International Journal of Business and Management Invention
ISSN (Online): 2319 – 8028, ISSN (Print): 2319 – 801X
www.ijbmi.org || Volume 6 Issue 7 || July. 2017 || PP—06-17

Assessment of Firm's Global Performance: Available Tools and Proposal of a New Module

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Abstract : *Firm's performance can not be limited to minimizing costs and increased production volumes. It now requires a continuous improvement approach, overall, resulting in deployment of all economic, environmental and social dimensions of enterprise: so this is a so-called overall performance to be considered. Financial performance is no longer sufficient to assess firm's performance. Therefore, companies should measure their progress from a more comprehensive performance including, apart from economic dimension, environmental and social dimensions. Goal of this work is to design a module for obtaining a global composite index in order to determine integrated information on economic, environmental, social and global performance of firm in time. Normalized indicators were associated into three sustainability sub-indices and finally composed into a global indicator of firm's global performance. A case study was used to validate this module, interpretation of results is given and the utility of our module with its relevance is pointed out.*

Key-words: *Sustainable development, Performance indicators, Global performance, Mathematical module,Case study.*

Date of Submission: 05-07-2017 Date of acceptance: 20-07-2017

I. INTRODUCTION

Global performance, defined as "the aggregate of economic, social and environmental performance" [1], is a multidimensional concept difficult to measure technically. Indeed, evaluation systems currently used by companies to measure progress through their CSR (Corporate Social Responsibility) initiatives do not provide satisfactory answers. Not being able to assess progress prevents companies to know where to focus their improvement efforts. Today, the challenge for companies is to measure interactions between different performance dimensions: economic, social and environmental. This paper raises question of the existence of a global performance measurement. To answer this question, we will analyze the current performance evaluation tools used by proactive companies in the field of social responsibility by highlighting the obstacles which prevent overall measure of performance. But before turning to the question of measurement, it is important to understand global performance concept.

Old mechanisms of performance measurement, such as costs, do not give firms a clear view on consequences of their management practices. Approaches currently available are mainly focused on environmental sphere, when firm's management practices are more complex, integrating the three dimensions of sustainable development (economic, environmental and social). It's true that public institutions encourage firms to make sustainable development a strategic issue. In firm, sustainable development is a transversal concept which affects all stakeholders who have different and sometimes conflicting goals. Performance is complex to master given different processes to consider, various stakeholders to integrate and various dimensions in which stakes are declined. To take into account all firms impacts, it is essential to develop a comprehensive performance evaluation methods. These latters must be consistent with specificities of each stakeholder. Now, difficulty in firms is to measure interactions between the three dimensions of global performance.

II. SUSTAINABLE DEVELOPMENT CONCEPT

Sustainable development is talked about that for twenty years, and yet it goes back much further. Since oil shock of 1973 and the first environmental disasters, scientists are aware of the danger that mankind poses to planet and for its own survival.

Sustainable development concept was born of the will of the World Commission on Environment and Development (WCED) to propose a path of reconciliation between economic development and ecological balances. This is the Brundtland report, which proposes the definition currently used for sustainable development. Forty years: history is still short. But forty years is enough to bring hundreds of heads of state.

Since 1972, the ideas cheminent, the first reports are published and international conferences on the environment are increasing. In forty years, international community has promised much but has only partially implemented.
Sustainable development concept encompasses three dimensions: economic, environmental and social united by a set of complex synergies and tradeoffs.

- **Economic issues**

The current economic system is liberal is to say it is based on the principle of a market where competition is free. The economic activities if they provide wealth and employment, are causing serious social and environmental problems. Sustainable development should enable to integrate other than financial concerns in the functioning of economic actors. Indeed, we find that the wealth produced is always more unequally distributed, both between countries and between social classes within a country. The challenge is of size: restore the economy's place in society, a necessary activity but not motor of choices.

- **Environmental issues**

Warning signs on the planet health are becoming more and more numerous:

- Global warming and its attendant consequences: rising sea levels, increased frequency and strength of severe weather events (storms, floods, heat waves, ...). Scientists predict a temperature increase of 1.4 to 5.8 degrees by 2100. To give an idea, just a difference of 4 degrees to change from an ice age (when glaciers in the Alps went to Lyon) to current climate!
- Biodiversity erosion: it is estimated that rate of species extinction is several hundred times faster since the modern era than usually observed on a geological scale.
- Many natural resources are threatened with depletion or pollution: water for example is concerned with both types of risks. On this point, the calculation of the ecological footprint of humanity, that is to say the area required to produce all the resources necessary for its operation is instructive: if everyone in the world lived like a European, would require the equivalent of two Earth to meet their needs!

This last point raises the major question of equity between different human groups, especially between rich and poor countries. This brings us in the social issues sphere of sustainable development.

