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An Analysis of Best Practice Patterns for Corporate Social Responsibility in Top IT Companies

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Abstract: In order to show their compliance with Corporate Social Responsibility (CSR) goals, companies report their “sustainable initiatives” into their CSR reports. However, from small companies to multinational, it is hard to see the real benefits of sustainable strategies’ implementation, since there are actually no general patterns defined which can ensure high impacts on sustainability. Moreover, there are few metrics and process to assess the efficiency of a sustainability strategy, but the different studies made in that field can show different results, this induces a part of uncertainty to evaluate the performance of a sustainable strategy. Therefore, in this paper, we contribute a pattern approach to implementing sustainability in a company. To do that, we performed an analysis of the 25 CSR reports coming from the 25 biggest companies in the IT sector in order to extract sustainability patterns that are provided in an online catalog to (1) give first tracks to companies which would engage in sustainability initiatives and do not really know where to start; and (2) to give an indicator to companies who already have taken up sustainability initiatives and would like to establish an evaluation of it.

Keywords: sustainability; corporate social responsibility; patterns; industry; IT; sustainable strategies

1. Introduction

According to the 2015 Centre for Energy-Efficient Telecommunications (CEET) report [1], Information and Communication Technology (ICT) represents around 2% of the global CO₂ emissions. If we look at the energy consumption of the Internet, it represents between 1.5% and 2% of the world energy consumption, meaning that if the Internet were a country, it would be ranked as the fifth largest energy consumer in the world. This energy consumption is expected to double by 2020 if no actions are taken to reduce it. Moreover, from a social point of view, the increasing level of new technologies released in that sector induces a higher level of complexity in the education for future and current workers.

Behind Information and Communication Technology (ICT) and the Internet, there are all the IT companies which are the entity that can help solve these issues. Unfortunately, it is hard for a company to implement strategies to increase their sustainability since it is time consuming and has a lot of parameters (social, environmental, and economic) on the which a company can have positive impacts. Moreover, most of the recent studies related to companies’ sustainability through the topic of Corporate Social Responsibility (CSR) mainly focus either on economic aspects, such as financial performance [2–4] or marketing [5–8]; or on the performance of specific CSR strategy (employee voluntariness [9], consumer engagement [10], anti-corruption policy [11], etc.). But there are no studies about general CSR strategies that can promise a significant impact on corporates’ sustainability. In other words, there are no CSR patterns for companies that would like to engage into sustainability. Thus, we identified two main research gaps. First, there are no studies analyzing the actual content of CSR

reports in an IT company context. Meaning that there is no research investigating best practices in CSR strategies. Second, which is quite related to the first one, we realized that there is no general set of ready-to-implement sustainable strategies at a global level, most of the research focusing on the impact of a specific initiative or on a specific impact coming from different initiatives. Therefore, our research objective is to extract general patterns showing high impacts on sustainability at an IT company level.

Therefore, our main research question will be what an IT company can do as a means to improve its sustainability. We decomposed this question into four sub-questions:

1. What are the different sustainability initiatives and strategies coming from the biggest IT companies regarding the different dimensions of CSR?
2. What are the success patterns in these strategies and initiatives?
3. What are the different (potential) benefits and outcomes?
4. How to assess or evaluate them using metrics?

In order to answer these questions, we decided to collect the CSR reports coming from the 25 biggest IT companies regarding their annual turnover based on a previous paper [12], available in Appendix A. Our objective is to explore these reports to extract repeatable sustainable strategies regarding the categories defined on ISO 26000 [13], these repeatable strategies will then form a set of sustainability patterns. We then investigate the different compositions of these patterns and cover all the issues described in the precedent paragraphs. We also identify a way on how we can best represent the data model defined in this research, in order to be able to represent the results in an online catalog in the future. In short, the contribution of this research is to carry out an analysis of 25 CSR reports to extract sustainability patterns for sharing them through an online catalog. The study claims that this can help to guide companies willing to engage in sustainability initiatives, but also provides them with an indicator for sustainability evaluation purposes.

2. Background

In this part, we describe the different concepts involved in this research. Starting with an overview of the evolution of the concept of CSR showing its different aspects, we then move to the state of the art of sustainable business practices describing how we can formulate a sustainable business practice and the issues related to its implementation. Finally, we analyze the concept of patterns and define what a pattern in CSR represents for us.

Corporate Social Responsibility (CSR) has been a constant area of investigation since the beginning of the 1950's. According to Carroll's literature review (1999) [14], the first definition of CSR was given by Bowen (1953) [15]. In this definition, Bowen considered the 100 biggest corporate entities as "a vital point of power and decision making", therefore any actions or initiatives of this "vital point" would obviously have an effect on citizens. In other words, this first definition only takes into account social impacts as direct responsibility from corporations.

After this first definition, the concept of CSR went a long way and began to include economic impacts in addition to the social ones. In 1991, Carroll defined CSR as a pyramid build built around four pillars [16]: Philanthropical, Ethical, Legal, and Economic. Moreover, Moir [17] went a bit further and defined three theories to define CSR. The stakeholder theory, which implies that corporates have only an impact on their different stakeholders, and, therefore, that companies should then just try to improve themselves on their effect in this category; the social contract theory which estimates that businesses should consider what matters prior to the society and act depending on society's expectations; this theory is quiet linked to the legitimacy theory which says that corporates should only consider the actions and initiatives that influence their legitimacy, in order to use it as a publicity [17].

In the beginning of the millennium, the international community started to strongly consider climate change as a global and urgent threat which should be fought by inverting its process, this consideration was especially translated by the ratification to the protocol of Kyoto (1997, applied in 2005) [18]. Therefore, the concept of corporate social responsibility had to evolve in order to integrate

these environmental aspects and match the political expectations of society. This has led to a huge proliferation of definitions of CSR between 2000 and 2005 [19]. In order to get an unbiased definition of CSR, Dahlsrud [19] decided to perform a content analysis of 37 definitions of CSR, definitions, which were dated from 1980 to 2003. He concluded that CSR is composed of five dimensions as shown in Table 1.

Table 1. The five dimensions of CSR coming from Dahlsrud [18].

