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DIFFERENT APPROACHES TO INTEGRATE SUSTAINABILITY IN CORPORATE VALUATION

The case of Eni S.p.A.

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Abstract

Against the increased attention to sustainability in corporate valuation, the scope of this paper is to compare alternative methods, both traditional and innovative, to gauge the role of sustainability when determining a company's fair value. A few main findings emerge from the empirical analysis on Eni S.p.A, a global Italian company operating in the utilities and energy sector. First, all corporate valuation methods accounting for sustainability (Sum of the Part (SOP) adjusted and Real Option Pricing Method) provide a stock price higher than the analysts' and market one, pointing to sustainability not being valued (or being negatively valued) by the analysts and the market. Second, the quantification of the sustainability intangible, although different according to the approach taken, is positive. Third, such a difference may be reconnected to the rating used to adjust the SOP, whereby such a rating appears to be insufficient to fully capture Eni's sustainability commitments. Our results suggests that the sustainability asset may drive-up stock prices once analysts factor it in in their valuations.

Keywords: sustainable finance, Socially Responsible Investments (SRI), Environmental, Social, Governance (ESG), corporate valuation methods

J.E.L. classification: G12, G30, M14, Q01

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Introduction

Sustainability is increasingly influencing global political debates, shaping regulations, particularly in Europe, and impacting businesses of all sizes and sectors. ESG (Environmental, Social, Governance) issues have advanced rapidly due to the efforts of international and supranational institutions setting sustainability and environmental targets.

Against this backdrop, companies have reacted differently. Some have integrated sustainability into their business models and processes, others have complied with disclosure obligations by publishing Non-Financial Statements without making significant structural changes, while others, not mandated by regulation, have chosen not to adopt ESG principles. A relevant issue for practitioners and academics is whether these strategies lead to economic benefits, such as higher investment returns, lower capital costs, increased cash flows generated by business activities, or greater resilience in facing demand shocks.

Historically, debates about sustainability have focused on whether companies should prioritize maximizing shareholder wealth or serve the broader interests of all stakeholders (LoPucki, 2023). Notable milestones include Henry Ford's early 20th-century efforts at social responsibility, the 1987 Brundtland Report by the World Commission on Environment and Development (WCED) that introduced the concept of sustainable development (UN, 1987), the 1999 Global Compact (Annan, 1999) and the 2015 UN Agenda 2030 (UN, 2015), which further accelerated the push towards sustainable finance thanks to the statement of the 17 Sustainable Development Goals (SDG). The European Union's initiatives, such as the European Green Deal (European Commission, 2019) and the NextGenerationEU, underscore the regulatory momentum towards sustainability (European Commission, 2020).

Consumer behavior is also driving change, with younger generations showing a willingness to pay more for sustainable products. However, there remains a "sustainability premium" that can prevent from broader adoption. Despite these challenges, businesses are increasingly expected to integrate ESG considerations into their strategies and operations to meet the evolving expectations of consumers, investors, and regulators (Capgemini Research Institute, 2022).

Academic research indicates that while many companies acknowledge the importance of sustainability, fewer have fully adapted their business models to incorporate these principles (Atz et al., 2019). There is a growing recognition among asset managers of the value of sustainable investments, with significant amounts of capital now being directed towards ESG-labeled assets (Downing et al., 2019). The challenge lies in developing reliable metrics to measure the positive impacts of sustainability investments, which can help justify these initiatives to investors and shareholders. This ongoing shift emphasizes the need for businesses to embrace sustainability as

a core element of their long-term strategy. However, the relationship between sustainability and corporate profitability remains debated. Some studies, like Atz et al. (2019), highlight a positive correlation between sustainability measures and long-term performance, while others, such as Cornell (2021), argue that ESG investments might lead to lower returns despite social benefits. Research by Bassen et al. (2015) supports a stable positive impact of ESG factors on financial performance, whereas Cornell and Damodaran (2020) suggest that the real cost lies in being socially irresponsible due to reputational risks. Criticisms of the stakeholder model include legal constraints, lower profitability in stakeholder-based strategies, conflicting stakeholder interests, property rights and the relationship between managers, shareholders, and stakeholders and questions about corporate responsibility for externalities.

Despite varying opinions, including scholars reaffirming Friedman's mantra (Friedman, 1970) that "*the business of business is business*", the trend towards socially responsible businesses continues to grow: the business of business is increasingly seen as more than just business and the question now is whether this shift reflects a genuine commitment to social responsibility or simply an economic advantage, and whether this trend will be sustained in business practices or turn out to be a passing fad.

Different approaches have been proposed in order to integrate sustainability into corporate valuations ranging from variations of traditional corporate valuations methods to innovative ones, but, as far as we know, a comparison of different methodologies has not yet been proposed. The scope of this paper is to compare alternative methods, both traditional and innovative, to account for sustainability as measured by ESG ratings when determining a company's fair value. The empirical analysis is based on Eni S.p.A, a global Italian company operating in the utilities and energy sector.

To this end, the present paper is structured as follows. Section 2 provides a brief overview of the evolution of the economic and institutional framework concerning sustainability, highlighting the significant European regulatory shift from the Non-Financial Reporting Directive to the Corporate Sustainability Reporting Directive; it examines approaches for integrating sustainability into both corporate strategies and investment decisions and concludes with a discussion of the emerging stakeholder-oriented paradigm, which is increasingly replacing the traditional shareholder-oriented model. Section 3 focuses on methods for incorporating sustainability into business valuation ranging from adjustments of traditional valuation models (such as the Discounted Cash Flow Model – DCF and the Sum of the Parts Method – SOP) to methods that more effectively capture ESG characteristics. Section 4 implements and compares

these methods to the case of Eni S.p.A. and compares the methods used. The final section provides Conclusions.

2 The evolution of the economic-institutional framework

2.1 From the Non-Financial Reporting Directive to the Corporate Sustainability Reporting Directive

To support companies in adopting sustainable policies with a material impact on their business, the European Union has introduced two main directives: the Non-Financial Reporting Directive – NFRD (2014/95/EU directive) (EU, 2014) in 2014 and the Corporate Sustainability Reporting Directive – CSRD (EU, 2022) in 2022.

The NFRD was a crucial step towards integrating sustainability within companies, since ir requires that listed companies with more than 500 employees, on average during the accounting period, to produce within the management report a non-financial report. This latter report should highlight the company's commitment to social and governance matters, respect for employees and human rights, and efforts to fight corruption and abuse of office. This framework encouraged companies to adopt long-term strategies aimed at creating sustainable value in the future.

On April 21, 2022, the European Commission adopted the "Proposal for a Corporate Sustainability Reporting Directive", and on December 16, 2022, the CSRD was published in the Official Journal of the European Union, with the aim to contribute to the UN Agenda 2030 (UN, 2015), including achieving climate neutrality by 2050. In fact, the directive has two main objectives: to make information comparable across companies while ensuring disclosure duties towards stakeholders, and to make management bodies aware of Environmental, Social and Governance (ESG) issues by introducing the concept of double materiality. This principle requires companies to consider sustainability at par with economic matters, meaning they must disclose both the social and environmental risks they face and the impact their activities have on ESG matters. In sum, the CSRD enhances the quality of non-financial information mandated by the NFRD by also introducing external auditing. This implies that non-financial information must be verified by an independent auditor who certifies its accuracy and reliability.

2.2 Different ways to integrate sustainability

ESG issues are evolving rapidly thanks to international and supranational institutions that set sustainability targets, such as those included in the European Green Deal (European Commission, 2019). This progress is also driven by the growing awareness that today's decisions and policies impact future generations. In this context, companies are behaving in different ways:

some explicitly integrate sustainability into their business models and polices; other comply with non-financial disclosure requirements without taking significant actions to integrate sustainability; while some others do not consider sustainability at all unless required by regulation.

Academic literature emphasizes that to achieve long-term advantages sustainability should be integrated in every strategic phase of a company and embedded in the management's culture (Fink and Whelan, 2016; Eccles and Serafeim, 2013; Porter and Serafeim, 2019; Serafeim, 2020 and Serafeim and Trinh, 2020). Corporate sustainability strategies can be categorized in four different groups, based on the company phase they influence:

i. Strategic view strategies (Beith et al., 2013; Jensen, 2005);
ii. Company process strategies (Eccles & Serafeim, 2013; Serafeim, 2020; Capgemini Research Institute, 2022; Porter & Kramer, 2011; Pfitzer et al., 2013);
iii. Product strategies (Serafeim & Trinh, 2020);
iv. Reporting strategies (Downing et al., 2019).

This taxonomy can be very useful for companies adopting sustainability strategies for the first time and needing tools for implementation. Besides, it can also benefit companies aiming to increase their investment in sustainability. Tools and policies can either be adaptations of standard tools or newly created ones designed to better integrate sustainability.

