A consistency analysis of LCA based communication and stakeholders needs to improve the dialogue on new electric vehicle

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Abstract

The launch of new technologies such as electric vehicles will be a major change on several levels such as new business models and possible changes of consumer's habits. The results of the Life Cycle Assessment (LCA) are key as they will be used for decision support for governmental policies, for vehicle design, and finally to disclose environmental data to specific stakeholders around the world. It was clear that only a multidisciplinary approach could open a successful way in this work. A new methodology is proposed, by crossing the capability of understanding and action, through the Human Development Index and level of awareness by using the Environmental Performance Index. Based on these indexes it is possible to asses the "eco-maturity" level of many countries. Main stakeholder needs in environmental information are then screened. The various life cycle based communication are analysed on four axes, feasibility, life cycle coverage, ability to help the decision and finally educate the consumer. An example is calculated to show concrete facts and the LCA communication strategy wheel is created to determine the right effort to provide, toward the right target, in the most efficient way.

1 Introduction

The launch of new technologies such as electric vehicles will be a major change on several levels such as new business models and possible changes of consumer's habits. The results of the Life Cycle Assessment LCA are key as they will be used for decision support for governmental policies, for vehicle design, and finally to disclose environmental data to specific stakeholders around the world.
Within the first stage of LCA, the definition of an appropriate impact assessment method is a key point of the study. In our case, this choice significance is emphasized when coming to comparative assessment of new products & services.
As a consequence, a thorough analysis is required to clarify actual needs for LCA communication between stakeholders and an appropriate way to disclose results for the comparative assessment of technologies. This paper discusses this issue and explains how a methodology was created to make recommendation to disclose the new electric vehicle LCA results.

2 Materials and methods

For each country, specific needs are identified by crossing the human development index and the environmental state. Eight stakeholders have been identified, among them; we will find policy makers, suppliers, company's decision makers, fleet customers, financial investors, etc. For each of them, their needs have been qualified and a ranking as been made based on the importance of LCA information disclosure in the dialogue for their specific countries. It will allow us to determine the right communication path for each stakeholder and country.

2.1 The Human Development Index (HDI) & the Environmental Performance Index (EPI)

The Human Development Index (HDI) is a summary measure of human development. It measures the average achievements in a country in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living. The HDI is the geometric mean of normalized indices measuring achievements in each dimension as describe in [1].

Tab.1: Construction of the Human Development Index from three dimensions to the final aggregated index

3 Dimensions =>	4 Indicators =>	Dimension index =>	Aggregated Index
1/ Long and healthy life	Life expectancy at birth	Life expectancy index	Human Development Index (HDI)
2/ Knowledge	>Mean years of schooling >Expected years of schooling	Education index	
3/ A decent standard of living	Gross national income (GNI) per capita	GNI Index	

The second index chosen for this work is the Environmental Performance Index (EPI). This index tracks national environmental results on a quantitative basis, measuring proximity to an established set of policy targets using the best data available [2].

Tab.2: Construction of the Environmental Performance Index from ten policy categories to the final aggregated index (adapted from [3])

10 Policy Categories =>	2 Objectives =>	Aggregated Index
Air Pollution (effects on ecosystems)	Ecosystem Vitality	Environmental Performance Index
Water (effects on ecosystems)		
Biodiversity & Habitat		
Forestry		
Fisheries		
Agriculture		
Climate Change		
Environmental Burden of Disease	Environmental Health	
Water (effects on humans)		
Air Pollution (effects on humans)		

25 performance indicators describe the ten policy categories.

For this paper, we will focus on the ecosystem vitality index to reflect the environmental condition of the countries.

By crossing these two indexes, it is possible to enlight the situation of 153 countries around the world, covering all the continents as shown in Fig. 1.

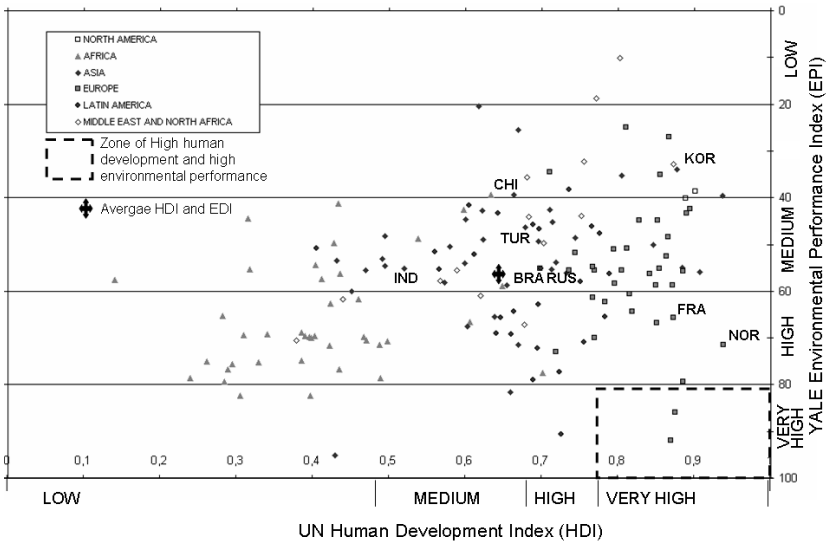

Fig.1: Mapping of countries according to the HDI and EPI (ecosystem vitality) indexes

Eight countries will be emphasized since they cover 50% of Renault group worldwide sales and are representative of each region: France, Korea (Republic of south), Brazil, Turkey, Morocco, Russia, China, India.

