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SCRAP NETWORK FOR AN INDUSTRIAL SUSTAINABILITY AT THE LOMBARDY REGION

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"Solid wastes" are the discarded leftovers of our advanced consumer society. This growing mountain of garbage and trash represents not only an attitude of indifference toward valuable natural resources, but also a serious economic and public health problem.
-- Jimmy Carter

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1. ABSTRACT

Abstract English Version:

The current standard industrial model has allowed the societies to grow and expand rapidly due to accelerated production models that have been established during the last decades, nonetheless this aggressive growth has brought with it, several collateral problems among them, generation of industrial waste which has had a negative impact on nature, environment and public health. Therefore this project is proposed as a possible solution to reduce the negative impacts of this post-industrial waste, which arises while materials are in process, so this will propose new solutions to it. In economic matters, it refers to the availability of resources in terms of design practices (Green Economy) with productive projections (eco business). The innovative idea focuses on the drafting of an Atlas of scrap materials available and accessible to the public through a web 2.0 platform, where it is possible to get information, while determinating the location and the availability of the scraps from industrial production in order to recirculate these material resources for the benefit of all the society. This atlas is powered by a network of affiliated companies which make their scraps available in a database, by creating an information tool nourished with second-hand materials, which are existing materials but with new qualities and properties that emerge from the transformation process, that enables cataloging and creating a compendium of new raw materials useful for designers, artists, craftsmen and the general public. The project structure is a tool that enhances and stimulates various cultural environments (design, art, fashion, architecture), new technologies (3d printing and 3d scanning) and new scenarios (scrap stores, scrap workshops, scrap business); offering an innovative approach to the project development, providing at the same time a new way to see the waste not as a nuisance but rather as a business opportunity.

Abstract Versione Italiana

Il modello industriale moderno ha permesso alla nostra società di espandersi rapidamente grazie agli accelerati modelli di produzione stabiliti durante le ultime decadi. Questa crescita aggressiva ha portato però con sé vari problemi collaterali tra cui la generazione di rifiuti industriali, i quali hanno un impatto negativo sulla natura, l'ambiente e la salute pubblica. Dunque il progetto presentato è proposto come una possibile soluzione al fine di ridurre gli impatti negativi di questi rifiuti post-industriali prodotti durante la trasformazione dei materiali. L'idea affronta nuove soluzioni sia in materia economica, come il tema del reperimento delle risorse materiche (green economy) sia in materia di modalità progettuali e orizzonti produttivi (eco business).

L'idea innovativa verte sulla redazione di un Atlante Materico di sfridi industriali attraverso una piattaforma web 2.0, dove sarà possibile ottenere informazioni sui materiali allo stesso tempo determinarne la loro locazione e eventuale disponibilità, allo scopo di rimettere in circolo risorse materiche a beneficio di tutti i soggetti di una collettività (nuova filiera). Questo atlante è gestito da una network di aziende affiliate, le quali mettono a disposizione i loro sfridi in un database creando in tal modo uno strumento d'informazione nutrito da dati sulle materie seconde, cioè materiali già esistenti a livello chimico nelle biblioteche materiche, ma con qualità e proprietà fisiche nuove dovute ai processi di trasformazione che esperimentano durante la fase di produzione. Questo permette di poter catalogare e creare un compendio di nuove materie prime utile per i designer, gli artisti, gli artigiani e il pubblico in genere.

La struttura del progetto amplifica e stimola diversi ambiti culturali (design, arte, moda, architettura), nuove tecnologie (stampa, scanner 3d,) e modalità di approccio innovative sia alla progettazione sia alla realizzazione di manufatti, fornendo allo stesso tempo un nuovo modo di vedere i rifiuti: non più come una molestia, ma piuttosto come un'opportunità di business.

1. INTRODUCTION

Scrap Netwok for a sustainable Future

1. INTRODUCTION

Scrap network for a sustainable future

The economic system in which we live, progressively has changed the relationships between material, energetic and human resources. The impact of industrial production on the ecosystem has been increasing simultaneously in an exponential way. Therefore is necessary to review the growth and the developing concepts, starting with the environmental problems derived thereof. This review began in the early 60 s of the twentieth century, assuming global dimensions however only up to the 1990s was introduced a very intimate bond between the environmental issue and the industrial production, after the political and normative discussions of the eighties (1) nevertheless in spite of the different dissertations about the intimate bond that exist between environmental issue and the industrial production at present we are a race moving towards extinction, far faster than the dinosaurs (2) because our systems of life and product manufacturing has not been sustainable, giving us serious problems to ourselves and our environment therefore becomes necessary a reassessment of these old models, generating a space for the inclusion of new ones substantiated on the concept of sustainable development, to guarantee not only an improvement of the production and consumption system if not that also allows guarantee to the future generations an availability of resources equally shared out (3) .

Within this thinking of reassessment of old models has been created this project called “Scrap Network for a sustainable future” which is a new perspective in the field of the Scrap reuse, is an effort to create a plausible reality with a new outlook, is a sustainable model where scrap reuse goes beyond, actually become a real project, a workable one that will generate a new product’s consumption way which use as raw material the scraps generated by the Lombardy companies registered on a systematic scrap network , a public character network that makes available the various scrap materials into a free digital atlas’ materials, which through a database enables the participation of interested public making this project an inclusive system where people can use for free all the materials included into, thus allowing the possibility of reuse these secondary materials which otherwise would become waste. In turn this model does allow, track down the materials location and their availability, functioning as a search tool to different figures (associations, partners, Industries, educational institutions, subject matter experts, and public at large)

On the other hand, this scrap network makes an effort to create a new perception of the scrap materials, transforming their perception of “rejected materials” into a new category called secondary materials, that is to say, the network pull out the production scrap from the macro world of wastes and

1. Barbero Silvia; and Brunella Cozzo. Ecodesign. (Cologne Germany: Könemann, 2009), 10.
2.Casotti Anna (a cura di).Progettare il Futuro: Il Disegno della Materia.(Milano: Editoriale Modo, 2002). 92.

3. Casotti Anna (a cura di).Progettare il Futuro: Il Disegno della Materia.(Milano: Editoriale Modo, 2002). 76

puts it into a new classification which assigns to scrap the meaning of raw material instead of its old designation of unwanted. This new conception would allow change the legal framework, giving to the industrial system a new vision of the future as regards to sustainable products and above all of their source materials developing a premise which says“ there is not handled waste into our network but instead are handled of raw materials to the creation of sustainable products” , reducing under this philosophy the number of wastes which reach landfills and besides offering a second life to “unwanted” through the reuse.

Figure 1.1. “Everything you throw away comes back” — Ad campaign for an Italian Environmental Group.
Advertising Agency: Forchets, Milan, Italy
Source: http://www.puppiesandflowers.com/?p=2614

2. SCRAP HANDLING

The reworking of and old model

2. SCRAP HANDLING
The reworking of an old model

A few years ago the scrap generated by manufacturing companies acted out the inefficiency of the industrial system as a maximum level, given that the industries didn't pay any attention to waste caused by their production systems, what made of landfills their most viable way out to their nuisances. Nowadays the problem persist, however new laws and legislations have been changing the outlook of waste management improving industrial practices and scrap handling.

The interventions of the various public and private entities have changed the panorama of waste control during the last years, improving in many companies the life cycles of their products and above all a relentless search to produce closed industrial loops in an attempt to find a sustainable production, besides, these kind of interventions have been shifting also the mindset of the common people, widespread an ecological awareness which has been aroused during the last several decades. All the same one of the challenges is to identify productive uses for materials that are currently regarded as wastes, understanding the nature of industrial and post-consumer wastes (4) but although this challenge seems quite difficult, as stated above, in recent years people began to see material reuse in a much different way; for example, lately people started to recycle because are concerned about the environmental consequences of the waste disposal, turning so these concerns into a moral behavior. In addition to, this people began to get involve with public programs which collect and process postconsumer recyclables and in some cases some even go to recycling centers to drop off various materials (5); nonetheless there are some who argue that waste management involves a high economical cost being more a problem for their pockets than a competitive advantage thereby creating an erroneous reading of the situation that triggers a growing vicious circle to relies on wrong perspectives, generating a huge problem to the aim of obtaining a sustainable system in a near future. Notwithstanding in spite of this trouble, there are some committed to the cause who work with scrap and see a lucrative business, especially in these tough economies times, institutions and people for whom waste generation means more potentially salvageable materials and a excellent source of money, reasons that motivates them to focused their efforts on helping the environment by reusing, must be noted that scrap business is a booming business, highly lucrative, where steel is the most recycled material which leaves more profits.

One of the major problems, in an overview, lies in that waste is one of an open system, this translates into materials pass from raw materials to manufactured systems to consumer items to waste, when instead it
ought to be a closed industrial loop where materials are recycled into the manufacturing process, extending the lifecycle and reducing burdens on the environment . Industrial ecologist recognize closed loops as the basis for recycling and currently are working to maximize the efficiency of such loops

4. Argument made by the ecologists, David T. Allen and Nasrin Beshmanesh, for further informationconsult the book of Zimring, Carl A. Cash For Your Trash:

5. Zimring, Carl A. Cash For Your Trash: Scrap Recycling in America. Piscataway (New Jersey: Rutgers University Press, 2009), 2 . Scrap Recycling in America.

in the market economy, thus promoting a plus to industrial monetary system; is worth adding that no industry has been more instrumental to the success of material reuse than the scrap material industry which generates savings in energy (75%) , raw materials used (90%), air pollution (86%), water use (40%), water pollution (76%) mining wastes (97%) and lower greenhouse gas emissions (6) . On the other hand material reuse since revere's times has changed because of economic, cultural and social forces, for example In the late nineteen and early twenty centuries, particularly in the United States cleanliness became a way not only to prevent illness but also to separate oneself to laborers, indigent, and foreign(7). However many factors contributed to change that situation, the advent of industrialization and its production and modification of waste management techniques have had a tremendous effect on the way people have treated materials discarded, nonetheless in nowadays there are some, who continue with a complex and often contradictory attitude about consumption, waste production and waste management, distancing themselves from the consequences of consumption and considering management and trade of waste like a pejorative job.
generating conflict and recrimination to people who work with discarded materials and post industrial production ,this marginalization is unfortunate when one considers how their work allows extend the lives of postconsumer and postindustrial discards, giving us a cleaner and a better planet; but

6."Benefits: Scrap metal",Norstar, Accessed July 10, 2013, http://www.norstar.com.au/Recycling/Processing/Benefits.aspx
7. Zimring, Carl A. Cash For Your Trash: Scrap Recycling in America. Piscataway (New Jersey: Rutgers University Press, 2009), 4.

while the retractors keep on with their immovable positions and limiting the recycling activity as a fantasy, couldn't go ahead with the porpoise to have a sustainable world.

