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Reduction, Recycling and Reuse of Refuses: Prerequisites of a New Technological Culture of the Project.

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SH3-1. Environment and sustainability
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Abstract:
Consumption control of main resources and reuse and recycling capability of building materials, appear more and more among the operational strategies of sustainable building. The knowledge of production processes, methods of purpose, disposal and reuse of materials and products is the requirement for a possible administration of related environmental consequences. Particularly, the flow of waste control that goes to the implementation of the building project should be approached thinking, in addition to recycling, of effective strategies for reducing the source. It is right to think that the technological culture of the project should re-appropriate its capability of efficiently orient the planning choices in favour of a renewed environmental awareness.

Reflection for eco orient yourself

For years now, an awareness of the need for an act more sustainable is determining important changes to mitigate the environmental weight of building "eco[1]" by directing the project to several scales – territorial, urban, architectural and of interior design. Technological innovation of product, project, and building increasingly refers to implementation of the requirements and environmental performances along the production chain and among alternative and synergic pathways strongly appear the opportunity and the need of reuse materials from production chains pre and post consumption[2]. In fact, today is always easier to find building products obtained from recycling pre and post consumption processes in new buildings (Morabito, Bianchi, 2010) (Addis, 2005), as a consequence, building companies that use materials and products unknown until few decades ago modify their arrangement; contextually it's not unusual to attend to typical reticence to innovation of several "traditional" companies (Sinopoli, Tatano, 2002)[3]. At the end, the need of eco-orient collide also to the technological transfer methods of innovations from the industrial branch to the building one. Andrea Campioli writes: «In the building branch, innovation arises with a multiple character. First of all because situations belonging to manufactory industries (materials, products, components, tools) and situations belonging to services industries (planning societies, consultants, management societies) deeply interact together in it. Secondly because the pathways through which innovation can carry out are very well-structured and sometimes are contorted»[4].
Turning attention toward the potential of reuse of waste materials (from pre and post consumption), it meets a normative framework in continuous evolution. From the European context emerge orientations sometimes descriptive sometimes prescriptive, that force/suggest/encourage the Countries belonging to the European Union to adopt regulations, protocols and procedures to reduce the environmental impacts. Hierarchy of legislation (new Framework Waste Directive, EC 2008) puts at the first place the recycling activities and promote the reuse activities of wastes and refuses from pre and post consumption[5]. While for a real reduction of environmental impacts of building, the aim remains the reduction of waste itself. In this sense, referring to the planning, building and disposal phases, the possible recycling and reuse activities of

materials and buildings, describe interesting operative and research scenarios coherent with cultural and normative framework indicated. According to the rules in force, recycling and reuse of manufacturing waste and by products (from pre and post consumption) (fig. 1), must generally take place in the manufacturing process itself or thank to the synergies of industrial production chain (Campioli, Lavagna, Migliore, Oberti, Paganin, Talamo, 2014). On the other hand the reuse or recycling of building and demolition waste (from post consumption), can take place *in situ* or normally, by a first storage or preliminary treatment (fig. 2) followed by a transfer to the seat of transformation (Monsù Scolaro, Spanedda, 2014).

Fig. 1. Former brick factory in Porto Torres (photograph by A. Monsù Scolaro)
Fig. 2. Final product from the thermal treatment of waste reduction of polystyrene foam (photograph by A. Monsù Scolaro)

