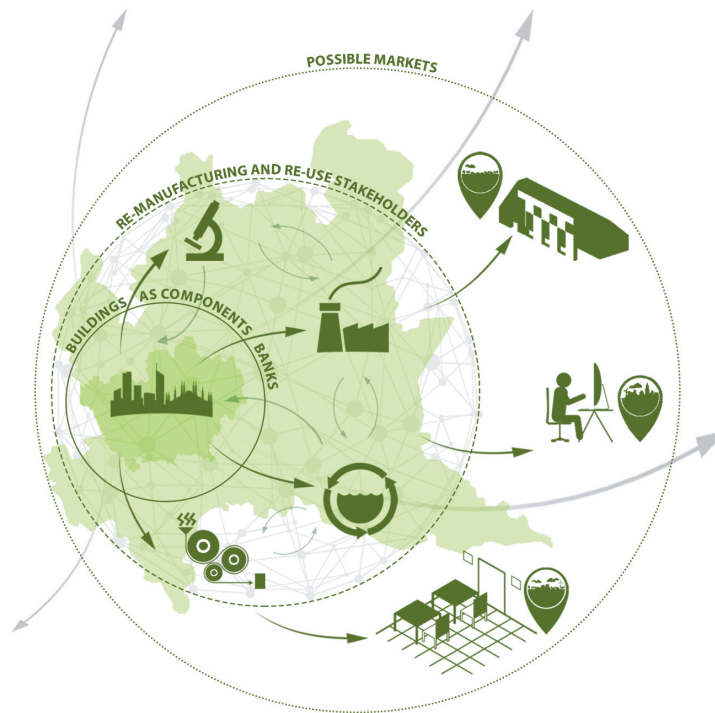


Re-manufacturing networks for tertiary architectures

Innovative organizational models towards circularity

edited by Cinzia Maria Luisa Talamo



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FrancoAngeli

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towards circularity**

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The book presents the results of the project “*Re-NetTA (Re-manufacturing Networks for Tertiary Architectures). New organizational models and tools for re-manufacturing and re-using short life components coming from tertiary buildings renewal*”, developed at Politecnico di Milano (2018-2021) and supported by Fondazione Cariplo, grant n° 2018-0991 (Call “Circular Economy for a sustainable future 2018”).

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Introduction

This book deals with re-manufacturing, recondition, reuse and repurpose considered as winning strategies for boosting regenerative circular economy in the building sector.

The book presents many of the outcomes of the research “Re-NetTA (Re-manufacturing Networks for Tertiary Architectures). New organisational models and tools for re-manufacturing and re-using short life components coming from tertiary buildings renewal”. The research was funded in Italy by Fondazione Cariplo for the period 2019-2021 and developed by a multidisciplinary group composed of all the authors present in this publication.

The field of interest of the book is the building sector, focusing on various categories of tertiary buildings, characterized by short-term cycles of use.

The building sector is a fundamental lever for the activation of circular economy. European Commission identifies the construction sector as a “Priority area” involved in specific challenges in the context of circular economy: according to the Eurostat statistical data in EU-28 the main field that produces waste is construction sector, contributing to 33.5% of the total waste generated by all economic activities and households in 2014. Besides, the construction sector is an important driver for circular economy as it provides, according to European Commission data, 18 million direct jobs and contributes to about 9% of the EU GDP. The application of new circular economy strategies can create new jobs, social benefit, energy and resource efficiency and a sustainable environment.

Currently, the circular strategy more promoted in the built environment is recycling. Most of European Projects (e.g. HISER PROJECT, Resource Efficient Use of Mixed Waste, DEMOCLES, ENCORT) and particularly Life Project investigate on recycling (inter-sectoral or within the construc-

tion sector) of construction and demolition waste and deal with specific recycling topics (e.g. LIFE-PSLOOP Polystyrene Loop; CDW recycling Innovative solution for the separation of construction and demolition waste). Often recycling implies the downcycling and requests complex and energy-consuming processes. On the contrary, if well-organized, re-manufacturing and reuse require very simple and low-impacting processes, reduce the generation of waste and maintain over time the value of the resources embodied in manufactured products – once they are removed from the buildings – by extending their useful life and their usability with the lowest possible consumption of other materials and energy and with the maximum containment of emissions in the environment.