In the first category, tools like Porter's five forces analysis (Beith et al., 2013), SWOT analysis (Beith et al., 2013), and the Balanced Scorecard (Jensen, 2005) can be considered.

In the second category, the performance frontier proposed by Eccles & Serafeim (2013) is widely adopted in the industry. Serafeim (2020) suggests another strategy where he emphasizes the importance of dynamism in the materiality of ESG issues which represent the drivers of the sector. Besides, the Capgemini Research Institute (2022) suggests actions to integrate sustainability into company processes and Porter & Kramer (2011) and Pfitzer et al. (2013) recommend strategies related to shared value, which create economic value while addressing societal needs and changes.

In the third category, Serafeim & Trinh (2020) propose seven dimensions to analyze for evaluating a product's impact. This framework, once implemented, could enable consumers to make more informed choices and prefer sustainable products by understanding the social and environmental impacts of their purchasing decisions.

In the latter category, Downing et al. (2019) highlight a method to evaluate the environmental and social impacts of polices. This approach helps managers understanding how their companies affect the environment and society, enabling them to make positive contributions to ESG issues by considering all aspects, not just the economic impact.

2.3 Tools to integrate sustainability in investment decisions

When companies face investment choices and need to evaluate which option is better, sustainability should be considered to make a more informed decision. Beith et al. (2013) provide an extensive literature review on traditional methods for integrating sustainability, and show that higher ESG disclosure leads to greater confidence in ESG performance and risk management, which is reflected in the Equity Risk Premium (ERP).

To accurately assess sustainability in investment decisions, several methods have been employed, though most are qualitative due to the difficulty in quantifying ESG dimensions. These methods fall into two main categories: traditional approaches adjusted for sustainability (e.g. sustainability beta) and new methods developed specifically to evaluate sustainability (e.g. Return On Sustainable Investment, or ROSI).

In the former category, Lucas-Leclin and Nahal (2008) propose adjusting the beta (and, indirectly, the cost of capital) with some sustainability indicators to evaluate the financial impact of non-financial factors. They introduce a Sustainability Beta, which, although acknowledged as a rough initial proxy since it does not fully account for Environmental and Social issues, is calculated as the product of three components:

$$\text{Sustainability } \beta = \text{Activity } \beta \times \text{Company } \beta \times \text{Quality of Management } \beta \qquad (1)$$

where:

Activity β = mean of the beta of companies in the same sector or with the same core business;

Company β = a beta specific for the company;

Quality of Management β = it is the sustainability factor (or ESG facor) of the formula and it evaluates the ability of management to reach at least strategical goals.

Since the management falls within the governance (the G leg of ESG), the authors consider the beta obtained from (1) as a sustainability beta. The Quality of management beta generally depends on the management ability to reach given goals: a higher beta corresponds to more uncertainty and consequently a higher required rate of return.

The value of the Quality of management beta is determined through scoring techniques, which involve ranking ESG practices on a scale from worst to best and assigning a score to each practice: companies with governance performance below the average receive a score higher than 1, while those performing better receive a score lower than 1. The authors state that this is a preliminary step towards a true sustainability beta, as corporate governance is just one pillar of

ESG. Beith et al. (2013) refer to this adjusted beta as a "Sustainability Beta." They acknowledge that this is a quite rough measure, indicating that academic research in this area is still relatively underdeveloped. Therefore, it is necessary to develop other methodologies, such as adjustments to the beta that depend on both exogenous factors (such as standardized ratings) and endogenous factors. In this case, it is essential to quantitatively evaluate all three ESG pillars, not just corporate governance.

Another way to adjust beta for sustainability is proposed by Sycomore Asset Management (PRI, 2020). This method evaluates a company's sustainability based on its ability to create value for its stakeholders, using the SPICE (Suppliers/Society/States, People, Investors, Clients and Environment) rating. Sycomore derives this rating by analyzing over 90 qualitative and quantitative criteria related to the five key stakeholders, assigning ratings on a scale of 1 to 5, and calculating a weighted average of these ratings. The weights are based on the company's sector and business lines, with default weights being 10% for Society, 15% for People, 50% for Investors, 15% for Clients and 10% for Environment (Sycomore, 2022).

Sycomore Asset Management's fund managers then adjust the beta of observed companies based on the SPICE rating, as shown in Table 1.

Table 1 – SPICE rating and beta adjustment

SPICE rating	Beta adjustment
A+	-20%
A	-10%
B	0%
C	+10%
C-	+20%

Source: PRI (2016).

The SPICE rating allows for an assessment of the sustainability risks the observed company is exposed to and must manage, such as risks related to business ethics, taxes, human rights, working conditions, subcontracting chain, environmental disasters, ecological and energy transition and personal data protection (Sycomore, 2023).

Another method traditionally used for choosing between different investments is Economic Value Added (EVA). To recall the definition of EVA:

$$\mathrm{EVA_t} = (\mathrm{ROIC} - \mathrm{WACC}) \times \mathrm{IC_t} \qquad (2)$$

where:

ROIC (Return On Invested Capital) = return on the investment divided by the amount of capital needed for that investment;

IC (Invested Capital) = amount of capital used for the investment;

WACC (Weighted Average Cost of Capital) = weighted average between cost of equity and cost of debt, given by the formula:

$$\text{WACC} = \text{coe} \times \frac{\text{E}}{\text{E+D}} + \text{cod} \times (1 - \text{t}_\text{c}) \times \frac{\text{D}}{\text{E+D}} \quad (3)$$

where:

coe (Cost of Equity) = cost of the own capital of the company, which can be considered as the rate of return for investors;

$\frac{\text{E}}{(\text{E+D})}$ = amount of equity on the total amount of capital;

cod (Cost of Debt) = cost of the debt that the company has to bear;

t_c = tax rate;

$\frac{\text{D}}{(\text{E+D})}$ = amount of debt on the total amount of capital.

The sustainability adjustment can be achieved in three ways. First, ROIC is indirectly modified by sustainability investments, as they can enhance future financial performance (Beith et al., 2013). Second, WACC is indirectly adjusted by incorporating sustainability parameters into the beta, which affects the cost of equity and consequently the WACC: higher levels of sustainability reduce the beta and thus the cost of equity. Third, the cost of debt, which is part of the WACC as outlined in (3), depends on the company's level of sustainability: higher levels of sustainability help companies secure financing at a lower cost since they can better manage ESG risks.

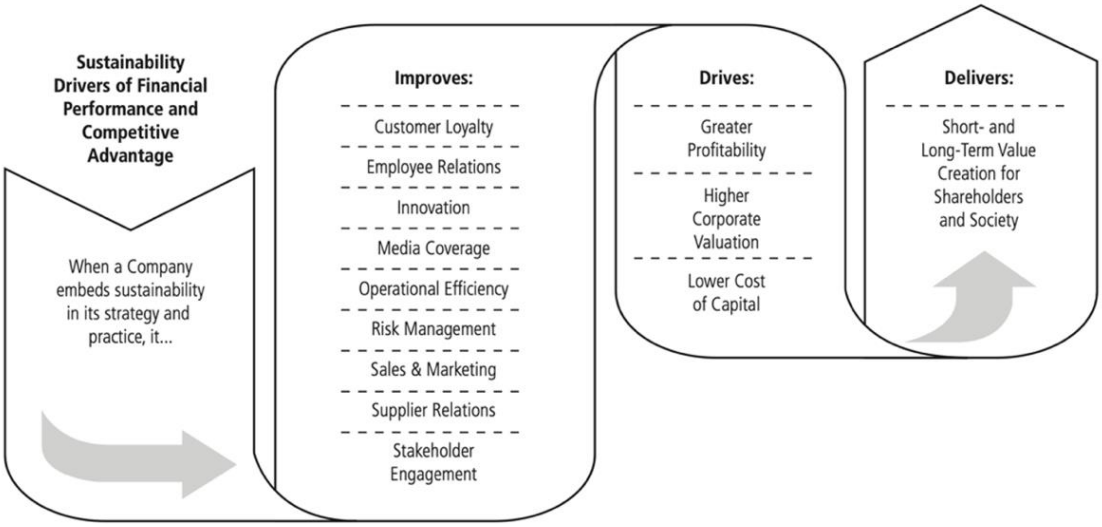
In contrast to Lucas-Leclin and Nahal (2008), Beith et al. (2013) argue that valuing non-monetary issues like ESG with traditional models is not appropriate for three main reasons:

i. Time inconsistency: traditional methods are based on shorter time horizons, whereas ESG investments require a long-term perspective to show their effects;
ii. Need of information: ESG information requires more resources to acquire and evaluate compared to traditional financial information, which is readily available from balance sheets and the income statements. Acquiring, verifying and comparing ESG information is challenging;

iii. Materiality: while it is straightforward to determine what is material for a company economically, it is not easy for ESG matters. There are numerous sustainability issues, and companies must identify which are most material for their business model.