The handling of waste involves both energy expenditure and environmental impacts usually depending on the distance and characteristics between seat of waste production and belonging recycling production chain. The advantage of the recycling process thus depend on both economical factors –strongly connected to technologies and transformation techniques used (Schmidt, 2010) – and real environmental impact related to transformation processes and production chains[6]. The recycling process of waste from post consumption should be compared to the recovery of building materials for reuse: this last case, especially if carried out in construction site, thank to the limited handling materials should appear as the alternative procedure with a restricted energy expenditure and a better environmental evaluation. However, even if realized out of the construction site, the recovery of materials from post consumption for reuse shows clear energy expenditures of transformation. This assumption, which underpins the recovery and reuse of matter, should be referred to a cultural and operative framework that range from the famous report of ACHP of 1979[7] until the recent guide lines of European project *EeBGuide Project*[8]. In the matter of requalification projects of existing buildings, the EeBGuide cites several European rules (in particular the EN 15804 and EN 15978[9]) referred: from one hand to a standardized set of requirements for the development of environmental product declarations (EPD) for building field; on the other hand to a standardized method for procedure LCA application to building field.
Particularly, the environmental indicators of EN 15978 relate to “border of the system” – canonical building field – but they consider an additional module (D) that account of a possible implementation of environmental performances of the process thank to a potential reuse, recycling and recovery of building and pre-existing materials, as a safety of main resources.
The operational framework is finally enriched by the online platform, *free access*, named *Net WRAP Tool*[10]. Synthetically, this work describes a scenario in which some topics of interest emerge and we try to summarize them in the following points:
- The pressing request to improve the refuses cycle management entails a progressive technological innovation of processes to reduce production costs and improve secondary products performances (product innovations);
- The enormous quantities of building wastes should principally inspire actions towards reduction of volumes produced (project innovations);
- In the future, the recovery of products and materials to be reused appears the most efficacy strategy to control the primary resources utilization and to reduce the environmental impacts of building.

However, the recovery and reuse of post consumption wastes need a check of the real economical convenience related to the performance of products obtained, according to the actual operational

possibilities under the rules in force[11]. All of this exhorts to ask if and how it should be possible to conciliate matters that arise inside the project process. On which prerequisites should and could found a planning approach correctly, eco oriented that specifically consider the aim of reduction of post consumption wastes.

Recycle, reuse or decrease?

Produce, plan, build and then demolish and/or disassemble and finally recover, reuse and recycle: as shown none of these steps can be defined independent in a systemic logic of "eco oriented building project". The concept of eco innovation *"...is one of the main driver of sustainable development..."* (Morabito and Barberio, 2014)[12] and it involves the building process during its execution –from the decisional phase to the planning one both effective and executive until the management and the end life phase-. The eco innovation of the building process entails, as in other fields, an approach and efficiency that mark the transition from a "linear economy", founded on the basis of produce-consume-reject, to a "circular economy" that, on the other hand, prefers reuse instead of reject, longing for the extension of a product life reducing both wastes volumes and primary resources consumption[13]. Eco innovate the building process, considering the reticence of actors, appear a very hard task. But in addition to the pressing requests, especially in Europe, that try to orient the trade towards an eco compatible approach, the reconversion of the field should be justified by the over 500.000 new jobs estimated in the next five years inside a "green re-industrialization"[14]. Applying this line of reasoning to the building field it is evident which is the potential hidden under this reconversion and emerge some aspects on which it should be appropriate to define eco innovation in terms of process through:

- Creation of new products and materials, recyclable but above all reusable (able to use a low percentage of primary resources and able to consume minimum quantity of energy during the productive cycle);
- The evaluation of methods of utilization for planning purpose (the creation of a catalogue of materials, products and components at low environmental impact with clear indications about technological performances and assembly methods);
- The fine tuning the construction techniques both the existing ones and those related to the new products (from which emerge the utilization limit of recycled and recyclable materials in the disposal and reuse phase);
- The optimization of transformation processes of refuses into resources (appointing to each product, material or component the related production chain of disposal, reuse and recycling process to guarantee the circular flow and to define the separate share of linear flow that belong to it).