In the perspective of circular economy, the focus of this book on tertiary buildings derives from some considerations:

- cities all over the world are characterized by high quantities of tertiary buildings with various destinations (public and private offices, accommodation facilities, retail, exhibition facilities, temporary shops, etc.);
- there is an increasing stock of unused, often obsolete, tertiary buildings, especially after the pandemic;
- tertiary buildings are more and more characterized by quick cycles of renewal and reconfiguration of interior spaces following a series of phenomena that determine a fast functional obsolescence and frequent reshaping such as: recent approaches that shift attention to the use of buildings in terms of service (such as hoteling, leasing, co-working, smart working and various declinations of sharing) determining a high degree of temporary use; shortening of leases; transformations in the Real Estate market; transformations in the models of commerce;
- this kind of buildings generate significant quantities of disused elements and systems that become waste if not reused or remanufactured. These products (in particular interiors, services, equipment and furnishings) have usually a high degree of residual performances and are characterized by being dry assembled (therefore easy to disassemble), composed of high-value raw materials, generally equipped with manufacturer technical datasheets (therefore easily traceable) and, besides, by having a high added value.

This book investigates the most promising strategies and organisational models to maintain over time the value of the environmental and economic resources integrated into manufactured products, once they have been removed from buildings. Some novel concepts for the construction sector should be introduced:

- the integrated “re-actions” (re-manufacturing, re-condition, re-purpose, reuse, repair) as strategies for keeping building products and their embodied materials in use for longer time with significant decrease of waste, energy and water use and emissions through the reduction of manufacturing activities;
- the building as “components bank”. The building is no longer meant as the last destination of industrial products, but as a node within circular processes;
- “planned obsolescence” as a proactive strategy for addressing and optimizing the “re-actions”;
- decommissioned building products meant not as waste but as “bought and sell” items available for purchase from catalogues or other sources;
- “reverse supply chains” that is the delivery of goods (decommissioned elements) from the owners to the reuse or remanufacture operators.

These new concepts are connected with various possible approaches, innovative for the construction sector:

- from product to service, i.e. overcoming the purchase of building elements towards “pay per use” approaches which assume the presence of an operator who supplies products for defined periods and uses and who withdraws them and re-introduces them into the use network, possibly after re-manufacturing, repair, etc.;
- “disown ownership”, possibly with forms of peer to peer market, which assume the presence of networks that facilitate the sharing, renting or leasing and exchanging of products that can be remanufactured and repaired over time;
- lengthening of the life cycle of products through services, with low or zero consumption of materials and energy, based on the scheduled monitoring and updating (re-manufacturing, recondition, repair). These services may be integrated within FM (Facility Management) services related to space and maintenance management;
- assessing the reduction of impacts and the consumption of resources from the point of view of environmental (LCA), economic (LCC) and social (SLCA) sustainability in order to evaluate the effectiveness of circular economy strategies based on re-manufacturing and reuse processes.

By assuming these concepts and approaches the book introduces some challenges to the existing paradigms:

- from the design of products, meant as “black boxes”, to the design of systems that can be divided into items, identified for the different durations and for the possibility of being disassembled, remanufactured, traced and reused once isolated;
- from the sale of a product (the building element) to the supply of a service, enhancing the “extended producer responsibility” and “shared responsibility” along the supply chain through the introduction of new re-manufacturing operators;
- from the ownership of an asset to the delivery of a service (for example renting and leasing models).

Also thanks to the hints that emerged from the intense dialogues and many roundtables involving various categories of stakeholders, conducted during the *Re-NetTA* research, the book intends to identify and analyse the most important barriers to the development of effective re-manufacturing practices and the possible strategies to overcome them.

The book is articulated into three parts and 15 chapters.

Part I BACKGROUND introduces the current theoretical background and identifies key strategies about circular economy and re-manufacturing processes within the construction sector, focusing on tertiary architectures. It is divided into three chapters.

Chapter 1 deals with the relationships between circular economy and building sector, proposing tertiary architectures as promising testing ground for assessing circular strategies.

