. The Nomenclature of Economic Activities (NACE) is an integrated classification system for products and economic activities commonly used in Europe and similar to the North American Industry Classification System (NAICS) used in the United States. Both databases contain a sample of 1,033,737 enterprises grouped into 79 NACE divisions and covering enterprises with three or more employees. Combining the two databases posed no problems as all NACE divisions were perfectly congruent, and the data referred to the same year: 2018. We have excluded four NACE divisions, representing a total of only 75 organizations, because some data were masked by ISTAT in order to ensure statistical confidentiality. Specifically, the excluded NACE divisions are the tobacco industry, with only 7 active enterprises, the extraction of crude oil and natural gas, with only 9 active enterprises, the support activities for extraction, with only 59 active enterprises throughout the national territory, and the extraction of metallic minerals, with a total of data masked by ISTAT. After these exclusions, our sample consists of 1,033,662 enterprises grouped in 75 NACE divisions.

4.2. Variables and measures

The identification of sustainable and innovative practices implemented by enterprises proposed here is based on two sections of the ISTAT permanent business census: section 9 “Environmental sustainability, social responsibility and safety” and section 5.1, “Activities in innovation projects”.

In Section 9 (Sustainability: S), enterprises are identified by five types of sustainability actions. These actions are in line with the widely accepted concept of sustainability discussed above (Elkington, 1998, 2004), as they include the additional dimensions of social and environmental issues in addition to the traditional economic dimension.

The questionnaire includes the following sustainability items:

S1: reduce the environmental impact of their activities;

S2: improve employee well-being, equal opportunities, parenting, and work-family balance;

S3: support or implement initiatives of collective interest outside the company;

S4: support or carry out initiatives for the benefit of the productive fabric of the territory in which the company operates;

S5: increase safety levels within the company or in the territory where the company operates.

Section 5.1 (Innovation: I) identifies enterprises involved), firms engaged in innovation projects. The questionnaire introduces a general statement that may include both product and process innovation types. This choice was made by ISTAT experts at the level of survey design. Thus, innovative enterprises are identified by the following item:

I1: the company is engaged in innovation projects.

The GPG estimation is based on the ISTAT periodic data set “Labor and Wages”, section “Labor and wages, hourly wages of private sector employees”.

Publicly available data have been used, with observations grouped by 2-digit NACE economic activity.

The Business Census database is updated every three years (currently until 2018) and the Labor and Wages database is updated annually (currently until 2019). The measures used here from both refer to enterprises with at least three employees in 2018.

A total of 77 collective observation units (out of 88 theoretical NACE division codes) are available, covering more than one million organizations. Only two covered NACE divisions were excluded: crude oil and natural gas extraction, with only nine active companies, and extraction support services, with only 59 active enterprises nationwide.

All frequencies (number of different types of sustainable/innovative enterprises in each NACE division) have been normalized into percentages by relating them to the total number of active enterprises by NACE division.

For the estimation of the GPG, the following variables were used from the wage dataset:

- average hourly wage of males;
- average hourly wage of females.

The GPG was calculated according to the following formula:

$$\text{GPG} = \frac{(\text{average male hourly earnings} - \text{average female hourly earnings})}{\text{average male hourly earnings}} \%$$

The choice of hourly pay in the calculation of the GPG allows a direct comparison of wages between men and women working the same number of hours at the same hourly rate. According to Eurostat,³ this approach takes into account differences in hourly earnings regardless of whether one works full-time or part-time.

In addition, hourly pay is useful for making a fair comparison between workers with different levels of experience or seniority in an organization, who may be paid differently depending on the time spent in the same position.

In summary, calculating the GPG on the basis of hourly pay allows for more accurate and fair measurement of pay differences between men and women, thus eliminating some sources of confusion or distortion in salary comparisons.

In our analysis, the GPG is calculated for each individual job position by comparing the hourly pay rates of men and women in that specific position within each NACE sector. However, we did not have access to

Table 1

Average GPG.

	Mean	Std. Err.	[95% Conf. Interval]	
Mean GPG	0.0921084	0.0113688	0.0694607	0.1147561

¹ Please refer to: <http://dati-censimentipermanenti.istat.it/?lang=en>.

² Please refer to: <http://dati.istat.it/?lang=en>.