All of this should be supported and accompanied by a policy of economic incentives to the utilization of green products and technologies – for example, according to the criterion of "double dividend"[15] – or also thank to new trades organizations based on the recycle and reuse of products and materials through the reuse centres[16]. In any case is better to know that something will "always" remain out of the circular flow –following the linear flow- because the request of primary resources is still stable and the production of waste to be disposed of is enormous[17]. Realistically, on the other hand, an eco innovation process in the building field[18], both in the case of new building planning and requalification of existing buildings, must consider two variables. They are respectively the grade of knowledge diffusion and technological transfer of information from the industrial field to the construction one and the material consistence of pre-existing building. In the case of new constructions, the capability of wastes reduction and thus the time still necessary to an effective decrease of volumes to be treated, depend on both the knowledge of products and available technologies and the gradual capability to use them (in addition to their environmental profile)[19]. Moreover, the project should consider an efficacy process of reutilization of building materials and find flexibility margins that allow the adjustment to a new use in spite of building demolition.

Much more complex it is the management of the waste stream generated by the action of the requalification of the existing buildings that depends on the materials and construction techniques used (fig. 3). In this case, the choice of an intervention of refurbishment, will assume a preliminary environmental assessment of the negative impacts due mainly:

- The removal of the debris (generally inert) and to the divestment of unusable components to landfills;
- The flow of new materials to refurbishment intervention;

Taking also into account the positive impacts on the environment due to:

- The proportion of materials, products, and reusable components (even in the case of partial collapse) or easily recyclable;
- The level of residual performance of the technical elements, which will involve different levels of intervention of technology refurbishment;

In the latter case, the environmental balance will result from the comparison between the degree of technological performance based on the alternative intervention techniques and the "environmental impacts" of the materials employed (fig. 4).

Overall, in the context of a circular economy, in order to implement the environmental impact positive - both in the case of the new and of the recovery of the existing- you need to use products[20]:

- That leverage a lower content of primary resources (environmentally friendly);
- That has a greater durability;
- That requiring a lower energy consumption during the production phase and in use (and thus more efficient);
- That are easily convertible (recyclability);
- That is easily separable (reusability);
- That is easily maintainable (reparability, maintainability and substitutability increased).

As said, if applied in a systematic way, in accordance with the current estimates, could contribute to the reduction of the use of primary resources of the 17 % -24% by 2030 in the application of an echo conversion of the sector edile[21]. In summary, that invokes a horizon "Zero Waste"[22] in the field of building, and covers both the process of product than that of project and construction without forgetting, at the same time, the policy choices prior to the intervention of transformation of the territory that relate to the substrate cultural, economic and social inclusion strategy[23].

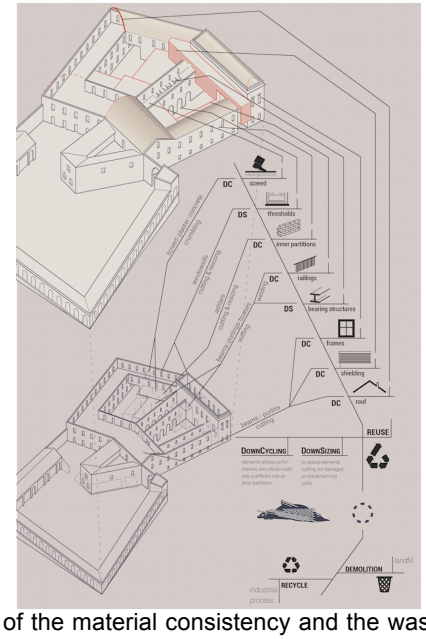

Fig. 3. A former factory made of reinforced concrete, requires an assessment of the material consistency and the waste stream due to a refurbishment (photograph by A. Monsù Scolaro)
Fig. 4. A schematization of the possible flow of materials and products in a redevelopment of existing buildings: the building becomes a "quarry materials" (graphic elaboration by G. Costa)