Chapter 2 introduces and discusses a hierarchy of the possible “re-actions” for circularity, each of one characterized by the return of a used product, trying to highlight the fundamentals and the basic conditions for propagating re-manufacturing, recondition, reuse and repurpose.

Chapter 3 provides an overview of the most existing consolidated practices of re-manufacturing within different industries and highlights possible strategies and approaches to transfer to the building sector.

Part II PROMISING MODELS outlines, according to a proposed framework (Ch. 4), a set of promising circular organizational models to facilitate re-manufacturing practices and their application to the different categories of the tertiary sector: exhibition, office and retail. This part also reports the results of active dialogues and round-tables with several categories of operators, adopting a stakeholder perspective. The chapters 5,6,7 describe each of the three models and share the same structure: the description of the organizational model, cases and views from the

perspective of some key stakeholders in the field-sectors, the enabling and hindering elements.

Chapter 4 proposes three promising circular organizational models and discusses some key features useful for deepening them: *rent contract as a support for re-manufacturing*; *all-inclusive solution to support re-manufacturing*; *alternative/secondary markets for re-manufactured products*.

Chapter 5 introduces the rent contract, focusing on value chain key factors that enable circular practices. Representative case studies for the tertiary sectors are discussed.

Chapter 6 presents the characteristics of an innovative organizational model proposed for the tertiary architecture based on the integration of all-inclusive services with the goal of promoting re-manufacturing practices. The investigation is developed considering the exhibition, office and retail sectors.

Chapter 7 The chapter presents the characteristics of an innovative organizational model aimed at promoting circular dynamics through the setting of a supply chain that identifies alternative/secondary markets as potential destinations for reused, re-manufactured and repurposed products.

Part III INSIGHTS provides some insights on the issue of re-manufacturing, analyzed from different perspectives with the aim of outlining a comprehensive overview of challenges and opportunities for the application of virtuous circular processes within building sector. In particular, Part III is organized in four key topics: A) Design for re-manufacturing; B) Digital Transformation; C) Environmental Sustainability; D) Stakeholder Management, regulations & policies.

Topic A “Design for Re-manufacturing” investigates the relevance of original product design in the specific context of re-manufacturing in tertiary architecture, with a focus on design strategies and guidelines.

Chapter 8 focuses on the topic of design for re-manufacturing (DfRem), presenting a set of guidelines that can facilitate product re-manufacturing processes toward more circular and sustainable organizational models in specific contexts, with particular attention on the tertiary sector.

Chapter 9 deepens the subject of design for re-manufacturing and circular processes applied to the field of textile architectures.

Topic B “Digital Transformation” explores the possibility to apply digital technologies to re-manufacturing practices, highlighting possible solutions to streamline current activities and to exploit the novel availability of real-time information and advanced data management capabilities offered by Information and Communication Technologies (ICTs).

Chapter 10 investigates how digital technologies can support the transition to circular economy of tertiary building through the digital simulation of the disassembly and remanufacturing stages.

Chapter 11 discusses how some barriers to the spreading of re-manufacturing practices may be handled more effectively by means of the Information and Communication Technologies (ICTs), especially Internet of Things (IoT), highlighting the key role of information platforms towards stakeholder collaboration and co-operation.

Topic C “Environmental Sustainability” focuses on the environmental benefit of re-manufacturing practices, emphasizing the application of life cycle tools to support the sustainability assessment of circular practices, encouraging the materials flow monitoring and information exchange among stakeholders.

Chapter 12 focuses on the assessment of the environmental sustainability of building products derived by re-manufacturing organizational models, in order to support eco-innovative approaches for the development of long-term value and green products. In this context, the material flows associated with re-manufacturing process are mapped and analyzed in depth, providing a framework for the application of LCA to re-manufacturing processes and re-manufactured products.

Chapter 13 deals with the traceability tools (e.g. materials passports, pre-demolition audit, etc.) useful to keep information related to building components in their entire life cycle (from material extraction to the disassembly after use and the end of life).

Topic D “Stakeholder Management, Regulations & Policies” deals with the definition of regulations supporting the relationships between the stakeholders and of approaches to the management of the re-manufacturing supply chain, providing also value chain insights to foster circular processes in the building industry.

