ACTIONS FOR A SUSTAINABLE WORLD FROM THEORY TO PRACTICE

BOOK OF PAPERS

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Avant qu'il ne soit trop tard: a "circular" approach from theory to practice

Modeling an innovative technical solution through LCA

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Abstract

It is proven theory, unfortunately not implemented yet, that *"sustainability"* is not (should not be) an issue that can be dealt with separately as an individual sector; since it involves every aspect of society: i.e. our model of economic development; welfare; the environment.

ESG (Environmental/Social/Governance) itself in defining the sustainability of investments incorporates the five Ps of sustainable development: Planet, Partnership, Peace, People, Prosperity.

However to correlate economic, social and environmental sustainability, we should start by reversing the scale, starting from the bottom, from the territorial districts, moving upward to the Region and finally reaching the national level. The job should start immediately as it can't wait any longer: *avant qu'il ne soit trop tard* and effectively, the transition from theory to practice should begin by analyzing the specificities of the economic context (industry 4.0), social (migrants, aging population, urbanization), environmental (green economy).

The following research (the result of a collaboration between the PDTA - Sapienza di Roma Department with a family business enterprise - AC Engineering SpA) combines social sustainability (eco-friendly building), environmental sustainability (LCA) and economic sustainability (a family business that is taking off towards construction 4.0). The proposed methodology – and the applied criteria, replicable in other realities – provided for the analysis of the context from a social, economic and environmental point of view; a survey on the tools, operators, rules available today; to then proceed with a technical proposal paying particular attention to the environmental aspects measured through a "gate to gate" LCA to quantify the impacts and propose solutions to: improve environmental performance, proceed towards the Environmental Product Declaration (EPD) certification and, thus as required by the new Procurement Code, meet the Minimum Environmental Criteria (CAM).

How to proceed: in a transition phase that is already looking beyond industry 4.0, companies are called to innovate operating models: shifting from product companies to *"product as service"* companies. For those of us who work in universities, we need to collaborate with Competence Centers, centers of technological excellence, coordinated by universities using the public-private partnership formula, facilitating companies in digital transformation, while respecting the environment, towards the fourth industrial revolution.

Keywords: Eco-solidarity, Family business, Industry 4.0., LCA, Prefabricated Components

1. Introduction

It is proven theory, unfortunately not implemented yet, that sustainability (be it economic, social or environmental) can't (should not) be dealt with as a separate element or sector, since it involves every aspect of society. This is also what emerges from the reference framework provided by the United Nations in the 17 Strategic development goals. (UN, 2015).

For some time now, the acronym ESG Environmental, Social and Governance has been used: a standard that defines the sustainable approach to investments, incorporating the five Ps of sustainable development: planet, partnership, peace, people, prosperity.

Thesis confirmed also by Bob Giddings, Bill Hopwood e Geoff O'Brien: "*Sustainable development is a contested concept" …economy and environment issues are interconnected with the economy dependent on society and the environment while human existence and society are dependent on, and within the environment. The separation of environment, society and economy often leads to a narrow techno-scientific approach, while issues to do with society that are most likely to challenge the present socio-economic structure are often marginalized, in particular the sustainability of communities and the maintenance of cultural diversity*". Giddings et al. (2002).

Moreover a theory that has been represented and fully accepted, among the topics of the Conference: Production, consumption and innovation; Economic aspects of sustainability; Social foundations of sustainability.

In fact, if it is already difficult to coordinate environmental policy on a global scale (see the various Cops), how is it possible to correlate economic, social and environmental sustainability? The scale must be changed and reversed from bottom upward, from the territorial districts, moving upward to the Region finally reaching the national level.

In this context, a significant role is played by small and medium-sized enterprises (SMEs) which, together with family businesses, operate in the territory, in industrial districts, in Special Economic Zones (ZES) (DL n.91, 2017) or geographically and clearly identified areas, where business companies are already operational, and those setting up can benefit from special investment opportunities and development. Today there are more than 4,500 ZES in the world, established in 135 countries, which contribute to the maintenance of about 70 million jobs. So close to the demand and therefore constituting effective production systems, and being local, also more aware of the sustainability of the built environment.

However it is necessary to begin right away: *avant qu'il ne soit trop tard* (from Laurent Dussaux's film of 2005) and effectively not only on paper, from theory to practice.

However it is necessary to identify and analyze the various contexts before operating "immediately" and "concretely".

The economic context: the actual "take-off" of "industry 4.0" to solve the problem of scarcity of financial resources, to recover points of GDP lost as a consequence of the economic crisis.