Toward a "new" technological culture eco oriented project

In the opinion of Giuseppe Ciribini (1984) the technological design culture is «a set of skills that relate to the analysis and the prediction about the impact that technology, seen as global expression of a spiritual and material culture, has today and will tomorrow on the life of the man (individual and society) in relation to the physical environment and biological in which he and place». The summons, in its breadth and depth of meanings, part still today exhaustively the complexity that accompanies the processing project.
Ciribini adds that «if the problem of the quality of the built environment is recognized as the cornerstone of the technical activities and the project, the project is to turn the hinge of the industrialisation of the building, and each step of the construction process is the project way».
In the years '80, a period of great change, Ciribini says that the process becomes ever more central (Bosia, 2013); this topic today is very current because they actually grow the complexity and implications in the process of project, intended as delicate transformation of the natural environment in which we live and to adapt the built environment. The design phase is the fundamental moment of the construction process from which depend on the choices that induce environmental impact direct and indirect (Nardi, 2003), of the previous and following steps, internal and adjacent to the process itself. Manufacturing, design, construction, disposal, and reuse are the phases during which to be measured against the objectives of a spatial quality and technology of each project with respect to environmental impacts derivati[24]. The designer should recover its role and “return to educate the customer”, should also guide production and promote innovation of product through the design choices. Referring to both production processes and the performance characteristics of the materials; referring to the technical possibilities for assembling, disposal and reuse of materials and components is necessary to rediscover the foundations of the technological culture of design[25]. Moreover, it is evident that until it spreads a environmental culture between the operators of the

sector, it is not reasonable to think to systemic actions of reduction of impacts of waste products from the activities building and transformation of the environment (fig. 5).

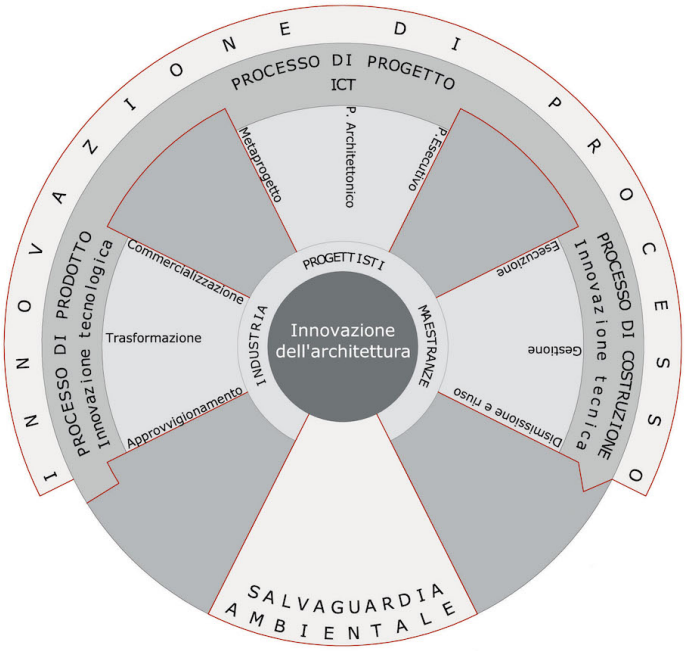

Fig. 5. Diagram of the building process based on the concept of circular economy, from production to material reuse (graphic elaboration by A. Monsù Scolaro)

This assumption defines a framework for applied research complex, multidisciplinary and multi scale that, from the point of view of the project cannot regardless of spatial quality and technology of the architectural project. Then, by trying to describe the contents of an “updated profile” for a “new” technological design culture, you should:

Starting from the production process
- To understand the impacts of the production chain – in terms of material fluxes at the inlet and outlet- and evaluate how a product and production process are truly *eco friendly* (and not eco trendy). In particular through the requirements of reduction in the flow of raw material and energy consumption (stages of production, commissioning, to re-use and transformation post consumption);
- to encourage the exchange of knowledge useful for the creation of operational synergies between producers (such as the ability for a company to use the waste from pre consumption of another company);
- Strength the sustainable procurement of raw material and stimulate the market for raw materials;
- To promote the traceability of the products and production processes, to stimulate the economic and social sustainability related and strengthen the system of environmental product declaration (EPD);