- **Social issues**

Social consequences of our choices development are also worrying. Globally, there is increasing inequality: 20% of population concentrates 80% of wealth produced annually. Over one billion people live on less than one dollar by day and lack access to basic needs (drinking water or medical care for example). These issues also concern the so-called rich countries: one European in six lives in poverty. Natural environment pollution are causing many public health problems in the southern countries as in the industrialized countries: infectious diseases due to poor quality water, breathing problems, cancer, antibiotic-resistant strains, ... , water-borne diseases alone cause 2.2 million deaths annually (whose 1.5 million children) or 4 times more than deaths from wars. A growing part of the population feels excluded either by degradation of social ties (old age, family breakdown) or due to inability to find work or housing.

III. FIRM'S GLOBAL PERFORMANCE

3.1. Definition

Since 1920s (Taylorism), performance is seen as the relationship between the result and the goals set at the beginning. Thus, "highly efficient one who achieved its objectives" [2], this definition also applies to organization as well as the individual. However, with technological evolution and globalization, performance henceforth covers several concepts, mobilizing many levers, involves various actors, is framed by multiple repositories and is measured by multiple indicators disseminated by different vectors [3]. In a sustainability project, apprehension of performance can't longer be limited to minimizing costs and increasing production volume, but today requires continuous improvement, overall, which translates by deployment of all economic, social and environmental firm's dimensions.

Many theoretical studies have sought to conceptualize these performance themes called global [4]. In the current management literature, this concept is used to assess the implementation by firms of sustainable development concept [5]. It is defined as "aggregation of economic, social and environmental performance" [1], [6] or also by "the reunion of financial, social and societal performances" [7]. Performance can besides that be described as "global" when a firm strives to meet expectations not only of investors but also of other Stakeholders (Employees, customers, suppliers, state, general public, future generations,...) [3]. This author also puts emphasis on complexity of overall performance justifying the ambiguity of this concept by the existence of multiple searches in which it was subject (more than 200 items have been identified in major academic journals worldwide over the period 1980-2010), and the absence of a single overall indicator of performance capable of

measuring synthetically economic, social and environmental performances of a company. Overall performance concept, although it is central in many studies, remains so a fuzzy and vague concept [8]. For our part, we will retain that overall performance is multidimensional. It results from interaction between the three dimensions of sustainable development at firms scale, i.e. comes from aggregation of economic, social and environmental performances.

3.2. Measurement tools currently available

Because of its complexity, no company has managed to measure, nor integration degree of the three dimensions of sustainable development nor its return on investment. For this moment, companies are content to measure this performance from existing tools. We will review the current tools for assessing overall performance, then we will see how to approach overall performance implementation.

- **Balanced ScoreCard (BSC)**

Balanced ScoreCard, comes from the work of American consultants R. Kaplan and D. Norton. Born in the early 90s in the United States, Balanced ScoreCard is become in last ten years followed its creation a tool increasingly distributed in companies, often set up with the support of consulting firms. Originally presented by its designers as a strategy assessment tool and measuring performance, BSC is a combination of financial and operational measures ranked according to four dimensions: financial results, customer satisfaction, internal processes and organizational learning. One of BSC newness was to highlight the importance of non-financial indicators [9]. However, it is accused of creating a hierarchy between the four axes and subordinate the other three axes to financial axis: customer satisfaction, internal processes and organizational learning are only the means to achieve the financial goals (shareholder satisfaction). Thus human skills (in organizational learning axis) permit to improve productivity and quality of services (internal processes), which in turn contribute to customer satisfaction and ultimately serve company financial goals. BSC in its original meaning is still a tool very oriented to economic and financial result and cannot be considered as a tool for evaluating overall performance.

- **Triple Bottom Line (TBL)**

Triple Bottom Line, a concept developed by John Elkington (sustainability co-founder, a British consulting firm specializing in CSR) and made popular in his book "Cannibals with Forks" (1997) takes into account financial result but also firm's social and environmental performances.

Triple Bottom Line is the Anglo-Saxon approach to measuring overall performance. It defends idea which firm's overall performance should be measured based on its triple contribution to economic prosperity, environmental quality and social capital. In its narrowest sense, this concept is a framework to measure and report results of an organization according to some economic, social and environmental parameters. In its broadest sense, the term refers to set of values, points and processes which a company must observe to minimize damage from its activity and to create economic, social and ecological value. This implies a clear company purpose and taking into account needs of all company stakeholders (shareholders, customers, employees, business partners, governments, local communities and public).

However, TBL as BSC does not escape segmented view of overall performance. Indeed, in practice, TBL remains a segmented results into the three parts (economic, social and environmental) established separately, to be then compiled without considering correlations with each other. The three dimensions of sustainable development are compiled in Triple Bottom Line without a causal diagram. It lacks a integration concept, which is very important according (Dubigeon O., 2002) [10] because it expresses relationship between company's performance and overall results for society.