It is evident in nowadays that there is change of mind about scrap handling, more positive than a couple of years ago, however it is also clear that we have many challenges in this regard, where there is necessary to implement policies more stringent and inclusive which engage the various industry players and consumers to participate actively, it becomes necessary that governments include in their programs, budget and policies to improve the systems' life cycles and postconsumer recyclables, nonetheless it's necessary a compromise from all of which must be hatch from home, schools, public entities and above all privates.

Figure 2.1. line of cranes working at the scrapyard
Source : http://www.danieli.com

2.1.. SCRAP MATERIALS AND NEW PRODUCTS

Real cases of companies and Artist around the world who've been doing new objects with materials considered scrap

The cases shown below are real cases of companies which work with scrap materials and have been created new products with them, here are shown some examples of how a wasted material can be a new product and how reassessing a material can be reused to give tangible life to a new object.

2.1.1. SCRAP: Creative Reuse Store for Arts and Play / (UK)

Scrap (Company's name) is a social enterprise focused on helping the environment by reusing waste materials from businesses as resources for art and Play, has a warehouse which is open to everyone, full to the rafters of discarded materials, originally destined for landfill. These materials are sold at very low prices and reused for art and play purposes by local community groups, schools, students and individuals.
As part of its program they offer training for adults and children, scrapsheds, containers full of outdoor play resources for schools, family learning, art drop- in sessions , schools projects and out of school activities all based around the environment and reuse. Membership is open to everyone.

Figure 2.2. Outdoor games made with scrapshed (metal shipping containers filled with a selection of 'loose parts', waste materials)
Source: http://www.scrapstuff.co.uk/

Figure 2.3 Indoor puppet made with scrap materials
Source: http://www.scrapstuff.co.uk/

2.1.2. SCRAPSTORES UK: Supporting Creative Reuse / (UK)

Scrapstores is a British scrap center who support reuse of resources for community benefit through the diversion of clean reusable scrap waste materials from businesses. Scrapstores UK is a registered charity incepted by scrapstores themselves to gather and share information about issues, barriers, opportunities, good practice, achievements, promotions and publications. Scrapstores has been set up by members of the scrapstore community to support the reuse of unwanted resources for the benefit of children and communities. Clean reusable scrap materials (which businesses find hard to recycle so would otherwise be land filled) are made available for children to play with through a network of independent "scrapstores" .

Figure 2.4. Scrapstore mascot created by Beth Hill from Worcester Resource
Source: http://www.scrapstore-suk.org/

Figure 2.5 Crafty Cardboard Owls handmade from waste materials
Source: http://www.scrapstore-suk.org/

2.1.3. Business Waste: Making waste things play things/ (UK)

The Children's Scrapstore in Bristol is an independent charity established in 1982 and there are 1,350 Group Members ranging from after school clubs, arts groups and care groups to child minders, colleges and community groups: crèches, drama groups and education groups to holiday play schemes, pre-school groups and toy libraries. The waste will equip each Scrapstore PlayPod with new materials for children to use for education and play, as well as contributing to the overall materials that supply scrap to literally 100's of thousands of children for art, craft, education and play through the national network of scrapstores. .

Figure 2.6. Boy playing with toys made with scrap
Source: http:// http://www.businesswaste.org.uk

2.1.4. SCRAP: a source for the resourceful/ (USA)

SCRAP is the Bay Area's oldest creative reuse center, and has been diverting waste from landfills for use as art supplies for more than 30 years. SCRAP was founded in 1976 to provide art supplies to art teachers in the San Francisco Public School system during America's last serious financial crisis. Creative reuse includes all projects that incorporate materials that would otherwise be thrown away. As usual people who find materials at SCRAP are teachers, artists, crafters, and designers who transform what could have been discarded into something with new value. As much arts-related as it is environmental, creative reuse demonstrates that artistic creativity and learning can take place anywhere and everywhere and with all manner of materials, and that "junk" has value for those who can see meaning beyond the discarding of things. As a response to ever-filling landfills, overproduction, and diminishing natural resources the ethos of creative reuse is shared by all people.

Figure 2.7. Trimmings made with bottle caps
Source:http://ww-w.scrap-sf.org

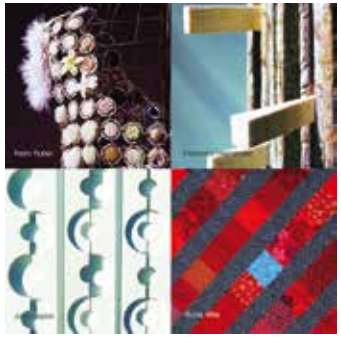


Figure 2.8. Scrap Art – SCRAP's 4th Creative Reuse Exhibition
Source:http://ww-w.scrap-sf.org

2.1.5. SCRAP / (USA)

Scrap was founded in 1998 by a group of teachers who wanted to find a home for their leftover classroom materials. They brought these materials to A Teacher's Space, a resource center for Portland Public School teachers, and left them on a table for others to use. In 1999, an innovative teacher named Joan Grimm got together with a handful of her friends and received a grant from DEQ to open a small creative reuse center for the community. Located first inside The Rebuilding Center and then on N. Williams, SCRAP moved to its current location on NE MLK in 2009. In 2012, SCRAP diverted over 129 tons of usable material from the waste stream—an increase of 13 tons over the previous year. SCRAP now has four satellite locations across the country as part of its SCRAP USA program, including in Denton, TX; Humboldt, CA; Washington, DC; and Traverse City, MI.

Figure 2.9. Hat made with fabric scraps
Source:http://scrappdx-.org/visit/reboutique/

Figure 2.10. Collage made with scrap and charcoal.
Artist :Nicole Pool
Source:http://scrappdx-.org/visit/reboutique/

2.1.6. Lancaster Creative Reuse/(USA)

Lancaster Creative Reuse connects community excess to those who can use it creatively.

The project inspires creativity, increases access to the arts through affordability, and encourages reuse.

Opened in August 2010, the LCR store provides low-cost supplies as well as an Open Craft table. Lancaster's excess craft stashes, fabric room cleanouts, and business samples and seconds are sorted here and made available to the community at low cost**.**

Figure 2.11. Collage made with scrap and charcoal.
Artist :Nicole Pool
Source:http://scrappdx.org/visit/reboutique/

2.1.7. Reverse Garbage / (Australia)

Reverse Garbage was established in 1974 by a group of teachers determined to help the environment by diverting industrial discards from landfill and by reusing materials in their classrooms.

Almost 40 years later, Reverse Garbage is now an internationally recognized, award-winning environmental co-operative committed to promoting sustainability. Each year Reverse Garbage collects tonnes of resources including reusable off-cuts, over-runs, art & craft materials, stage props, nic-nacs, furniture and other items from hundreds of supporting commercial and industrial businesses, as well as through the generosity of the community.

Figure 2.12. materials for builders and home renovators
Source: http://reversegarbage.org.au/

Figure 2.13. materials and resources available at Reverse Garbage
Source:http://scrappdx.org/visit/reboutique/

2.1.8. REcircle: Creative Reuse Center/(Belgium)

Recircle is a non-profit organization which collects, sorts, educates with and distributes clean and safe industrial scrap. The mission of Recircle is to stimulate societal awareness of the value of creative reuse of waste-material, and thereby to contribute to a greater ecological awareness in society.
Recircle stimulates the concept of reuse above recycling in order to close the usage circle, they see waste-material not as garbage but treat it as an opportunity for creation and communication.
The different activities are focused on communities where the realization of the Recircle mission can make a particular impact on the economic, social, educational, cultural and ecological wellbeing of the community.

Figure 2.14. Recircle's Members shop area
Source:http://www.re-circle.org/

2.1.9. Urban Source: Alternative Art Materials/ (Canada)

Urban Source has been Vancouver's number one choice for alternative art materials for over 15 years. They collect from over 100 different local industries, diverting safe, useable off-cuts, discards, misprints and over-stock from the land fill. Materials are then sorted, organized and prepared for the store. They come up with a variety of innovative uses for everything they collect.
Artists, designers, teachers, students, daycare workers and families go there for providing one of a kind art materials. The Local industries are satisfy to have us haul away their unwanted goodies thereby reducing their disposal costs.

Figure 2.15. work made by children in the workshops
Source:http://www.urban-source.bc.ca/

Figure 2.16. Bulk Barrels with Items to choose from
Source:http://www.urbansource.bc.ca/

2.1.10. Arts Junktion MB / (Canada)

Arts Junktion MB Is a community-based, charitable organization committed to redistributing reusable materials, gather reusable materials from businesses, organizations and individuals, that would otherwise be considered waste, sort them and make them available to all at no charge was incorporated in August 2007 and has Charitable Tax Status. It is a non-profit organization run by a volunteer Executive Board and funded by Friends, Partners, Corporate Sponsors and Funders.

Support community artists and arts organizations through promotion of their art through fairly paid employment opportunities and also providing them with materials, workshop and gallery space,

This group also offer educational opportunities to community groups and community members on various techniques using recycled materials in art. With its work Arts Junktion Mb reduce the amount of waste that ends up in landfills and raise the awareness in the community regarding environmental issues and sustainability.