Norway is a world leading country on the HDI Index. Costa Rica is one of the leader in term of environment. Iceland, Switzerland and Sweden are the three countries reaching the "sustainability zone" where human development is achieve without compromising the environment.

The selected countries can be sorted in 5 "eco-maturity" levels presented in Table 3.

Tab.3: Classification of countries in "eco-maturity" levels

"eco-maturity" level	Countries	Human Development Index	Environmental Performance Index
Level 1: Mastering	Norway France	Very high	High
Level 2: Managing	Korea (Republic of)	Very high	Low
Level 3: Understanding	Russian Federation Turkey Brazil	High	Medium
Level 4: Recognizing	India Morocco	Medium	Medium
Level 5: Recognizing	China	Medium	Low

Note: A leading level "Excellence" could be given to Iceland and Switzerland

2.2 Stakeholders information needs

According to [4], stakeholders are in principle any party that has an interest (“stake”) in a company or its products. We will focus on customers, employees, public authorities, financial analysts, and suppliers who are considered as primary stakeholders.

Life cycle assessment is widely considered as the most transparent and complete tool to dialogue toward various stakeholders for its comprehensive approach with broad scope and system boundaries. [5]

Nevertheless, expectations are different between each stakeholders and each country environmental maturity.

Based on a full life cycle study, it is possible to envisage several level of communication.

2.3 LCA based communication format

It is widely admitted that Life Cycle Assessment is a trustful tool to evaluate the environmental potential impacts of products. Results can be published under the ISO 14025 scheme. Unfortunately, LCA results are often too complex to understand for a wide public.

It is possible to simplify the dialogue by reducing the environmental scope, such as Product Carbon Footprint focussing only on greenhouse gases or focusing only on the use stage of the product.
A second possibility is to sum several impacts into a single score. In that case, it is of utmost importance not to disclose this single score alone to the customer. This would be misleading and insufficient for a decision.
Finally, an ecological label is a seal or a logo indicating that a product has met a certain set of environmental attributes. As an example, Renault decided to propose an innovating approach with a life cycle environmental performance oriented label versus the classical "technology" oriented label. The effective impact reduction for the planet is possible only if the product remain economically accessible for all. This is the base statement for Renault ecological and economical label: Renault eco².

The different type of environmental communication are describe by four criteria [6] linked to the sustainable production (for the industry) and consumption (for the consumers) concept.

Tab.4: Summary of the 7 life cycle communication possibilities

+: yes - : no	Production		Consumption	
	Is it easy to calculate ?	Is it complete on Life Cycle & Multicriteria	Does it help consumers to choose	Does it Educate consumers
CO2: ranking from [A..G]	+ + +	- - -	+	+
TECH: Technology label	+ +	-	-	-
PERF: Performance label	+ +	+	-	+
PCF: Product Carbon Footprint	+	+	+	+
SCOR: EcoScore	+	+	+ +	- -
ECO: EU Ecolabel	+	+ +	+ +	+ +
LCA: such as Environmental Product Decleration	-	+ + +	-	+ + +

3 Results

3.1 LCA case study, the electric vehicle

The studied product is a Renault Fluence ZE
Definition of the functional unit according to the ILCD handbook [7] and the reviewed study of Renault Laguna [8]:

what	Transportation of persons alone or with passenger
how much	150 000 km
how long	10 years
in what way	Respect of the norms for M1 type approval

Functional unit: Transportation of persons alone or with passenger for a distance of 150 000 km, during 10 years, in the respect of the norms for M1 type approval
Product system: Renault Fluence Z.E. in Europe, 2011

3.2 LCIA priorisattion

An LCIA allow the practitioner to transform inventories in potential impact on the environment. These are various in term of importance for each specific product and present more or less uncertainties on the characterisation methodologies.
Several workshops conducted by Renault with more than 40 eco-design/LCA researcher or student. Several methods were tested such as willingness to pay, preferences, auctions or cultural choices. The result for the automotive products is a larger interest in Global Warming Potential 100 years (GWP), Abiotic Resource Depletion Potential (ADP) and Photochemical Ozone Creation Potential (POCP). We will keep those for this paper even if Renault assessed other potential impacts categories in its studies.

3.3 Application on the 7 communication level

Electric vehicle LCAs vary very significantly from one country to another. This is a consequence of the political choices regarding the primary resources selected to produce the electricity, necessary to fill the battery and drive. As an example, four countries are compared in table 5.