A recent methodology specifically designed to account for sustainability is ROSI (Return On Sustainability Investment) by Atz et al. (2019). ROSI involves monetizing the expected and actual financial benefits of sustainability actions through five steps and evaluating nine mediating factors. Figure 1 illustrates how sustainability actions create value and how mediating factors – customer loyalty, employee relations, innovation, media coverage, operational efficiency, risk management, sales and marketing, supplier relations, stakeholder engagement – can be identified, quantified and monetized to assess the financial benefits of sustainability actions. It is important to note that companies, depending on their sector or business, have different material mediating factors, therefore identifying the most relevant factors is crucial for the effectiveness of sustainability actions.

Figure 1 – Impact of the mediating factors on companies' value



Source: Atz et al. (2019).

According to Atz et al. (2019), incorporating mediating factors into the valuation framework is essential when analyzing sustainability projects because it allows explaining conceptually how sustainability drives intermediate measures of a company's financial performance, such as better cash flows, lower costs, higher incomes; capturing benefits beyond tangible results, like mitigating the risk of a reputational scandal; focusing on metrics that are more manageable than final measures, such as stock price, since the results of sustainability investments could be dispersed across different business units or owned by different managers.

Atz et al. (2019) propose five steps to monetize sustainability actions:

1. Identifying material strategies and actions for sustainability;
2. Listing potential benefits that could generate financial and social value from sustainability actions;
3. Quantifying costs and benefits associated with sustainability actions;
4. Constructing scenarios, document hypotheses and iterate research;
5. Monetizing and calculating the value for the whole benefits.

However, these steps come with several potential pitfalls:

i. Counting more times the benefits of a single sustainability action;
ii. Forgetting material benefits, costs or actions;
iii. Technical mistakes due to the work with complexed spreadsheets;
iv. Omitting important stakeholders' opinions;
v. Not to document critical assumptions, such as the discount rate.

Beith et al. (2013) propose a useful framework that includes a list of ESG issues that could be material for businesses, which helps in evaluating the goodness of an investment (Table 2). The authors highlight that material ESG issues must be quantitatively and qualitatively measurable, material to the business being analyzed, and have a macro impact.

Table 2 – Material ESG issues to evaluate investment projects

Environment	Social	Governance	
		Companies	Funds
■ Climate change ■ Environmental policy ■ Sustainability best practice ■ Environmental management ■ Water supply ■ Sustainable transport ■ Waste management	■ Consumer rights ■ Supply chain management ■ Health and safety ■ Product safety ■ Labour relations, inc. relationships with unions ■ Community / stake holder relations	■ Board structure ■ Independant directors ■ Chairman / CEO split ■ Exec. pay ■ Shareowner rights ■ Accounting / audit ■ Business ethics ■ Conflicts of interest	■ Fund governance ■ Advisory committee powers and composition ■ Valuation issues ■ Free structures

Source: Beith et al (2013).

Unlike ROSI, this methodology does not directly measure the benefits arising from sustainability politics, but it can still be valuable for investment evaluation. In fact, by assigning a score to each ESG issue of the investment being analyzed, it is possible to derive a comprehensive score that includes all three dimensions (environmental, social and governance). This score can then be integrated into traditional models (e.g. Internal Rate of Return, Net Present Value, Payback period, etc.) to compare different investment choices.

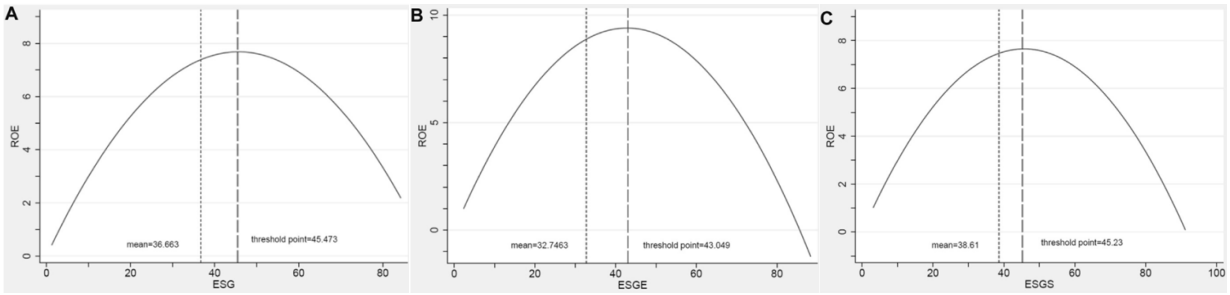
2.4 New paradigm: stakeholders vs shareholders

Until recent years, the prevailing business idea was that a company's responsibility was to maximize the value for shareholders based on purely economic criteria of value creation, specifically when the return on invested capital is higher than the cost of capital. With the growing sustainability consciousness among consumers and institutions, this paradigm has been changing. The interests of a broader group of stakeholders (i.e. anyone with an interest in the company's development) have become increasingly important.

Some scholars, such as Goedhart et al. (2015), argue that the aim of companies is to create value for shareholders, but this value should be long-term rather than short-term, focusing on the sustained development of the company rather than immediate high dividends or capital gains. This perspective aligns the stakeholder-based paradigm more closely with the shareholder-based one.

The shareholder-based paradigm is rooted in Milton Friedman's idea that "*the business of business is business"* (Friedman, 1970), meaning that anything outside the company's direct control, such as the consequences of externalities, should be managed by the State, not by companies. According to this view, companies have a duty only to their shareholders. However, recent years have witnessed a shift: some scholars now believe that the ultimate goal of companies should be to maximize stakeholder value, with shareholder wealth maximization as the means. Others argue that a company's survival depends on addressing the needs of all stakeholders. Empirically, Cornell and Damodaran (2020) find that the causality between financial performance and ESG rating runs from performance to rating. This means that higher profits provide companies with more financial resources to invest in social responsibility, not the other way round. In this context, corporate social responsibility can be viewed as a luxury good that companies purchase to enanche their reputation. Conversely, Chang et al. (2022) demonstrate the opposite causality, summarized in Figure 2: ESG performance increases return on investment. They show that, so far, the magnitude of investments in ESG is below the threshold point, indicating that increasing ESG investments enhances financial performance for companies. This finding holds true for overall ESG (A), the Environmental leg only (B) and the Social leg only (C), but there is no evidence of a relationship between the Governance leg and ROE.

Figure 2 – Relation between ESG, ESGE, ESGS and ROE



Source: Chang et al. (2022).

Regarding the idea that maximizing shareholder value also maximizes stakeholder value, Jensen (2010) argues that this is not possible when externalities are involved. Companies, through their production processes, contribute to water and air pollution, the release of microplastics and other pathogens, the creation and exacerbation of financial crisis, the spread of child labor and slavery and the violation of human rights. It is evident that the same companies responsible for these negative externalities often expect the government to bear the costs arising from them.

A theory that bridges the gap in between the two paradigms is the Enlighted Value Maximization Theory (Jensen, 2010). According to this theory, when managers make decisions, they should consider the interests of all stakeholders, but only to the extent that these interests do not diminish shareholder wealth. The idea is that by maximizing the company's long-term value, the management can make compromises between otherwise incompatible interests.

Table 3 – Comparison between old and new company paradigm

Dimension	Old paradigm	New paradigm
Objective of corporation	Profit maximisation	Purpose driven
Control of the corporate	Shareholders	Stakeholders
Decision-making	Net present value based on financial factors Max FV	Long-term value creation potential Max IV = FV+SV+EV
Reporting	Financial	Financial & extra-financial
Compensation	Stocks/options	Financial and sustainability targets
Securities pricing	Efficient markets hypothesis	Adaptive markets hypothesis
M&A appraisal process	Anti-competitive and political	Societal cost-benefit analysis

Note: FV = Financial Value, SV = Social Value, EV = Environmental Value; IV = Integrated Value.

Source: Schoenmaker e Schramade (2020).

Schoenmaker and Schramade (2020) provide a comparison between the two paradigms (Table 3). Notably, the optimization objective contrasts short-termism and the maximization of shareholder value with the long-term maximization of the value of all stakeholders. Additionally,

reporting should include non-financial information, and the compensation system should provide different incentives aligned with these broader goals.