- **Global Reporting Initiative (GRI)**

Global Reporting Initiative (GRI), undoubtedly the most advanced reporting standard in sustainable development, provides an approach encompassing different dimensions of sustainable development in company scale. GRI performance indicators are classified according to the three sustainable development dimensions. Economic indicators measure a company impacts on economic situation of its stakeholders and on economic systems at local, national and global level. As for environmental indicators, they assess impact on natural living systems or not, especially ecosystems, soil, air and water. These indicators are of general application (valid for all companies) or specific to a company or a sector. Finally, social indicators measure an organization impact on social systems in which it operates. Even if they are the subject of a weak consensus due to cultural differences, extent and diversity of the possible impacts, GRI proposes to indicate informations on staff, clients, public local, supply chain, business partners, respect of labor rights in company and at suppliers, human rights, etc.

Despite significant progress in defining its indicators, GRI does not escape criticism. In management literature, there is a consensus that sustainable development can not be measured solely by reducing its impacts

to the three performance dimensions but also through interaction between these impacts. So, GRI is criticized due the absence of an integrated performance measuring interactions between different performances, criticism because it accepts recognizes that: "Limiting performance indicators to these three categories may not be enough to capture entire performance of an organization ... Therefore, in addition to economic, environmental and social dimensions, a fourth axis must be considered: integrated performance.

Currently, developing an integrated indicators which reflect company's overall performance is fraught with technical and cultural barriers. None of measurement tools, we introduced, allows to integrate the three sustainable development dimensions and provide firm's overall performance measurement. These three measuring instruments (BSC, TBL, GRI) face an obstacle which is integrating social, environmental and economic performances. Their measurement proposals provide a segmented vision (TBL, BSC) and/or partial vision of performance (dual for GRI).

IV. PROPOSAL OF A MODULE TO MEASURE FIRM'S GLOBAL PERFORMANCE

To measure firm's global performance, and thus facilitate decision making, we propose an analytical evaluation module, which each sustainable development dimension is characterized by a number of indicators (table 1).
We based our indicators selection on the three recommended requirements by (Roy B., 1985) [11]:

- Completeness: we must not it has too few indicators; otherwise, it means that some assessment elements were not taken into account.
- Non-redundant: it should not be some indicators that are duplicated, thus more than necessary.
- Consistency: global preferences (all indicators) are consistent with local preferences (for a single indicator).

4.1. Correlation of global performance indicators with firm's decisions

We analyzed the possible correlations between selected sustainable development indicators and the decision variables of the mathematical module, to build mathematical expressions which formalizes and measures the value of these indicators. Thus the performance evaluation is operationalized so consistently.

Table 1. All mathematical module indices [12]

Index	Meaning
R	All employees residential regions
j	Region
f	Supplier
S	All potential suppliers for raw materials
SC	All potential subcontractors for semi-finished products
C	All customers
p	Product
P	All products
RM	All raw materials
MP	All manufactured products
MPsf	All semi-finished products manufactured
MPf	All finished products manufactured
OMPsf	All manufactured semi-finished products which can be outsourced.
	$P = RM \cup MP; MP = MP_{sf} \cup MP_f;\ OMP_{sf} \subset MP_{sf}$

Table 2. All decision variables of mathematical module [12]

Decision variable	Meaning
CM_p	Unit cost to manufacture product p
X_p	Quantity of manufactured product p
CL	Unit cost of labor
Lab_j	All employees residing in region j
CI_p	Unit cost of ownership of stock of product p
I_p	Quantity in stock of product p at the end of period t
CA_{pf}	Unit acquisition cost of product p from the supplier f
QS_{pf}	Quantity of product p purchased from supplier f
CS_{ps}	Unit acquisition cost of product p from the subcontractor s
QSC_{ps}	Quantity of product p purchased from subcontractor s
CTU_{pf}	Unit transport cost of product p from supplier f
YSF_{pf}	Quantity of product p transported from supplier f
CTU_{ps}	Unit transport cost of product p from subcontractor s
$YSCF_{ps}$	Quantity of product p transported from subcontractor s
CTU_{pc}	Unit transport cost of product p between firm and customer c
YFC_{pc}	Quantity of product p transported from firm to customer c

2. Aggregation of the three sub-indices of sustainable development to get the global composite index which measures firm's global.

When aggregating we face two difficulties. The first one concerns the heterogeneity of units of indicators measurement, hence the need to normalize thereof. The second one touch to inequality of indicators importance, suggesting weighted indicators to express their relative importance. To do this, we use the principle of weighting of AHP method [13], which was used to calculate composite index of sustainable performance [14], [15].
We propose an aggregation of indicators as follows:

- **Step 1**: identification and classification of indicators I_{ijt}^{+} et I_{ijt}^{-}

$I_{ijt}^{+}(I_{ijt}^{-})$: the value of indicator i of dimension j of sustainable development, at the time t, which improves (deteriorates respectively) the performance of dimension j when its value increases:

$$I_{ijt}^{+} \in \left[I_{ijt,\ Inf}^{+}, I_{ijt,\ Sup}^{+}\right]$$

$$I_{ijt}^{-} \in \left[I_{ijt,\ Inf}^{-}, I_{ijt,\ Sup}^{-}\right]$$

$I_{ijt,\ Sup}^{+}(I_{ijt,\ Inf}^{-})$: target goal to reach by indicator $I_{ijt}^{+}(I_{ijt}^{-}$ respectively).