Dimensions	The Definition Is Coded to the Dimension It Refers to	Example Phrases
The environmental dimension	The natural environment	“a cleaner environment” “environmental stewardship” “environmental concerns in business operations”
The social dimension	The relationship between business and society	“contribute to a better society” “integrate social concerns in their business operations” “consider the full scope of their impact on communities”
The economic dimension	Socioeconomic or financial aspects, including describing CSR in terms of a business operation	“contribute to economic development” “preserving the profitability” “business operations”
The stakeholder dimension	Stakeholders or stakeholder group	“interaction with their stakeholders” “how organizations interact with their employees, suppliers, customers and communities” “treating the stakeholders of the firm”
The voluntariness dimension	Actions not prescribed by law	“based on ethical values” “beyond legal obligations” “voluntary”

We can already notice that Corporate Social Responsibility is deriving from the concept of sustainable development at a level of a company; since it includes three pillars, social, economic, and environmental.

In the very beginning of the decade the norm ISO 26000 was published (2010). Herciu (2016) proposed an analysis of this norm [13]. According to her, this norm has the objective to define Corporate Social Responsibility, describing then the different categories of impact of Corporate Responsibility, which are Community involvement, Labor Practices, Environmental, Governance, Fair Operating Practices, Human Rights, and Consumer Issues, as shown on Figure 1.

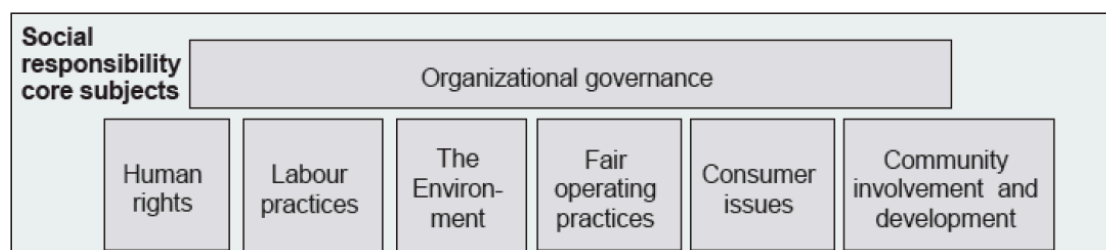


Figure 1. Corporate Social Responsibility Core Subjects according to ISO 26000 [13].

Moreover, the author suggests that the application of this norm would maximize contribution of companies to sustainable development. This contribution is most of the time translated by the implementation of sustainable business practices.

This concept of sustainable business practice is closely related to the concept of sustainable business model. Indeed, the implementation of a sustainable business practice can lead to the emergence of a sustainable business model. A sustainable business model requires innovation to be fully effective [19] and is defined as “business models that incorporate pro-active multi-stakeholder management, the creation of monetary and nonmonetary value for a broad range of stakeholders, and

hold a long-term perspective” [20]. A sustainable business practice can be seen as the implementation of sustainable strategy. According to the authors of a previous paper [21] there is a long way between formulation of a sustainable strategy and its implementation that induce a delay between the conception of a sustainable business practice and its implementation. Moreover, the conception of a particular sustainable business practice may not be mature enough for implementation and requires a maturity measurement, which consumes even more time. Finally, even if the publication of articles related to sustainable strategy investigation from a project point of view is recently emerging [22], most are coming from the literature and not from a company perspective. Therefore, it could be interesting to provide a set of mature sustainable strategies for a company which would like to start engaging into sustainability. In order to be easily broadcasted and to be simple to reproduce we decided to orient ourselves into a pattern approach for sustainable strategy.

In fact, we are surrounded by patterns. They can be found approximately everywhere, in a natural state in fields, like genetics, biology, or chemistry for example; or at an artificial state in architecture, software, or electronics. Historically, patterns were mostly used in architectural design [23] which explains the two first definitions of patterns provided in the website of Oxford English Dictionary [24]:

- “A repeated decorative design”
- “A model or design used as a guide in needlework and other crafts”

Then, patterns started to be used in engineering, which explains the third definition contained in the Oxford English Dictionary: “An example for others to follow” [24]. Therefore, according to these three definitions, we can consider a pattern as something “repeatable” which is used as “a model” created in order to be broadcasted for “others to follow”. These definitions of a pattern are easy to understand; however, we are using them to give a general idea of what is a pattern. In order to get a more precise idea of it, we went to the side of Tešanovic [25]. She describes a pattern as an artifact which is made of three components: a context, which refers to the scope of the pattern; a problem which refers to a set of forces which appears in the context; and, finally, a solution, which, refers to a configuration adopted to resolve forces generated by the problem. Obviously, additional components can be added to a pattern structure (such as benefits, consequences, relations with other patterns, etc.) depending on their fields and specificities. In our case, a pattern will be considered as successful when it has a positive impact on one of the categories defined in ISO 26000. In case of two patterns affecting the same metric, we keep the one with the highest impact on this metric.

Finally, in terms of sustainability evaluation, there are several studies that provide different metrics and processes for evaluation. Unfortunately, these metrics and processes are either not global or related to the IT industry field. Indeed, if we look at the metrics of a previous study [26], which is related to measuring CSR performance, we can notice that the authors mainly focus on economic performance and especially on the link between CSR practices and profitability, moreover, this study only consider three dimensions of CSR (environmental, Human Resources, customer and suppliers). If we look now at the metrics of another past paper [27], that aims to evaluate efficiency and sustainability of CSR strategies, we can see that the authors only take into account qualitative metrics and base their evaluation on a survey. Nevertheless, studies that take into account global sustainability evaluation do exist. They are not related to the IT industry, but are related to other sectors such as airlines [28] or urban transportation [29] for example. Thus, our objective in this research is to provide for each strategy a set of quantitative and qualitative metrics related to the different dimensions of CSR defined in ISO 26000.

To give an overall conclusion on this part, we can notice that we set up an innovative approach compare to other studies. Indeed, we based our analysis on CSR reports, meaning that these reports are considered as raw materials for our study. Moreover, we mainly focus on the whole content of CSR and not only focus on specific initiatives, as we are interested by all the three aspects of sustainability (social, economic, and environmental) and not a particular one.

3. Materials and Methods

As we stated at the end of our introduction, our objective is to extract repeatable strategies in CSR reports coming from the 25 best IT companies, in order to build a pattern from it. Our applied methodology is the following. First, we gathered a list of companies in order to collect their CSR reports. If we look at Appendix A (Table A1), we can notice that we collected 20 reports out of 25, these 5 missing reports either did not exist or were not accessible publicly.