Starting to the design process[26]
- To evaluate the possible combinations of functional materials, products and components or semi-finished products, as a function of performance and spatial aspects (in particular linked to textures);
- To require the plan to dispose and reuse of materials used in the project, based on their assessment of the environmental impacts related;
- To develop the technical specifications for mounting in order to reduce the scraps in processing step;
- To assess the alternative intervention techniques in relation to environmental impacts derivatives;
- To choose existing buildings to retrain on the basis of the environmental impacts due to demolition, the landfill, the reusable components and/or recyclable);

Starting to the construction process (in relation to the hypothetical processing history)
- To accurately perform the removals of components to be reused;
- To perform the selection of materials and waste present in the yard for the recovery, reuse, or recycling, incineration and landfill);
- To check the correspondence between forecasts and the actual waste stream in order to develop a forecasting model of support;
- To check the compliance with the specifications executive performance to limit waste and follow the forecasts for the reuse of building materials.

In addition, it is important to note how the themes of the reuse and recycling pose some serious questions regarding the configuration of the architectural space. The first aspect concerns the localization of the intervention (fig. 6), which should also be influenced by considerations on the opportunity to take full advantage of the existing infrastructure, land in need of reclamation, advantages of proximity and microclimatic conditions due to the presence of other buildings. These opportunities are generally related to strategies of densification or replacement but depending on the specificity of the sites and the programs can be followed different ways. The fundamental point is to build a system of relations with its context that allows as much as possible the exploitation and the reuse of the present buildings on the site. A further aspect concerns the shape of the building and its construction methods (Monsù Scolaro, Spanedda, 2014). In the case of operations for recycling or reuse the outcome of which materials are similar to those normally used for production processes and aspect, the problem is substantially updating of designers, developers, and operators to make understand the slight differences of the new material than those already known. An example is the concrete obtained from the recycling of concrete elements demolished, apparently indistinguishable from that obtained with usual procedures. On the other hand, in the case of reuse or recycling of structural elements and materials with properties and look completely different from those normally in use, it is need to invent the configuration and an aesthetics of the material and to be able to communicate and share it with the customer. In this sense, one last example can be considered the "Papierhouse on the world heritage Zollverein" Dratz&Dratz Architekten, made in Essen in 2010 (fig. 7), the walls of which of recycled cardboard produce visual experience and tactile completely different from a traditional wall[27].