The social context: the profound transformations of society expressed in those "battle words": migration, suburbs, waste, criminality, which require greater investment in social housing, services and redevelopment of the suburbs.

The environmental context: natural disasters, the green economy, enhancing natural resources, forestation, quality agricultural production, culture tourism, promoting local development.

The analysis of the context in terms of new demand to be satisfied and of the tools and economic resources to be put into the field was carried out – thanks to a third party research between a family business operating in the seismic field and the PDTA - to create a technical solution capable of satisfying, at least in part, the new emerging needs.

Particular attention – in configuring and patenting the technical proposal – was placed on environmental aspects using the Life cycle thinking approach; modeling the technical solution according to the Minimum Environmental Criteria (made mandatory by the new Procurement Code). Currently it is proceeding towards the EPD certification. From theory to practice, following a "circular" approach.

2. Analysis of the context and evaluation tools

The following research (the result of the collaboration between the PDTA Department - Sapienza di Roma with a family business enterprise - AC Engineering SpA) combines social sustainability (eco-building), environmental sustainability (LCA) and economic sustainability (a family business that is taking off towards construction 4.0).

The proposed methodology – and the applied criteria, replicable in other realities – provided for the analysis of the context from the social, economic and environmental point of view; a survey on the tools, operators, rules, available today.

The main goal was to come up with a technical solution taking into account social and economic issues – set up according to a qualitative analysis of the context – focused on environmental aspects measured through a "gate to gate" LCA. Further research activity on the subject will ensure the development of the Life Cycle Sustainability Assessment, LCSA (Kloepffer, 2008) that will include the Life Cycle Cost, LCC (Hunkeler et al, 2008); the Social Life Cycle Assessment, S-LCA (Jørgensen et al., (2008) and a "cradle to cradle" Life Cycle Assessment (ISO 14040: 2006).

What are the implications of a new demand for services, in which legal or regulatory framework and productive context could a possible answer be given, which innovations should be considered to meet the complex needs required by today's society? Specifically, what process and product innovations can a family business model pursue by collaborating, through the "third party" formula, with a University Department?

In fact, there is a different demand for goods and services (which can be summarized with the term eco-solidarity architecture), both in terms of a circular economy (environmental sustainability) and in terms of a changed technical/economic context (industry 4.0). The client is involved (both public and private): building property is no longer owned but only "used", connoted by digital & social and management/maintenance processes.

a) The new social demand

What are the implications of a new services demand: social commitment, solutions to environmental emergency problems and housing emergency caused by new forms of discomfort increased by the growing urbanization and migration phenomena that together determine further criticalities in the suburban and internal areas. (CENSIS, 2017).

Unfortunately, the new demand arises from emergencies, *the predictable ones:* aging of the population, decrease of the population due to the decline in births; economic crisis that has cut welfare, progressive environmental damage; *the partly predictable ones*: reception of migrants; *the unpredictable ones*: earthquakes and/or environmental disasters.

Disasters that as such, or rather unresolved emergency situations, also reveal waste and inefficiencies.

But emergency or crisis, conversely, also stimulates social commitment that translates into forms of active participation, collaborative platforms, co-design according to the *open source* model.

The question is how adequate a response can be depends on factors such as the population of cities that keeps increasing; (according to the UN World Population Prospects more than 7 billion people are settling in the cities and another 2.5 billion are expected between now and 2050), the needs of single citizens and the elderly, the population living in conditions of extreme poverty (from 2007 to 2016 there has been an increase of 106.9%) requiring homes that can also guarantee "*personal services*".

b) Now, what is the *economic and regulatory context* in which the building sector is today operating to satisfy the demand: industry 4.0., the digitalization of processes and the new Procurement Code. A sector that is also changing its name from the construction sector to the *built environment sector* that cannot fail to favor: the SMEs that make up the connective tissue of the territory at national level, which are confirmed as the country's production center, with the capacity to link the different components of the supply chains with each other and to the research world; within them the *family businesses*; which are the "proximity" production, oriented to the domestic market that pulls the tertiary or service sector into the smart cities and in the smart land of local districts.

Digitalization: which modalities should be implemented to influence the design, the continuity of the information processes from the formulation of the requirements by the client up to the completion of the executive project; also through its immediacy guaranteed by real time and finally leading to the management and disposal phase.

In construction, an instrument such as BIM, Building Information Modeling, serves to change the traditional processes of commissioning, design, execution, maintenance, management and demolition as it deeply changes the nature of the real estate product.