³ Please refer to: [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Gender_pay_gap_\(GPG\)](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Gender_pay_gap_(GPG)).

Table 2
Weighted average GPG.

	Mean	Std. Err.	[95% Conf. Interval]	
Mean GPG	0.0450917	0.0000885	0.0449182	0.0452652

disaggregated data regarding the number of men and women within each NACE sector.

On average, the GPG in favor of men is 9.21%; women are paid more in only 14 out of 75 NACE divisions (see Table 1). In our analysis, we have taken into account the differences in pay for each type of contract (manual, non-manual, managerial) and by gender. The gender distribution of employees does not exert any influence on the average, as it is computed based on categorical and gender-specific groupings.

Normalizing the data as a function of the number of observations per NACE two-digit, we find that GPG is reduced by half (from 9.21% to 4.51%) (see Table 2). This is consistent with the most recent statistics reported by European Commission surveys. In fact, Italy is one of the member countries with a lower average value.⁴

In Table 3 we show the five positive and negative extremes of the GPG found in our database.

For the sake of completeness, we point out that, according to the data, the GPG generally increases as the firm's size increases both for blue-collar workers and for employees and managers. The complete data for NACE sector, employee class, and gender are reported in Appendix A.

4.3. Statistical analysis

Before running a regression analysis, it is important to assess the relationship between the variables involved. This is usually done by correlation analysis, which measures the strength and direction of the linear relationship between two or more variables.

The results shown in Graph. 1 represent moderate levels of correlation, with the exception of the correlation between variables S1 and S5 and between variables S3 and S4, for which slightly high levels of correlation are shown. Therefore, in the case of high levels of correlation, which in themselves do not imply the fallacy of the model (Hair et al., 2006), we follow the suggestions of Hair et al. (2006) and proceed to measure the variance inflation factor (VIF) of the variables in order to exclude multicollinearity problems for the model under investigation.

To test the two hypotheses, we used a weighted linear regression analysis, where the dependent variable is the gender pay gap (GPG). The

independent variables are the measures of sustainability (variables S1–S5) and innovation practices (variable I) presented above (see Table 4).

Specifically, a multiple frequencies weighted linear regression is used to test our hypotheses. This is a generalization of ordinary regression in which knowledge of the variance of the observations is incorporated into the regression. The dependent variable is the “y”, i.e., the GPG, and the “xs” are the independent variables: S1–S5 and I1, expressed as percentages by NACE division. For each NACE division, we have a variable number of enterprises ranging from 124 to 141,275, for a total of 1,033,662 observations (number of enterprises). It is therefore appropriate to weight the number of enterprises in the regression model. To do this, we calculated the percentage impact of each variable on the total number of enterprises for that specific sector. For example, for variable S1 and NACE Sector 10 “food industries”, there are a total of 28,968 companies, of which 19,872 report reducing their environmental impact. Therefore, the percentage used in the regression is 6.86. By doing this for each variable, all data are comparable and the different number of companies for each specific NACE sector does not affect the goodness of the model. With regard to the GPG, it has been calculated using the above formula and expressed as a percentage representing the GPG between men and women for each NACE sector, again using the number of companies in each sector as the frequency weight.

Based on the results of the Variance Inflation Factor (VIF) analysis, it can be concluded that multicollinearity is not a significant problem in this study. Specifically, the maximum VIF value for any of the independent variables is below the recommended threshold of 10, as suggested by previous literature (e.g., Hair et al., 2006; Neter et al., 1985). Furthermore, the average VIF value across all equations is 5.32 (see Table 5), which further supports the conclusion that multicollinearity is not a significant problem. As a result, we can say that the regression model adequately captures the relationships between the predictor variables and the response variable and that the estimates of the regression coefficients are reliable.