Once we aggregated the reports, we needed to define the evaluation criteria to evaluate their quality and classify and categorize the contents as well as the strategies. Using these criteria, we performed a qualitative and quantitative analysis for each report, to finally analyze the repeatability of each strategy and build patterns. In this research, we only consider information referenced in CSR reports, meaning that, if a company did not speak about a strategy that it implements, this strategy was not taken into account.

Before starting our analysis, we define different evaluation criteria on which it will rely on. We will define two different types of criteria, which are showed in Appendix B.

First, the content criteria, this one served us to categorize the content of each reports and classify the strategies regarding the categories. We developed these categories on the basis of the seven defined in the ISO 26000. We could have used another popular standard which is the GRI Guidelines for CSR reporting which is very used among the reports, but our choice of ISO 26000 was motivated by a comparison study [30] which shows that ISO is the most complete evaluation criteria to compare different CSR. However, the norm is not totally complete and misses a component: the employee social responsibility as suggested previously [31]. To overcome this lack, we decided to add this employee responsibility into the labor practices category. We then referenced all the strategies contained in each report regarding these categories (Appendix B, Table A2) in the analysis.

Second, according to the authors of a previous paper [17], companies might use these CSR reports to gain some notoriety and communicate around it. Moreover, the investigated companies and the authors who wrote these reports represent the same entity. Thus, we needed to define quality criteria to evaluate the quality of each report in order to have trust in the strategies and results described in them. Habek and Wolniak came up with a factorial analysis on quality evaluation criteria for CSR reports [32]. This analysis followed a previous framework developed by the duo (2015) [33] in the which they explain how to use the criteria to evaluate the quality of CSR by scoring from 0 to 4 (0: no information about the criterion, 1: little mention, 2: most important aspects included, 3: detailed information included, 4: best practices/original practice), on one hand, the credibility of information; and the relevance of information (Appendix B, Table A3) on the other. Afterwards they calculate the mean of the credibility score (Cm) (Equation (1)) and the mean of the relevance score (Rm) (Equation (2)), to finally calculate the quality score (Qs) (Equation (3)) of the report by calculating the mean of Cm and Rm's sums.

$$Cm = (C1 + C2 + \dots + C5 + C6)/6, \quad (1)$$

$$Rm = (R1 + R2 + \dots + R10 + R11)/11, \quad (2)$$

$$Qs = (Cm + Rm)/2. \quad (3)$$

Once our criteria were defined, we performed a content analysis for each report according to the ISO 26000 categories they are impacting. In other words, we investigated all the reports and referenced all the strategies described inside it. We referenced the pages regarding the information they were containing: the one describing the different strategies, those including the data associated with the strategies, those providing concrete examples of a given strategy, and finally, those describing the outcomes of the strategy, as shown in Table 2. Then we evaluated the repeatability of each strategy among the reports to define patterns.

Table 2. Example of the strategy referencing of AT&T's CSR report using the ISO 26000 criteria (This report didn't mention any strategy about human rights this is why the category does not appear in the table).

Community	Labor Practices	Governance	Environmental	Fair Operating Practices	Consumer Issues
Develop sensitization campaign p8	Provide training to employees p8	Collaborate with other companies/create international standards p9,14,16	Implement energy efficiency projects p9 d9	Encourage suppliers to track their GHGe p15 o15	Provide online instructions for use p8
Fund/Participate to educational program/projects p10 d10,17,18	Employee reward program p8	Set clear sustainability objectives p11–19	Carbon savings program p9 o12	Sustainability code of conduct for suppliers p15	Provide online references about products' environmental impacts p9,12,3 o12,13
Provide their own teaching platform p10 d10	Employee volunteering program p8 d8,7	Reduce energy consumption of the company p12 o12	Supplier scorecard system p15		Provide products/services which help customers to increase their own sustainability p14
Enhance people connectivity to internet p12 o12	Build diverse and inclusive workforce p8	Use/produce their own renewable energy p12			Propose a take back program to recycle products p13 o13
Connect disadvantaged people p12 o12,18		Use/promote alternative vehicles p12 p12			
Fund social actions programs p17,18,19		Design energy efficient products/services p9			
Build their own charity foundation p10					

After the repeatability analysis had been done, we carried out a qualitative analysis on the different reports, using the quality criteria described in the previous section. Thus, we used a qualitative coding software, Saturateapp [34]. We choose this software because it is an online tool, which allows users to share their coding with peers if they request it. We used this tool to code each paragraph of each CSR report which is in relation with the quality criteria. In order, at the end, to get an overview of the quality of each report and, then, distribute the quality score among the reports.

4. Results

4.1. Content Analysis

We counted the number of strategies shown in each category in each report. If every category had the same weight in terms of consideration, we would have an occurrence frequency around 15%. As we can see in Table 3, Consumer issues and Human rights are particularly under-represented in the reports and Fair operating practices are lightly taken into account. Despite that, we can see that the four remaining categories are more or less equally distributed.

Table 3. Number of strategies per category in all the reports and the frequency of occurrence of each category.

Category	Total	Frequency of Occurrence (%)
Community	115	16.55
Labor Practices	131	18.85
Governance	142	20.43
Environmental	147	21.15
Fair Operating Practices	78	11.22
Human Rights	34	4.89
Consumer Issues	48	6.93
Total	695	100

After that we analyzed the repeatability of 36 strategies which seemed to be reiterated in a sufficient sample of reports. Each strategy has an identifier defined by the category it is impacting and possibly two numbers: CAT XY, CAT is the name of the category, X is the number of the strategy in this category, and, optionally, Y the number of the sub-initiative of the strategy X, this sub-initiative will be considered as an additional component of a particular strategy. We defined repeatability as a percentage representing the number of reports mentioning this strategy out of the total number of reports. We set up a repeatability threshold (75%) under which we estimated that the strategy is not repeatable enough to be taken into consideration. All the strategies satisfying this threshold are surrounded in green, except for the one that reach exactly 75%.

As shown below on Table 4, out of the 36 evaluated strategies, 16 were above the threshold and 5 exactly reached 75% for a total of 21 potential strategies. But, repeatability should not be considered as the only metric to include a strategy into the patterns building process. We will combine this repeatability with the mean of the quality score of the reports containing it to define a new metric: the level of confidence.

Table 4. Repeatability in percentage of each of the 36 evaluated strategies. (The lines in grey mean that the strategy reached the repeatability threshold we set up).

- (a) Repeatability in percentage of the different strategy impacting community involvement and development.