Contrary to what has been said by many parties, BIM is used to improve the consolidated processes for how they have always been, without having to rethink them. BIM is a cultural rather than instrumental approach, but culture must be shared. According to this logic, teaching students and operators the first rudiments of BIM today should take place with this spirit, taking into account the expected evolution of the market. (Ciribini, 2013).

The use of tools such as BIM will provide an opportunity to relaunch the sector; involving clients, operators and future users; it is found in every phase of the building process, it is mentioned in the Community Directive on Public Procurement and, as a result of this, in the new Procurement Code (D.Lgvo 50/2016) as mandatory by the (reticent) public client. in Europe, private customers have already made extensive use of the method. (Eubim, 2016)

An investment plan that targets the sector can only be part of an industrial policy for the *built environment*, in parallel and in synergy with the National Industry 4.0 (MISE, 2016).

Technical procedures: industrial culture has so far been mistakenly identified solely as prefabrication, rather than by more sophisticated organizational solutions envisaging more significant technological innovations.

Although prefabrication in a non-industrialized sector exists, conversely there is an industrialization that does not use any prefabricated components; today many qualified research centers provide a massive relaunch of the "off-site" approach.

Financial instruments: in view of the scarcity of public funding, a strategic role to relaunch investments can be played by public-private partnerships (PPPs); The CRESME National Observatory notes that the current critical issues could be solved by means of quality control systems for public services. The PPP, therefore, is no longer considered just a way to integrate public resources, but above all a tool capable of improving the quality of services. (CRESME, 2017).

The only way forward is the "Industrial Plan for the Country" focused on investments. It will also be necessary to support private investments for the acquisition and development of 4.0 competence and skills while enhancing the Competence Centers, centers of technological excellence, coordinated by universities using the public-private partnership formula, facilitating companies in digital transformation, while respecting the environment, towards the fourth industrial revolution.

The 4.0 industry plan requires, in addition to the technologies and competences, new models of work organization using the National Energy Strategy guiding Italy toward energy/power independence.

c) New environmental demand

The Italian territory's exposure to natural calamity and catastrophes is high; the vulnerability of the building stock resulting 70% inadequate in the event of a shock of average magnitude. Constant reference should be made to the 2030 Agenda for Sustainable Development adopted in 2015 by the 193 UN countries and to the 17 Strategic Development Goals which underline the close relationship between environmental dynamics and economic and social growth (ASVIS, 2017).

The building sector has a set of defined guidelines to follow: urban regeneration, infrastructural reorganization of the territory, a "circular" approach for the economy, all of which need to be "fuelled" by public investment.

The urban redevelopment sector is the only one to register a positive trend in the construction field; in the last three years it has grown by 20% and today represents 70% of the total market. An estimate elaborated by ENEA for the residential sector that on its own absorbs about 40% of energy consumption shows that consumption could decrease by one third. The improvement concerns 60% of the buildings built 40 years ago with high heat loss and with over 50% of consumption powered mainly by natural gas. (ENEA, 2017).

A circular economy represents the future of companies but a change in business models will be necessary: performance measurement will be extended to the whole life cycle, including reuse or disposal. (Symbola&Unioncamere, 2016).

Regulatory instruments: the new Procurement Code (D. Lgvo. 50/2016) has established new procedures and, although with lights and shadows and continuous setbacks, has also sought to further assume responsibility for the client, by analyzing the "technical and economic feasibility project ".

Therefore the Minimum Environmental Criteria instrument, the so-called CAM, has been updated; the decree has defined the environmental criteria, identified for the different phases of the tender procedure, ensuring above-average environmental performance. In summary it establishes that: the administrations must refer to the CAM in the drafting of the documents of public tenders and must also indicate the highest score to be assigned to the offers that have the lowest impact on health and on the environment. (Decreto 11 ottobre, 2017).

Annex 2 of the Decree defines the minimum environmental criteria and guidelines on the assignment of design services and works for the new construction, renovation and maintenance of buildings. In particular: the designer must guarantee, when possible, the recovery of existing buildings, the reuse of brownfield sites, the location of the work in already urbanized areas. A reward score is attributed to the proposal of a professional accredited by the energy and environmental certification of buildings. The companies must be certified with the EMAS Eco-Management and Audit Scheme registration (EMAS Regulation No. 1221/2009) or a certification according to ISO14001: 2015 "Environmental management systems - Requirements and guidelines for use" or according to European and international environmental management rules.