Chapter 14 introduces the Sustainable Product-Service Systems (S.PSS) discussing to which extent they can enable value chain opportunities for re-manufacturing practices in the context of tertiary architectures and focusing on the application of product-service based models attached to re-manufacturing activities in the tertiary architectures context.

Chapter 15 aims to provide an overview of the main aspects on novelty introduced by reuse and remanufacturing practices assuming as a sample the Italian regulatory framework of the building sector, in particular focusing on aspects related to negotiation (sale, donation and leasing), safety, environmental and waste management.

*15. Reuse and re-manufacturing
in the building sector:
current regulatory framework and future needs*

by *Nazly Atta, Luciano Zennaro*

15.1 Sale, donation and leasing: regulatory framework for the transfer of goods within re-manufacturing processes

The Chapter aims to provide an overview of the main aspects of novelty introduced by reuse and re-manufacturing practices within the current Italian regulatory framework of the building sector. In particular, the Chapter focuses on three key fields that, from a regulatory point of view, result to be more affected by the introduction of new circular strategies, namely:

- negotiation aspects in the context of sale, donation and leasing (Par. 15.1);
- safety aspects and involved actors (Par. 15.2);
- environmental aspects and waste management (Par. 15.3).

Hence, the present paragraph introduces a study of the three main channels for the marketing and transfer of re-manufactured assets in relation to the proposed Re-NetTA organizational models (see Chapter 4), namely sale, donation and leasing. The objective of the paragraph is to highlight the limits and potentials – from a regulatory point of view – of these practices within the construction sector, hence identifying possible drivers for the effective and efficient implementation of circular practices of reuse and re-manufacturing.

It is important to underline that the research is conducted on a national level, in line with the geographical area of reference of the Re-NetTA project (from the territory of the Lombardy region up to the national level). However, the methodological scheme applied for the analysis of the regulatory context can be replicated in different national contexts (referring to their own legislative references) as well as at the European scale.

15.1.1 Potentialities and criticalities of the sale of products in circular processes

In the context of the Italian legislation, the deed of sale, on a general level, is mainly governed by two regulatory tools:

- the Civil Code (“*Codice Civile*”);
- the Consumer Code (“*Codice del Consumo*”) (Legislative Decree *d.lgs.* 206/2005).

The civil laws are dispositive, i.e. they may be waived by the will of the parties. According to Art. 1470 *et seq.* of the Civil Code, «the sale is the contract which has as its object the transfer of ownership of a thing or the transfer of another right to the consideration of a price» and it implies the following obligations for the seller:

- delivery of the “thing” (i.e. physical asset) to the buyer;
- acquisition of the property of the “thing” or the right, if the purchase is not an immediate effect of the contract;
- guaranteeing the buyer the absence of defects of the “thing”.

In particular, for what concerns the last point, «the seller is required to ensure that the sold thing is free from defects that make it unsuitable for the use for which it is intended or appreciably decrease its value. The agreement by which the guarantee is excluded or limited has no effect if the seller has concealed in bad faith the defects of the thing to the buyer» (Art. 1490 of the Italian Civil Code). Hence, the legislator leaves this aspect to the will of the parties who, acting in good faith, can define specific agreements to exclude or limit the guarantees. Therefore, in the context of the sale of “not new” products, these agreements could have particular relevance. In fact, the contractors usually know the history of use of the objects to sell and the presence of possible physical deterioration.

On the other hand, the provisions of the Consumer Code are different. They are imperative and therefore cannot be waived between the parties: in fact, any agreement prior to the communication to the seller of the lack of conformity, aimed at excluding or limiting – even indirectly – the rights recognized in the matter of guarantees is null and void. The duration and characteristics of the guarantee are governed by Art. 128 and following. In particular, Art. 132 states that the seller is responsible when the lack of conformity occurs within two years from the delivery

of the goods, extending the guarantees also to re-manufactured products. Indeed, the provisions also apply to the sale of used consumer goods, taking into account the time of previous use and solely the defects not deriving from the normal use of the thing. More precisely, in the case of used goods, the parties may limit the duration of the liability to a period of time in any case not less than one year.