ID	Name	Repeatability (%)
COM1	Support educational projects or actions	90
COM11	Create their own educational platform	45
COM12	Provide scholarships	35
COM2	Support social projects, actions or non-profit organizations	95
COM21	Health	35
COM22	Undeserved people	65
COM23	Environmental	50
COM24	Societal	35
COM25	Create their own charity foundation	45
COM26	Participate to sensitization campaigns	35
COM27	Encourage employees' donations	35
COM3	Enhance access to technology in the community	60
COM4	Donations after humanitarian disasters	45
COM5	Economic empowerment of the community	45

- (b) Repeatability in percentage of the different strategy impacting Labor practices.

ID	Name	Repeatability (%)
LP1	Provide training to employees	85
LP11	Skills training	80
LP12	Career management	70
LP2	Encourage employees to volunteer	90
LP3	Organize employee award ceremony	40
LP4	Employee well-being program	80
LP41	Health and safety management	80
LP42	Compensations program	60
LP5	Sensitize employees to environmental issues	80
LP6	Build diverse and inclusive workforce	85
LP7	Employees' feedback	65

- (c) Repeatability in percentage of the different strategy impacting Governance.

ID	Name	Repeatability (%)
G1	Set clear sustainability objectives through dedicated team(s)	90
G2	Use standardized measurements tools or methods	45
G3	Collaborate with peers	90
G31	Comply with regulations, laws, standards and norms	80
G32	Participate to the creation of laws, regulations, standards and norms	85
G33	Engage stakeholders in the definition of sustainability objectives	55
G4	Sustainability Management	75
G41	Implement Risk Management	50
G42	Implement Environmental Management System (EMS)	70
G5	Transparency	100
G51	Report environmental impacts	100
G52	Report political contributions	35
G53	Report charity donations	70
G6	Create Code of Conduct	65

(d) Repeatability in percentage of the different strategy impacting Environment.

ID	Name	Repeatability (%)
ENV1	Produce or use renewable energy	90
ENV2	Energy Efficiency	90
ENV21	Products or services	60
ENV22	Facilities	75
ENV23	Projects in the company	60
ENV3	Design ecological products	85
ENV31	Circular economy	70
ENV32	Hazardous material	65
ENV4	Resource efficiency	90
ENV41	Paper	55
ENV42	Water	70
ENV43	Waste Generation	85
ENV5	Propose alternative solutions for commuting, transportation	75
ENV51	Alternative vehicles	60
ENV52	Air travel reduction program	40
ENV53	Car pooling	30
ENV6	Involve in biodiversity or nature conservation activities	40

(e) Repeatability in percentage of the different strategy impacting Fair operating practices, Human rights and Consumer issues.

ID	Name	Repeatability (%)
FOP1	Supplier Code of Conduct	75
FOP2	Sensitize supply chain to sustainability	95
FOP3	Build a diverse supply chain	60
FOP4	Proceed audits in the supply chain	45
FOP5	Avoid conflict mineral usage	60
HR1	Conflict free mineral policy	60
HR2	Data privacy and security policy	75
HR3	Sensitize employees to Human Rights	50
CONS1	Provide end of Life Management	75
CONS2	Provide products or services which help customers to increase their own sustainability	85
CONS3	Design accessible products	35
CONS4	Provide information about environmental impacts of their products	30

4.2. Quality Analysis

To define the level of confidence, we performed a quality analysis. This analysis allowed us to give a quality score, between 0 and 4, to each report. The results of this analysis are shown in Table 5. We can see that the average of the quality of our reports is 2.1975. Meaning that our reports include, on average, the most important aspects of the different quality criteria. Even if some criteria are poorly covered among the reports; especially for C5 (possibility to give feedback) and C6 (independent verification).

The level of confidence is defined as following: for each strategy we will calculate the mean of the quality score of the report containing it. In other words, if a strategy is contained in n reports we will add the quality score of these n reports divided by the number, n , of reports to obtain the quality mean of a strategy (Q_{tm}) (Equation (4)). Then, we combine Q_{tm} with the repeatability of the strategy among the reports to obtain the level of confidence (L_c) (Equation (5)) of a particular strategy k .

$$Q_{tm} = (Q_1 + Q_2 + \dots + Q_{(n-1)} + Q_n) / n, \quad (4)$$

$$L_c(k) = \text{Repeatability}(k) \times Q_{tm}(k). \quad (5)$$

Then we define our thresholds using the previous strategy for repeatability (75%), and the average of the quality of the reports (Table 5) which is 2.1975. Thus, our level of confidence threshold to

consider a strategy will be 1.648125 (Equation (6)), under which, a strategy will not be used to build a pattern.

$$Lc(k) \geq 0.75 \times 2.1975. \quad (6)$$

If we look now at Table 6, we can see that we obtained very similar results compared with the repeatability analysis since only one strategy (ENV 5) did not reach the threshold. We are now able to rank our strategies regarding their level of confidence and define the most appropriate strategy in case of two patterns affecting the same metrics. In order to get a scoring which is more representative, we also defined a relative level of confidence (Confidence score), which represents the ratio between the level of confidence and the maximum level of confidence reachable (2.1975) expressed with a 0 to 10 score.

Table 5. Quality score of the reports from the highest to the lowest and all the different quality criteria.

Company	Credibility Score	Relevance Score	Quality Score
HP	2.67	3.36	3.12
Microsoft	2.17	3.64	3.12
Cisco	2.50	3.36	3.06
Intel	2.67	3.38	3
Xerox	1.5	3.09	2.53
Qualcomm	2.17	2.55	2.41
IBM	1.5	2.82	2.35
CSC	1.83	2.55	2.29
Cognizant	1.67	2.55	2.24
Verizon	1.67	2.55	2.24
EMC	2	2.77	2.18
Oracle	1.5	2.36	2.06
AT&T	1.33	2.18	1.88
Western Digital	1.67	1.91	1.82
Apple	2	1.64	1.76
Arrow	1.5	1.82	1.71
Google	1.5	1.82	1.71
Comcast	1.5	1.73	1.65
Avnet	1.17	1.64	1.47
Century Link	0.83	1.64	1.35
Average	1.7675	2.433	2.1975

Table 6. The level of confidence of each strategy based on a 0 to 4 scale for the global level of confidence and on a 0–10 for the confidence score. (The lines in grey mean that the strategy reached the quality threshold we defined.)

- (a) Level of confidence and confidence score of the different strategy impacting community involvement and development.