Figure 2.17. Motherhood Artwork (Calendar)
Source: http://artsjunktion.mb.ca/

Figure 2.18. Motherhood Artwork (painting and collage)
Source: http://artsjunktion.mb.ca/

2.1.11. Kunst-Stoffe / (Germany)

Kunst-Stoffe is a collection and distribution center for scraps and trash that can be creatively reused for art and culture. Materials such as fabric, paint, metal, wood, tiles, plastic, foam, cardboard, etc. that are of no further use or value to their owners are collected in our warehouse where they are made available to artists, cultural, educational and social organizations. By that, Kunst-Stoffe stimulates creativity and environmental awareness. This center provides a new platform for recycling and re-using materials. Scraps can be donated to us, and we collect them before they lose their value and negatively impact the environment as trash. This is an effective way of conserving resources and reducing waste.

Figure 2.19.Scrap materials to arts and crafts.
Source: http://www.kunst-stoffe-berlin.de

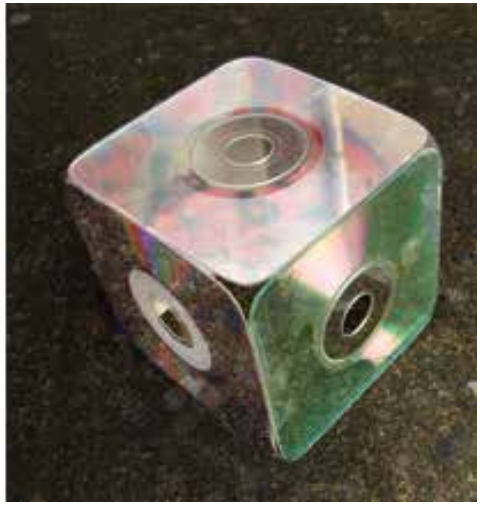


Figure 2.20. Artistic Cube made with used cd's
Source: http://www.kunst-stoffe-berlin.de

2.1.12. Remida / (Italy)

Remida promotes the idea that waste materials can be resources. The center collects, exhibits, and offers alternative and reclaimed materials, obtained from unsold stock and rejects or discard materials from industrial and handicraft production, with the aim to reinvent their use and meaning. Remida is a cultural project that represents a proactive way of approaching environmentalism and building change through giving value to reject materials, imperfect products, and otherwise worthless objects, to foster new opportunities for communication and creativity in a perspective of respect for objects, the environment, and human beings.

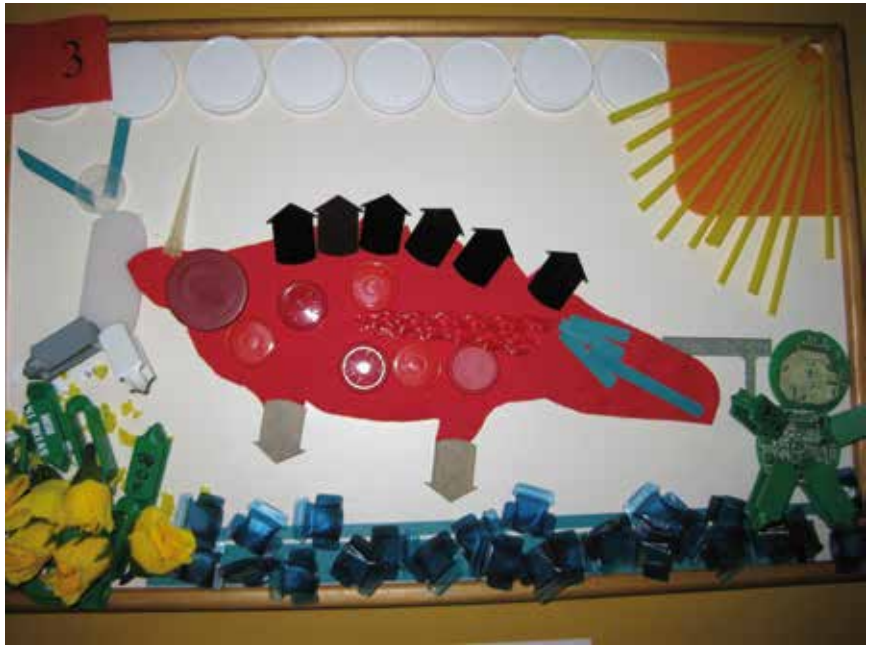


Figure 2.21. Remida's Early Years programs: "The Grinch stabbed the dragon's tail, which made the dragon eat the bunny" Thornlie Christian College Year 2

2.1.13. Skiprat.co: Eco design Upcycled forniture art

Skiprat is a project of a free lance artist who in 1995 Co –managed a unique little shop called Sasha (Devonshire Street, Sheffield), which served as inspiration to established the brand Skiprat.co defined as an actual shop with a market place where recycling is a core part of its products . Commissions taken for Mosaic Mirrors, furniture renovations and room make decor makeovers, All pieces are totally unique having been lovingly Upcycled making each art piece completely practical and durable. Each item is always signed individually.

Figure 2.22. Green Witches Table
Source: http://sally-skiprat.blogspot.it/

Figure 2.23.Bathroom ceiling Installation Illuminated.
Source: http://sally-skiprat.blogspot.it/

2.1.14. ART FROM SCRAP/(USA)

Art From Scrap provides the community with a Green Schools environmental education program, an Arts Center, and a Reuse retail store. Green Schools students learn the waste reduction methods of Reduce, Reuse, Recycle, and Compost, pollution prevention actions to improve creek and ocean water quality, and contribute to a sustainable community through organic gardening and service learning projects. Art From Scrap's Reuse store keeps thousands of pounds of clean, reusable materials from ending up in the Santa Barbara County landfill each year. All kinds of treasures donated by local businesses and individuals.

4. Figure 2.24. September 29 - November 11, 2007
"Swapped Not Sold"
"Artist Trading Cards - Various Artists"
Source: http://www.artfrom-scrap.org/index.html

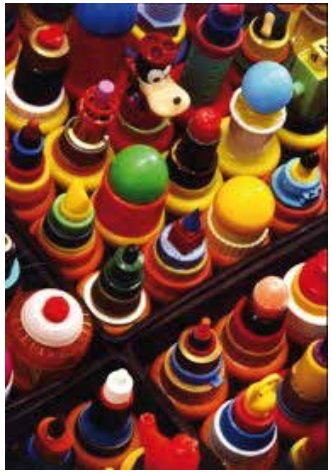


Figure 2.25. September 26-October 24, 2009
Plastic Planet (group exhibition of 16 artists that explores the uses, reuses, abuses, and excesses of plastic)
Source:http://www.artfrom-scrap.org/index.html

3.WASTE, SCRAP AND DISCARD

Meanings and differences

3. WASTE, SCRAP AND DISCARD
Meanings and differences

Waste, scrap and discard; are three words which are related and strongly linked, however either one has a different meaning within the context of semantics which mutates and changes in the social imaginary because these ones switch from one person to another depending on the level of knowledge that each one may have on the matter, thereby all of this terms acquire a value of subjectivity which approaches to the correct definition through the understanding of these issues and also by means of the environmental awareness; it means that an individual related with these subjects will understand more of these terms than one who doesn't have any contact with them before. Therefore In this chapter will be analyzed these three aspects, delving and clarifying the true significance of themselves, in an attempt to develop a less ambiguous meaning.

3.1. Waste; overall view and meanings

Waste has vexed civilization for thousands of years, Most recently however, waste concerns have grown exponentially with the industrial and the petrochemical revolutions, a rapid growth in world population, and greater consumerism (8) , in addition to this, wasted management and recycling have been disregarded concepts despite the fact that these are neither new concepts nor new activities(9) generating a latent problem which tends to grow with the population explosion and the economical expansion given that waste generation was a necessary reality associate with economic development.

Waste can be interpreted In many ways, so what a public official the term waste means may be different from the perspective of an engineer or city planner. For example The Merriam Webster encyclopedia define the word Waste in the Industrial field like a damaged, defective, or superfluous material produced by a manufacturing process as material rejected or an unwanted by-product of a manufacturing process, chemical laboratory, or nuclear reactor(10) . Among other definitions appear the one made by the United Nations Statistic division who says that Wastes are materials that are not prime products for which the initial user has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded." (11) . In this introductory overview we have two different meanings, both have a correct definitions, but yet different, nonetheless these two put in evidence that waste is always an indication of inefficiency, a defect which continue to threaten society and impinges in public health and the integrity of our ecosystems, generating human diseases and ecological costs; and last but not least are added to these

8. Letcher Trevor M. et al; Waste: A Hand Book for Management, ed. Trevor M. Letcher and Daniel A Vallero (Amsterdam: Elsevier Inc, 2011), XIV
9. Letcher Trevor M. et al; Waste: A Hand Book for Management, ed. Trevor M. Letcher and Daniel A Vallero (Amsterdam: Elsevier Inc, 2011), 3
10.Merriam Webster "Encyclopedia Britannica" Merriam Webster, accessed June
11. United Nations Statistics Division "Glossary of Environment Statistics." 1997. UNSD. 1997. unstats.un.org, Glossary of Environment Statistics, June 2013. Web.

problems the economic cost of cleaning up badly controlled unmanaged waste sites. According with OECD (Organization for Economic Co-operation and Development) the most hazardous wastes and the most prevalent sources of pollution are contained in five general categories (targeted for immediate attention) of which are household waste. Post-consumer tires, demolition waste, used cars, halogenated solvents and hospital waste.

Waste and how manage it ends up toward the bottom of the environmental policy agenda alongside topics like air quality , global climate change and energy (12) According to the U.S environmental protection agency (EPA), more than a third of the waste generated in the united states comprises product packaging and paper; also is included into this waste category materials such as aluminum cans, bottles, plastic milk jugs,and newspapers which are pick up and recycling by the trash collection service . On the other hand this study revealed that 12 percent of municipal solid waste comes from organic matter like lawn clippings and food scraps, other 7 percent are from rubber, leather and textiles other 6 from wood and 3 percent from miscellaneous origin (US EPA 2007). Nonetheless the lack of agreement and the different perspectives among the stakeholders on waste issue, make difficult for policy managers to determinate how serious the problem is, and how best to deal with it. Local state and federal legislation and regulations require leaders to know, what are the main vicissitudes to overcome, taking into consideration, the waste stream, the cost of collecting and disposing of these wastes and above all the topics related with health and safety.