It is important to stress that the Consumer Code is addressed only to the individuals or “natural persons” (*persone fisiche*) acting for purposes unrelated to any entrepreneurial, commercial, craft or professional activity. Therefore, the Consumer Code does not apply to legal persons (*persone giuridiche*) or other comparable subjects such as self-employed workers, freelancers or the so-called Third Sector (Legislative Decree *d.lgs.* 117/2017). In particular, third sector entities include: voluntary organizations, social promotion associations, social enterprises, social cooperatives, associative networks, mutual aid societies, associations, foundations, etc. set up for the non-profit pursuit of civic, solidarity and social utility purposes.

The following table (Tab. 15.1) describes possible scenarios for the sale of re-manufactured products, focusing on some sale cases between subjects belonging to different categories. In this regard, it is important to highlight the role of the public administration that could favor the use of re-manufactured products within public tenders by regulating, or excluding, certain guarantees.

Tab. 15.1 - Sale of re-manufactured products within the construction sector: laws and scenarios

Sale by private owner	
Sale between individuals (natural persons, “<i>persone fisiche</i>”)	Feasible with restrictions The individual can sell re-manufactured or reused products on an occasional and sporadic basis (not allowed on a periodic and permanent basis).
Sale from a legal person (or other business or professional entity) to an individual	Feasible with restrictions Subject to both civil law provisions (derogable) and the provisions of the Consumer Code. These latter provisions cannot be waived and therefore the selling party must guarantee, for the non-new product, a legal guarantee of at least one year.
Sale between legal entities (or other entrepreneurial or professional entities)	Feasible Subject to civil law provisions, which – by the will of the parties – can also be waived in the field of guarantee (Article 1490 of the Civil Code).

Tab. 15.1 - continued

Sale by private owner	
Sale from legal person (or other entrepreneurial or professional entity) to Third Sector	<p>Feasible Subject to civil law provisions, which – by the will of the parties – can also be waived in the field of guarantee (Article 1490 of the Civil Code).</p>
Sale from legal person or (or other entrepreneurial or professional entity) to public body	<p>Feasible with restrictions Subject to civil law provisions, to the R.D. 2440/1923 (on the general accounting of the State) and the related implementing regulation (R.D. 827/1924), as well as by L. 241/1990 (administrative procedure). It is not subject to the Consumer Code but to the provisions of the announcement, basically with specifications regarding guarantees or certifications.</p>

15.1.2 Potentialities and criticalities of the donation of products in circular processes

The donation is governed, in the first instance, by the Civil Code. The Art. 769 of the Civil Code defines the donation as the contract by which, out of a spirit of liberality, one party enriches the other, disposing of a right in favor of the latter or assuming an obligation towards the same. The donation must be made by public deed, under penalty of nullity, with the exception of donations of movable goods of modest value, as can be the case of products to be re-manufactured. The modest value is also to be evaluated in relation to the economic conditions of the donor. The donation may be burdened by a charge (so-called modal donation) such as the possibility of donating furniture with the express purpose of using them in a circular building process. The “good” must be accepted by the *donee* (i.e. the one who receives the good) and it has no forms of guarantee if exercised in good faith. Art. 797 of the Civil Code affirms, in fact, that the donor must give a guarantee to the *donee* for the “eviction” (withdraw) of the donated good only in the following cases: if he has expressly promised the guarantee; if the eviction (withdraw of the good) depends on the willful misconduct or personal fact of the donor; in the case of a donation that imposes charges on the *donee*, or a remunerative donation. In this last case, the guarantee is due up to the amount of the charges or the amount of services received by the donor. While the following article provides that unless special agreement, the donor’s guarantee does not extend to defects in the

thing, unless the donor has been fraudulent (e.g. presence of non-visible asbestos fibers of which he is aware).

The following two tables describe some scenarios for the donation of reused/re-manufactured products, performing a distinction between public bodies (Tab. 15.2) and private law entities (Tab. 15.3).