In addition, the project must include: in order to reduce environmental impact, without prejudice to compliance with applicable laws and the provisions of the specific product technical standards, a set of criteria common to all building materials/components such as: the *disassembling* capacity: at least the 50% weight of the building components and of the prefabricated elements, excluding the systems, must be subject to selective demolition at the end of their life-cycle and *be recyclable or reusable*. Of this percentage, at least 15% must consist of non-structural materials; recovered or recycled materials: must be at least 15% of the weight evaluated on the total of all the materials used; *absence of hazardous substances*.

In addition, in all cases there is an obligation to verify: the designer must specify the information on the environmental profile of the chosen products and must prescribe that during the procurement phase the contractor abide by the criterion. The percentage of recycled material must be demonstrated through an environmental declaration of Product Type III (EPD), compliant with the UNI EN 15804: 2014 "Sustainability of buildings - Environmental product declarations - Key development rules by product category" and the standard UNI EN ISO 14025: 2010 "Environmental labels and declarations - Type III environmental declarations - Principles and procedures".

Unfortunately although the Minimum Environmental Criteria CAM, is (as stated above) a necessary requirement it is not fully satisfied since awarding procedures which are largely based on the "most economically advantageous offer", are determined by public procurement committees whose attention to environmental issues is often lacking.

3. Methods

This is the context from which we started and which we have taken into account to design the technical proposal and the relative patent that is summarized here. Experimentation is part of the changing process "today" that has been outlined thus far; it has developed technical solutions and design assumptions whose main innovative features refer to both the process and the product.

It is the patent of a prefabricated building system (*Home Done*) consisting of a base panel, in reinforced expanded polystyrene (reinforced EPS), with dimensional and morphological flexibility, for the realization of three-dimensional modules; an open prefabrication construction system, almost a kit, with a series of accessories in the catalog, with variable-setting furniture solutions, which allow the same space to be used with different functions. The module idea in turn supports both the seriality of the product and the flexibility of living spaces.

In reference to the process the entire production cycle presents a fourth generation industrialization process, efficiently managing each operation to be carried out in the factory, from the moment of arrival and storage of materials, to the packaging of the panels in ready-to-transport pallets.

The core of the productive system is the printing machine (see Figure 1) assembling the three-dimensional steel wire with expanded polystyrene; this has also been designed to accommodate different types of moulds so that it is possible to produce flat and curved panels with different thicknesses and dimensions. Among the advantages in the use of EPS: the absence of risks to health (does not discharge harmful substances, cannot be affected by humidity or microorganisms) and durability (50 years) while maintaining its properties unaltered over time. This significant simplification reduces costs, time and waste.

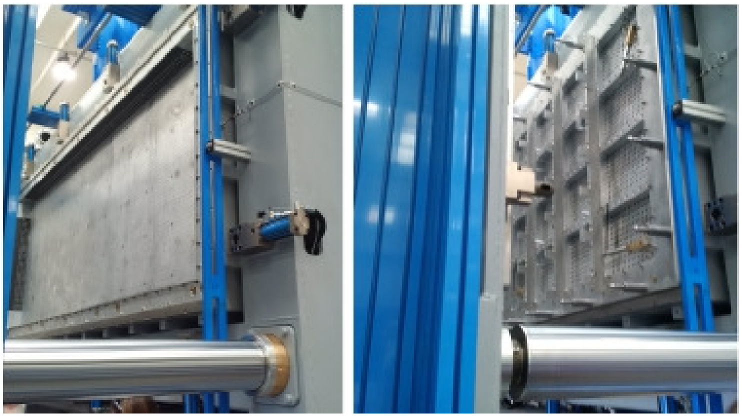

***Figure 1**. The printing machine that assembles a three-dimensional steel cage polystyrene. The entire production cycle, fourth generation industrialization, is in line with industry 4.0. Company in Umbria, photo, A.S. Sferra*

In reference to the product the basic element of the project is the panel that can be used both as a buffer and in internal partitions; it is composed of a three-dimensional galvanized steel wire incorporated in high density EPS; both the steel wire and the EPS coating can have variable dimensions depending on the different mechanical and physical performances required. The panel, for example can vary up to a height of 2.5m, thicknesses from 8 to 20cm; and density also variable between 10-55 kg/m^3 and can have inside up to four steel wires.

The panels can be easily moved by just two people, and can be assembled (and disassembled) dry by using a simple key; the connection between panels is through a hook (patented by the company) that allows fast anchoring between them in sequence. The different solutions available provide for the total or partial installation of the systems (air conditioning, electric, toilets and kitchen block).