3 Methods for the integration of sustainability into corporate valuation

3.1 ESG ratings as a tool to measure sustainability

One way to quantify a company's sustainability are ESG ratings, which can be divided into two main categories: disclosure ratings (e.g. Bloomberg's ratings) or compliance rating (e.g. MSCI ESG Rating and Sustainalytics ESG Risk Ratings). [1]

The MSCI ESG Rating measures a company's resilience to long-term, financially relevant ESG risks and its management's ability to handle ESG opportunities (https://www.msci.com/our-solutions/esg-investing/esg-ratings). MSCI identifies industry leaders and laggards based on their exposure to ESG risks and their capability to manage these risks compared to their peers. The rating scale ranges from AAA and AA (leaders) to B and CCC (laggards), with average companies rated A, BBB and BB.

Similarly, Sustainalytics ESG Risk Ratings assess a company's exposure to industry-specific material ESG risks and its management of those risks (https://www.sustainalytics.com/esg-data). However, the methodology and ratings differ. Sustainalytics categorizes ESG risk severity that could have an impact to company's enterprise value into five levels: Negligible (0-10), Low (10-20), Medium (20-30), High (30-40) and Severe (40+).

As MSCI (2020) highlights, ESG ratings are primarly for fundamental and quantitative analyses of companies, portfolio construction, ESG risks management and benchmarking against other companies. ESG ratings enable an initial assessment of the impact of ESG strategies by comparing companies with different ESG ratings and adjusting the cost of capital or the growth rate according to the rating level. This assessment should then be integrated into the traditional economic valuation.

3.2 Adjustments to traditional corporate valuation methods

In this section, we analyze the incorporation of sustainability metrics into absolute valuation models such as the widely-used Discounted Cash Flow Model (DCF), both in its traditional form and as the Sum Of the Parts Method (SOP), which involves evaluating the DCF model for different segments of the company.

[1] The literature on the divergence of different types of ratings is extensive and beyond the scope of this paper (see Berg et al. (2022), Dimson et al. (2020) and Dorfleitner et al. (2015) for more details).

We do not consider relative valuation models like the multiple approach since, as Beith et al. (2013) show, analysts tend to use absolute valuation models (DCF and Economic Value Added – EVA) rather than relative valuation models such as the price/earning (P/E) multiple is due to the time mismatch: multiples are based on a short-term view (2/3 years), whereas ESG investments have a long-term horizon, as sustainability itself is oriented toward the long term. Similarly, factors models (e.g. the Fama and French Three-Factors Model and the Arbitrage Pricing Model) are not ideal. Cornell (2021) demonstrated that considering sustainability as an additional risk factor is inappropriate because ESG factors carry negative returns, representing an insurance premium paid to hedge environmental and social risks.

The first valuation model we analyze is the Discounted Cash Flow (DCF):

$$EV = \sum \frac{UFCF_t}{(1+WACC)^t} + \frac{UFCF_n \times (1+g)}{\frac{(WACC-g)}{(1+WACC)^n}} \qquad (4)$$

where:

EV (Enterprise Value) = market value of the company's activities;

UFCF (Unlevered Free Cash Flow) = financial cashflows produced by the core business of the company.

Wacc = weighted average cost of capital;

t = reference time period;

g = rate of expected growth of the UFCF;

n = period of time referred to the terminal value.

$\frac{UFCF_t}{(1+WACC)^t}$ = expected value during the analytical forecast period;

$\frac{UFCF_n \times (1+g)}{\frac{(WACC-g)}{(1+WACC)^n}}$ = terminal value, i.e. capability to produce cashflows in the future (this part should be affected more by sustainability since it produces long-term results).

DCF can be adjusted for sustainability through three different inputs:

1) Cash Flows: sustainability investments may generate lower cashflows in the short term but higher revenue in the long term;
2) Discount rate: the cost of equity, cost of debt and WACC can be adjusted by sustainability matters. Higher sustainability levels can reduce beta and thus the cost of equity and sustainable companies may also benefit from lower costs of debt due

to better ESG risk management. Besides, if the government decides to incentive the development of sustainability companies, the benefits of the tax shield become important;

3) Expected growth rate: sustainability can lead to higher growth, farther influenced by a lower cost of capital that increases investment opportunities. In fact, companies neglecting sustainability may face significant risks (e.g. reputational risk, change in regulation, etc.), potentially reducing their terminal value to 0.

An interesting approach to adjusting the WACC for sustainability is proposed by Oddo Securities (PRI, 2016) and is called Weighted Average Cost of All Capital (WACAC). According to Oddo, social and environmental themes necessitate a broader perspective in computing the discount rate used in the DCF model. WACAC integrates the traditional balance sheet with assets and liabilities related to human, social and natural resources, reflecting all stakeholders' interests in the balance sheet. WACAC is computed as follow:

$$\text{WACAC} = \frac{E}{E+D+N+H} \times r_E + \frac{D}{E+D+N+H} \times r_D + \frac{N}{E+D+N+H} \times r_N + \frac{H}{E+D+N+H} \times r_H \qquad (5)$$

where:

E = equity;

D = debt;

N = natural capital;

H = human capital;

r_E = cost of equity;

r_D = cost of debt;

r_N = cost of natural capital;

r_H = cost of human capital.

Additionally, the cost of equity should be adjusted as follows:

$$\text{Adjusted cost of equity} = R_f + \beta_S \, E[R_S - R_f] \qquad (6)$$

where:

R_f = risk-free rate;

β_S = sustainability beta (specific calculation not disclosed by PRI (2016));

R_S = return required by investors for specific sector risks (including market, environmental and social risks).

The SOP method is used by multi-business companies and involves applying a DCF for each business unit, then aggregating the different core enterprise values and obtaining, through the sum of surplus assets and the deduction of the financial debt, the value of equity of the company. This method, differently from traditional DCF, allows for evaluating each business unit with a tailored discount rate (WACC) and expected long-term growth rate (g), rather than using uniform parameters for all units. Differences in WACC are mainly due to variations in beta (due to variations in the cost of equity) and tax rate (due to variations in the cost of debt). The expected long-term growth rate (g) reflects the growth of future cashflows more accurately.

Thanks to this feature of evaluating single business units with tailor-made expected growth rate and discount rate, this approach enables companies integrating ESG issues to determine a more accurate value, impacting the fair value and consequently the market price.

3.3 New approaches for the valuation of sustainability

Intangible assets are immaterial assets that produce economic benefits and, similarly, sustainability is intangible as it is non-monetary, non-tangible and capable of generating future economic value. Hence approaches, previously used to estimate the value of intangible assets, can be developed to value sustainability since the valued added by sustainability is similar to that produced by intangible assets such as patents and trademarks.

In recent decades, an increasing portion of companies' intrinsic and market value has depended on their ability to manage intangible assets. Evaluating a company without considering the value sustainability may underestimate its true value. Since intangible assets are not recorded in the balance sheet or income statement, these documents alone are insufficient to grasp the magnitude of intangibles, including sustainability.

Several methods to evaluate sustainability as an intangible asset are particularly suited for this purpose: the Multi-Period Excess Earning Method, the With and Without Method, and the Real Option Pricing. The Multi-Period Excess Earning Method is based on the idea that if an intangible asset can produce extra economic value (and extra income), company can leverage it after remunerating all other production factors. Similarly to this method, the With and Without Method compares a company with the intangible asset to one without it, thus determining the fair value of the non-accounted intangible. This latter method, which is more suitable for the aim of this analysis, was proposed by Damodaran (2006) and it is called "Real Option Pricing". This method is ideal for intangibles that do not currently generate cashflows but could produce significant positive cashflows in the future, similar to early-stage sustainability investments.

This method relies on the Black-Scholes formula (e.g. Hull, 2018):

$$\text{Intangible value} = S_o N(d_1) - Ke^{-rT} N(d_2) \quad (7)$$

where:

$$d_1 = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma^2\sqrt{T}} \quad (8)$$

$$d_2 = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r - \frac{\sigma^2}{2}\right)T}{\sigma^2\sqrt{T}} = d_1 - \sigma\sqrt{T} \quad (9)$$

Where:

S_0= present value of the expected future cahsflows from the intangible;

K = present value of the costs necessary to produce the intangible;

T = expected life of the intangible;

r = risk-free rate;

σ^2= variance of the expected present value;

N(x) = cumulative normal distribution function.

In conclusion, while traditional methods for computing a company's value can be adjusted to account for sustainability, new models or models traditionally used for other purposes, such as those for estimating intangible asset value, can also be applied. Among these methods, the Real Option Pricing appears to be the most suitable for evaluating sustainability issues within a company.

4 The valuation of Eni S.p.A.: different methodologies at comparison

4.1 The choice of Eni

Eni S.p.A. is a global company operating in the utilities and energy sector through its five business units: Refining & Marketing & Chemicals Services, Exploration & Production, Corporate & Other Activities, Global Gas & LNG Portfolio and Plenitude & Power. There are four main reasons for choosing Eni S.p.A. to compare different methodologies for valuing sustainability: first, it operates in a crucial sector for the Ecological Transition; second, it declares in its documents (Eni, 2023b; Eni, 2023c; Eni, 2023d) to integrate sustainability policies into its business model; third, it is widely covered by financial analysts; finally, it has a high ESG rating. The empirical analysis refers to 2023, specifically: accounting data used are derived from Eni's balance

sheet as of the close of 2022, while the market data (including discount rates, prices, etc.) are as of June 27th.