3.2. Scrap; overall view and meanings

Basically the scrap consist of recyclable or reuse materials left over from manufacturing processing and consumption. According with Merriam Webster encyclopedia scrap are Fragments of stock removed in manufacturing, also is considerate scrap, the manufactured articles or parts rejected or discarded and useful only as material for reprocessing; especially waste and discarded metal.

In recent years, working with scrap has begun to be an interesting business for many people, From a local perspective can be found that scrap has played an important role in the American economy (US) given that scrap industry contributed $65 billion in 2006 and not only this, also has helped to reduce greenhouse gas emissions; as well has contributed with energy conservation and conservation of natural resources. Another major contribution has been the reduction of waste amount in landfills (around 145 million short tons (13)) . The demand for scrap in industrial America has been growing since the nineteenth century however the number of people who work with it, is not proportional to the growth in demand, since then American households began to throw

12. Vaughn Jacqueline. Waste Management. (Santa Barbara California: ABC – CLIO Inc, 2009), XVII

13. Teen Franklin “Recycling facts” B. Miller recycling, September 2009. Web. 02 July 2013. <http://www.bmillerrecycling.com/facts.html>

away more materials and the manufacturers began to seek out more discarded materials .

On the other hand the demand of manufacturing industries for scrap materials has been transformed local activities like blacksmiths and artisans into systems of specialized collecting activities which deal materials in larger volumes (14). one of the most interesting examples related with "manufacturing industries for scrap materials" is the renowned phenomenon of the "scrap stores" which are not for profit organizations centered in the re-use whom are in charge of make clean waste products (scrap) and redistributing it, operate as charities and social enterprises being these features the business models that are used within. Usually the materials are obtained through donations from local industries; these "scrap stores" are significantly different from scrap yards given that the reuse tends to be dominate by art and craft activities, often aimed at those working with young children. The scrap stores also does exchange of large amounts of materials between themselves, thereby meeting local needs and putting to use any excess materials, thus creating a network which growing and becoming stronger, a network able to collect, store and distribute many kinds of reusable materials (15).

According with Forbes Magazine, "The scrap business" is shaping the global economy especially the scrap metal recycling industry, each day businesses dispose of countless products that can be reused and recycled, moreover its operations are so widespread generating only in the united states more than $90.6 billion, making of this industry similar in size to the fishing industries combined and nation's forestry, therefore can be said to *"scrap metal recycling industry is a good barometer for the global economy because of the role it plays in the fundamental and technical side of the economy"* (16). Furthermore the scrap recycling industry in America supports around 450.000 jobs and generates $10.3 billion for federal, state, and local governments. In an overview it may be concluded that scrap metal recycling industry generates a positive impact on the economy, on the environment and above all in our culture.

3.3. Discard; overall view and meanings

The disposal of solid waste has become increasingly difficult for municipalities as landfills close down and environmental laws further reduce or eliminate options such as incineration. Notwithstanding a few have come to understand that Recycling offers an environmentally friendly means for disposing of solid waste while at the same time providing resources for manufactures (resources as -so called discarded materials)

Discard are those items which are cast aside or throw away; according with Merriam Webster encyclopedia, discard is everything to get rid of especially as useless or unwanted

14. Zimring, Carl A. Cash For Your Trash: Scrap Recycling in America. Piscataway (New Jersey: Rutgers University Press, 2009), 35.
15. "About Scrap stores", Scrap stores UK, accessed July 04, 2013, http://www.scrapstoresuk.org/

16.Fava Philip " Scrap Metal Recycling: A Recap" Forbes, December 20, 2011.

(such as a pile of discarded tires). However from the technical industrial viewpoint, discard is a product that comes out defective in a production line or which is affected during the production process. Most of the time these products are marketed without an appropriate monitoring, creating problems to the costumers then and in many cases a health hazard. In this regard, defective product liability claims arise for three important reasons: defective manufacture, defective design or failure to provide adequate warnings or instructions concerning the proper use of the product. In these cases, traders are bound to "recall their products".

On the other hand, the mechanism of a recycling system about discarded products is running with a few critical roles and processes, moreover the discard implies an economy loss for a company and more waste to the environment, however The experience and research on remanufacturing of discarded products have attracted great efforts of business and academic field. Many articles are published on the sorting, recycling and processing methods (17), these conducted researches aim to design different procedures and methods based on the categories of discarded products. In some cases "defectives" are reinserted into the market, are remanufactured and resale nonetheless is a critical activity which needs of a number of additional operations to re-transform and validate the product, operations like disassembly, cleaning, testing, part replacement/repair, and reassembly operations because the quality of remanufactured products should be identical to entire new ones. However the challenge is changing the quality status and the old model of discarded products given that "discard" have another interpretation (defective product) when they arrive to collecting centers.

For products renewed there are several different categories of customers preference because products In practice have many differences regarding purchasing habits and the type of buyer, such as unbalance of development on economy, education and fashion, which may increases the uncertainty of demands on products renewed, becoming as real challenge the transformation of costumers' behaviors in relation to recycled products, So it is essential to transform customers from environmental ignorance into strong environmental protectors inasmuch as the customers' attitudes on discarded products and consumption of renewed products will decide the situation of recycling business (18).

17. De Xia; and Fangru wu "Towards More Sustainability: A Dynamic Recycling Framework of Discarded Products Based on SD Theory" School of Management, Wuhan University of Technology, accessed July 5, 2013, page 43

4. FIFTY CASE STUDIES OF SCRAP GENERATION

Fifty manufacturing processes and their scrap impact

4. Fifty Case Studies Of Scrap Generation: Fifty manufacturing processes and their scrap impact

In postmodern society the culture of consumption pervades every aspect of daily life, We find ourselves, in fact, living a social condition, economical and psychological characterized by a widespread accessibility of any type of good and the multiplication of the versions of each product type(19), nevertheless is an obvious fact that this life style implicates a subsequent effect in our ecosystem with negative impacts inasmuch as the industrial production create every day a huge scrap rate derived from the manufacturing processes who give life to a product which ends up being wastes for our environment, therefore consumption trends, and the associated impacts on natural ecosystems are of universal importance and interest to countries in all geographic regions and income groups (20).

In the following case study, will be analyzed fifty types of manufacturing processes correlated with scrap's generation, indicating at the same time the impact of scrap rate into each process as this is high or on the contrary low. Once obtained these data will proceed to create the comparison chart of the various scrap materials indicating those with a high scrap rate taking into consideration only those processes which leave suitable scrap material to be reused. In turn the case study shows the different companies working in the Italian region of Lombardy which work with high scrap rate's processes being these last the referents for the network approach into this research.

Figure 4.1. scrap from blind's, PVC Scrap (2013)
Source: Photography by Recyclechina.

19. Rutelli Pietro; and Elisa Bortolanza. Gli Oggetti di Qualità ei Loro Significati. (Milano: Raffaello Cortina Editore,2006), 120.
20. Hammond Allen and Emily Matthews "Critical Consumption Trends and Implications: Degrading Earth's Ecosystems". World Resources Institute, August.

4.1. The fifty cases

1. Plastic Injection Molding

plastic injection molding scrap rate is high, generally about 15% to 25%, because each injection will produce a certain amount of gating system cannot be recycled condensate material, especially for small products.

2.Transfer Molding

The Scrap produced into this process is really high because, The scrap produced in every cycle goes out in the form of the leftover material in the base of the well and lateral channels, called the cull. In addition the sprue in pot transfer is scrap material. Because the polymers are thermosetting, the scrap cannot be recovered.

3. Extrusion Blow Molding

Multiple parison molding allows multi-layered parts but the process requires close observation as uneven parisons will produce significant waste material. Extrusion blow molding allows a continuous operation but increases the waste material as the complexity of the mould also increases however by reusing waste scrap which reduces the scrap rate, bottle makers can save thousands of dollars a year in raw material costs for that reason there are some machines on market for these purposes .

4. Rotational Molding

In the rotational molding there is practically no scrap, there is little or no waste due to resin scrap. The majority of materials used in rotational moulding are MDPE and HDPE. The materials are widely recycled using technology available around the world. While most of the recycled material goes into the blow moulding industry more and more products are being developed to put rotational moulding material back into rotationally moulded products such as water systems bunding pallets cattle troughs and other "non potable" applications.

5. Pressure Thermoforming

Pressure Thermoforming generates greater amount of scrap, cost of the sheet materials is raised (because of separate sheet-forming step) however Most thermoforming companies recycle their scrap and waste plastic, either by compressing in a baling machine or by feeding into a granulator (grinder) and producing ground flake, for sale to reprocessing companies or re-use in their own facility. Frequently, scrap and waste plastic from the thermoforming process is converted back into extruded sheet for forming again.

1. Plastic Injection Molding: *HSM Wishsino. “Plastic Case Injection Molding”. Wishsino Plastic Injection Molding Company, August. 2011. Web. 26 May. 2012. < http://www.injection-molding-manufacturers.com/Plastic-case-injection-mloding.html >

2.Transfer Molding: *Groover P Mikell. Fundamentals of Modern Manufacturing: Materials Processes and Systems (Quebec: World Color Press, 2010), page 298.

3. Extrusion Blow Molding *Liang Helen. “Manufacturing Techniques For Plastic Components”. Helen Liang, January. 2003. Web. 03 January.2004. <http://people.bath.ac.uk/en3hl/blow.html>

4. Rotational Molding: * Equistar. A Guide to Rotational Molding (Houston: Lyondell Chemical Company, 2009), 3, 5.

5. Pressure Thermoforming: *Throne J.L. Understanding Thermoforming (Cincinnati: Hanser Gardner Publications, Inc, 1999).

6. Compression Moulding

Compression molding is a forming process in which a plastic material is placed directly into a heated metal mold, then is softened by the heat, and forced to conform to the shape of the mold as the mold closes. It is one of the lowest cost molding methods compared with other methods such as transfer molding and injection molding; moreover it wastes relatively little material, generating low scrap rate, giving it an advantage when working with expensive compounds.