4.4. Results

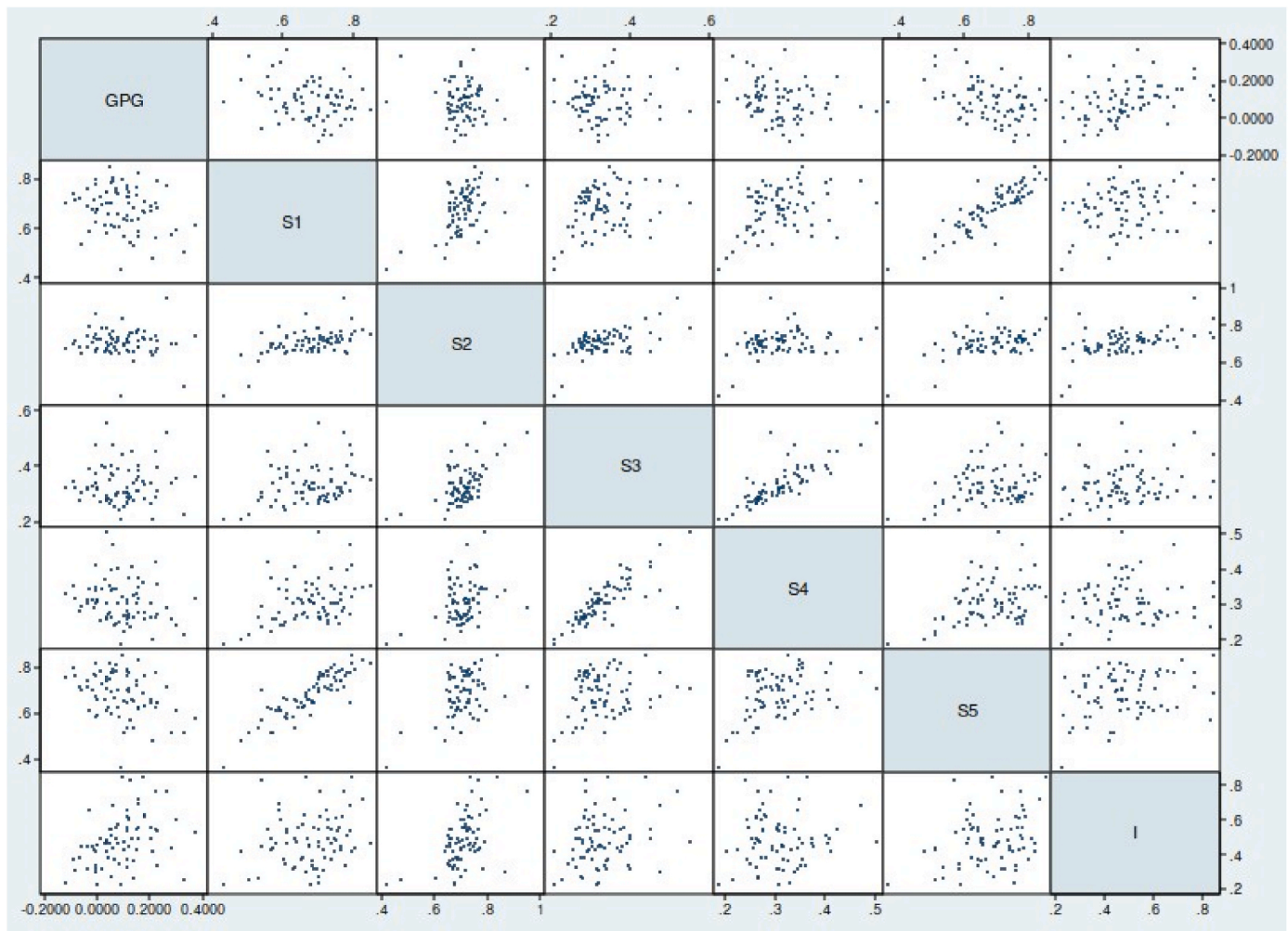
The results of the regression are shown in Table 4; the model has fitted the data quite well, and the existence of a strong relationship between sustainability activities, innovation, and GPG is indicated by the high value of explained variance (over 60%).

It should be noted that the sign of the regression coefficient indicates

Table 3
Positive and negative extremes related to gender-pay-gap.

NACE DIVISIONS	Active companies with 3 and more employees	Average male hourly earnings	Average female hourly earnings	GPG
41: Construction of buildings	29,636	12.33	13.82	−12.08%
42: Civil Engineering	3,363	15.95	17.41	−9.15%
43: Specialized construction activities	77,912	11.66	12.67	−8.66%
16: Industry of wood and products of wood and cork (except furniture), manufacture of articles of straw and plaiting materials	8,625	11.98	12.80	−6.84%
80: surveillance and investigation services	1,398	10.75	11.39	−5.95%
65: Insurance	159	34.16	25.09	26.55%
70: business management and management consultancy activities	6,597	24.48	17.58	28.19%
58: Publishing activities	1,405	29.47	20.64	29.96%
50: Water transport	683	24.58	16.46	33.03%
66: Activities auxiliary to financial services and insurance activities	13,029	24.78	15.58	37.13%

⁴ Please refer to: https://ec.europa.eu/info/policies/justice-and-fundamental-rights/gender-equality/equal-pay/gender-pay-gap-situation-eu_en.