In "Eni for 2022 – Performance di sostenibilità" (Eni, 2023c) we can find the information reported in Table 4, which presents the economic value generated and distributed by Eni from 2018 to 2022. This table shows that out of the 120 billion generated in 2022, 85% are operational costs, 7% are payments to Public Administration, 5% are payments to capital providers and 3% are wages for employees. Eni also notes in the same document that part of the distributed economic value is directed toward the development of local communities, aiming to make energy resources accessible to everyone and to protect their rights, culture and traditions.

Table 4 – Economic value generated and distributed by 2018 to 2022 (in millions of €)

	2018	2019	2020	2021	2022
Economic value generated	**77.381**	**71.565**	**45.638**	**78.092**	**134.232**
Economic value distributed	67.912	63.103	41.437	66.138	120.451
of which: operational costs	55.622	50.874	33.551	55.549	102.529
of which: wages for employees	3.093	2.996	2.863	2.888	3.015
of which: payments to capital suppliers	3.971	4.165	2.974	3.975	6.419
of which: payments to Public Administration	5.226	5.068	2.049	3.726	8.488
Economic value retained	9.469	8.462	4.201	11.954	13.781

Source: (Eni, 2023c).

As part of its sustainability strategy, Eni publishes "Eni for – A just transition" and "Eni for – Performance di sostenibilità" annually, where it details stories, demonstrations and practical cases of what the company does to achieve its sustainability objectives, including those related to the energy transition and access to energy for local communities. To support the energy transition with high investments, in 2021 Eni created Plenitude, a company that combines renewable energy generation, retail services, charging stations for electric cars and innovative energy services.

4.2 Implementation of traditional methods adjusted for sustainability

In this section we integrate Eni's sustainability information into the Discounted Cash Flow (DCF) method and the Sum Of the Parts (SOP) method. By doing so, we can check, through a

comparison with the market price, if sustainability is already included in the cashflows, indicating whether the market accurately prices all ESG matters related to the company.

4.2.1 Discounted Cash Flow with analysts' data

The first step in the analysis is to observe analysts' predictions about the future market price of the stock at the observation date, when The the market price observed is €12.73. (at the date of June, 27th) Table 5 shows an underestimation by the market compared to analysts' estimates. Reviewing 34 international analysts, we find that the market price, is about 22% less than the average of analysts' valuation. Additionally, 60% of analysts recommend a "Buy" and 40% recommend a "Hold", indicating a bullish view.

Table 5 – Summary of analysts' forecasts

Buys	58.8%	Total Buy Recs	20
Holds	41.2%	Total Hold Recs	14
Sells	0%	Total Sell Recs	0
Last Price (27/06/2023, h 16:00)	12.73	Mean Target Price	16.24

Source: Own elaborations of Bloomberg and www.eni.com's data.

Since this preliminary analysis suggests that Eni's stock is underestimated, we want to assess whether this underestimation is due to incorrect market estimates of the company's operational prospects or the market's inability to price sustainability accurately. To answer this, we contacted some analysts who study the stock to understand the methodologies they use. The analysts who responded are fromSociété Générale, (Intesa Sanpaolo and Bestinver Securities. Table 6 presents the analysts' considerations about their methods, listed in an order that ensure anonymity.

Table 6 – Analysts' evaluation criteria

ANALYST	METHOD	RISK-FREE	MARKET RISK PREMIUM	WACC	g	SUSTAINABILITY APPROACH
Analyst 1	SOP	4%	6.5%	8.87%	0.35%	ESG matrix (qualitative valuation)
Analyst 2	DCF	Not available	Not available	8%	0%	Not available
Analyst 3	SECTOR MULTIPLES	Not available	Not available	Not available	Not available	Rating ESG (subjective valuation)

Source: Elaboration analysts' data.

The methods used by the three analysts to evaluate Eni differ: Analyst 1 used a SOP method to evaluate each business unit separately, based on a 4% risk-free rate, 6.5% market risk premium, 8.87% cost of capital (Table 6 shows an average WACC weighted for each business unit concerning the Enterprise Value of each sector), and a 0.35% expected long-term growth rate (g). Besides, Analyst 1 did not use a quantitative method to integrate sustainability but included an ESG matrix, that maps the sustainability of the company.

Analyst 2 used a DCF method based on an 8% WACC and a 0% expected long-term growth rate, indicating no growth after the analytical forecast period (the terminal value is discounted by WACC and then carried to time 0). This analyst did not indicate whether sustainability was integrated, but the growth rate of 0% and unadjusted WACC and cashflows suggest it was not.

Analyst 3 did not explicitly include sustainability factors, since it is extremely difficult to incorporate all factors determining business sustainability into a model. His analysis is based on sector multiples, applying a discount or premium to define the stock's valuation range and the discount or premium depends on subjective factors, including ESG ratings. Since literature suggests market multiples are not ideal for evaluating sustainability due to the misalignment of time horizons, we did not use these data in our analysis.

Using data form Analysts 1 and 2, we computed a DCF reflecting their assumptions. Analyst 1's disclosed information divided by business unit allowed us to calculate a weighted average WACC of 8.87% and a weighted expected long-term growth of 0.35%. Averaging these values with Analyst 2's, we derived a WACC of 8.44% and a growth rate of 0.18%. Using Analyst 1's cashflows, we computed the DCF shown in Table 7.

The equity value per share obtained is €21.25, 21% higher than the mean expected price of €17.55 from the two analysts. This difference may be due to the cashflow of the terminal value, estimated from the first four years of the analytical forecast, and the higher discount rate used by Analyst 1, who discounted the most cashflows (the 92% of the total EV) at a higher discount rate.

Table 7 – DCF with analysts' input

	2022	2023	2024	2025	2026	TV
WACC	**8.44%**	**8.44%**	**8.44%**	**8.44%**	**8.44%**	**8.44%**
g						**0.18%**

	2022	2023	2024	2025	2026	TV
UFCF	9,078,000,000	8,552,700,000	8,276,800,000	7,696,700,000	7,285,696,220	6,896,640,042
Discounting factor	*1.0844*	*1.17592336*	*1.275171292*	*1.382795749*	*1.49950371*	
PV UFCF	8,371,449,650	7,273,178,075	6,490,735,837	5,566,042,568	4,858,738,376	
Σ PV UFCF	32.560.144.506					
PV TV						55,781,603,560
Evcore	**88,341,748,066**					
Surplus Assets	15,593,000,000					
Financial debt	11,977,000,000					
Provision	16,053,000,000					
Equity value	**75,904,748,066.30**	Shares in circulation	3,571,487,977			
Equity value per share	**21.25**					

Source: Own elaboration on Eni (2023d) and analysts' data.

4.2.2 Discounted Cash Flow with market's data

For the DCF with market data, we need inputs for WACC, expected long-term growth rate (g) and unlevered free cash flows (UFCF). As shown in Table 8, the cost of equity changes over time due to the fluctuating risk-free rate (computed using Euro Swap Zero Rates at 10 years with monthly frequency), which impact the equity risk premium. In contrast, the beta (levered at 2 years with weekly frequency, using the FTSE-MIB as a benchmark) and the market return (using a 10-year BTP) remain constant during the period.

Table 9 shows the cost of debt calculation during the plan. The cost of debt before taxes is computed by taking the Euro Swap Zero Rates (at 10 years with monthly frequency) and by adjusting them for Eni's rating using spreads proposed by Damodaran (https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ratings.html). The tax rate is estimated at 40% (apart from the first year, where the data was available), reflecting Eni's average tax payments as a percentage of gross income.

Table 8 – Cost of equity for the provisional plan

	2022	2023	2024	2025	2026	TV
Rf	2.04%	3.37%	3.71%	3.40%	3.17%	2.96%
Beta	0.8487	0.8487	0.8487	0.8487	0.8487	0.8487
Mkt return	12.77%	12.77%	12.77%	12.77%	12.77%	12.77%
Erp	10.66%	9.40%	9.06%	9.37%	9.60%	9.81%
Cost of equity	**11.15%**	**11.35%**	**11.40%**	**11.35%**	**11.32%**	**11.29%**

Source: Own elaboration of Bloomberg's data.