- **Step 2**: normalization of indicators I_{ijt}^{+} and I_{ijt}^{-}

$I_{Nijt}^{+}(I_{Nijt}^{-})$: value of normalized indicator i of dimension j of sustainable development, at the time t, which improves (deteriorates respectively) the performance of dimension j when its value increases:

$$I_{Nijt}^{+} = \frac{I_{ijt}^{+} - I_{ijt,\ Inf}^{+}}{I_{ijt,\ Sup}^{+} - I_{ijt,\ Inf}^{+}} \quad \text{with } I_{Nijt}^{+} \in [0,1] \ (02)$$

$$I_{Nijt}^{-} = 1 - \frac{I_{ijt}^{-} - I_{ijt,\ Inf}^{-}}{I_{ijt,\ Sup}^{-} - I_{ijt,\ Inf}^{-}} \quad \text{with} \quad I_{Nijt}^{-} \in [0,1] \ (03)$$

- **Step 3**: indicators weighting I_{ijt}^{+} et I_{ijt}^{-}.

For each j ∈ {Eco, Env, Soc}, we build a matrix A_j = (P x P) where indicators of each j dimension are compared 2 by 2 by the decision maker. The comparisons are made by posing the question which of two indicators i and i' is more important. The intensity of preference is expressed on a factor scale from 1 to 9 (table 3).

Table 3. Comparison scale of AHP method [16]

Preference factor, p	Importance definition
1	Equal importance
3	Moderate importance of one over another
5	Strong or essential importance of one over another
7	Very strong or demonstrated importance of one over another
9	Extreme importance of one over another
2,4,6,8	Intermediate values
Reciprocal, 1/p	Reciprocal for inverse comparison

The value of 1 indicates equality between the two indicators while a preference of 9 indicates that one indicator is nine times more important than the one which it is being compared. This scale was chosen, because in this way comparisons are being made within a limited range where perception is sensitive enough to make a distinction. In the matrix A_j, if indicator i is "p-times" the importance of indicator i', then necessarily, indicator i' is "1/p-times" the importance of indicator i, where the diagonal $a_{ii} = 1$ and reciprocal property $a_{i'i} = \left(\frac{1}{a_{ii'}}\right)$ such as $i, i' = 1.., n$.
Weight of indicators i (w_{ij}) is given by the formula:

$$w_{ij} = \frac{\sum_{i'} \frac{a_{ii'}}{\sum_k a_{ki'}}}{n} \quad n: number\ of\ indicators \ (04)$$

One disadvantage of AHP method outlined in literature [17] is the problem of intransitivity preferences. Indeed, pair wise comparison may lead to the non-transitivity that cannot be removed as part of AHP method.

However, perfect consistency rarely occurs in practice. In AHP method the pair wise comparisons in a judgment matrix are considered to be adequately consistent if the corresponding consistency ratio (CR) is less than 10% [13]: CR should not exceed the value of 0.05 if Aj is (3 x 3), 0.08 if the matrix is (4 x 4) and 0.1 if the matrix is greater than or equal to (5 x 5) [18].

CR coefficient is calculated as follows: first a consistency index (CI) needs to be estimated. This is done by adding the columns in the judgment matrix and multiply the resulting vector by the vector of priorities (i.e., the approximated eigenvector) obtained earlier. This yields an approximation of the maximum eigenvalue, denoted by $\lambda_{\max}$. Then, CI value is calculated by using the formula:

$$CI = \frac{\lambda_{max} - n}{n - 1} \qquad (05)$$

Next, CR is obtained by dividing CI by random consistency index (RI) as given in table 7.

Table 4. RI values for different values of n [19]

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

n	11	12	13	14	15	16	17	18	19	20
RI	1.51	1.54	1.56	1.57	1.59	1.60	1.61	1.62	1.63	1.63

Otherwise matrix A should be evaluated:

$$CR = CI/RI \qquad (06)$$

- **Step 4**: calculate the sub-indices I_{sjt}

I_{sjt} : the sub-index of the performance of dimension j of sustainable development, at time t, which is calculated by equation below:

$$I_{sjt} = \sum_i w_{ij} \times I^{+}_{Nijt} + \sum_i w_{ij} \times I^{-}_{Nijt} \text{ with } \sum_i w_{ij} = 1\,,\ w_{ij} \geq 0 \ and \ 0 \leq I_{sjt} \leq 1 \quad (07)$$

  - If $0 \leq I_{sjt} < 0.5$: the performance of dimension j of sustainable development of firm is low in period t;
  - If $I_{sjt} = 0.5$: the performance of dimension j of sustainable development of firm is average in period t;
  - If $0.5 < I_{sjt} \leq 1$: the performance of dimension j of sustainable development of firm is good in period t;

- **Step 5**: weighting of sub-indices I_{sjt} using AHP method (same principle as in step 3).
- **Step 6**: calculate the index of firm's global performance I_{gt} :

I_{gt} : the index of firm's global performance at time t which is calculated by the equation below:

$$I_{gt} = \sum_{j=1}^{j=3} W_j \times I_{sjt}\,; \qquad \sum_j W_j = 1\,;\ W_j \geq 0 \ (08)$$

W_j : weight of sub-index I_{sjt} and $0 \leq I_{gt} \leq 1$

- If $0 \leq I_{gt} < 0.5$: firm's global performance is low in period t;
- If $I_{gt} = 0.5$: firm's global performance is average in period t;
- If $0.5 < I_{gt} \leq 1$: firm's global performance is good in period t;

By comparing the value of global composite index calculated with desired goal (value 1), we get the level reached ((+) or (-)) for firm's global performance.