Graph 1. correlation between variables.

Table 4
Regression results.

Gender Pay Gap	Coef.	St. Err.	t-value	P> t	Sig
S1 - Env. Impact	0.408	0.002	204.0	0.000	***
S2 - Empl. well being	-0.202	0.002	-108.8	0.000	***
S3 - Coll. Interest	0.226	0.004	60.4	0.000	***
S4 - Territorial benefit	-0.134	0.004	-32.6	0.000	***
S5 - Safety	-0.770	0.001	-594.7	0.000	***
I1 - Innovation	0.574	0.001	935.5	0.000	***
Constant	0.160	0.001	201.2	0.000	***
R-squared	0.6015				
F-test	6.103				
Mean VIF	5.32				

the nature of the relationship: if positive, it indicates a concordance between the variables (an increase in x corresponds to an increase in y); if negative, it indicates a discordance (the opposite). All variables are statistically significant at the 1% level.) The analysis of the coefficients shows that the signs of the independent variables included in the regression model are both positive and negative. This is quite surprising:

Table 5
Measure of fit.

Variable	VIF	1/VIF
S4 - Territorial benefit	8.89	0.112522
S3 - Coll. interest	7.31	0.136832
S1 - Env. impact	6.03	0.165931
S5 - Safety	4.70	0.212822
S2 - Empl. well being	3.11	0.321316
I1 - Innovation	1.90	0.526361
MEAN VIF	5.32	

a negative sign of the coefficient indicates that an increase in the value of the variable reduces the GPG, while a positive sign of the coefficient indicates that an increase in the value of the variable increases the GPG. Therefore, according to hypothesis 2, we would expect all coefficients related to the variables measuring sustainability practices to be negative. Instead, the variables with a negative coefficient are only three out of five and concern investments in initiatives that: S5: increase safety levels within the company or in the territory where the company operates (-0.770); S2: improve employee well-being, equal opportunities,

parenting, and work-family balance (-0.202); S4: support or carry out initiatives for the benefit of the productive fabric of the territory in which the company operates (-0.134).

Conversely, the variables with a positive coefficient associated with an increase in GPG are investments in initiatives that S3: support or implement initiatives of collective interest outside the company ($+0.226$); S1: reduce the environmental impact of their activities ($+0.408$). In addition, as expected according to hypothesis 1, investments in innovation, i.e., I1: are dare engaged in innovation projects, are positively related to GPG ($+0.574$).

Considering the results, Hypothesis 1, that is: “*There is a positive relationship between innovation and GPG*”, is confirmed, while Hypothesis 2, i.e., “*There is a negative relationship between sustainability and GPG*”, is only partially confirmed.

5. Discussion

Based on our results, we attempt to provide an explanation for these findings in the following paragraphs. Practices such as sustainable sourcing, reduced environmental impact, and fair treatment of workers can be viewed as concrete HRM tools that companies can use to translate a sustainability agenda into organizational goals. The adoption and implementation of a sustainability agenda imply a significant effort to reduce the GPG, indicating a negative relationship between sustainability and GPG. This belief aligns with recent scientific evidence that highlights the increasing influence of purpose-driven motives over purely instrumental ones (Wickert, 2021; Čater et al., 2023), emphasizing the involvement of stakeholders beyond shareholders, including employees and other relevant parties. Regarding the second hypothesis, the apparently contradictory nature of these results must be evaluated with caution: further studies could shed more light on this interesting issue, possibly using a qualitative, in-depth analysis of a carefully selected number of cases. Nevertheless, we propose an explanation based on two opposing motivations. The first motivation, which often characterizes more detached and utilitarian approaches, is that of the instrumental type; a second motivation can instead be related to the value type, identifying a genuine interest in the purposes of the initiative (Wijen, 2014).