Tab. 15.2 - Donation from public bodies of re-manufactured products within the construction sector: laws and scenarios

Donation from public bodies	
Donation from public body to another public body	Feasible if it achieves the best and correct management of public assets and the satisfaction of a public interest (see Resolution no. 16/2020/SRCPIE/PAR of the Court of Auditors of Piedmont).
Donation from a public body to the Third Sector	Feasible if it falls within the conventions and procedures referred to in: Art. 55 of Legislative Decree 117 of 2017 (Third Sector Code), Law 241/1990 (rules on administrative procedures) and according to the rules governing the social planning of the area. This through: – co-programming (identification of needs and interventions); – co-planning (identification of needs and interventions); – accreditation through comparative procedures reserved for the same (Third sector association). Always subject to the statutory provisions on donation.
Donation from public to private body	Not feasible According to art. 3, par. 1, of the R.D. 2440/1923, the acts of alienation of public assets must be included in the “active contracts”, which must result in an entry in the financial statements of the entity (see Lombardy Court of Accounts, judgment no. 164 of 7 May 2019).

Tab. 15.3 - Donation from private operators of re-manufactured products within the construction sector: laws and scenarios

Donation by private owner	
Donation from an individual to another private law entity	Feasible Subject to civil law provisions: – guarantee for withdrawal; – liability for defects.
Donation from a legal person (or other entrepreneurial or professional person) to another person under private law	Feasible with restrictions It must be motivated, such as in cases of “corporate social responsibility”, since – from a fiscal point of view – the donation may not be considered congruent with the profit-making purpose of a company.

Tab. 15.3 - continued

Donation by private owner	
Private donation to the Third Sector	<p>Feasible The Ministerial Decree of 28.11.2019 of the Ministry of Labor and Social Policies also regulates the conditions for tax deductions.</p>
Donation from private to public body	<p>Feasible with restrictions Subject to the statutory provisions on donation. Subject to the regulations of the single public administration. For example, Article 75 of the Accounting Reg. of the Municipality of Milan provides «without prejudice to the authorizations of the law, the City Council (Municipality) provides for the acceptance or refusal of bequests and donations of goods according to their respective competences; the relative resolution establishes the destinations of these and of any profits deriving from them».</p>

15.1.3 Potentialities and criticalities of the leasing of products in circular processes

The leasing and long-term rental of movable goods in the corporate world are becoming more and more frequent, particularly for goods that require constant maintenance, such as cars and computer or multimedia devices. Leasing is a legal transaction with which an entrepreneurial entity – generally a company of a financial nature or specialized in the provision of loans – offers the use of assets, requesting the payment of a consideration paid in periodic fees.

The leasing and long-term rental can be extended to furniture and building elements, increasing the possibility of reuse and re-manufacturing in the construction sector – as proposed in the organizational models introduced in Chapter 4 (especially OM1 and OM2).

The leasing contracts often also include a maintenance contract. The provision of a maintenance service represents for the owner of the asset an opportunity to record all the interventions performed on the asset itself (maintenance history of the element), being able to inform and guarantee – in case of reuse – the end user on the actual quality of the good. Lastly, it should be stressed that usually leasing is reserved for legal entities and bodies with profit-making purposes, while long-term rental can also address the individual private (natural person, “*persona fisica*”).

15.2 Safety aspects and involved actors: certifications, qualifications and responsibilities

The issue of safety is crucial in the context of reuse and re-manufacturing processes within the construction sector. In particular, in the most common case of employment of reused or re-manufactured elements in the context of a workplace, the issue is addressed by the Legislative Decree *d.lgs.* 81/2008. According to the Legislative Decree *d.lgs.* 81/2008, in workplaces, the assessment of all risks to health and safety in order to reduce exposure for workers is an obligation of the employer. The use of “safe” materials and products, therefore, falls within the general protection measures. Measures that in addition to the employer may involve:

- “designers of places/workplaces and technological systems”, who must comply with «the general principles of prevention in the field of health and safety in the workplace when making design and technical choices» and choose «the equipment, components and protective devices that comply with the relevant legislative and regulatory provisions» (Art. 22 of the Legislative Decree *d.lgs.* 81/2008);
- “manufacturers, suppliers and installers”, as it is «forbidden to manufacture, sell, rent and license work equipment, personal protective equipment and systems that do not comply with the laws and regulations in force on health and safety at work» (Art. 22 of the Legislative Decree *d.lgs.* 81/2008).