We summarize the method of calculating the composite index of global performance which is divided into several parts in the Fig. 1.

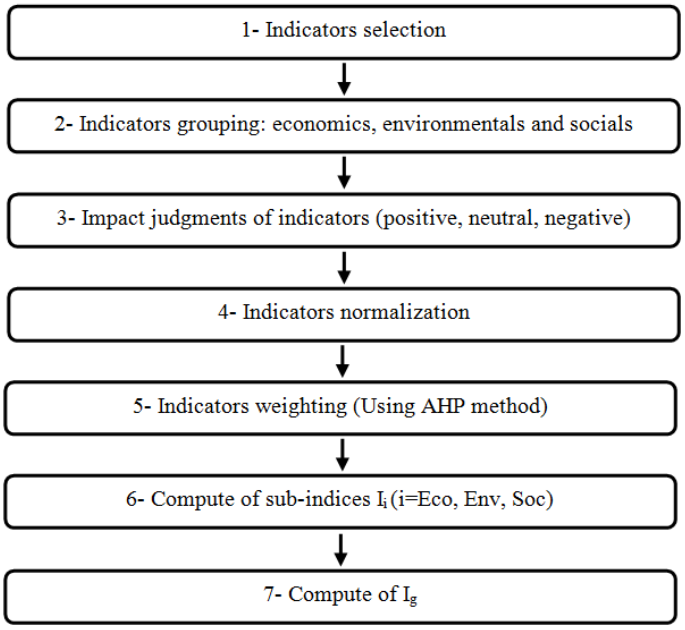

Fig. 1. I_g calculation procedure

4.3. Firm's economic Performance

several studies focus on economic and financial dimension for measuring firm's global performance. The modules offer different typologies and classify the indicators and issues according to different categories.
Analysis of this inventory highlights five main criteria, which are ***reliability, reactivity, flexibility, quality and financial performance*** and nine indicators (table 3).

Table 5. Indicators of firm's economic performance

Issue	N°	Indicator I	Symbol	Impact	Unit	Value	I_{Inf}	I_{Sup}
Reliability	1	Orders reliability	O_R	Positive	Number	Orders delivered in good conditions	0	All orders delivered
	2	Stocks reliability	S_R	Negative	Hour	Downtime because of an out of stock	0	Total working time
Reactivity	3	Conception reactivity	C_R	Positive	Number	Orders designed on time	0	All orders to design
	4	Procurement reactivity	P_R	Positive	Number	Orders supplied on time	0	All orders to supply
	5	Production reactivity	$P_{R'}$	Positive	Number	Orders produced on time	0	All orders to produce
	6	Reactivity of returned products	R_R	Positive	Number	Returned orders traited on time	0	All returned orders
Flexibility	7	Orders flexibility	O_F	Positive	Number	Quantity achieved to respond to change orders	0	All changed orders
Quality	8	Percentage of defective products	P_D	Negative	Number	Defective products	0	All orders delivered
Financial performance	9	Firm's total cost	T_C	Negative	M€*	T_C	0	Firm's total budget

*: Million euro
Firm's total cost (T_C) is calculated as follow ((Equation (1)):

$$T_C = \sum_{p\in P}[(CM_p.X_p)(a) + (CL\sum_j Lab_j)(b) + \sum_{p\in P}(CI_p.I_p)(c)] + [\sum_{f\in S;\, p\in RM} CA_{pf} \sum_{f\in S;\, p\in RM} QS_{pf}](d) + [\sum_{s\in SC;\, p\in MP_{sf}} CS_{ps} \sum_{s\in SC;\, p\in MP_{sf}} QSC_{ps}](e) + [\sum_{f\in S;\, p\in RM} CTU_{pf}.YSF_{pf}](f) + [\sum_{s\in SC;\, p\in OMP_{sf}} CTU_{ps}.YSCF_{ps}](g) + [\sum_{c\in C;\, p\in MP_f} CTU_{pc}.YFC_{pc}](h) \quad (1)$$

(a): production cost; (b): labor cost; (c): stock cost; (d): cost of raw materials; (e): cost of semi-finished products; (f): transportation cost of raw materials between supplier and production sites; (g): transportation cost of semi-finished products between subcontractors and production sites; (h): transportation cost of finished products to customers

4.4. Firm's environmental performance

Decisions and activities of firms have an impact on the natural environment, regardless of the implantation site thereof. These impacts can be associated with the use of biological and non-organic resources by the company, with the generation of pollution and wastes and with the impact of its activities (products / services) on natural habitats. So to reduce their environmental impact, it is that companies adopt an integrated approach that takes into account the wider implications of their decisions and activities from an environmental point of view. The inventory analysis of environmental criteria met in the very abundant literature allows us to isolate three environmental criteria, which are ***environmental management, use of resources*** and ***pollution*** and nine indicators (table 4).