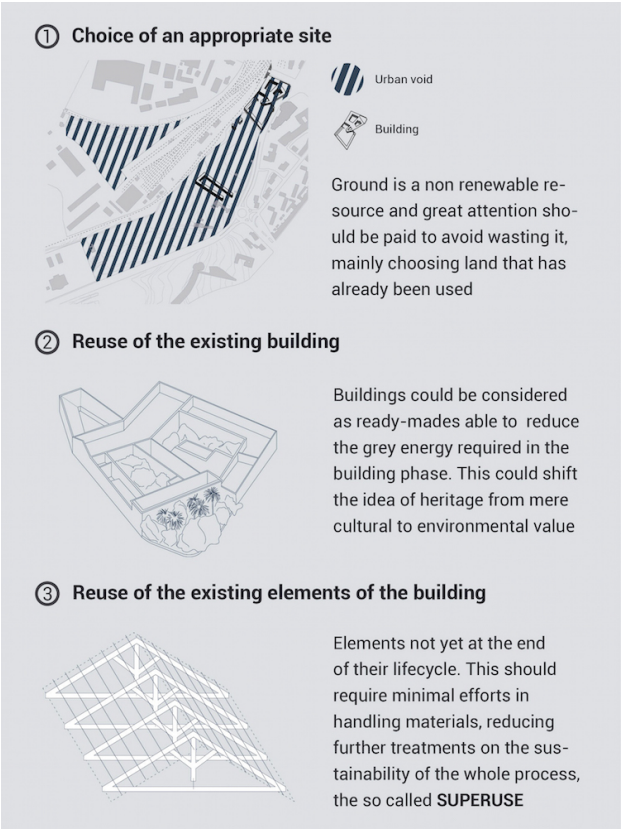

Fig. 6. The process that leads from the location of the site to the reuse of existing building materials for maximum exploitation of the *embodied energy* (graphic elaboration by G. Costa)
Fig. 7. The basic elements of construction of the Paper House: products following the first reduction treatment of the paper, preliminary to subsequent recycling (photograph by A. Monsù Scolaro)

Open conclusions and ongoing research activities

The present reflections seeking an answer to the question whether it is possible to reduce the flow of waste products in the field of building and what strategies could be implemented. In summary, it is clear the need for a radical review of the operational scenario consolidated (starting from the production processes) and then come up with design choices that rather enjoyed staying materials and recycled products and recyclable, but above all, recovery and in particular reusable. The reuse of materials promises the best environmental performances of the project, but a new technological culture must be reconfigured to ensure the request technological performances and architectural qualities. This scenario, that is still to investigate, requires an integrated and cross-border examination at least on three areas:
- The productive dimension and the environmental quality of the product;

- The space dimension and the architectural quality of the project;
- The technological dimension, understanding what is the project of the technical solutions and construction choices.

These areas reflect the research interests of the group, and in particular:
- Technological innovation you can reuse the waste production chains (a national scale, by the writing of a research project FIRB 2012, suitable not funded);
- The quality and the type of waste from pre consumption and waste from post consumption, in particular related to the construction industry (a regional scale, in 2013, by the writing of a project for the call promoted by SardegnaRicerche entitled "Program Cluster projects. Materials for the sustainable construction", suitable not funded);
- The search for products and production chains with a low environmental impact, for a first catalog of constructive solutions for the recovery of existing buildings (a regional scale, in 2014, appropriate, and funded by the Foundation Tour of Sardinia, in the course of carrying out);
- The census materials and waste products from post consumer, from collection centers, or first treatment, at regional scale. This research project was developed in July 2014 together with leading companies in the field of the recovery and recycling of waste, aims at defining the procedures for treatment of certain categories of materials - in particular, wood and metals- and the possibility of king placing on the market.

The latter research project is the prelude to the definition of "centers for the reuse" of residues materials and wastes from post usage: today, the only ongoing project in Italy funded by the European Community is the so called project "PRISCA. Pilot project for stairs re-use starting from bulky waste stream" on funds "LIFE"[28].

Antonello Monsù Scolaro is the author of the whole article except for the third paragraph of the chapter: "Towards a new technological culture of eco oriented project".
Francesco Spanedda is the author of third paragraph of the chapter: "Towards a new technological culture of eco oriented project".