However, except in the cases defined by specific regulations, to date there is no mandatory law that defines for the furniture (such as a table or a chair) or the constructive elements (such as a movable wall or an internal door) which are the criteria for defining them as “safe”. It is, therefore, often referred to the “technical data sheets” provided by the manufacturer. For example, the well-known “conformity mark” of the European Community is mandatory only in cases expressly established by the Brussels regulations, which concern the kind of goods that, due to their use or material, could be harmful or dangerous to the health of the consumer or user, such as toys, medical devices, glasses, electrical devices, gas devices, machines, radios and TVs, household appliances, etc. Hence, reused or re-manufactured furniture or non-plant construction elements are not included in the category of assets under the Community scrutiny. It is, therefore, a discretionary assessment that the employer must carry out with the support of skilled professional roles. Among these professionals there are:

- the “supervisor” (person in charge, “*preposto*”), that is the person who, by reason of professional skills and within the limits of hierarchical and functional powers appropriate to the nature of its assignment, supervises the work activity and guarantees the implementation of the directives received, checking the correct execution by the workers and exercising a functional power of initiative;
- the “head of the prevention and protection service” (RSPP – “*Responsabile del Servizio di Prevenzione e Protezione*”) that is the person who owns the skills and professional requirements (pursuant to Art. 32 of the Legislative Decree *d.lgs.* 81/2008) designated by the employer (to whom he responds) to coordinate the risk prevention and protection service.

These professionals, based on the specificity (functions and features) of each individual furniture or building element, evaluate with adequate and certified technical knowledge if the safety requirements are respected or not.

Another figure who can acquire an important role is the “construction supervisor”, that is the qualified professional who must verify the correspondence of the work to the project, the observance of the project execution requirements, the quality of the materials used and the installation. The construction supervisor issues, when included in the assignment, a report in which he can certify compliance with these requirements, including the safety of re-manufactured products.

It is important to underline that this discipline does not apply to properties subject to specific regulation: such as – first of all – the business activities subject to fire prevention under the Presidential Decree *d.p.r.* 151/2011, e.g. garages, shops with an area greater than 400 square meters, offices with more than 300 employees or with an area greater than 5,000 square meters, hotels with more than 25 rooms, theaters, cinemas, schools and many types of productive buildings. For all these buildings subject to accident/fire prevention it is not possible to use re-manufactured products where fire reaction (class 0, 1, 2, 3, 4, 5) or fire resistance (REI 30, REI 60, REI 120 etc.) requirement are imposed, for example in escape routes. However, there is still some room for using re-manufactured elements also in these buildings, focusing on not critical spaces. For instance, in an office with more than 300 employees, a re-manufactured door – if not subjected to laboratory tests – cannot be used to separate two passive fire protection compartments or to access escape routes, but it can instead be used for separating the toilets from the anteroom.

15.3 Environmental aspects and waste management

In the last forty years, European and national policies have been increasingly sensitive to environmental and waste management issues. In this regard, in the long run, the donation and selling of building elements for reuse and re-manufacturing could represent a viable alternative to land-filling. However, currently there is one major still-open issue that needs careful consideration. In fact, the boundary between the interpretation of what is considered waste or scrap and what can be considered material/product to be reused and/or re-manufactured is currently unclear and uncertain.

In the event that the materials/products from construction and demolition activities are disposed of, it is unequivocal that they become a waste (specifically defined by the Legislative Decree *d.lgs.* 152/2006 and by the most recent Legislative Decree *d.lgs.* 116/2020) and so subject to the aforementioned legislation.

Furthermore, Art. 183 of the abovementioned decree defines as “waste” any substance or object that the holder discards or has the intention or obligation to discard. However, with the term “discard” there is a risk that a product to be re-manufactured may be equated with waste and therefore subject to specific legislation, hindering reuse and re-manufacturing processes.

This uncertainty, that currently risks to hinder the diffusion of circular reuse and re-manufacturing practices within the construction sector, requires the introduction of an *ad hoc* legislation for this new field and its business operators.