ID	Name	Global Level of Confidence	Confidence Score (Out of 10)
COM1	Support educational projects or actions	2.02	9.18
COM11	Create their own educational platform	1.06	4.08
COM12	Provide scholarships	0.75	3.41
COM2	Support social projects, actions or non-profit organizations	2.11	9.59
COM21	Health	0.78	3.55
COM22	Undeserved people	1.47	6.68
COM23	Environmental	1.07	4.86
COM24	Societal	0.67	3.05
COM25	Create their own charity foundation	1.05	4.77
COM26	Participate to sensitization campaigns	0.69	3.14
COM27	Encourage employees' donations	0.75	3.41
COM3	Enhance access to technology in the community	1.37	6.23
COM4	Donations after humanitarian disasters	1.09	4.95
COM5	Economic empowerment of the community	1.11	5.05

(b) Level of confidence and confidence score of the different strategy impacting Labor practices.

ID	Name	Global Level of Confidence	Confidence Score (Out of 10)
LP1	Provide training to employees	1.94	8.82
LP11	Skills training	1.87	8.5
LP12	Career management	1.62	7.36
LP2	Encourage employees to volunteer	2.02	9.18
LP3	Organize employee award ceremony	0.87	3.95
LP4	Employee well-being program	1.82	8.27
LP41	Health and safety management	1.82	8.27
LP42	Compensations program	1.47	6.68
LP5	Sensitize employees to environmental issues	1.82	8.27
LP6	Build diverse and inclusive workforce	1.94	8.82
LP7	Employees' feedback	1.54	7

(c) Level of confidence and confidence score of the different strategy impacting Environment.

ID	Name	Global Level of Confidence	Confidence Score (Out of 10)
ENV1	Produce or use renewable energy	1.99	9.05
ENV2	Energy Efficiency	2	9.09
ENV21	Products or services	1.41	6.41
ENV22	Facilities	1.69	7.68
ENV23	Projects in the company	1.44	6.55
ENV3	Design ecological products	1.95	8.86
ENV31	Circular economy	1.68	7.64
ENV32	Hazardous material	1.53	6.95
ENV4	Resource efficiency	1.98	9
ENV41	Paper	1.17	5.32
ENV42	Water	1.61	7.32
ENV43	Waste Generation	1.87	8.5
ENV5	Propose alternative solutions for commuting, transportation	1.55	7.05
ENV51	Alternative vehicles	1.23	5.59
ENV52	Air travel reduction program	0.84	3.82
ENV53	Car pooling	0.58	2.64
ENV6	Involve in biodiversity or nature conservation activities	0.94	4.27

(d) Level of confidence and confidence score of the different strategy impacting Fair operating practices, Human rights, and Consumer issues.

ID	Name	Global Level of Confidence	Confidence Score (Out of 10)
FOP1	Supplier Code of Conduct	1.74	7.91
FOP2	Sensitize supply chain to sustainability	2.11	9.59
FOP3	Build a diverse supply chain	1.46	6.64
FOP4	Proceed audits in the supply chain	1.14	5.18
FOP5	Avoid conflict mineral usage	1.44	6.55
HR1	Conflict free mineral policy	1.44	6.55
HR2	Data privacy and security policy	1.77	8.05
HR3	Sensitize employees to Human Rights	1.25	5.68
CONS1	Provide end of Life Management	1.67	7.59
CONS2	Provide products or services which help customers to increase their own sustainability	1.85	8.41
CONS3	Design accessible products	0.83	3.77
CONS4	Provide information about environmental impacts of their products	0.69	3.14

(e) Level of confidence and confidence score of the different strategy impacting Governance.

ID	Name	Global Level of Confidence	Confidence Score (Out of 10)
G1	Set clear sustainability objectives through dedicated team(s)	2.04	9.27
G2	Use standardized measurements tools or methods	0.95	4.32
G3	Collaborate with peers	2	9.09
G31	Comply with regulations, laws, standards and norms	1.8	8.18
G32	Participate to the creation of laws, regulations, standards and norms	1.89	8.59
G33	Engage stakeholders in the definition of sustainability objectives	1.39	6.32
G4	Sustainability Management	1.72	7.82
G41	Implement Risk Management	1.21	5.5
G42	Implement Environmental Management System (EMS)	1.61	7.32
G5	Transparency	2.2	10
G51	Report environmental impacts	2.2	10
G52	Report political contributions	0.89	4.05
G53	Report charity donations	1.61	7.32
G6	Create Code of Conduct	1.51	6.86

4.3. Evaluating Impacts

For the set of 20 strategies, we evaluated their impact on sustainability so that future users can predict and assess the application of one of these strategies. The metrics will be social, economic, or environmental, according to the dimensions. Most are included in the CSR reports themselves and directly linked to the strategy they are related. For example, Table 7 shows the one used for the pattern ENV1. Moreover, as suggested previously [35], we also evaluated sustainability by assessing Sustainable Development goals (SDG) defined by the United Nations [36]; referenced in Appendix B. We decided to extend this methodology by including the evaluation of the Paris Agreement Objectives [37] where possible. In other words, we provide conventional metrics to measure sustainability impacts of the repeatable strategies, but we also link these strategies to the UN SDGs and/or the Paris Agreement objectives that they are impacting. So, if we keep taking the example of ENV1 the related SDG will be: UN Sustainable Development Goal 7: “Affordable and clean energy” and, for the Paris Agreement, Paris Agreement Article 2b and c.

Table 7. Example of metrics to evaluate strategies with the example of ENV 1.

ID	Name	Metric	Problematic
ENV1	Produce or use renewable energy	CO ₂ emissions per year(tons/year)	Paris Agreement Article 2b
		Part of renewable energy in the energy mix (%)	Paris Agreement Article 2c
		kWh of renewable energy produced (kWh/year)	UN Sustainable Development Goal 7
		kWh of renewable energy bought (kWh/year)	

4.4. Defining a Pattern Structure

As a final step, we defined our pattern structure, or, more precisely, our data-model. As a reminder, a pattern is defined around three main components [24]: context, problem, and solution. In our case we decided to define each component with several elements. The context is defined by four elements: its name, its level of confidence among the set of reports, its time of effectiveness (short, mid, and long term), and its ISO 26000 category; then, the problem is represented by three elements: the international regulations it impacts (Paris Agreement or SDGs), the metrics needed to evaluate the impacts, and the outcomes of the pattern; finally, the solution is modeled by three elements: the description of the pattern, the examples of its application coming from the reports, and the potential additional components related to the pattern. We then developed an UML representation of our pattern structure using these ten elements as shown in Figure 2.