Notes

1. Costantino Cipolla wrote "*Eco is the sociology of coevolution and this is only possible if it is contemplated in the physical-biological substrate of mankind*"
2. See the norm EN ISO 14201:2001 to "Definition of recycled content", as a "*Portion, by mass, of recycled material in a product or packaging. Only the materials pre-consumer and post-consumer can be considered in the determination of recycled content, consistent with the following definitions*". Material from pre-consumption: subtracted from the waste stream during a manufacturing process. It eclude reuse of materials reworked, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated them. Material from post-consumer: generated by households or commercial installations, industrial or institutional facilities in their role as end users of the product, which cannot be used for its intended purpose. This includes the return of material from the distribution chain. These definitions are then taken from LD 3 aprile 2006, n. 152, art. 184-bis.
3. Both in relation to the use of new products that improvement in environmental profile of construction processes. The construction companies, especially small and medium, maintain a trim and an internal organization that resists traditional innovations: both technological that techniques and this slows down innovation in the industry.
4. Campioli A, 2011, *Qualità dell'architettura: innovazione, ricerca tecnologica e progett*, in TECHNE' 1/2011, pagg. 62-69
5. The improvement in waste management both urban that, in particular, construction and demolition waste is a mega trend (MGT) of SOER 2010 will be maintained and enhanced in the SOER 2015 (according to Implementation Plan of 2014). In terms of technological innovation in the field of products containing recycled materials, on the one hand it will improve both the processes of separation of waste that processing techniques, on the other hand you have to look at the reduction of energy consumption of the processes themselves, ensuring however the quality of the final product.
6. For product categories engaged by recycling, see the document "*The european environment. State of outlook 2010. Materials resources and waste*", European Environment Agency.
7. In which he argued in a organic way about energy expended for the redevelopment, demolition and new construction of buildings and the opportunity to re-use of buildings and existing materials in particular in terms of *energy embodied*.
8. Operational Guidance for Life Cycle Assessment Studies of the Energy Efficient Buildings Initiative. The EeBGuide promotes the application of LCA methodology - simplified or full - referring to both materials (part A) and buildings (Part B) in relation to measures to improve energy efficiency of buildings, new and existing; among the several parameters examined, provides for the calculation of the environmental impacts of waste management from construction of new buildings as well in the operations of refurbishment of existing buildings.
9. EN 15804:2012 "*Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products*" ed EN 15978:2011 "*Sustainability of construction works – Assessment of environmental performance of buildings – Calculation method*"
10. The "*Net WRAP Tool*" extends and replaces the previous "*The WRAP. Evaluation Tool for Recycled Content in Construction Projects (RC Tool)*". This calculation tool allows to evaluate -both during the siting choice that during project phase- alternatives for waste reduction and therefore the related costs. In relation to the design choices, both for engineering works that construction of new buildings or recovery, it is also possible to evaluate the content of recycled material used and the losses or gains depending on the use of materials obtained from primary resources. In other words, is an interesting tool for preliminary evaluation of the ability to waste or optimization of matter.
11. See in particular the recent definitions of "end of waste" and "secondary raw material", both in reference to the most current legislative framework (national and European) that in relation to DM February 5, 1998
12. Morabito and Barberio continue: "*and of transition to a new economic model based on the supply and more sustainable use of resources and reduction of environmental and social impacts, for the purpose of a general improvement in quality of life".*