15.4 Future perspectives for the building sector

Going beyond the “waste-resource” approach, reuse and re-manufacturing are able to prevent the creation of waste by anticipating end-of-service-life management actions and setting up suitable product maintaining and transformation processes, in order to reach a “resource-resource” approach. Re-manufacturing practices, albeit still experimental, are today carried out by several operators in the construction sector with satisfactory results and benefits. From a regulatory point of view, reuse and re-manufacturing practices are not yet included in the current Italian law framework of the construction field. In absence of specific regulatory tools, the present Chapter proposed an overview of the applicability of current standards and laws in the context of circular business models,

highlighting main responsibilities and restrictions. The regulatory barrier seems to hinder the spreading of reuse and re-manufacturing practices for the systematic sale of reworked products among companies but at the same time it leaves room for experimentations and trials in the fields of donations and leasing. The operators of the construction sector recognize the multiple potentialities linked to these circular practices that entice both companies and legislative entities to harmonize the references on the subject of re-manufacturing and to outline together new guidelines for a future systematic adoption of these circular practices in the construction sector.

As a starting point, among the possible viable actions to promote the re-manufacturing market, it is possible to propose:

- the allocation of volumetric bonuses for operators who use re-manufactured products in new construction (pursuant to Art. 3.1 letter e of the Presidential Decree *d.p.r.* 380/2001);
- the attribution of volumetric bonuses in building renovation interventions (pursuant to Art. 3.1 letter d of the Presidential Decree *d.p.r.* 380/2001) – which also include the demolition and reconstruction of buildings (or parts of) – for operators who use re-manufactured products in new buildings and who have activated re-manufacturing actions for existing products within demolition processes;
- tax incentives for operators who use re-manufactured products in new works in the interventions of extraordinary maintenance, conservative restoration and building renovation (pursuant to Art. 3.1 letters a, b, c and d of the Presidential Decree *d.p.r.* 380/2001).

These proposals are consistent with both the volumetric bonuses provided for sustainable construction by various urban planning instruments, such as the urban government plan (“*Piano di Governo del Territorio – PGT*”) of the Municipality of Milan, and by some urban regeneration laws, such as the L.R. Lombardy 18/2019 as well as by the state legislation on tax incentives for energy saving, including the well-known D.L. 34/2000 conv. L. 77/2020 (so-called “*Ecobonus 110%*”).

Concluding, the diffusion of this new field in the construction sector requires a revision of the current regulatory framework together with a review of the design and production practices of the construction elements toward reusability, placing at the center of construction activities the principles of sustainability.

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This book deals with re-manufacturing, recondition, reuse and repurpose considered as winning strategies for boosting regenerative circular economy in the building sector. It presents many of the outcomes of the research *Re-NetTA (Re-manufacturing Networks for Tertiary Architectures)*. *New organisational models and tools for re-manufacturing and re-using short life components coming from tertiary buildings renewal*, funded in Italy by Fondazione Cariplo for the period 2019-2021.

The field of interest of the book is the building sector, focusing on various categories of tertiary buildings, characterized by short-term cycles of use.

The book investigates the most promising strategies and organizational models to maintain over time the value of the environmental and economic resources integrated into manufactured products, once they have been removed from buildings, by extending their useful life and their usability with the lower possible consumption of other materials and energy and with the maximum containment of emissions into the environment.

The text is articulated into three sections.

Part I BACKGROUND introduces the current theoretical background and identifies key strategies about circular economy and re-manufacturing processes within the building sector, focusing on tertiary architectures. It is divided into three chapters.

Part II PROMISING MODELS outlines, according to a proposed framework, a set of promising circular organizational models to facilitate re-manufacturing practices and their application to the different categories of the tertiary sectors: exhibition, office and retail. This part also reports the results of active dialogues and roundtables with several categories of operators, adopting a stakeholder perspective.

Part III INSIGHTS provides some insights on the issue of re-manufacturing, analyzed from different perspectives with the aim of outlining a comprehensive overview of challenges and opportunities for the application of virtuous circular processes within building sector. Part III is organized in four key topics: A) Design for Re-manufacturing; B) Digital Transformation; C) Environmental Sustainability; D) Stakeholder Management, Regulations & Policies.



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