7. Plaster Mould Casting

Plaster mould casting is a metalworking casting process similar to sand casting except the molding material is plaster of paris instead of sand. Plaster mould casting produces minimal scrap material doing of this feature an advantage.

8. Plastic resin Casting

Epoxy resin is the main material used in plastic resin casting is most known as a thermosetting polymer which makes difficult the recast process however a hybrid of thermosetting and thermoplastic resins improves the properties of the product during use while at the same time making it easy to decompose the resin at the end of its life cycle. The hybridization process involves blending the thermosetting resin with a small amount of thermoplastic resin, which can be broken down by organic solvents or heat, thereby reducing the scrap rate.

9. Plastic Extrusion

In plastic extrusion is unavoidable that scrap is generated in changeovers; this is why it critical to use efficient changeover methods. Of course, scrap can also be generated during production when the product goes out of specifications or when cosmetic problems occur. However scrap parts can be ground and re-extruded with minimal degradation, making extrusion a popular method for reducing or recycling plastic waste, thus reducing the scrap amount.

10. Blown Film extrusion

Plastic materials can account for 70-90% of film production cost. Operating the extruder most efficiently is of major importance. Any new technology that reduces scrap, for example during shut-down, is of vital interest to processors. Scrap rates influence every aspect of from cost to profit for the processor and the converter. The better the quality of the film, the more reliably it can be converted and the lower the scrap

6. Compression Moulding: *Peterson Charles W, G Ehnert, R Lieboldand and R Kühfusz. Compression Molding (Geauga County, Ohio: ASM International, 2001), 516–535.7. Plaster Mould Casting: *Todd Robert H, Dell K allen and Leo Alting. Manufacturing Processes Reference Guide (New York: Industrial Press Inc, 1994), page 283.
8. Plastic resin casting: *Raju Thomas, Poornima Vijayan and Sabu Thomas "Recycling of Thermosetting Polymers" School of Chemical Sciences, Mahatma Gandhi University, accessed June 3, 2013, http://www.trnres.com/ebook/uploads/-fainleib/T_13324076224%20Fainleib.pdf

9. Plastic Extrusion: *Rauwendaal Chris. "Tips and Techniques: Boosting Extrusion Productivity - Part III of III: Trim Your Material & Energy Costs". Plastics Technology, November 2010. Web. 3 June.2013. < http://www.ptonline.com/articles/tips-and-techniques-boosting-extrusion-productivitypart-iii-of-iii-trim-your-material-energy-costs >
** Thomasnet. "Plastic Extrusion Process" Thomasnet, June 2013. Web. 3 June. 2013. < http://www.thomasnet.com/articles/plastics-rubber/extrusion-plastic>
10. Blown Film extrusion: *Rossato D.V. Extruding Plastics Practical Processing Handbook (Massachusetts: Norwell Massachusetts publishers, 1998), page 303.

rate. Scrap rates can typically run between 3-6% for each stage of a typical extruding/printing/converting processing line. For the total line, the scrap rate could be between 9-18% overall. With changeovers film extrusion lines can produce scrap at the rate of 227-454kg/h (500-10001b/h).

11. Plastic Pultrusion

Some of the advantages in Plastic Pultrusion include minimal kinking of fibers/fabric, rapid processing, low material scrap rate and good quality control.

Ceramics

12. Float Glass

Flat glass is approximately a $20 billion/year industry worldwide, with almost all float glass products being manufactured on float glass lines. The float glass manufacturing process produces minimal waste (low material scrap rate) products and an extremely small amount of toxic wastes. The float process recycles virtually all its glass waste during production. This glass (known as cullet) is reintroduced to the float batch mix to aid melting.

11. Plastic Pultrusion: * Vimala Shekar, " Effect of Fiber Architecture on Properties of Pultred Composites"(Master of science tesi; West Virginia University, 2007), Accessed June 03, 2013, ProQuest Information and Learning Company (Umi Microform 1451669)
12. Float Glass* Na Byungsoo, Shabbir Ahmeda, George Nemhauser and Joel Sokol. "Optimization of Automated Float Glass Lines" H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, accesed June 3, 2013, http://www2.isye.gatech.edu/~sahmed/glass.pdf

13. Glassblowing

Glassblowing is a glass forming technique that involves inflating molten glass into a bubble (or parison), with the aid of a blowpipe (or blow tube). Regarding scrap, one of the advantages is that Glass could be recycling because glass waste could be separated by chemical composition, and then, depending on the end use and local processing capabilities, might also have to be separated into different colors.

Metal Casting

14. Aluminum Sand Casting

World class performance for the aluminum sand casting process is 10% to 12% scrap however experience shows that foundries that use exclusively turbulent filling methods such as most investment foundries, experience on average about 25 – 50 per cent scrap of which 5- 10 per cent is the total of miscellaneous minor processing problems such as broken molds, casting damage during cut off and other factors. The remaining 15 per cent is composed of random inclusions.

15. Shell Molding

Materials Advantages Can form complex shapes and fine details, Very good surface finish, High production rate, Low

13.Glass blowing: *Technology Quarterly, "Case History The Truth About Recycling" The Economist, June 7, 2007, http://www.economist.com/node/9249262
14. Aluminum Sand Casting: *Campbell John. Castings Practice: The Ten Rules of Castings (Oxford: Butterworth–Heinemann, 2004) page 17.
15. Shell Molding: * Degarmo E Paul, Black J T and Ronald A Kohser. Materials and Processes in Manufacturing. (Hoboken, Nueva Jersey: John Wiley & Sons, Inc, 2003) Page 309.

labor cost, Low tooling cost, Little scrap generated Can produce very large parts, Can form complex shapes, Many material options, Low tooling and equipment cost, Scrap can be recycled

16. Permanent Mold casting

The process lends itself very well to the use of expendable cores and makes possible the production of parts that are not suitable for the pressure die casting process. Other advantages are the rapid production rate with low scrap loss.

17. Low pressure casting

The plant performs heat treating and liquification of aluminum. Raw material comes in the form of aluminum ingots. Then, natural-gas-fired reverb furnaces melt the aluminum, which is transferred to hold fornace adjacent to each low-pressure permanent mold machine via heated ladles.
After casting, flash and scrap parts are sent back to a jet-melt furnace with this method the scrap rate is reduced considerably.

16. Permanent Mold casting: *Engineers Edge. “Permanent Mold Casting Process” Engineers Edge, June 2013. Web. 3 June.2013. < http://www.engineersedge.com/manufacturing/permanent_cast_process.htm>
17. Low pressure casting:* Wong Harvey. “Amcast Industrial Corporation Energy Assessment” Office of Industrial Technologies Energy Efficiency And Renewable Energy, U.S. Department Of Energy, February 2001. Web. 2 May.2013 < https://www1.eere.energy.gov/manufacturing/tech_assistance/pdfs/amcast.pdf>

18. Slush Casting

Slush casting is a variant of permanent molding casting to create a hollow casting or hollow cast. In the process the material is poured into the mold and allowed to cool until a shell of material forms in the mold. The remaining liquid is then poured out to leave a hollow shell. This is a method with a reduced scrap rate.

19. Die casting

Magnesium is a highly recyclable material, consuming only 5% of the energy required to manufacture the primary metal. Consequently, the recycling of high quality magnesium scrap from the die casting process is a key element in determining the cost competitiveness of using this material for automotive applications .

Aluminum die casting alloy recycling has been in place almost from the beginning of custom die casting production, over 95% of the aluminum die casting produced in North America are made of post-consumer recycled aluminum. Since the production of recycled aluminum alloys requires approximately 5 % as much energy as primary aluminum production, there is a dramatic conservation of nonrenewable energy resources.

18. Slush Casting: * Degarmo E Paul, Black J T and Ronald A Kohser. Materials and Processes in Manufacturing. (Hoboken, Nueva Jersey: John Wiley & Sons, Inc, 2003) Page 327.
19. Die casting: *North American die casting Association. “Environmentally Friendly Process” North American die casting Association, December 2012. Web. 3 december.2013 < http://www.diecasting.org/environment/>

20. Die casting dies

Overall scrap rate and individual die scrap rates are important because they help determine the number of shots a die must make to produce a given number of castings. The production run is determined by the net good per day. Overall Scrap Rate is 13 Per Cent, The Net Good Per Day is inflated by the proper number of castings to reflect scrap. However one of the advantages of this process lies in scrap is recycled by remelting giving to this process an additional value.

21. Centrifugal casting

Sometimes called rotocasting, is a metal casting process that uses centrifugal force to form cylindrical parts. Can form very large parts, good mechanical properties, good surface finish and accuracy, low equipment cost, low labor cost and above all Little scrap generated. The true centrifugal casting process also limits inclusion defects, Fewer defects means fewer scrapped castings for the metal caster and metal casting buyers.

22. Sheet metal stamping

Sheet metal stamping utilizes sheet products, mostly alloys of steel, stainless steel, aluminum and copper, with steel alloys being predominant. The engineered scrap rate for some types of stampings that are alternatives to forging may be as high as 50% and is occasionally higher. It includes perimeter material in the clamp and binder areas of the die, and openings in the stamping. Engineered scrap is recycled but little of the original purchase price is regained, particularly with sheet steel.

23. Spray Forming

Spray forming is a method of casting near net shape metal components with homogeneous microstructures via the deposition of semi-solid sprayed droplets onto a shaped substrate. Spray forming is a competitive low cost alternative to ingot metallurgy for manufacturing. Inside process There is a spray rolling approach, spray rolling is an innovative technique to produce aluminum net-shape products, It requires less energy and generates less scrap than conventional processes (Low scrap Rate).