Table 6. Indicators of firm's environmental performance

Issue	N°	Indicator I	Symbol	Impact	Unit	Value	I_{inf}	Isup
Environmental management	1	Environmental budget	E_b	Positive	M€	Environmental budget	0	Firm's total budget
	2	Environmental certifications	E_c	Positive	Digit	Number of environmental certifications	0	Total number of environmental certifications
Use of ressources	3	Energy consumed	E_C	Negative	Joule (J)	Quantityt of energy consumed	0	Maximum of energy consumed by firm during the last 10 years.
	4	Water consumed	W_c	Negative	(m^3)	Quantityt of water consumed	0	Maximum of water consumed by firm during the last 10 years.
	5	Raw materials consumed	RM_c	Negative	(kg)	Quantity of raw materials consumed	0	Maximum of raw materials consumed by firm during the last 10 years.
Pollution	6	Liquid pollutants	L_p	Negative	(m^3)	Quantity of liquid pollutants generated	0	Maximum of liquid pollutants generated by firm during the last 10 years.
	7	Solid pollutants	S_p	Negative	(kg)	Quantity of solid pollutants generated	0	Maximum of solid pollutants generated by firm during the last 10 years.
	8	Greenhouse gas	G_g	Negative	(kg)	Amount of greenhouse gases generated	0	Maximum of greenhouse gases generated by firm during the last 10 years.
	9	Noise pollution	N_p	Negative	(dB)	Number of decibels generated	0	Maximum of decibels generated by firm during the last 10 years.

4.5. Firm's social Performance

Social responsibility also led to evaluate social performance. It measures the social consequences of the company's activity for all of its stakeholders who are mainly employees (working conditions, remuneration level, no discrimination, ...), suppliers, customers (security and psychological impacts of products), local communities (nuisances, respect of cultures) and society in general. The analysis of the inventory of social criteria found in the recent literature allows us to isolate five social criteria, which are ***labor rights, working conditions, health and safety, community involvement and consumers*** and twenty indicators (table 5).

Table 7. Indicators of firm's social performance

Issue	N°	Indicator I	Symbol	Impact	Unit	I_{Inf}	I_{Sup}
Labor rights	1	Staff number who are submitted to case of no respect of free competition	N_{FC}	Negative	Number	0	Total staff number
	2	Staff number who are submitted to case of injustice caused by hierarchical power	N_{HP}	Negative	Number	0	Total staff number
	3	Staff number who are submitted to case of discrimination	N_D	Negative	Number	0	Total staff number
	4	Staff number representatives	N_R	Positive	Number	0	Total staff number×0.02
	5	Staff number who has a forced labor	N_{FL}	Negative	Number	0	Total staff number
	6	Staff number who are children	N_{Ch}	Negative	Number	0	Total staff number
	7	Staff number participated in professional elections	N_{PE}	Positive	Number	0	Total staff number
	8	Staff number who are submitted to case of violations of privacy	N_{VP}	Negative	Number	0	Total staff number
Working conditions	9	Ratio of lowest wage / cost of local life	$R_{LW/LL}$	Positive	%	0	1
	10	level of salary retention in case of illness	N_{RI}	Positive	%	0	1
	11	Number of services offered to staff (nursery, gym, canteen, ...)	N_S	Positive	Number	0	20*
Health and security	12	Staff number who are victims of occupational accidents	N_{OA}	Negative	Number	0	Total staff number
	13	Staff number who are victims of diseases caused by work	N_D	Negative	Number	0	Total staff number
Community involvement	14	Number of jobs created	N_J	Positive	Number	0	Sum of local active population of each entity
	15	Staff number with CID	N_{CID}	Positive	Number	0	Total staff number
	16	Staff number with CDD	N_{CDD}	Negative	Number	0	Total staff number
	17	Number of CDD transformed to CID	N_{DI}	Positive	Number	0	Total number of CSD
	18	Number of layoffs	N_L	Negative	Number	0	Total staff number
	19	Budget destined to promote social activities	B_{SA}	Positive	Euro	0	Firm's total budget
Consumers	20	Number of products / services subject of claims following a non-compliance issue	N_{N-C}	Negative	Number	0	All products / services

* : approximate number

V. APPLICATION

Reliability of proposed module has been tested in a case study. We chose an automotive firm installed in north of Morocco (Tangier), which its principal business activity is electrical harnesses for cars. Achieving the leadership of its branch is therefore a core principle at firm. Needed data have been obtained from General Management team.

To determine global performance of this firm, our proposed module was applied and delivered for the first quarter of 2017.