Tab.5: Summary of the 7 life cycle communication possibilities

	2010 average car in Europe	Switzerland (Hydro 50% and nuclear power plant)	France (Nuclear power plant, 77%)	Netherland (Natural gas power plant, 57%)	Germany (Coal power, 49%)
CO2: ranking from [A..G]	C	A	A	A	A
TECH: Technology label	dCi or TCe	Renault ZE	Renault ZE	Renault ZE	Renault ZE
PERF: Performance label		Renault eco²	Renault eco²	Renault eco²	Renault eco²
PCF: Product Carbon Footprint and EcoScore	100%	32%	36%	72%	69%
SCOR: EcoScore UBP	100%	27%	59%	61%	69%
ECO: EU Ecolabel	NO	NO	NO	NO	NO
LCA: CML2001					
GWP(100yr)	100%	32%	36%	72%	69%
ADP	100%	54%	91%	68%	60%
POCP	100%	23%	24%	25%	25%

Note: Electric vehicle results are normalized in regard of the 2010 European average Renault passenger car sold in Europe.

Note: The results are claculated with the GaBi Software(R) and Renault Simplified LCA Model

3.4 Results for the communication and discussion

On the basis of the Human Development Index and the Environmental Performance Index, it is possible to asses the "eco-maturity" level of one country.
Main stakeholder needs in environmental information are screened.
The various life cycle based communication are analysed on four axes, feasibility, life cycle coverage, fulfil its role to help the decision and educate. An example is calculated to show concrete facts.

When crossing these analysis and ranking, it opens the possibility to define with communication is suitable for each stakeholder in each country, especially toward the supplier and the market as shown on Fig.2 with the new created LCA communication strategy wheel.

This assessment tool will allow the group to adopt the right communication level for each party today. The LCA communication is now adapted to the capability to understand and then the capacity for acting.

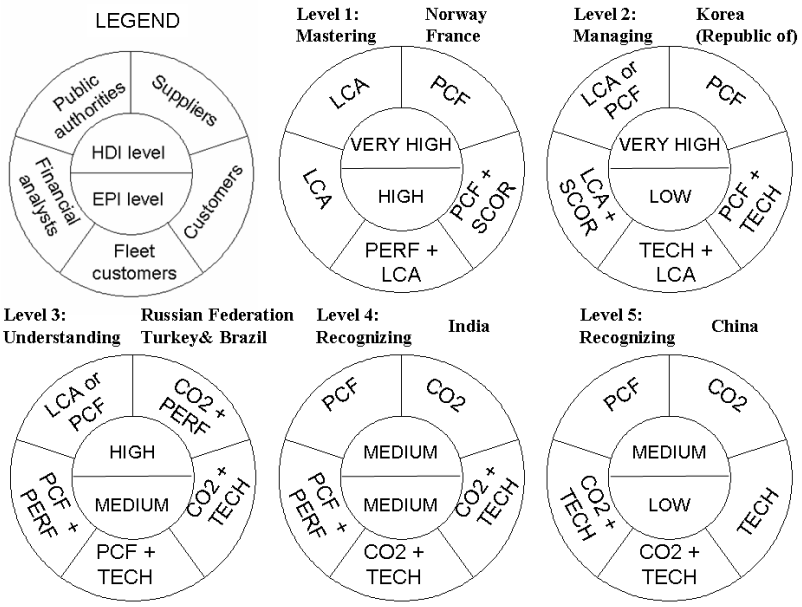

Fig.2: LCA communication strategy wheel for each "eco-maturity" level

In most advanced countries, LCA could be widely used, it could be sometime usefull to add a score index to an LCA or PCF, but Score shall never be used alone for public information as stated in the ILCD guidelines [9].

Staring from the lowest "eco-maturity" level to the highest, it is possible to read the road to follow to achieve an LCA communication in line with people expectations.

4 Conclusions

When performing an LCA study, the choice of the LCIA method is a key point to ensure the quality of the dialogue within the actors of the value chain. Since LCA development is accelerating worldwide, it brings the necessity to deepen this question.

This article describes a methodology to consider and propose relevant indicators for the dialogue on automotive technologies.

The communication type are nevertheless related to the automotive sector environmental stakes and shall be adapted if this method would be considered for electronic or textile products were the water is a more important topic.

Water footprint were not considered at this time due to the current development ongoing but could be surely added later.

Governmental level was difficult to link with the indexes and a ground study should be performed with a network of public affair responsible. Another possibility would be to assess the potential role of LCA when applying the ISO 26000 [10] which highlights the 7 principles of social responsibility including the environment, consumer issues and community involvement topics.

Finally, this approach also open the way for a time dynamic strategy making by looking forward on the Human Development Index and Environmental Performance Index, it makes it possible to forecast the coming years needs in term of environmental information.

5 References

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