5.1. Instrumental motivation

According to this interpretation, initiatives are not necessarily adopted because the organization genuinely and seriously “believes” in them and actively pursues the associated economic, social, and environmental sustainability goals. Rather, they may be adopted because of the need to comply with behaviors, standards, and regulations that are perceived as virtuous. In many cases, these actions are partly influenced by custom or even legal obligations. This category also encompasses initiatives adopted primarily for reasons of reputation, image, and brand, and in any case, more related to a concern for indirect economic-financial effects than to a genuine interest in sustainability. This type of approach is sometimes referred to in the environmental field as greenwashing or façade environmentalism, in the sense of “a deliberate corporate action with the presence of misleading elements, focused on the deception of stakeholders” (Freitas Netto et al., 2020, p. 10). In the pursuit of sustainability-oriented initiatives, the phenomenon of greenwashing becomes relevant, where companies may engage in socially responsible communication and claims without adequately

backing them up with substantial and meaningful corporate actions. Understanding these different motivations, including the potential existence of greenwashing, is critical when assessing the true commitment of organizations to sustainability principles and the extent to which their innovation practices align with genuine sustainability goals. By identifying and differentiating between instrumental and purpose-driven approaches to sustainability, researchers and practitioners can gain valuable insights into the effectiveness and authenticity of sustainability-oriented innovation efforts. Addressing greenwashing and promoting purpose-driven sustainability initiatives are essential steps toward addressing the challenges of economic, social, and environmental value creation in today’s business landscape.

5.2. Purpose-driven approach motivation

Initiatives born out of value-driven motivations differ significantly not only in their strong commitment to the stated goals of sustainability but, above all, because this commitment translates into greater attention to the actual pursuit, verification, and monitoring of the sustainability goals adopted, with a direct impact on the day-to-day decisions and behavior of the organization’s members.

5.3. Instrumental/purpose-driven approach and gender pay gap

Different motivations may help to interpret the results of the analysis. Initiatives that are more general and more “distant” from the organization’s perimeter –such as those related to innovation, environmental impact, and external collective well-being– seem to be those that lend themselves more easily to an instrumental approach, both because they are more difficult to monitor and because they are issues of great interest, often the subject of standards and regulations that require or encourage their adoption, to which individuals may therefore be more inclined to align themselves with compliance and greenwashing approaches. These three categories of initiatives are also those that correspond to a worsening of the GPG, as indicated by the positive coefficients of the variables. On the other hand, initiatives that are more focused within the company or in its closest territorial environment, such as those for the benefit of the territorial productive fabric, those for work safety, and those for well-being at work, could indicate a value motivation with a concrete and direct interest for people and the territory. In this case, the negative coefficients indicating an improvement in GPG would find a valid justification.

6. Contribution

This study provides valuable insights into the relationship between sustainability initiatives, innovation, and the GPG in Italian companies, which has received little attention till now, going in the direction of supporting interest towards these issues which are declared challenging and proposed as goals to pursue. The results suggest that companies with a stronger focus on sustainability initiatives oriented to the safety, well-being, and benefit of the company and the territory (interpreted as a “value-based motivation”) are more likely to have a lower GPG. On the other hand, the unexpected evidence of a higher GPG in presence of sustainability investments on “initiatives of collective interest outside the company” and on projects to “reduce the environmental impact of their activities” can be interpreted as a sign of “instrumental motivation”. This appealing explanation could be a promising first step for

further investigations to produce empirical evidence of greenwashing.

The study also contributes to enrich the growing body of literature on the so-called CSR-HRM nexus (Podgorodnichenko et al., 2021), which highlights the role of HRM practices in translating sustainability agendas into action and performance. By demonstrating the link between “true” sustainability initiatives and GPG reduction as an indicator of improved gender equality, this study highlights the importance of integrating sustainability goals and HRM strategies and practices, monitoring the GPG as a “true” sustainability KPI and paving the way towards finding new ways of detecting and controlling “false” sustainability initiatives by checking for their effect on GPG.

7. Implications

These findings have implications for theory and practice. From a theoretical point of view, this study adds empirical support to the CSR-HRM nexus, (Podgorodnichenko et al., 2021), and that this can offer benefits towards more equity in the organization. Indeed, it is recognized that fairness conditions promote a better internal climate and positive working conditions. From a managerial point of view, such a finding implies the need for a stronger strategic involvement of HRM in sustainability agendas, since it is evident that actual practices require prior knowledge about the characteristics and expectations of employees in order to combine them in coherent actions.