As far as transportability is concerned, the disassembling of the structure into separate components allows an adequate distribution during loading and maneuverability and while unloading with contained processing time, opening possible alternative solutions such as self-construction. The construction system has the advantages of the structures being already assembled in the factory: the assembly is very fast (the 42m^2 residential unit can be assembled with only two workers in less than 5 hours) without limitations in shape and mass in relation to the legislation and possibilities of the means of transport.

The constructive system is flexible in terms of satisfying the "*new demand*", both for the continuous technological innovations and for the adoption of more performing materials.

The residential module therefore meets the requirements of: reduced volume weight, resistance to earthquake, resistance to strong winds, fire, thermal and acoustic impacts; it also guarantees speed of assembly/dry disassembly, durability, maintainability. All these properties have been certified as required by law; moreover the modules are compatible with different coating/finishing materials/solutions.

In emergency situations, it is able to provide actual operational proposals in terms of: a) m^2 of (functional) dwellings that can be realized in one day/week/month; b) costs per m^2; the foundations, the sewers, light and water supply provided by local companies. As far as costs are concerned, the production system allows to predetermine costs accurately at the factory according to the scale of the order. (see Figure 2)

Figure 2. *From residential emergency, fixed in time, to an eco-sustainable/environment-friendly solidarity architecture dilated in time in order to the interpretation of the new demand, photo AC Engineering*

From an environmental point of view, a *gate-to-gate* LCA with primary (direct) data of the activities carried out in the Company – related to the production/assembly of 1m^2 of a reinforced EPS panel – was conducted on the basis of the acquired direct data. Furthermore, according with the LCT approach, the upstreaming activities (extraction and processing of raw materials and related transport) and down-streaming ones (management and maintenance), disposal and management of waste have been set qualitatively.

The production process in the Company (Core process) consists in the expansion and transformation of high density EPS polystyrene, installed first in the moulder machine, then in the panel machine to be assembled together with the wire mesh.

The functional unit (FU) was 1 m^2 of panel (thickness 10cm, density 45k/m^3) considering a 50-year durability hypothesis.

The system boundaries were considered using a gate-to-gate approach where impacts were evaluated considering the transport of the materials (wire galvanized steel 2.6 kg/m^2 and expandable polystyrene 4.5 kg/m^2 of which 10% comes from recycling directly in the plant) to the factory, and its transformation until obtaining the panel ready for delivery (to the gate).

The materials are transported from the supplier company to the production plant along 300 km and 1000 km by road, respectively. The process requires 1.67 kW/m^2 of electricity and 1.1 liters/m^2 of water (taken from the recycling plant).

The life cycle inventory data used in the assessment "gate to gate" of the panel are summarizes in Table 1. In order to identify the environmental aspects associated the Ecoinvent v.3 database, from SimaPro 8.0.4.30 library was used; the impact assessment was carried out using baseline characterization factors from CML assessment method. Table 2 summarizes the main tested technical properties of the reinforced EPS panel related to the FU.

Table 1. *Life cycle inventory primary data during the factory production process of 1m^2 of reinforced EPS panel.*

	Stage	Input	Quantity (unit)
	transport	transport truck >10t, Euro3 default	5,7 tkm
	manufacturing	electric power from the Italian's national grid	1,67 kWh
		process water	1,1 l

Table 2. *Main technical properties of the reinforced EPS panel related to the FU.*

Property	Value (unit)	Rif. code
thickness	10 cm	-
weight/m	8,68 kg/m^2	-
density	45 kg/m^3	-
bending strength	260 daNm	ACI 318, n
compression strength	408 daNm	ACI 318, n
shear strength	6566 daNm	ACI 318, n
thermal conductivity	0,0315 W/mK	UNI EN 13163
transmittance (vertical panel)	0,32 W/m^2K	UNI EN ISO 9972:2015
fire resistance (vertical non-load bearing)	Class E	UNI EN 1363-1:2015

4. From a (general) context to (local) experimentation: results/discussion

As it was mentioned in the methodology, the manufacturing process (activities carried out in the Company) and transports (from the supplier company to the production plant) were considered in this *gate to gate* LCA. Table 3 shows the contribution of the manufacturing process and transports to each impact category. Main impacts in the ADFF and GWP are related to the consumption of fossil fuels for electrical energy requirements and transports.