Table 9 – Cost of debt for the provisional plan

	2022	2023	2024	2025	2026	TV
Tax rate	36.68%	40.00%	40.00%	40.00%	40.00%	40.00%
Cost of debt before taxes	3.79%	5.12%	5.45%	5.15%	4.92%	4.92%
Cost of debt before taxes	**1.39%**	**2.05%**	**2.18%**	**2.06%**	**1.97%**	**1.97%**

Source: Own elaboration of Bloomberg and Eni (2023d)'s data.

Table 10 presents the WACC computation for all years of the analytical forecast and the terminal value. The stock of equity and debt are assumed constant during the plan, even if this is a strong assumption, especially for equity, as market capitalization depends on market price, which depends on the cost of equity, according to Formula 10 (Ricci & Torricelli, 1992):

$$P_0 = E(\widetilde{P_e})[1 + R_f + \lambda\, Cov(\widetilde{R_j}, \widetilde{R_m})]^{-1} \qquad (10)$$

where:

P_0 = today's stock price;

$E(\widetilde{P_e})$ = expected value of the stock price;

R_f = risk-free rate;

$\lambda\, Cov(\widetilde{R_j}, \widetilde{R_m})$ = riskiness of the share with respect to the market.

Table 10 – Wacc for the provisional plan

	2022	2023	2024	2025	2026	TV
Cost of equity	11.15%	11.35%	11.40%	11.35%	11.32%	11.29%
Equity	59.21%	59.21%	59.21%	59.21%	59.21%	59.21%
Cost of debt	1.39%	2.05%	2.18%	2.06%	1.97%	1.97%
Debt	40.79%	40.79%	40.79%	40.79%	40.79%	40.79%
WACC	**7.16%**	**7.56%**	**7.65%**	**7.57%**	**7.51%**	**7.49%**

Source: Own elaboration of Bloomberg and Eni (2023d)'s data.

After computing the WACC, we estimated the UFCF (Table 11) based on Eni's 2022 balance sheet, reports (Eni, 2023d) and Bloomberg data. It is important to say that while the cashflows for the first five years were computed using a financial value (UFCF), the terminal value was computed using an income value to avoid bias from the investment dynamics.

Table 11 – Estimation of the UFCF

	2022	2023	2024	2025	2026	TV
EBIT	20,391,000,000	14,166,000,000	12,731,400,000	11,620,100,000	10,698,571,429	**3,596,911,139**
+ Depreciation	7,205,000,000	7,396,700,000	7,355,600,000	7,347,110,526	7,322,857,142	
EBITDA	27,596,000,000	21,562,700,000	20,087,000,000	18,967,210,526	18,021,428,571	
- Taxes	8,088,000,000	6,039,353,846	5,354,830,769	5,030,100,000	3,641,200,000	
- Delta Net Working Capital	1,838,000,000	1,838,000,000	1,838,000,000	1,838,000,000	1,838,000,000	
- Operational Capex	8,200,000,000	9,500,000,000	9,052,466,667	9,095,714,286	9,122,333,333	
= Unlevered Free Cash flow	**9,470,000,000**	**4,185,346,154**	**3,841,702,564**	**3,003,396,240**	**3,419,895,238**	**3,596,911,139**

Source: Own elaboration of Eni (2023d)'s data.

Eni's remuneration policy aims to distribute 25-30% of Cash From Operations (CFFO) through dividends and buyback, with a forecasted annual dividend increase of 7% for 2023, reaching €0.94 per share. Due to the difficulty to split, for the next exercises, the part of the

dividend and the part of the buyback, future dividend trend were estimated analytically, with an expected growth rate of 2.42%[2].

Table 12 shows the equity value per share obtained from these computations, slightly higher than the analysts' average target price of €16.24 and lower than the price obtained from Analysts' projections (€21.25). The main problem of this value is that it depends too much on the terminal value: in the previous model the terminal value represented 63% of the EV_{core}, while in this case it is equal to 72%, indicating higher uncertainty in post-forecast projections.

Table 12 – DCF with analysts' input

	2022	2023	2024	2025	2026	TV
WACC	**7.16%**	**7.56%**	**7.65%**	**7.57%**	**7.51%**	**7.49%**
g						**2.42%**

	2022	2023	2024	2025	2026	TV
UFCF	9,470,000,000	4,185,346,154	3,841,702,563	3,003,396,240	3,419,895,238	3,596,911,139
Discounting factor	*10.716.166*	*115.698.346*	*124.743.618*	*1.339.003.262*	*1.436.487.073*	
PV UFCF	8,837,115,810	3,617,464,118	3,079,678,645	2,243,008,904	2,380,735,130	
Σ PV UFCF	20,158,002,608.68					
PV TV						50,611,724,203.30
Evcore	**70,769,726,810.98**					
Surplus Assets	15,593,000,000					
Financial debt	11,977,000,000					
Provision	16,053,000,000					
Equity value	**58,332,726,810.98**	Shares in circulation	3,571,487,977			
Equity value per share	**16.33**					

Source: Own elaboration of Eni (2023d), market and analyst's data.

To be noted the strong volatility of the terminal value with respect to the growth rate: The sensitivity analysis in Table 13 demonstrates that small changes in the growth rate (g) significantly impact the present value of the terminal value and, consequently, the fundamental stock price. In fact, a 3% variation in g results in a 58% stock price increase.

Table 13 – Sensitivity analysis of growth rate – PV TV – Price per share

[2] Further information about the computations is available under request.

g	PV TV	Price per share
0%	33,443,764,446.93	11.52 €
0.50%	36,013,916,412.67	12.24 €
1.00%	38,979,857,498.04	13.07 €
1.50%	42,440,638,312.07	14.04 €
2.00%	46,531,368,903.84	15.19 €
2.42%	**50,611,724,203.30**	**16.33 €**
2.50%	51,441,271,081.00	16.56 €
3.00%	57,443,782,370.32	18.24 €

Source: Own elaboration of Eni (2023d)'s data.

In conclusion, both models provide a price higher than the market price. Although these valuations do not explicitly consider sustainability, they offer a good starting point for deeper analysis using the SOP method and valuing sustainability as an intangible asset.

4.2.3 Sum Of the Parts with unadjusted beta

The Sum Of the Parts (SOP) method involves using a Discounted Cash Flow (DCF) analysis to compute the enterprise value core for each segment of Eni (Refining & Marketing & Chemicals Services, Exploration and Production, Corporate & Other Activities, Global Gas & LNG Portfolio, Plenitude & Power). This is done by applying different discount rates and growth rates for each segment, aggregating the values, and then computing the total company value.

To determine the WACC for each segment, we need to split the cost of capital into its two main components: cost of equity (coe) and cost of debt (cod). The cost of equity varies by segment due to differences in beta, while the cost of debt differs due to varying tax rates.

To compute the coe, we used the levered betas published by Damodaran (https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html), and the cod was calculated using the effective tax rates for each segment. Table 14 shows the values of coe, cod and WACC for each segment.

Table 14 – Coe, cod and Wacc for each segment

		2022	2023	2024	2025	2026	TV
Refining & Marketing & Chemicals Services	coe	12.08%	12.16%	12.18%	12.16%	12.15%	12.14%
	cod	0.99%	1.25%	1.33%	1.25%	1.20%	1.20%
	Wacc	**7.56%**	**7.71%**	**7.76%**	**7.71%**	**7.68%**	**7.67%**
Exploration & Production	coe	11.75%	11.87%	11.91%	11.88%	11.86%	11.84%
	cod	1.66%	2.08%	2.22%	2.10%	2.00%	2.00%
	Wacc	**7.64%**	**7.88%**	**7.96%**	**7.89%**	**7.84%**	**7.82%**
Corporate & Other Activities	coe	12.08%	12.16%	12.18%	12.16%	12.15%	12.14%
	cod	1.99%	2.49%	2.66%	2.51%	2.40%	2.40%
	Wacc	**7.96%**	**8.22%**	**8.30%**	**8.22%**	**8.17%**	**8.16%**
Global Gas & LNG Portfolio	coe	10.97%	11.19%	11.24%	11.19%	11.15%	11.12%
	cod	2.12%	2.67%	2.84%	2.68%	2.56%	2.56%
	Wacc	**7.36%**	**7.71%**	**7.81%**	**7.72%**	**7.65%**	**7.63%**
Plenitude e Power	coe	11.34%	11.51%	11.55%	11.51%	11.48%	11.45%
	cod	1.37%	1.72%	1.83%	1.73%	1.65%	1.65%
	Wacc	**7.27%**	**7.52%**	**7.59%**	**7.52%**	**7.47%**	**7.46%**

Source: Own elaboration of Eni (2023d) and market's data.