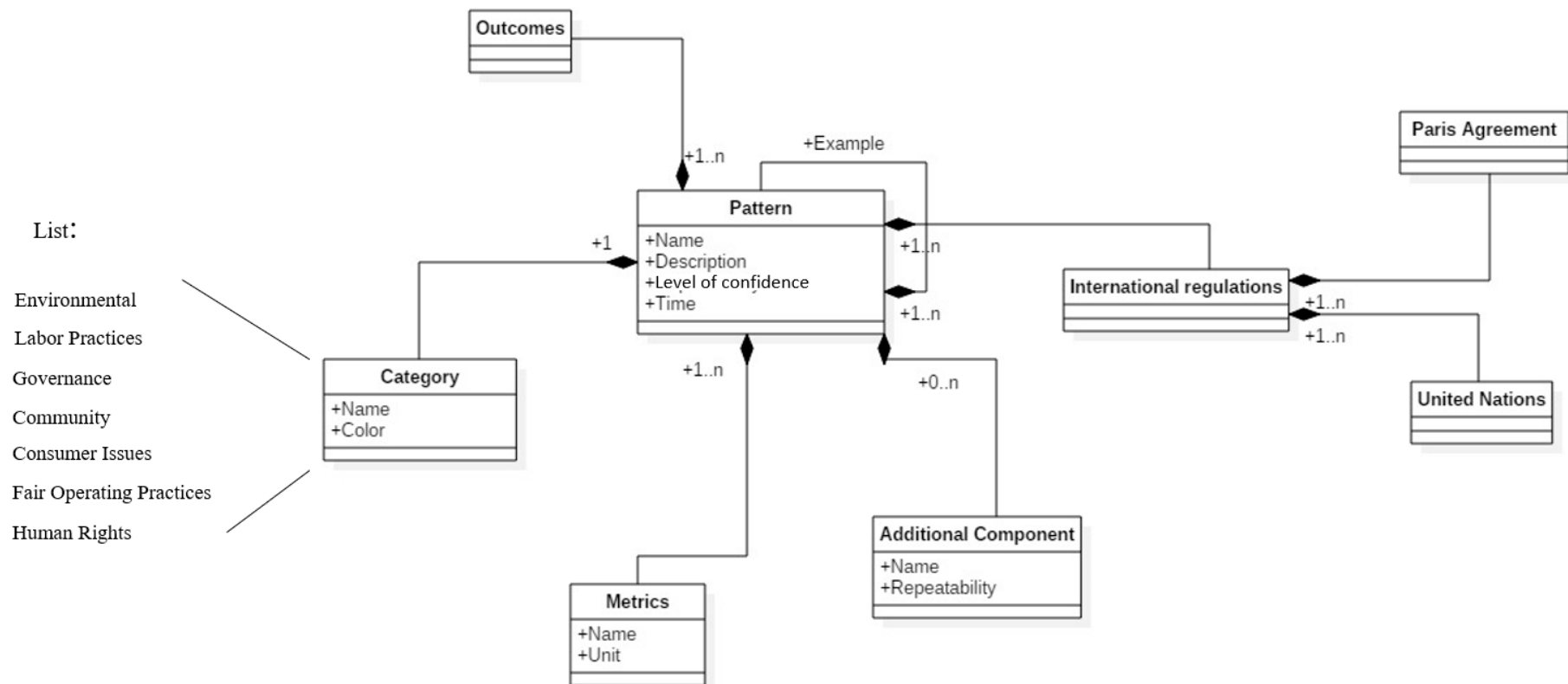


Figure 2. UML representation of the pattern structure.

The class “category” can take only one of the seven values defined in its list, the class “example” is considered as an instantiation of the class “pattern” since it represents example of application of the pattern. This representation will be used to define our data-model for the future implementation of an online reference catalog.

5. Discussion

In this part we discuss the different results and contributions highlighted in this research. First, we used a qualitative method to evaluate CSR reports. We based this on two frameworks evaluating different aspects of the reports, the quality and the content. Regarding the quality, our set of reports had, on average, good quality since the average quality score indicates that the reports were including the most important aspects of credibility and relevance of information defined in the framework [32] (shown in Appendix B) even if some aspects were poorly covered (e.g., possibility to give feedback and independent verification). For the content analysis, depending on the categories we looked at, the results were satisfactory. Indeed, most of the reports focused on environmental, labor practices, governance, and community strategy categories, which explains why we were able to extract more patterns for these categories. Based on the results of this analysis we were able to classify our different strategies to rank them using the level of confidence we defined. Based on our results, we defined a data-model that we can apply to all our patterns and decided to create descriptive documents for all of them. As shown below on Figure 3 with the example of “LP6: Build a diverse and inclusive workforce”.

LP6: Build Diverse and Inclusive Workforce

Time of Effectiveness	Mid-term Long-term
Repeatability	85% (17 reports out of 20)
Level of Confidence	8.82/10
Category	Labor Practices
Outcomes	<ul style="list-style-type: none"> Promote Connection between employees with the same culture Allows employee to have a more diverse point of view in their decision making Give opportunity to undeserved communities Promote equality between human beings
Metrics	<ul style="list-style-type: none"> Part of employee by ethnicity per position (%/ethnicity/position) Part of women per level of position (%/position) Satisfaction and engagement of employees who followed the trainings (survey)
Problematic	<ul style="list-style-type: none"> UN SDG 5: Gender Equality UN SDG 8: Decent work and economic growth UN SDG 10: Reduced inequalities
Additional Components	None

Figure 3. Cont.

Description

Nowadays, diversity and inclusivity started to be crucial aspects and challenges of our society. Inclusivity concerns every action which is taken in order to reach a better representativity of women in a company; diversity is the same idea applied to ethnicity. In order to promote it, and also to show the way in those fields, companies implemented measures and policy to apply these aspects. The policies can vary depending on the company but most of the time concern: men/women parity and equality of salary, employment programs for undeserved communities, ethnic diversity in the leading positions or the creation of community-based research groups.

Example: Intel (p.34-36, 41)

Intel took several initiatives in order to create a more inclusive workforce. They created a Network of Executive Women, in 2015 the memberships to that network increased by 35%. They also claim that they reached a 100% pay parity between men and women. Regarding diversity, they organized different diverse hiring events and were hoping to reach 40% of diverse hiring for 2015, they exceeded that goal and reached 43.1%. Moreover, they created different research group to link employees with common interest and became then more attractive for underrepresented peoples. In terms of statistics, the progress regarding diversity and inclusivity at Intel are shown on the table on the right coming from Intel report.