Powder Metallurgy / Powder Compactation

24. Isostatic pressing

Hot Isostatic processing is a process in which components are

20. Die casting dies: *Flynn Edward W. “Die Cast Tooling Die Management & planning: An Excel Spreadsheet Approach”. Edward W. Flynn, Novembre 2012. Web. 21 Novembre. 2012.
21. Centrifugal casting: *Custompart.Net. “ Centrifugal Casting” Custompart.Net, June 2013, Web. 3 June. 2013. < http://www.custompartnet.com/wu/centrifugal-casting>
22. Sheet metal stamping: * Forging Industry Association. “Sheet Metal Stamping”. Forging Industry Association, June 2013. Web. 3 June 2013 < https://www.-forging.org/design/3421-sheet-metal-stamping >

23. Spray Forming: *Degarmo E Paul, Black J T and Ronald A Kohser. Materials and Processes in Manufacturing. (Hoboken, Nueva Jersey: John Wiley & Sons, Inc, 2003) Page 355, 446.
**Division of Materials Sciences and Engineering. Energy materials Coordinating Committee: Fiscal year 2004.(Washington: U.S Department of energy , 2005) Page 62.
24. Isostatic pressing: * Kittyhawk Products “Hot Isostatic Processing - What Is It”. Kittyhawk Products, June 2013. Web. 05 June. 2013 < http://kittyhawk-inc.com/why-choose-us/hot-isostatic-pressing-what-is-it >

subjected to the simultaneous application of heat and high pressure in an inter gas medium. The pressure is uniform in all directions or Isostatic. Hot isostatic processing results in startling improvements in materials' mechanical properties , as well as significantly reduced scrap losses (Low crap Rate) and decreased rework and weld repair.

25. Die Pressing

The dominant technology for the forming of products from powder materials, in terms of both tonnage quantities and numbers of parts produced, is Die Pressing. This forming technology involves a production cycle this technology consists of three steps; mixing elemental or alloy powders, compacting those powders in a die at room temperature and then sintering or heating the shape in a controlled atmosphere furnace to bond the particles together metallurgically. Generally, scrap rates for the process are less than 3 per cent (Low scrap rate).

Forming

26.Near net shape

This process is also known as precision forging It was developed to minimize cost and waste associated with post-forging operations. Therefore, the final product from a precision forging needs little or no final machining. Cost savings are gained from the use of less material, and thus less scrap, the overall decrease in energy used, and the reduction or elimination of machining.

27. Hot forging

With Hot forging, Flash losses can be in the range of 30 to 60 percent. Reduce defects predict and improve grain flow and microstructure, reduce scrap (low scrap rate), optimize product design and increase die life, Reduce die wear.

28. Blanking and piercing

Are shearing processes in which a punch and die are used to modify webs. The tooling and processes are the same between the two, only the terminology is different: in blanking the punched out piece is used and called a blank; in piercing the punched out piece is scrap, (High scrap rate).

29. Roll Slitting

One of the advantages in-house slitting is the possibility to Sell edge trim material as scrap to offset costs. Disposing of edge trim is necessary in any slitting operation. The slitter

25. Die Pressing: *Metal Powder Industries Federation. "Conventional Powdered Metal Components". Metal Powder Industries Federation, April 2006. Web. 7 April 2006 < http://www.mpif.org/designcenter/conventional.pdf>
**Degarmo E Paul, Black J T and Ronald A Kohser. Materials and Processes in Manufacturing. (Hoboken, Nueva Jersey: John Wiley & Sons, Inc, 2003) Page 461.
26.Near net shape: *Degarmo E Paul, Black J T and Ronald A Kohser. Materials and Processes in Manufacturing. (Hoboken, Nueva Jersey: John Wiley & Sons, Inc, 2003) Page 398.

27. Hot forging: *Altan Taylan "Hot Forging: Trends and Applications" The Ohio State University and ERC for Net Shape Manufacturing, accesed June 5, 2013, http://nsmwww.eng.ohio-state.edu/Altan_ForgingWorkshop_Schuler08.pdf
28. Blanking and piercing: *Degarmo E Paul, Black J T and Ronald A Kohser. Materials and Processes in Manufacturing. (Hoboken, Nueva Jersey: John Wiley & Sons, Inc, 2003) Page 427.
29. Roll Slitting: * Russell Jim. "Evaluating in-house coil slitting: Key areas to consider". Fabricators and Manufacturers Association, April 2005. Web. 5 June. 2013 < http://www.thefabricator.com/article/coilprocessing/evaluating-in-house-coil-slitting>

operator seeks to dispose of scrap with as little added labor and downtime as possible. High-density scrap management saves labor, space, and commands a higher scrap price (High scrap rate).

30. Shearing

Shearing, also known as die cutting is a process which cuts stock without the formation of chips or the use of burning or melting. Strictly speaking, if the cutting blades are straight the process is called shearing; if the cutting blades are curved then they are shearing-type operations. the production of sheared scrap is high but felt from 19 million tons to 13million tons, and now the industry has made a shift toward shredded scrap (however, the high rate remains)

31. punching

Punching is a metal forming process that uses a push press to force a tool, called a punch, through the work piece to create a hole via shearing. The punch often passes through the work into a die. A scrap slug from the hole is deposited into the die in the process; depending on the material being punched this slug may be recycled and reused or discarded. The scrap material drops through as the work piece is advanced for the next hole. A large computer controlled punch press is called a computer numerical controlled turret (High scrap rate).

30. Shearing: *Wick, Charles; and Veilleux Raymond F. Tool and Manufacturing Engineers Handbook (Dearborn Michigan: McGraw Hill Book co, 1949) Page 6 - 20

**Degarmo E Paul, Black J T and Ronald A Kohser. Materials and Processes in Manufacturing. (Hoboken, Nueva Jersey: John Wiley & Sons, Inc, 2003) Page 424.

***Sieling Mark Scott, "Productivity in Scrap and Waste Materials Processing" Monthly Labor Review, April, 1990, 33.

31. punching: *Todd, Robert H, Dell K. Allen, and Leo Alting. Manufacturing Processes Reference Guide (New York: Industrial Press Inc.1994) Page 107.

**Kalpakjian Serope; and Schmid Steven R. Manufacturing Engineering and Technology (Upper Saddle River, NJ: Pearson Education Inc, 2006) Page 428.

32. Bending

In today's cost-conscious times, anyone involved in the tube bending process may instinctively consider perishables such as wiper dies, mandrels, and lubricants to be their biggest problems. However, a quick look into a scrap bin next to a tube trimming machine reveals a far bigger expense: bending scrap. For example, most vehicle exhaust systems are produced from stainless steel, the price of which has been known to double in 12 months. It is, therefore, straightforward to see that when the material costs 40 cents per inch, even 1 inch of material wasted per unit can add up to tens of thousands of dollars per year (High scrap rate).

33. Swaging

The process of swaging produces extremely uniform parts as there is nowhere for the metal to flow but within the confines of each cavity, so pin features occur at the exact same location piece after piece. What's more, there is virtually no scrap in the process. Scrap is inherent in both screw machining and stamping, 50 pounds of metal enter the process and 50 pounds of parts exit the process.

32. Bending: *McGrew Lonnie "Waste Not, Want Not: Reducing Scrap in Bending Tube, Pipe" The fabricator.com, November 2008. Web. 5 June 2013. < http://www.thefabricator.com/article/tubepipefabrication/waste-not-want-not---reducing-scrap-in-bending-tube-pipe>.

33. Swaging: *Bead Industries. "Swaging-Forging the Future". Bead Industries, August 2010. Web. 5 June. 2013. < http://www.beadindustries.com/blog/>

34. Metal Spinning

Metal spinning, also known as spin forming or spinning or metal turning most commonly, is a metalworking process by which a disc or tube of metal is rotated at high speed and formed into an axially symmetric part there is into the process minimal Scrap for this reason metal spinning is the most conservative metal forming process with material.

35. Roll Forming

Ideally, a roll forming system should produce parts at a scrap rate of 0-5%. increased levels of scrap can be attributed to the complexity of the profile, pre-punching or notched features and cut off related problems. While the quality of the incoming steel is very important tooling design, the setup and condition of the roll set contributes greatly to the amount of scrap produced, Tooling wear contributes to increased levels of scrap; Occurring gradually over time, as the tooling wears, the startup scrap rate will also increase. Efforts should be taken to investigate the causes and to take corrective actions. (High scrap rate).

34. Metal Spinning: *Degarmo E Paul, Black J T and Ronald A Kohser. Materials and Processes in Manufacturing. (Hoboken, Nueva Jersey: John Wiley & Sons, Inc, 2003) Page 435.
**Ultimate Spinning & Turning Corporation. “Advantages & Benefits of Metal Spinning”. Ultimate Spinning & Turning Corporation, May 2008. Web. 29 May 2008. < http://www.ultimatespinning.com/ultimate-advantages.html>
35. Roll Forming:
* Summerhill Chuck. “Is Your Roll Formed Production Scrap Rate Over 5%? Common Causes & Tips to Reduce Scrap”. Roll Kraft: Advancing the tube, pipe & roll forming industries, June 2013. Web. 5 June 2013. < http://www.roll-kraft.com/ask-the-doctor/tech-tips-roll-forming-articles/roll-forming-machine-operations/is-your-roll-formed-production-scrap-rate-over-5>

Machining

36. Turning operations

A machining process in which a single-point tool remove material from the surface of a rotating work piece. (Lathe). Even with highly specialized skilled machinist undertaking the burdens of producing acceptable parts the scrap rate is still extremely high.

37. Drilling

Is a cutting process that uses a drill bit to cut or enlarge a hole of circular cross-section in solid materials. The drill bit is a rotary cutting tool, often multipoint. The bit is pressed against the work piece and rotated at rates from hundreds to thousands of revolutions per minute. A high quality CNC machine was experiencing a 50% scrap rate (High scrap rate) because of difficulty controlling run out drilling a .047" DIA hole that is 2.170" deep (a length to diameter ratio of 46:1).