To compute the Unlevered Free Cash Flows (UFCF), we started with the value disclosed by Eni for the first year and then we forecasted future values for each component of the UFCF. Since Eni only discloses growth estimates for Plenitude in its Strategic Plan (Eni, 2023a), and given that this business unit is linked to the energy transaction with high growth targets, we use Eni's expected growth estimates to project Plenitude's values. We then weighted the EBIT of each segment to the total EBIT expected for the provisional plan, keeping the segment's share of the total group constant, except for Plenitude.

Before making these projections, adjustments were necessary to reconcile the value of each business area with the total amount in the balance sheet due to intra-sectoral issues or allocation difficulties. The UFCF of each segment is presented in Table 15.

Table 15 – UFCF for each segment

	2022	2023	2024	2025	2026	TV
Refining & Marketing & Chemicals Services	878,825,765.78	485,873,897,.36	1,012,457,381.07	398,902,304.87	425,423,096.48	477,703,815.25
Exploration & Production	8,431,704,725.36	4,124,752,647.93	3,477,794,698.32	2,477,855,039.17	2,487,460,171.76	2,487,460,171.76
Corporate & Other Activities	-1,140,863,594.18	-833,214,949.51	-730,254,486.90	-671,378,337.01	-547,393,161.76	-547,393,161.76
Global Gas & LNG Portfolio	1,205,106,960.61	794,630,308.02	693,308,233.46	587,452,958.24	620,720,589.60	620,720,589.60
Plenitude e Power	110,476,762.77	-177,211,898.83	205,427,619.16	536,215,395.91	816,598,482.13	816,598,482.13

Source: Own elaboration of Eni (2023d) and market's data.

For the long-term expected growth rates used to project the UFCF in the terminal value, we used the rates suggested by Analyst 1: 1% for Refining & Marketing & Chemicals Services, 0% for Exploration & Production, 0% for Corporate & Other Activities, 1.5% for Global Gas & LNG Portfolio and 2% for Plenitude & Power.

Using the UFCF and the long-term expected growth rates for each segment, we computed the enterprise value for each segment and then the total enterprise value (Table 16).

Table 16 – Computation of the total equity value per share

DCF	Refining & Marketing & Chemicals Services	Exploration & Production	Corporate & Other Activities	Global Gas & LNG Portfolio	Plenitude e Power
EVCore	8,419,307,011	39,488,112,438.53	-	10,346,397,773	11,740,267,685
Σ EVCore	69,994,084,907				
Surplus Assets	15,593,000,000				
Financial debt	11,977,000,000				
Provision	16,053,000,000				
Equity value	**57,557,084,907.11**	Shares in circulation	3,571,487,977		
Equity value per share	**16.12**				

Source: Own elaboration of Eni (2023d) and market's data.

The value computed using SOP method is very close to the value obtained with the standard DCF but is subject to less volatility, since the standard DCF relied on a perpetual dividend growth rate of 2.42%. Besides, this value is also close to the average valuations proposed by analysts (€16.24), higher than Eni's stock price at the valuation date (June 27, 2023, the market price was €12.73), and aligned with major analyses indicating an undervaluation of the stock relative to its fundamental values.

4.2.4 Sum Of the Parts with adjusted beta

The application of the SOP method suggests that Eni is undervalued even before accounting for sustainability. This is because the two analysts who provided the data did not quantitatively integrate sustainability into their valuation tools. Therefore, it is necessary to apply a correction method for sustainability to this model to analyze the stock's dynamics. In this context, the betas used in the SOP are adjusted to account for sustainability factors.

In Section 2, we discuss how the SPICE rating could be used to adjust the beta. Given Eni's high MSCI ESG rating (A), which assesses exposure to sector-specific ESG risks and the company's ability to manage them (similar to SPICE rating criteria), we used the MSCI rating as a proxy for the SPICE rating. Thus, the betas for the different divisions were discounted by 10%. Table 17 shows the new cost of equity and WACC, while Table 18 shows the enterprise value core for each segment of Eni, computed with the adjusted betas and the total value of the firm.

The adjustment of betas increased the equity value, and this value, though not significantly higher than analysts' projections, represents a fundamental value of Eni that includes sustainability.

Table 17 – Coe and Wacc with beta adjusted

		2022	2023	2024	2025	2026	TV
Refining & Marketing & Chemicals Services	**coe**	11.07%	11.28%	11.34%	11.29%	11.25%	11.22%
	Wacc	**6.96%**	**7.19%**	**7.25%**	**7.19%**	**7.15%**	**7.13%**
Exploration & Production	**coe**	10.78%	11.02%	11.09%	11.03%	10.99%	10.95%
	Wacc	**7.06%**	**7.38%**	**7.47%**	**7.39%**	**7.32%**	**7.30%**
Corporate & Other Activities	**coe**	11.07%	11.28%	11.34%	11.29%	11.25%	11.22%
	Wacc	**7.37%**	**7.70%**	**7.79%**	**7.71%**	**7.64%**	**7.62%**
Global Gas & LNG Portfolio	**coe**	10.07%	10.40%	10.49%	10.41%	10.35%	10.30%
	Wacc	**6.83%**	**7.25%**	**7.37%**	**7.26%**	**7.18%**	**7.14%**
Plenitude e Power	**coe**	10.40%	10.69%	10.77%	10.70%	10.65%	10.61%
	Wacc	**6.72%**	**7.03%**	**7.12%**	**7.04%**	**6.98%**	**6.95%**

Source: Own elaboration of Eni (2023d) and market's data.

Table 18 – Equity value per share adjusted for sustainability

DCF	Refining & Marketing & Chemicals Services	Exploration & Production	Corporate & Other Activities	Global Gas & LNG Portfolio	Plenitude e Power
EVCore	9,133,013,501	41,824,736,144	-	11,166,571,035	13,121,789,484
Σ EVCore	75,246,110,163				
Surplus Assets	15,593,000,000				
Financial debt	11,977,000,000				
Provision	16,053,000,000				
Equity value	**62,809,110,163.50**	Shares in circulation	3,571,487,977		
Equity value per share	**17.59**				

Source: Own elaboration of Eni (2023d) and market's data.

4.3 Implementation of new methods for evaluating sustainability: intangibles method

The Real Option Pricing Method, involves using the Black and Scholes formula to estimate the value of intangible assets. The first step is identifying the outgoing and incoming cashflows to quantify the intangible asset. In "Eni for 2022 – Performance di sostenibilità" (Eni, 2023c), Eni

outlines the trend of expenses in research and development and the tangible value generated from 2018 to 2022, summarized in Table 19.

Table 19 – Statement of expenditure in research and development

	2018	2019	2020	2021	2022
Research and development spendingm (in milions of euros)	197	194	157	177	**164**
of which: relating to decarbonisation (a)	74	102	74	114	**114**
renewable energies	22	23	10	18	**17**
energy storage (b) and fusion	2	5	9	13	**16**
capture, storage and conversion of CO2	13	13	9	17	**21**
chemistry from renewable sources	7	20	15	20	**23**
hydrogen and new energy carriers	12	12	12	23	**14**
environment (c)	6	5	5	9	**5**
biorefining	6	8	10	9	**13**
efficiency and energy recovery	6	16	4	5	**5**
of which: safety and risk reduction	25	20	11	8	**4**
of which: other including operational efficiency	98	72	72	55	**46**
Tangible value generated by R&D (in milions of euros)	921	1,126	951	1,253	**1,432**
First patent filing applications (number)	43	34	25	30	**23**
of which: deposits on renewable sources	13	15	7	11	**13**
Patents alive	7,280	7,687	7,471	7,290	**8,029**
Average age of patents (ages)	9.2	9.8	9.2	8.9	**9.2**
Number of R&D partnerships (d) (number)	1.127	1.221	733	766	**930**
of which: with universities and research centres	271	362	204	193	**156**

(a) R&D expenses related to decarbonization are allocated to the path to reducing the footprint of process carbon, circular economy, exploitation of renewable energy and confinement fusion magnetic.
(b) Includes technologies for the accumulation of thermal or electrical energy for subsequent use.
(c) Includes technologies aimed at environmental monitoring, protection and maintenance as well as those of reclamation.
(d) The partnerships consider purchase orders relating to goods and services functional to the R&D activity.
Source: Own elaboration of Eni (2023b)'s data.

The document (Eni, 2023c) also forecasts, differently from the previous strategic plan, an increase in Research and Development (R&D) expenditures from €811 million to €900 million for 2023-2026. The Table 20 shows the projections for R&D expenses for this period and an estimate of the tangible value generated by R&D activities. Since Eni does not specify how to allocate expenses between the years, the €900 million were evenly distributed over four years (2023-2026).