13. In this regard see the document COM (2014) 398 final, Brussels, 07.02.2014. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions entitled "*Towards a circular economy: the program for a Europe of zero waste*"
14. Ellen MacArthur Foundation, report vol. 3-2014. *Towards the Circular Economy: Accelerating the scale-up across global supply chains*. "*over US$1 trillion a year could be generated by 2025 for the global economy and 100,000 new jobs created for the next five years if companies focused on encouraging the build-up of circular supply chains to increase the rate of recycling, reuse and remanufacture. This would maximize the value of materials when products approach the end of their use*". Available on http://www.ellenmacarthurfoundation.org/business/reports/ce2014
15. View to promoting "new forms of energy and environmental taxation" also arises the recent tax law of Delegation (Law 03.11.2014, n. 23) in order to create sustainable development opportunities related to the green economy and, at the same time , the market moves in ways of sustainable consumption and production. The revision of the rules of excise duties on energy products and electricity, as well as a function of carbon content and emissions of nitrogen oxide and sulfur, in accordance with the principles that will be adopted with the approval of the proposal to amend the Directive 2003/96 / EC in the Communication COM (2011) 169 of the Commission of 13/04/2011, pursues the goal of "double dividend". Therefore the windfalls should be allocated primarily to the reduction of income tax, in particular on the work generated by the green economy, innovation and the diffusion of technologies and products with low carbon content and the financing of sustainable production and consumption patterns, as well as the revision of the financing of subsidies for the production of energy from renewable sources.
16. At the moment, in Italy, the Ministry for the Environment is involved in the definition of methods for organizing "centri per il riuso". Some regions have already issued specific regulations, as in the case of the Marche Region which approved the DGRM n. 1793 of 13/12/2010 "*First Guidelines concerning the regional centers of Reuse*".
17. In Europe, the flow of waste from construction and demolition waste is one of the heaviest and voluminous: accounts for about 25% - 30% of all waste generated in the EU. In addition there are many materials who are part of the recycling chains already consolidated as those of concrete, bricks, plaster, wood, glass, metals, plastics, whose costs, depend on the mode of separation and processing technologies. Nevertheless, at European level, it is estimated a large variability in the level of recycling and reuse of waste from C & D: from under 10% to over 90%, and still many wastes are largely disposed of in landfills.
18. Which requires an effective approach to circular economy and therefore a reduction of the waste stream and optimization of resources.
19. In this regard, we recall the current protocols LEED-GBC, ITHACA, SB100 (and others) that allow you to assign a "weight" to the environmental design choices and direct them with reference both to the production phase of the materials to the disposal; these protocols take into consideration a number of requirements that the materials and the technical elements must have as recyclability, recycled content, etc.. View the economy circular in construction would be important to include the requirement "reusable" as a characteristic of the issues related to the environmental impacts of the design and manufacturing choices.
20. For wider consultation addresses, see note 10
21. *Guide to resource efficiency in manufacturing: Experiences from improving resource efficiency in manufacturing companies*, Europe INNOVA, 2012.
22. We refer to the definition adopted by Zero Waste Management Alliance, or "*Zero Waste is a goal that is both pragmatic and visionary, to guide people to emulate sustainable natural cycles, where all discarded materials are resources for others to use. Zero Waste means designing and managing products and processes to reduce the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water, or air that may be a threat to planetary, human, animal or plant health*", available on http://www.zerowasteeurope.eu/about/principles-zw-europe/.
23. You can not think that sustainability is not related to the context, so the ability to reduce waste depends on the degree of evolution of the society and also by its evolution is not considering a proportionality between progress and ability to generate waste.
24. An eco-oriented design thinking should be based on knowledge of the peculiarities of the environmental context and be able to adopt environmentally sustainable choices; hence the suggestions arising dall'LCT, or by the Life Cycle Thinking, useful to define the scenario for a "new" technological culture design aimed at sustainable use of resources, development of effective design solutions and to reduction of waste.
25. The criticality of effective reduction of environmental impacts of building seem to depend from both '"ignorance" of the operators, that the lack of an integrated approach to the various levels (from producer to consumer). The responsibilities also extend to public administrators who should be "educated" or helped to assess right from initial planning of measures the environmental impacts of their choices is the territorial scale that urban.
26. «…*on Europe has to invest in a well-functioning circular economy where resources and products are sustainably sourced, designed to be re-used, remanufactured and recycled so that waste becomes a resource and less primary raw material needs to be used. This should improve the global competitiveness of our companies, secure our materials supply, create new jobs..*» da "Towards a resource efficient and circular economy" (second set of policy recommendations adopted in Brussels, 31 March 2014), in EUROPEAN RESOURCE EFFICIENCY PLATFORM (EREP) Manifesto & Policy Recommendations (Bruxelles, 17 December 2012).
27. All this presupposes a renewed ability to understand the underlying complexity from a building process attentive to the environmental effects of design choices - technological and spatial -. The progressive implementation of this approach will have to assume the operational integration of the stakeholders involved in the process - administrators, businesses, manufacturers - and the effectiveness of the predictions can be measured - roughly - inverse function of the reduction of the waste stream, from individual work sites. Finally, in technological terms, the effectiveness will depend on the ability to control the technical solutions through materials with a strong environmental profile and to dialogue constructively with the operating conditions of the context -social and cultural- that will never be neutral with respect to the horizons of this work although not at the time depth.
28. For further information see at http://www.progettoprisca.eu/index.php?lang=it.

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