The fact that investment in “compliance-based” sustainability projects is not always associated with more equal rewards for women suggests that internal GPG could be a useful signal for greenwashing practices, opening up new avenues for both research and practice.

The reported evidence of a strong direct relationship between investment in innovation projects and higher pay inequality for women is consistent with the numerous studies reviewed above.

This finding implies that there is already a long way to go in high-tech, high-innovation companies to ensure a balanced contribution -and reward- of men and women. It will take some time to overcome the complex, hysterically rooted social and cultural barriers that influence the still insufficient presence and contribution of women in certain STEM fields (Schmader, 2023).

8. Conclusions, limitations, and future developments

In conclusion, this study presents an initial analysis of newly available data from the Italian permanent Business Census in conjunction with the Labor and Wages dataset to deepen the understanding of the GPG. However, we are strongly aware that the GPG is just one of many pressing issues related to gender discrimination, and our aim is to contribute to increasing attention and awareness of all these issues through our study.

The high level of significance and the high value of explained variance (over 60%) suggest the existence of a strong relationship between sustainability initiatives, innovation, and the GPG, mainly in the sense predicted by our research hypotheses, which suggest a positive, fully confirmed relationship between innovation and the GPG and a negative, partially confirmed relationship between sustainability and GPG. We believe that our analysis contributes to increasing knowledge on this relevant issue and offers concrete elements towards a holistic approach that organizations need to adopt when managing these areas, which are much more complementary and interrelated.

This analysis has of course some limitations, which suggest a degree of caution in its findings. A first limitation is that the companies considered are very heterogeneous in terms of size, turnover, and

number of employees. A second limitation is the lack of homogeneity in the presence of men and women in the companies. It seems reasonable to assume that in organizations where men dominate, the dynamics of GPG may be quite different from those in companies with a good gender balance or where women predominate.

A third limitation is that the data relate to the Italian context, so further international studies would need to be conducted to investigate whether the results can be generalized or compared.

These limitations can be overcome by carrying out additional research. First, by obtaining and analyzing non-publicly available datasets down to the level of individual companies; second, by considering both the use of additional datasets and new methodologies, possibly including qualitative data in future extensions of our research.

Also, more research can be useful to better qualify the relationship between innovation and internal gender equity in the company, using a wider range of empirical indicators, such as the percentage of women in relation to employees in functions devoted to developing innovation measured with regard to the whole sector and also considering the level of regulation of the single sectors as well as the degree of environmental impact, in terms of pollution, of the productions carried out.

Further studies could investigate the role of different types of sustainability initiatives, such as those focused on environmental impact or work safety, and their relationship with gender equity outcomes. The proposed distinction between value and compliance-based motivations, with different effect on the internal GPG of the company, could be a promising first step for further investigations to produce empirical evidence of greenwashing.

CRediT authorship contribution statement

Gianfranco Ennas: Conceptualization, Methodology, Formal analysis, and first draft. **Daria Sarti:** Visualization, writing theory, literature review, positioning, and editing. **Teresina Torre:** Visualization, writing theory, literature review, positioning, and editing. **Francesco Virili:** Conceptualization, Methodology, Formal analysis, and first draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Please refer to Appendix B.

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Appendix B. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jclepro.2023.138517>.