Table 3. *Potential environmental impacts from the manufacturing of 1 m2 of reinforced EPS panel.*

Impact Category	Amount	Unit
Abiotic depletion (AD)	0	kg Sb eq
Abiotic depletion (AD FF)	0.402E+02	MJ
Global warming (GWP)	0.223E+01	kg CO_2 eq
Ozone layer depletion (ODP)	0.648E-07	kg CFC-11 eq
Photochemical oxidation (PO)	0.549E-03	kg C_2H_4 eq
Acidification (AC)	1.078E-02	kg SO_2 eq
Eutrophication (EU)	0.155E-02	kg PO_4 eq

Furthermore, Concerning both the a) up-streaming and b) down-streaming phases an initial quality survey was conducted to identify the most environmentally critical activities while waiting to conclude the direct data collection, to elaborate the *cradle to cradle* LCA and start the EPD certification procedure.

a) Up-streaming

Extraction and transformation of raw materials and /or transformation of materials coming from the recycling process: the production process in the factory is based on the use of galvanized steel wire and polystyrene (PS) to be expanded; both materials are obtained from processes external to the plant, both of extraction and subsequent processing of the respective raw materials and the use of "secondary" materials coming from recycling. Steel and PS cargos are transported by road. The unexpanded polystyrene is contained in plastic bags, while the electro-welded steel wire mesh in strapped containers. Depending on the % of materials coming from recycling, impacts can be reduced by about 40-45 %: those associated with transport are mainly due to the distance and to the means used rather than to weight; as far as packaging is concerned, both are recyclable.

b) Down-streaming

Installation/assembly: according to the needs of the client, the project specifications, the variables of the context (climate, wind, earthquake) it is possible to create many modular types; in all cases the panels are dry assembled; from two to three workers may be necessary, the auxiliary assembly equipment are: adjustable wrenches for screwing the hooks, access platforms and scaffolding in the case of multi-floor modules; assembly times can always be estimated: between 4 and 5 hours. Consumption of energy; during installation the impacts amount to *almost zero*. CO_2 emissions caused by transport of the panels to the construction sites are significantly influenced by the type of vehicle and the distance traveled, whereas the emissions associated with the weight of the panels are negligible. The installation does not generate waste.

Use/maintenance phase: during the use phase the technical characteristics of the prefabricated system guarantee simplicity and reduced costs of maintenance and management; as regards energy performance, the values of thermal transmittance guarantee energy consumption within the limits of the law.

End of life cycle/disassembly and waste management: once the programmed life cycle has been completed, disassembly activities are completely similar to those described in the installation: number of workers, equipment required and also in this phase, the estimated timetable. Sustainable waste management, following dismantling, firstly allows for reuse in the same way; panels can also be recycled: about 80% of EPS and 95% of steel. In case of the panels reuse the impacts are *almost zero*; in the case of recycling instead, they are variable according to the specific processes necessary for recycling.

5. Conclusions

At the end of this research phase, in terms of environmental sustainability, it emerged that the activities carried out in the factory mainly concern Abiotic Depletion (AD FF) and Global Warming (GWP); such results contribute to: the efficiency of the machines, the fourth generation production process (timetables, quantities, constant monitoring of costs), the recycling of 10-20% of the EPS directly at the plant and finally the plant for the recovery of water. Since the main impacts depend on the consumption of electric power produced from fossil fuels, at the factory in Santo Domingo (Dominican Republic) an experiment is under way to verify the technical and economic feasibility of the production of electrical power exclusively from renewable sources; the choice of the location was also motivated by the need to cope effectively with the relevant requests for housing caused by serious environmental emergencies. As stated above, further research activity on the subject will ensure the development of the Life Cycle Sustainability Assessment, taking into account the three pillars of sustainability.

How to proceed: (in particular the Academic/scientific world, i.e. those working within Universities and conducting research activities): by collaborating with *Competence Centers*:

- In this fast moving transitional phase, which is already looking beyond industry 4.0, it is necessary to support companies to innovate operating models: *(economic sustainability);*

- Favoring the change from product companies to "product as service" companies according to a logic of sustainable development in the building sector *(social sustainability);*

- Supporting SMEs and family businesses that by operating on-site and in tight synergy with their territories are more aware and sensitive to *environmental sustainability.*

Thus the three "types" of sustainability. I have written this article to provide some sort of contribution, and also, perhaps immodestly, to confirm what was stated in the introduction: "*It is proven theory, unfortunately not implemented yet, that sustainability (be it economic, social or environmental) can't (should not) be dealt with as a separate element or sector, since it involves every aspect of* society".

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