U.S. Representation versus Intel Market

	EOY 2014	EOY 2015
Female	23.5%	24.8%
Technical Female	19.0%	20.1%
Non-technical Female	51.8%	50.7%
Underrepresented Minorities	12.3%	12.4%
Technical African American	3.3%	3.3%
Technical Hispanic	8.1%	8.1%
Technical Native American	0.5%	0.5%
Non-technical African American	4.1%	4.4%
Non-technical Hispanic	9.6%	9.9%
Non-technical Native American	0.5%	0.6%

Figure 3. Document referencing LP6: Build a diverse and inclusive workforce.

Regarding the limitations and different challenges faced in this research, we can first notice that our scope of research was based on a particular ranking of IT companies which is only based on annual turnover of the companies. It could be interesting to pursue a similar work with a different type of ranking, for example, the most innovative companies.

We note that there are a few threats to validity for this work. First, our quality analysis might have been influenced by a subjectivity bias. In other words, the classification results of our analysis according to the framework were influenced by the individual perception of the authors. One way to overcome this obstacle is by asking an external expert to perform an additional classification to then compare both results. Unfortunately, it was not possible to do this in our context due to circumstantial constraints. However, a slight difference in the precise classification would not influence the identification or nonidentification of a pattern, therefore this threat can, in the worst case, only have a minor influence on the presented results.

Second, a subjectivity bias also may also have influenced the content analysis. Indeed, for some strategies it was hard to determine and decide the most closely related ISO 26000 category. If we take the example of “LP2: encourage employee to volunteer”, which consists of encouraging employees to provide voluntary activities for the community such as teaching or helping associations without getting paid. We can see that this particular strategy is between the categories “Community involvement and development” because the volunteer activity has obviously social impacts and “Labor Practices” because it is employees who are providing the volunteering. So, for this particular pattern, we decided to put it under the category of “Labor practices” but in its description we mention the strong relationship between “LP2: encourage employee to volunteer” and “COM2: Support social projects, actions, non-profit organizations”. We see this mainly as a problem of predominant decomposition, as the categories in ISO 26000 do overlap in their instances. A deeper analysis investigating the relation between patterns would be interesting to conduct. However, also in this case, the threat only refers

to the predominant related category and would, in the worst case, lead to minor corrections in the descriptions of the identified patterns.

Finally, the biggest challenge we faced was during the extraction of the different strategies and their definition. Indeed, it was hard to determine the most suitable level of granularity and detail. In other words, we had to determine the appropriate level of abstraction such that the patterns would not describe too specific initiatives. We decided then to stay into a high level of generalization, and, if a very particular initiative was stated many times among the reports we decided to define it as an additional component of a specific pattern. For example, “ENV3: Design ecological products” includes two additional components: reusing material by applying a circular economy and reducing the proportion of hazardous materials in the manufacturing of products. We can see that even if these two initiatives do not seem very close to each other, they both fall under the general idea of designing ecological products.

6. Conclusions

In this research, we presented an analysis and extraction of patterns from a set of CSR reports of the 25 biggest IT companies. From the analysis, which is based on the combination of two frameworks designed to evaluate CSR, and the UML representation of our patterns’ data model, in which we defined all components of our patterns through different elements. Before our contribution, most of the research in the area of CSR mainly focuses either on CSR performance or on the different ways to report it. In our approach, we evaluated the content of a particular set of reports in order to extract strategies for companies.

We plan to repeat this analysis on a different ranking of companies (e.g., most innovative IT companies) in order to increase the trust in our patterns and update the different strategies. The long-term goal is to help companies to be more and more sustainable with time by disseminating these patterns to a wide audience. For dissemination, we are developing a software tool, more precisely an online catalog, which will reference all our patterns; it is already being partially implemented as a prototype. All the strategies we identified and described are shown in Table 8. All pattern descriptions are available for the reviewers at <http://TinyURL.com/ybtvd9h5> and will receive a permanent location upon acceptance of the article.

Table 8. The list of all the patterns and their related additional components extracted at the end of our analysis.

ID	Name
COM1	Support educational projects or actions
COM11	Create their own educational platform
COM12	Provide scholarships
COM2	Support social projects, actions or non-profit organizations
COM21	Health
COM22	Undeserved people
COM23	Environmental
COM24	Societal
COM25	Create their own charity foundation
COM26	Participate to sensitization campaigns
COM27	Encourage employees’ donations
LP1	Provide training to employees
LP11	Skills training
LP12	Career management
LP2	encourage employee to volunteer
LP4	Employee well-being program
LP41	Health and safety management
LP42	Compensations program

Table 8. Cont.

ID	Name
LP5	Sensitize employee to environmental issues
LP6	Build diverse and inclusive workforce
G1	Set clear sustainability objectives through dedicated team(s)
G3	Collaborate with peers
G31	Comply with regulations, laws, norms
G32	Participate to the creation regulations, laws, norms
G33	Stakeholder engagement
G4	Sustainability management
G41	Implement risk management
G42	Implement Environmental Management System (EMS)
G5	Transparency
G51	Report environmental impacts
G52	Report political contributions
G53	Report charity donations
ENV1	Produce or use renewable energy
ENV2	Energy efficiency
ENV21	Products/services
ENV22	Facilities
ENV23	Projects in the company
ENV3	Design ecological products
ENV31	Circular economy
ENV32	Hazardous materials
ENV4	Resource efficiency
ENV41	Paper
ENV42	Water
ENV43	Waste generation
FOP1	Supplier Code of Conduct
FOP2	Sensitize supply chain to sustainability issues
HR2	Data privacy and security policy
CONS1	Provide end of life management
CONS2	Provide products or services which help customers to increase their own sustainability

Author Contributions: Conceptualization, B.P.; Methodology, B.P.; Validation, B.P.; Investigation, G.D.; Resources, B.P.; Data Curation, G.D.; Writing—Original Draft Preparation, G.D.; Writing—Review & Editing, G.D., B.P.; Visualization, G.D.; Supervision, B.P.; Project Administration, G.D., B.P.; Funding Acquisition, G.D.