Appendix A

Contractual occupation		blu collar											
Time		2018											
Employees class		0-9			10-49			50-249			250 and over		
Gender		males	females	GPG	males	females	GPG	males	females	GPG	males	females	GPG
NACE													
manufacturing													
electricity, gas, steam and air conditioning supply		9.98	9.24	7%	11.47	10.00	13%	12.97	11.43	12%	14.77	13.06	12%
water supply sewerage, waste management and remediation activities		11.19	9.72	13%	15.22	9.67	36%	17.16	9.97	42%	18.92	15.06	20%
construction		10.92	9.38	14%	12.25	9.70	21%	13.83	10.17	26%	14.95	10.65	29%
services (g to s. except o)		10.92	8.97	18%	11.29	9.38	17%	11.67	9.48	19%	13.16	9.22	30%
wholesale and retail trade repair of motor vehicles and motorcycles		10.11	9.77	3%	10.48	9.88	6%	10.42	9.45	9%	10.73	9.86	8%
transportation and storage		10.30	10.39	-1%	10.97	10.45	5%	11.43	10.67	7%	12.13	11.78	3%
accommodation and food service activities		11.14	9.44	15%	10.98	9.00	18%	10.67	8.84	17%	13.27	10.10	24%
information and communication		9.96	9.94	0%	10.35	10.23	1%	11.06	10.43	6%	11.41	10.44	9%
financial and insurance activities		11.64	10.65	9%	13.95	11.70	16%	15.91	13.05	18%	14.40	12.30	15%
real estate activities		9.72	9.52	2%	10.50	10.00	5%	*	12.80		35.59	*	
professional, scientific and technical activities		10.40	9.77	6%	10.68	10.06	6%	11.99	10.78	10%	10.28	9.49	8%
administrative and support service activities		9.92	9.50	4%	10.08	9.57	5%	9.96	7.81	22%	10.52	8.47	19%
education		9.22	8.50	8%	8.89	8.45	5%	8.90	8.45	5%	10.26	9.47	8%
human health and social work activities		9.72	8.97	8%	9.34	8.68	7%	9.54	9.01	6%	10.65	9.78	8%
arts, entertainment and recreation		9.24	9.36	-1%	9.40	9.44	0%	9.78	9.73	1%	9.95	9.82	1%
other service activities		9.79	9.80	0%	10.42	10.05	4%	10.32	10.05	3%	12.44	11.20	10%
		8.77	8.01	9%	9.39	8.61	8%	9.26	9.43	-2%	10.35	10.28	1%

Gross hourly wage per hour paid of blue collar jobs in euros (median)

Contractual occupation		executive; white collar											
Time		2018											
Employees class		0-9			10-49			50-249			250 and over		
Gender		males	females	GPG	males	females	GPG	males	females	GPG	males	females	GPG
NACE													
mining and quarrying													
manufacturing		14.67	12.92	12%	17.05	14.17	17%	25.67	18.28	29%	30.65	27.14	11%
electricity, gas, steam and air conditioning supply		13.43	11.04	18%	16.86	12.85	24%	20.25	14.95	26%	22.16	17.99	19%
water supply sewerage, waste management and remediation activities		16.13	12.52	22%	20.44	14.92	27%	21.74	16.09	26%	24.27	21.60	11%
construction		13.69	12.17	11%	16.30	13.97	14%	16.83	15.69	7%	20.55	17.33	16%
services (g to s. except o)		12.92	11.28	13%	14.82	12.43	16%	17.68	13.70	23%	21.14	17.24	18%
wholesale and retail trade repair of motor vehicles and motorcycles		12.19	11.28	7%	14.48	12.28	15%	16.40	12.73	22%	17.56	13.71	22%
transportation and storage		12.34	11.79	4%	14.78	12.52	15%	17.73	13.24	25%	14.34	12.52	13%
accommodation and food service activities		13.37	12.00	10%	15.58	12.74	18%	18.25	14.05	23%	17.33	15.31	12%
information and communication		11.06	10.79	2%	12.20	11.47	6%	12.88	11.76	9%	14.06	11.80	16%
financial and insurance activities		13.27	11.88	10%	15.77	13.41	15%	15.98	13.81	14%	19.13	16.98	11%
real estate activities		11.98	11.50	4%	21.61	14.83	31%	24.97	19.88	20%	25.89	22.70	12%
professional, scientific and technical activities		12.40	11.33	9%	17.14	13.28	23%	19.62	15.44	21%	19.00	18.13	5%
administrative and support service activities		12.29	11.29	8%	15.50	13.06	16%	17.29	13.45	22%	21.19	15.55	27%
education		11.65	11.11	5%	12.80	11.69	9%	12.69	11.07	13%	12.22	11.80	3%
human health and social work activities		11.03	10.30	7%	13.63	11.76	14%	15.82	13.50	15%	13.77	12.61	8%
arts, entertainment and recreation		10.80	10.34	4%	11.44	10.87	5%	12.12	11.09	8%	12.99	11.40	12%
other service activities		10.86	10.59	2%	11.73	11.55	2%	13.43	11.25	16%	14.09	12.90	8%
		11.31	10.05	11%	12.71	10.76	15%	11.33	10.53	7%	13.66	11.12	19%

executive and white collar

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