Table 20 – Projections of R&D expenses and tangible value generated by them

	2018	2019	2020	2021	2022	2023	2024	2025	2026
Tangible value generated / R&D expenses	4.6751	5.8041	6.0573	7.0791	8.7317				
Delta	/	24.15%	4.36%	16.87%	23.34%				
Mean of delta	17.18%								
Value / R&D expense ratio projections						10.2319	11.9899	14.0499	16.4638
Research and development expenses						225,000,000	225,000,000	225,000,000	225,000,000
Tangible value generated by R&D						2,302,181,618	2,697,723,753	3,161,224,723	3,704,360,662

Source: Own elaboration of Eni (2023b)'s data.

Table 21 shows the trend of R&D value and of the tangible value generated by R&D activities. These are actual values for 2022 and theoretical values for 2023-2026.

Table 21 – Prospectus of tangible value generated by R&D

	2022	2023	2024	2025	2026
Research and development expenses	164,000,000	225,000,000	225,000,000	225,000,000	225,000,000
Tangible value generated by R&D	1,432,000,000	2,302,181,618	2,697,723,753	3,161,224,723	3,704,360,662

Source: Own elaboration of Eni (2023b)'s data.

To compute Formula 7, we first calculate S0, the sum of the present values of the tangible value generated by R&D (Table 22).

Table 22 - Prospectus of present values of tangible value generated by R&D

	2022	2023	2024	2025	2026
Tangible value generated by R&D	1,432,000,000	2,302,181,618	2,697,723,753	3,161,224,723	3,704,360,662
PV tangible value generated by R&D	1,403,371,227	2,154,487,791	2,418,709,616	2,765,290,324	3,168,881,110
Σ PV tangible value generated by R&D (S0)	**11,910,740,067**				

Source: Own elaboration of Eni (2023b)'s data.

Table 23 shows the sum of the present values of the R&D expenditure, providing the K for Formula 7.

Table 23 – Prospectus of the present value of R&D expenditure

	2022	2023	2024	2025	2026
R&D expenditure	164,000,000	225,000,000	225,000,000	225,000,000	225,000,000
PV R&D expenditure	160,721,286	210,565,382	201,729,203	196,819,390	192,475,386
Σ PV R&D expenditure (K)	**962,310,648**				

Source: Own elaboration of Eni (2023b)'s data.

Using a risk-free rate of 2.04% (average for 2022) and a useful life of 12 years for the intangible asset (as investments in sustainability will be fully operational by 2035), with a variance of 4.10% (given by the sigma squared of the present value or the tangible value generated by R&D expenses), we apply Formulas 8 and 9, and then Formula 7 to find the value of the sustainability intangible (Table 24).

Table 24 – Computation of value of the intangible and value of the intangible per share

d1	21.17691215
d2	20.47561959
N(d1)	1.0000
N(d2)	1.0000
Value of the intangible	**10,948,429,418.77**
Number of shares in circulation	**3,571,487,977**
Value of the intangible per share	**3.065509247**

Source: Own elaboration of Eni's data.

According to Siblis Research Ltd (https://siblisresearch.com/data/price-to-book-sector/), the energy sector has a low price-to-book value multiple compared to other sectors, indicating fewer intangible assets (recorded and unrecorded). This is important because the comparison of the multiple P/BV (price-to-book value) and P/TBV (price-to-tangible book value) shows that any unrecorded intangible assets, if present, could be associated with sustainability.

Table 25 provides information on the tangible and intangible book value of Eni as of June 27, 2023, when the stock price was €12.73. The P/BV multiple being less than 1 is another indicator of an underestimation of the stock.

Table 25 – Computation of the endowment of intangible assets within the price 12.73

Price	12,73
BV	55.230.000.000
Number of shares	3.571.487.977
BV/nr. shares	15,4641
P/BV	0,8232
P/TBV	0,9518
TBV/nr. Shares	13,3747
TBV/BV	86,49%
P - BV	- 2,7341

Source: Own elaboration of Eni (2023d) and market's data.

Table 26 compares the endowment of intangibles (both booked and unbooked) at the SOP-adjusted price (€17.59) and the SOP-unadjusted price (€16.12). The difference in the unbooked intangible assets when the price is €17.59 versus €16.12 is €1.4703, which can be attributed to the computed value of sustainability. This suggests that sustainability is not fully integrated into the cashflows and discount rate but should be analytically included (e.g. adjusting the beta according to ESG parameters) or computed with other methods, such as the Real Option Pricing Method.

Table 26 – Comparison between the endowments of intangible assets

Price	17.59	16.12
BV	15.4641	15.4641
P/BV	1.1372	1.0421
TBV	13.3747	13.3747
Total intangibles	4.2114	2.7411
Booked	2.0895	2.0895
Unbooked	2.1219	0.6516

Source: Own elaboration of Eni (2023d) and market's data.

In conclusion, it is not sufficient to adjust the beta according to the SPICE rating alone. Companies need to develop methods to adjust the beta based on more accurate, company-specific criteria. In fact, despite Eni having a high Bloomberg ESG rating (a disclosure rating), the disclosed information available for the analysts and the market is not enough to accurately modify

the beta. Often, the information is qualitative or not easily convertible into economic values (e.g., disclosure on air quality, waste management policy, gender diversity, workplace safety, composition of the board of directors, etc.).

To confirm this, the beta adjustment using the SPICE rating was insufficient to precisely evaluate all of Eni's ESG investments (in fact, the difference between the SOP-adjusted price and the SOP-unadjusted price is not equal to the value of the intangible of sustainability). If it were sufficient, the intrinsic value obtained with the SOP methos adjusted for sustainability would be €18.52 per share (Book Value per share €15.46 + value of the intangible per share €3.06).

Conclusions

In recent years increasing attention towards corporate sustainability and its measurement has spurred the academia and the industry to elaborate methods to include sustainability in corporate valuation. In this paper, based on an overview of the methodologies proposed in the literature, we compare alternative methods, both traditional and innovative, to account for sustainability as measured by ESG dimensions in determining a company's fair value.

The empirical analysis is based on Eni S.p.A, a global Italian company operating in the utilities and energy sector through its five business units: Refining & Marketing & Chemicals Services, Exploration & Production, Corporate & Other Activities, Global Gas & LNG Portfolio and Plenitude & Power. The analysis refers to 2023, specifically: accounting data used are derived from Eni's balance sheet as of close 2022, while the market data (including discount rates, prices, etc.) are as of June 27th.The choice of the company is based on four main reasons: first, it operates in a crucial sector for the Ecological Transition; second, it declares in its documents (Eni, 2023b; Eni, 2023c; Eni, 2023d) to integrate sustainability policies into its business model; third, it is widely covered by financial analysts; finally, it has a high ESG rating.

The empirical analysis was performed in two steps. First, we compared the market price with the price provided by three main analysts, who declared not to explicitly account for sustainability in their valuations (i.e. resting on the assumption that sustainability is valued by cash flows) or to account for it in a merely subjective way. Second, based on an apparent undervaluation of the market, we tested whether this difference may be due to the market valuation of sustainability. To this end we implemented both traditional methods adjusted for sustainability (SOP and SOP adjusted) and a more innovative one treating sustainability as an intangible (Real Option Pricing Method).

From the empirical comparison of different methodologies a few results emerge. First, all corporate valuation methods accounting for sustainability (SOP adjusted and Real Option Pricing

Method) provide a stock price higher than the market one, pointing to sustainability not being valued (or being negatively valued) by the market. Second, the quantification of the intangible connected to sustainability differs according to the approach taken: comparing the price obtained by the SOP method and the SOP adjusted with beta reveals an unaccounted intangible of €1.47 per share, whereas the Real Option Pricing Method prices intangible asset for €11 billion, i.e. €3 per share. Both values are positive suggesting the sustainability asset could drive-up Eni's market price once analysts factor it into their valuations. Third, the difference in the valuation of the sustainability intangible between the two approaches may be reconnected to the SPICE rating used to adjust the beta in the SOP, whereby such a rating appears to be insufficient to fully capture Eni's ESG commitments, raising concerns on the information content of sustainability ratings currently available.

As a check of the potential increase in Eni stock price connected to sustainability intangibles, we can take Eni stock price at the time of writing that is €14.80 (31 July, 2024), which increased by 16.26% compared to the date of the present paper analysis (€12.73 on 27 June, 2023). While the accuracy of our analysis resting on the inclusion of sustainability factors can be better assessed over the long term, it interesting to observe that, after approximately one year, the market reassessed Eni's stock, driving its price closer to the valuation derived from the sustainability-adjusted SOP (€17.59) and the Real Option Pricing Model (€18.52).

In conclusion, while companies are indeed more sustainable than in the past, sustainability is not an end in itself. It should be viewed as a win-win solution where managerial strategies, influenced by regulations, aim not only to contribute positively to the planet and the society but also to enhance efficiency, optimize resource use, and reduce turnover. This, in turn, boosts both the bottom line and market value, ultimately benefiting shareholders, even as companies embrace a stakeholder-oriented model.

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