36. Turning operations: *Chen. S, D. head, and I.S. Jawair. “An Investigation of Machining Performance for Controlled Surface Quality Requirements in Porous Tungsten” Center for Manufacturing, Department of Mechanical Engineering, University of Kentucky, accesed June 6, 2013, page 1.
**College of Engineering. “Machining Operations and Machine Tools” Michigan State University, accessed June 6, 2013, http://www.egr.msu.edu/~pk-won/me478/operations.pdf.
37. Drilling: *Todd, Robert H, Dell K. Allen, and Leo Alting. Manufacturing Processes Reference Guide (New York: Industrial Press Inc.1994), 43-48.
** Big Kaiser. “Scrap Rate Drops From 50% To 1.5% With Big Kaiser Mega Micro Chuck”. Big Kaiser Precision Tooloing Inc, june 2006. Web. 6 June. 2013. < http://www.bigkaiser.com/news/techart-2006-april-scrap-rate-drops.php>

38. Water Jet Cutting

Due to its relatively narrow kerf water jet cutting can reduce the amount of scrap material produced, by allowing uncut parts to be nested more closely together than traditional cutting methods. Water jets use approximately one half to one gallon per minute (depending on the cutting head's orifice size), The garnet abrasive is a non-toxic material that can be recycled for repeated use; otherwise, it can usually be disposed in a landfill. Water jets also produce fewer airborne dust particles, smoke, fumes, and contaminants. (Low scrap rate)

39. Laser Cutting

The laser cutting process is one of the fastest and most accurate methods for cutting a variety of metals and non-metals. However , while a laser cutter can produce part accuracies approaching 0.001" with a very good surface finish, there are limits to the materials it can reliably process in this high tolerance range. A laser cutter would struggle and end up scrapping a lot of parts. (Low scrap rate)

38. Water Jet Cutting: *Lorincz Jim, "Waterjets: Evolving from Macro to Micro" Manufacturing Engineering Magazine, November, 2009.
39. Laser Cutting: *Machines NC International. "Laser Cutting". Machines NC International, April 2012. Web. 13 April. 2012 < http://www.cncmi.net/index.htm>

40. Laser Drilling

The scraps of the work piece would be carried away in molten state by the electrolyte jet whenever and wherever the material has reached the melting temperature. Thus, for this model, the isotherm line, which represents the melting temperature of the material, can be considered as the profile of the hole during electrolyte-jet-guided laser drilling. The Parts rejected later in the manufacturing cycle could not be reworked, and had to be scrapped. Lastly, lasers can reduce scrap metal because of their small kerf width and ability to common-edge-cut parts. The ability to cut odd-size pieces for welding customized blanks prior to forming can further minimize material scrap.

41. Plasma Cutting

In plasma Cutting Second, the software must determine where to locate starting points for piercing the plate in scrap material so that the outside contour of the cut is not distorted from piercing. Then, again using expert operator input, lead ins and lead outs are applied to the part drawing to lead from the pierce point to the actual contour of the part. The parameters promote good cut quality, low operating cost (consumable life, low scrap rates) and high productivity.

40. Laser Drilling: *Zhang Hua "Laser Drilling Assisted with Jet Electrochemical Machining" School of Mechanical Engineering, Nantong University, Nantong, Jiangsu China, accessed June 6, 2013, page 309.
**Association for Manufacturing Technology. "an Introduction to Laser Cutting", in Industrial Laser Processes an Introduction 1998, Published by. Laser Systems Product Group (Mclean Virginia: Association for Manufacturing Technology, 1998), 12,17
41. Plasma Cutting: *Colt Jim "State Of The Art: Cnc Plasma Cutting Software". Fabricating Metal and Working, December, 2012.

42. Abrasive Jet Machining

Abrasive jet machining (AJM), also known as abrasive micro-blasting, pencil blasting and micro-abrasive blasting is an abrasive blasting machining process that uses abrasives propelled by a high velocity gas to erode material from the work piece. Minimal burr compared to conventional machining, Environmentally friendly; no oil-soaked chips and minimal scrap. When machining or roughing out expensive materials such as titanium, the scrap still has value. This is because you get chunks, not chips. You can also get more parts from the same material because of the abrasive jets low kerf width.

43. Sawmill

This process generates a high scrap rate, for example In a domestic Sawmill market , such as Libreville in Gabon (Africa) with a small-scale chainsaw we can found an annual average consumption at 70.000 m3, of which 27 % comes from industrial sawmills, mainly as sawmill scrap, making of this process a highest scrap generator

44.Grinding

At present, grinding scraps are land filled with an involved cost of 60 D /t, because the oil content (equal to 6.40% by weight, b.w.) does not permit recovery in secondary smelt furnaces. Secondary smelt foundries in fact only accept turnings, borings, scraps and oily machinery waste with an oil content no higher than 1% b.w. The lubrorefrigerant fluid and heavy metal content of some grinding scrap samples have been determined (High scrap rate)

42. Abrasive Jet Machining: *Pande Kamlesh; and Forbes Marshal. “Abrasive Jet Machining Manual” Indian Institute of Technology Guwahati, Mechanical Engineering Students, Association (MESA), accesed June 6, 2013, page 11, 12.
43. Sawmill: *Lescuyer Guillaume, Paolo Omar Cerutti, Saturnin Ndotit Manguiengha and Laurentine Bilogo b Nong. “Results”, in The domestic market for small scale chainsaw milling in Gabon 2011, Published by. Center for International Forestry Research (Bogor, Indonesia: Cifor, 2011), 11.
44.Grinding: * Ruffino Barbara; and Zanetti, Maria Chiara. Resources, Conservation & Recycling (Amsterdam: Elsevier Publishing Solutions, 2008), 1315 - 1321

Rapid Manufacturing

45. Stereolithography (Rapid prototyping)

Stereolithography (SLA or SL), also known as optical fabrication, photo-solidification, solid free-form fabrication and solid imaging) is an additive manufacturing (or 3D printing) technology used for producing models, prototypes, patterns, and production parts. Materials are expensive, and the cost swells with waste, scrap (High scrap rate), inventory and material conversions. Stereolithography photopolymers, cost about $200 per kilogram.

46. Selected laser Sintering (SLS)

Is a laser -based, additive manufacturing method for creating functional parts. Parts are built from a CAD model, layer-by-layer. The part is built inside a powder bed, and most of this powder can be reused in subsequent builds. The solid

45. Stereolithography (Rapid prototyping) : * Wohlers Terry “The Real Cost Of RP” Time-Compression Technologies magazine, March 2002.
**Pothopolymer.com “Stereolithography” Savla Associates, June 2013. Web. 6 June. 2013 < http://www.photopolymer.com/stereolithography.htm>
46. Selected laser Sintering (SLS): * Telenko Cassandra; and Carolyn Conner Seepersad, “Assessing Energy Requirements and Material Flows of Selective Laser Sintering Nylon Powder”, The university of Texas Austin, Mechanical engineering department, accessed June 6, 2013,

freeform fabrication (SFF) community has identified multiple sustainable advantages of SLS. This research investigated the material waste of nylon powder in SLS and compared the embodied energy in a 1kg SLS part with a 1 kg part made from injection molding (IM). Findings from the literature and an interview with a local service bureau show that SLS processes generate more waste material than IM and use 5-12 times the energy per kg of final part. A comparison of the material and energy use of the two manufacturing methods across a range of plausible scrap rates (Low scrap rates) suggests that SLS is competitive with the least efficient IM operations and cannot compete with most IM efficiencies.

47. Laminated Object Manufacturing

Into the process slices are cut in required contour from roll of material by using a 25-50 watt CO2 laser beam. A new slice is bonded to previously deposited slice by using a hot roller, which activates a heat sensitive adhesive. Apart from the slice unwanted material is also hatched in rectangles to facilitate its later removal but remains in place during the build to act as supports. In this process, materials that are relatively cheaper like paper, plastic roll etc. can be used. Parts of fiber-reinforced glass ceramics can be produced. Large amount of scrap is formed.

47. Laminated object Manufacturing: *Pandey, pulak M, "Rapid prototyping technologies, applications and part deposition planning" Department of Mechanical Engineering, Indian Institute of Technology Delhi, accessed June 6, 2013

48. Fused Deposition Modeling

FDM (Fused Deposition Modeling) methods are usually used to make some prototypes for functional testing purpose instead of demo purpose. Additive manufacturing uses a digital model to construct objects in layers. The method can create complex 3-D shapes and produces far less scrap than conventional methods (Low scrap rate).

49. Laser Engineered Net Shaping

Sandia National Laboratories has developed a new technology to fabricate three-dimensional metallic
components directly from CAD solid models. This process, called Laser Engineered Net Shaping (LENS®), exhibits enormous potential to revolutionize the way in which metal parts, such as complex prototypes, tooling, and small-lot production items, are produced. Laser Engineered Net Shaping process, means more energy, efficiency and optimal results which translate into less material scrap.

48. Fused Deposition Modeling: *Fulps Linda "S&T's additive manufacturing project selected for funding" Missouri University of Science and Technology, accessed June 6, 2013, http://news.mst.edu/2013/03/sts_additive_manufacturing_pro/
**Rpworld.net " Fused Deposition Modeling". RP&M Sector of Summary Corporation, June 2013. Web. 6 June. 2013 < http://rpworld.net/cms/index.php/additive-manufacturing/rp-rapid-prototyping/fdm-fused-deposition-modeling-.html>
49. Laser Engineered Net Shaping: * Hilton Peter D; and Paul F Jacobs. Rapid Tooling- Technologies and industrial applications (New York: Marcel Dekker Inc, 2005), 263
**David Gill. "Laser Engineered Net Shaping". Sandia National Laboratories, April 2006. Web. 17 April. 2006 < http://www.sandia.gov/mst/pdf/LENS.pdf>

50. Three dimensional printing

3D printing (or additive manufacturing) is technology that allows building real objects from 3D drawings. This is done by "cutting" the virtual object in 2D slices and printing the real object slice by slice. Slices are printed on top of each other's and since each slice has a given thickness the real object gains volume every time a slice is added. The scrap rate is around 9% (Low scrap Rate) The Oak Ridge National Laboratory (ORNL) in Tennessee performed a case study in order to "determine the capability of additive manufacturing technologies to drastically reduce the cost and material scrap associated with the production of aerospace components"

50.50. Three dimensional printing: *ExOne The Americas "Complex Digital Core Cuts Lead Time in Half & Saves Thousands" Exone Digital Part Materialization, Novembre 2012. Web. 1 Novembre. 2012 < http://www.exone.com/sites/default/-files/Case_Studies/sand_Morel.pdf>

** Raszmann Emma; and Adam Paul "Three-Dimensional Printing: An Additive Manufacturing Process" in Three-Dimensional Printing Helps Efficiently Manufacture Aerospace Components, 2013, Published by. Pittsburg University (Pittsburg: Pittsburg University, 2013), 2,3.