5.1. Economic performance compute

Table 8. Firm's economic performance

N°	Indicator I	Unit	I_t	I_{Inf}	I_{Sup}	I_N	$w_{i\text{-}eco}$	$I_{N\times} w_{i\text{-}eco}$
1	Orders reliability	Number	41565	0	42000	0.990	0.163	0.161
2	Stocks reliability	Hour	13772	0	1692860	0.992	0.082	0.081
3	Conception reactivity	Number	1775	0	2000	0.888	0.076	0.067
4	Procurement reactivity	Number	1000	0	1100	0.909	0.076	0.069
5	Production reactivity	Number	42000	0	42000	1.000	0.076	0.076
6	Reactivity of returned products	Number	115	0	150	0.767	0.076	0.058
7	Orders flexibility	Number	1075	0	1500	0.717	0.12	0.086
8	Qualité of products/services	Number	51.5	0	42000	0.999	0.142	0.142
9	Firm's total cost	M€	7	0	17.5	0.600	0.189	0.113
I_{Eco}								**0.855**

Table 9. Firm's environmental performance

N°	Indicator I	Unit	I_t	I_{Inf}	I_{Sup}	I_N	$w_{i\text{-}env}$	$I_{N\times}\ w_{i\text{-}env}$
1	Environmental budget	M€	0.065	0	17.5	0.004	0.092	0.000
2	Environmental certifications	Digit	1.95	0	2.25	0.867	0.041	0.036
3	Energy consumed	Joule (J)	4250	0	6500	0.346	0.107	0.037
4	Water conumed	m^3	45	0	110	0.591	0.107	0.063
5	Raw materials consumed	kg	6500	0	8500	0.235	0.107	0.025
6	Liquid pollutants	m^3	55	0	150	0.633	0.111	0.070
7	Solid pollutants	kg	2800	0	4000	0.300	0.111	0.033
8	Greenhouse gas	kg	85	0	350	0.757	0.205	0.155
9	Noise pollution	dB	165	0	325	0.492	0.121	0.060
I_{Env}								**0.480**

5.3. Social performance compute

Table 10. Firm's social performance

N°	Indicator I	Unit	I_t	I_{Inf}	I_{Sup}	I_N	$w_{i\text{-}soc}$	$I_{N\times}\ w_{i\text{-}soc}$
1	Staff number who are submitted to case of no respect of free competition	Number	750	0	1450	0.483	0.028	0.014
2	Staff number who are submitted to case of injustice caused by hierarchical power	Number	1230	0	1450	0.152	0.028	0.004
3	Staff number who are submitted to case of discrimination	Number	850	0	1450	0.414	0.064	0.026
4	Staff number representatives	Number	29	0	29	1.000	0.025	0.025
5	Staff number who has a forced labor	Number	0	0	1450	1.000	0.063	0.063
6	Staff number who are children	Number	0	0	145	1.000	0.063	0.063
7	Staff number participated in professional elections	Number	1000	0	1450	0.690	0.027	0.019
8	Staff number who are submitted to case of violations of privacy	Number	37	0	1450	0.974	0.051	0.050
9	Ratio of lowest wage / cost of local life	%	0.035	0	0.05	0.700	0.065	0.046
10	level of salary retention in case of illness	%	0.04	0	0.05	0.800	0.042	0.034
11	Number of services offered to staff	Number	0.4	0	1	0.400	0.039	0.016
12	Staff number who are victims of occupational accidents	Number	8.8	0	1450	0.994	0.058	0.058
13	Staff number who are victims of diseases caused by work	Number	1100	0	1450	0.241	0.058	0.014
14	Number of jobs created	Number	1450	0	2500	0.580	0.075	0.044
15	Staff number with CID	Number	1315	0	1450	0.907	0.045	0.041
16	Staff number with CDD	Number	135	0	1450	0.907	0.038	0.034
17	Number of CDD transformed to CID	Number	25	0	2700	0.185	0.048	0.009
18	Number of layoffs	Number	2.7	0	29000	0.998	0.08	0.080
19	Budget destined to promote social activities	M€	0.005	0	350	0.000	0.051	0.000
20	Number of products / services subject of claims following a non-compliance issue	Number	35	0	840000	0.999	0.05	0.050
I_{Soc}								**0.687**

5.4. Global performance compute

Same weights (1/3) have been attributed to each sub-index to derive (Ig). Certainly, other methods of weighting the sub-indices of (Ig) could be applied, for example by using public opinion polls or involving expert judgment.

However, which makes equal weighting a sensible option.
Finally, we find global composite index (Ig), based on the following equation:

$$I_{gt} = \frac{I_{Eco} + I_{Env} + I_{Soc}}{3} = \frac{0.855 + 0.480 + 0.687}{3} = 0.674 \qquad (09)$$

5.5. Results interpretation

Nine economic indicators, nine environmental indicators and twenty social indicators indicators were aggregated into sustainable sub-indices for a case firm and finally aggregated into Ig. Figure 2 show values of sustainable sub-indices and Ig value for the case firm over the first quarter of 2017.
Economic performance has a value of 85.468% shown that this firm fulfilled a good economic result. This good economic performance based on the high value of positive indicators and the low values of negatives indicators. So, economic development affects, but does not determine the Ig result.