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Appendix A. IT Companies Investigated during This Study

Table A1. List of the 25 IT companies and the existence of their CSR reports (Y for yes, N for no) from a previous study [12]; from 2015 if year not mentioned.

Company	Reference Website	CSR Available	CSR Link
Apple	www.apple.com	Y	https://www.apple.com/environment/pdf/Apple_Environmental_Responsibility_Report_2015.pdf
AT&T	www.att.com	Y	http://about.att.com/content/dam/csr/sustainability-reporting/PDF/2016/ATT-Annual-Update.pdf
Verizon	www.verizon.com	Y	http://www.verizon.com/about/sites/default/files/annual/verizon-annual-2015/downloads/2015_Verizon_Corporate_Responsibility_Supplement.pdf
Amazon	www.amazon.com	N	
Hewlett Packard	http://www8.hp.com/	Y	http://www8.hp.com/h20195/v2/GetPDF.aspx/c05154920.pdf
Microsoft	www.microsoft.com	Y	https://www.microsoft.com/about/csr/downloadhandler.ashx?Id=02-01-12
IBM	www.ibm.com	Y	https://www.ibm.com/ibm/responsibility/2015/assets/downloads/IBM_2015_CR_report.pdf
Alphabet (Google)	www.abc.xyz	Y	https://abc.xyz/investor/pdf/google-2016-environmental-report.pdf
Comcast	www.xfinity.com	Y	http://corporate.comcast.com/images/2015-Corporate-Social-Responsibility-Report.pdf
Intel	www.intel.com	Y	http://csrreportbuilder.intel.com/PDFfiles/CSR-2015_Full-Report.pdf
Cisco	www.cisco.com	Y	http://www.cisco.com/assets/csr/pdf/CSR_Report_2015.pdf
Ingram Micro	http://www.ingrammicro.com/	N	
Oracle	www.oracle.com	Y	http://www.oracle.com/us/corporate/citizenship/corporate-citizenship-report-2563684.pdf
Avnet	www.avnet.com	Y (2014)	http://www.avnet.com/en-us/who-we-are/Documents/Avnet-CSR-Report.pdf
TechData	https://www.techdata.com/	N	
Qualcomm	www.qualcomm.com	Y	https://www.qualcomm.com/media/documents/files/2015-qualcomm-sustainability-report.pdf
EMC	www.emc.com	Y	http://www.emc.com/collateral/sustainability/emc-2015-annual-report.pdf
Arrow Electronics	www.arrow.com	Y	http://community.arrow.com/activities/custom/pdf/csr-report-15online-final.pdf
Xerox	www.xerox.com	Y	https://www.xerox.com/corporate-citizenship-2015/Xerox-2015-Global-Citizenship-Report.pdf

Table A1. *Cont.*

Century Link	www.centurylink.com	Y	http://www.centurylink.com/aboutus/docs/Corporate-Social-Responsibility-Report.pdf
Western Digital	www.wdc.com	Y (2012)	https://www.wdc.com/content/dam/wdc/website/about-wd/press-room/announcements/WDC%20Acquires%20SanDisk/corporate-responsibility-report.pdf
Synnex	www.synnecorp.com	N	
CDW	www.cdw.com	N	
Cognizant	www.cognizant.com	Y	https://www.cognizant.com/about-cognizant-resources/cognizant-sustainability-report2015.pdf
CSC	www.csc.com	Y	http://assets1.csc.com/cr/downloads/CSC_2015_CorporateResponsibilityReport.pdf

Appendix B. Evaluation Criteria

Table A2. Content classification criteria.

Category	Definition
Community	Every strategy or initiative which impacts the community outside the company. (example: educational project, association funding, etc.)
Labor Practices	Every strategy or initiative which has an impact on the workplace and/or on the employees (example: employees training, diversity in the company, etc.)
Governance	Every strategy or initiative which relates to laws, management, or reporting (example: participating to the creation of regulations, organizing a stakeholder dialogue)
Environmental	Every strategy or initiative which helps to reduce the negative impacts on the environment (example build ecological products, produce or use renewable energy, etc.)
Fair Operating Practices	Every strategy or initiative which impacts supply chain sustainability (example: creation of a Supplier code of conduct, internal audits of the supply chain, etc.)
Human Rights	Every strategy or initiative which impacts human rights and their diffusion (example: Conflict free mineral policy, data privacy, or security policy)
Consumer Issues	Every strategy or initiative which impacts a customer and helps them reduce their problems (example: design accessible products, provide end of life management, etc.)

Table A3. Quality criteria coming from [28].

Assessment Criteria		Comments
<i>Relevance of Information</i>		
R1	Sustainability strategy	The report presents the business strategy which relates to the aspects of sustainable development
R2	Key stakeholders	The report contains identification of organization's stakeholders, their expectations and a way of engagement with individual groups
R3	Targets	The report presents targets for the future, targets set in the previous reporting period and the level of their achievements
R4	Trends over time	The report contains indicators shown over several reporting periods indicating this way direction of change and ensuring their comparability
R5, R6, R7, R8	Performance indicators: R5: Market place R6: Workplace R7: Environment R8: Community	The report contains quantitative information concerning organization's performance achieved in particular areas (market place, workplace, environment, community).
R9	Improvement actions	The report describes improvement activities undertaken by the organization to meet the objectives of sustainable development; e.g. programs to increase resource efficiency, reduction of emission etc.
R10	Integration with business processes	The report contains information confirming that the aspects of sustainable development are included in the decision making process and implemented in the basic processes (purchasing, sales, marketing, production, etc.)
R11	Executive summary	The report provides a concise and balanced overview of key information and indicators from the reporting period
<i>Credibility of Information</i>		
C1	Readability	The report has a logical structure, uses a graphical presentation of the data, drawings, and explanations where required or uses other tools to help navigate through the document
C2	Basic reporting principles	The reporting period, scope and entity is defined in the report as well as limitations and target audience
C3	Quality of data	The report describes the processes, procedures of collection, aggregation and transformation of data and determines the source of the data
C4	Stakeholder dialogue outcomes	The report contains a description of the stakeholders' dialogue and the results of this dialogue in relation to aspects of sustainable development (surveys, consultations, focus groups, round tables, programs, engagement, etc.)
C5	Feedback	The report contains a mechanism that allows feedback process (contact point for suggestions or questions, hotline, e-mail, reply card, questionnaire etc.)
C6	Independent verification	The report contains a statement of independent body attesting the authenticity of data presented in the report as well as proposals for future improvements

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