That is very important since nowadays a great emphasis have been put on the economic assessments and less on the social and environmental one. Environmental performance of this firm has a value of 47.970%

which is a bad performance that is to say this firm has a very negative impact on environment. As social performance achieved a good value (68.740%), thing which reflect that this firm respect relatively social side. Taking into account these three performances, this firm achieved a median global performance (67.393%) which must be improved in the coming years especially through the improvement of environmental and social sides.

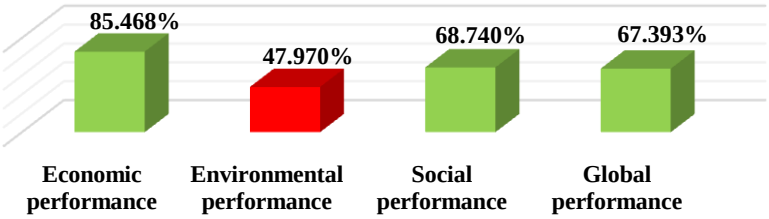

Fig. 2. Firm's sustainable performances over the first quarter of 2017

VI. DISCUSSION AND CONTRIBUTION OF OUR MODULE

(Ig) purpose is to give a simplified and quantified expression for a more complex composition of several indicators. It can be used to inform decision-makers of development trends in firm. However, it may also be included in a more targeted context, such as reflecting firm status regarding sustainability, providing information to critical decision processes, or possibly forming basis for firm to head in a certain direction. This evaluation module helps to highlight improvement opportunities and where best practices might be found. It provides early warning information and tracks sustainability of firm.

Decision-makers could easily interpret (Ig) and its corresponding sub-indices than trying to find a trend in many separate criteria of sustainable development. If included in annual sustainability report, we could use this module to present firm progress in terms of sustainability to the various interested parties in firm sustainability. Also, this evaluation module if would be applied to different firms, it would be possible to compare and rank them in terms of sustainability.

Based on our evaluation module of global performance we can decide if we apply or not a given best practice in firm following its sustainable performance calculated by (I_{Eco}, I_{Env}, I_{Soc} and Ig).

By this module, we provide to decision maker a tool which allows him:

1. To analyze current and potential value of activities implemented and to consider actions to strengthen this value such as implementation of sustainable best practices. This analysis allows him to define activities scope and to consider several options for this end, as part of differentiation strategy by CSR.
2. To analyze global performance profile related to firm decisions during planning phase, choose firm's configuration and the way to exploit it in advanced and optimized manner in order to ensure target level of global performance. This later defines the strategy or CSR policy which decision maker wishes to implement.
3. To know precisely additional investment in terms monetary, which he must engage to achieve the level of desired global performance.
4. To have quantitative performance indicator which used to control firm and for purposes of communication.

VII. CONCLUSION

measuring global performance, vague concept, is related to many difficulties and presented by many authors as the aggregation of the economic, social and environmental performances of firm. Analysis of different measurement tools used by companies to understand their performance, shows that no one is able to measure interactions between different segments of performance. For the moment, available tools (Balanced ScoreCard in its updated version of CSR, Triple Bottom Line reporting) provide a segmented view of global performance in three dimensions: economic, social and environmental. They measure these dimensions separately and then compile them regardless of correlations between these dimensions. In the best case, some tools (crusaders GRI indicators) evaluate interactions between two dimensions: economic / social or economic / environmental, but, they do not allow to significantly integrate the three dimensions of global performance. However, it should be recalled, as financial performance and choice of these indicators is a political arbitration. They must be built in a concertatif and strategic process with leaders agreement and participation of company stakeholders. In this perspective, global performance can be analyzed as a social convention co-constructed and negotiated between company's management and its various stakeholders.

While sustainability information is typically treated separately, this paper tries to translate it into a form which corresponds to needs of decision-makers. This work illustrates that it is possible to assess sustainable development in an integrated way which provides good guidance for decision-making. As the business case for

sustainable practices becomes increasingly clear, sustainability reporting offers a measurable value to those whose business is to assess current sustainability health of firms and influence future actions. At present, content of sustainability reports tends to appear in forms and units that are not readily convertible into unique terms. The module presented in this article promises advance in sustainability assessment of firm and makes sustainability information more useful to decision-makers. Core and supplemental indicators (I_{Eco}, I_{Env}, I_{Soc}) when combined into global composite index (Ig) can be used to reflect the achievements of firm towards sustainability.

Even though further development is called for, it is evident that this module for sustainable development assessment has the potential to become very useful as one of available tools. The combination of better assessment methods is likely to continue this movement towards a new generation of integrated sustainability performance reports.

ACKNOWLEDGMENTS

Authors are grateful to all leaders of this company for giving important informations and other colleagues for reading through the manuscript.

Conflict of interest statement:

Authors certify that they have NO affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter or materials discussed in this manuscript.

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