*** Create It Real "3D Printing Process" Create It Real, June 2013. Web. 6 June. 2013 < http://www.createitreal.com/index.php/about

Chart 4.1. Examples of objects made by these fifty processes (1 to 30).

1. Plastic Injection Moulding

2. Transfer Moulding

3. Extrusion Blow Moulding

4. Rotational Moulding

5. Pressure Thermoforming

6. Compression Moulding

7.Plaster Mould Casting

8. Plastic Resin Casting

9. Plastic Extrusion

10. Blown Film Extrusion

11. Plastic Pultrusion

12. Float Glass

13. Glassblowing

14. Aluminum Sand Casting

15. Shell Molding

16. Permanent Mold Casting

17. Low Pressure Casting

18. Slush Casting

19. Die Casting

20. Die Casting Dies

21. Centrifugal Casting

22. Sheet Metal Stamping

23. Spray Forming

24. Isostatic Pressing

25. Die Pressing

26. Near Net Shape

27. Hot Forging

28. Blanking and Piercing

Blanking Piercing

29. Roll Slitting

30. Shearing

1. Air Chair (1999):Designed by Jasper Morrison, Magis, http://images.businessweek.com/ss/06/05/phaidon/source/11.htm
2. Aerial lift buckets: Osborne Industries, http://www.osborneindustries.com/images/buckets.gif
3. Water bottle: Nike, http://images.sportsshoes.com/product/N/NIK4954/NIK4954_400_1.jpg
4. Snoop and woopy (2011): Designed by Karim Rashid, For B line, http://www.dezeen.com/tag/rotational-moulding/
5. Verve Chair (2008): Designed by John Sebastian's Verve, http://farm4.static.-flickr.com/3145/2530880187_812c50cd8e_o.jpg
6. Selene Chair (1969):Designed by Vico Magistretti Artemide, http://farm1.static-flickr.com/56/138427859_0f42562bbd_o.jpg
7. Big bull: Devshree Mineral Corporation, http://www.devminerals.com/plaster-mould.htm
8. Resin Lamp (2007): Designgedichtjes, http://www.trendhunter.com/trends/the-resin-lamp-clearly-a-winner
9. Extruded Chair (2007): Designed by Tom Dixon, http://www.chairblog.eu/2008/12/01/philips-de-pury-company-tom-dixon/
10. Heat seal Handle Plastic Shopping Bag: KYL International, http://image.made-in-china.com
11. Umbrella Battens: Glass fiber , Van Dijk Pultrusion products, http://www.dpp-pultrusion.com
12. Teso table (1985): Design By Renzo Piano, For Fontana Arte (Float Glass and burnished metal), http://hivemodern.com/public_resources/2932_photo_1_190638.jpg
13. Fucsia Pendants (1996), By Achille Castiglioni For Flos, http://st.houzz.com/fimgs/5131edd50dd200fe_8916-w268-h486-b1-p10---pendant-lighting.jpg
14. Circular aluminum tables (2013): Contrasting raw and uneven sand-cast surfaces with precise laser-cut legs.
Katrin Olina – Garoar Eyjòlfsson, http://www.dezeen.com/
15. Motorola RAZR V3 (2004): Motorola, http://dmtienda.com/files/2012/03/09/img1_motorola-v3_0.-jpg
16. Provance Bench with Cushion: Frontgate, Permanent Mold Casting, http://www.frontgate.com/outdoor-furniture/
17. STCS7 Wheel: Alufelgen Wheels, Aluminum grade and manufactured using low – pressure casting technology
http://www.bimmerboost.com/images/imported/2013/04/CS7WheelPage-1.jpg
18.Studebaker National Museum: Nati (USA) Studebaker – 7 (1948), Lead Slush casting, pale green, silver detail
http://www.vectis.co.uk/AuctionImages/31/3592_l.jpg
19. Alessi Juicy Salif, Citrus Squeezer (1990): Designed by Philipp Starck, For Alessi (mirror-polished aluminum casting)
http://s4e95fbd50f2c7.img.gostorego.com
20. Soup Pot: Industry Guangzhou Co Ltd,
http://www.alibaba.com/productgs/330733014/Die_casting_Aluminum_Non_Stick_Stock/showimage.html
21. Centrifugal Casting Sleeve: Leadertek Precision Inc., http://i00.i.aliimg.com/photo/256901305/Centrifugal_Casting_Sleeve.jpg
22. Stamping metal bracket: IQE Company, http://www.iq-enterprises.net
23. High-pressure die cast engine block with spray-formed Al/Si cylinder liners: Peak and Daimler-Benz,
http://www.tms.org/pubs/journals/JOM/9904/Leatham/Leatham-9904.html
24. Kyocera Kyotop Chef's Knife: Kyocera, http://www.hainlin.com/out/pictures/master/product/1/kt-140-h-z(1).jpg
25.Timing year: Zhejiang Yongfeng Powder Metallurgy Co., Ltd, http://powdermetall.en.made-in-china.com/product/eMhmqZtUHlVx/China-Timing-Gear.html
26. Suspension Components MacLean Fogg, http://es.macleanfoggcs.com
27. Auto Wheel Drum (Hot Forging): hwanglong, http://image.made-in-china.com
28. Blanking Euro Coin: European Central Bank, http://blogs-images.forbes.com/pierredelage/-files/2011/12/Euro-coin.jpg
Piercing Girotondo Fruit Holder: Designed by King Kong (Name adopted by Stefano Giovannoni and Guido Ven) For Alessi (shapes piercing its steel sides), http://www.californiahomedesign.com
29 Slitting Roll Sleeves, Burris Machine Company (made from high carbon, chrome alloy steel), http://www.burrismachineco.com/images/slitting-rolls-large.gif
30. Shear blades: Ace Grinding, http://ace.g63tech.com/wp-content/uploads/2013/04/shearing-blade-372.jpg

Chart 4.2. Examples of objects made by these fifty processes (objects from 31 to 50).

31. Punching

32. Bending

33. Swaging

34. Metal Spinning

35. Roll Forming

36. Turning Operations

37. Drilling

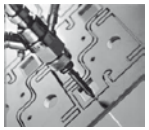
38. Water Jet Cuttimg

39. Laser Cuttimg

40. Laser Drilling

41. Plasma Cuting

42. Abrasive Jet Machining



43. Sawmill

44. Grinding

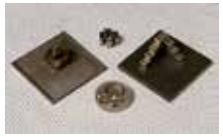
45. Stereolithography (Rapid prototyping)

46. Selected laser Sintering (SLS)

47. Laminated Object Manufacturing

48. Fused Deposition Modeling

49. Laser Engineered Net Shaping



50. Three dimensional printing

31. Punching: Perforated metal mesh: Haofeng perforated metal factory (Perforated sheet ,punching hole meshes), http://www.biztrademarket.com/User/198077/bb/---_uz1.jpg
32. Fold faucet: Designed by Lorenzo Damian, for Ceramica Flaminia, http://www.marvelbuilding.com/decorating/appliances
33. Swage Hinges: S&D Products The hinge and laser Specialist, http://www.sdproducts.com/Swage+Hinges/default.aspx
34. Metal spinning products: Metal Spinners Inc, http://www.metalspinners.com/metal_spinning.html
35. Architectural profiles: Nu-tech Rollforming, http://www.nutechrollforming.com/gallery.html
36. Pz3 - Floor Candlestick (2006): Designed by Peter Zumthor, For Alessi, http://www.alessi.com/en/3/1927/home-accessories/floor-candlestick
37. Brake Disco Corvette 88 – 95: Corvette, http://www.cardediimport.es/files/4821-14177-imagenAmpliada/disco%20freno%20corvette.jpg
38. Cogwheels: PSP (Dynamic water jet cutting), http://www.pennstainless.com/DynamicWaterjetCutting.php
39. KKGT - Girotondo, round tray (2009): Designed by King –Kong (Name adopted by Stefano Giovannoni and Guido Ven)
http://www.alessi.com/en/3/853/trays/girotondo-round-tray
40. Laser Hole Drilling in Metal: Photomac, http://www.potomac-laser.com/wp-content/uploads/2012/01/Metal01121.jpg
41. Cathedral Installation (2009): Designed By: Luke Morgan (made of welded, plasma-cut, mild steel), http://www.dezeen.com/2009/04/08/cathedral-installation-by-luke-morgan/
42. Abrasive Water Jet Machining piece: GK Industries, http://www.indiamart.com/gk-industries/water-jet-machining.html
43. Vintage Sawmill Critters Hand Painted Wood Slat Strawberry Basket: Etsy, http://www.etsy.com/listing/107079162/vintage-sawmill-critters-hand-painted?ref=market
44. Unique Performance Prisoners Vin Grinded Of Metal (Mustang) : Taiwan Parts Fraud Bondo, http://67mustangblog.com
45. Miicraft-light-based-3d-printer-high-resolution Stereolithography-sla-wired-design: By Joseph Flaherty, http://www.wired.com
46. Springs 3D – Printed Glasses (2013): By Ron Arad, For PQ (selective laser sintering (SLS) technology), http://www.dezeen.com/2013/04/10/springs-3d-printed-glasses-by-ron-arad-for-pq/
47. Laminated Object Manufacturing vase: Rpworld.net, http://rpworld.net/cms/images/stories/lom/lpm02.jpg
48. Fused Deposition Modeling pieces, 3D printing services Canada, http://3dprintingservicescanada.com/fdm.php
49. Sample work pieces show, Sandia National Laboratories, http://www.sandia.gov/media/images/-jpg/lensbird.jpg
50. 3D Printed Necklace: Hot Pop Factory., http://hannahrobinett.tumblr.com/

CHART 4.3. COMPARISON CHART OF THE VARIOUS SCRAP MATERIALS

NONMETALLIC MATERIALS	HIGH SCRAP RATE	LOW SCRAP RATE
1. PLASTIC INJECTION MOLDING	X	
2. TRANSFER MOLDING	X	
3. EXTRUSION BLOW MOLDING		X
4. ROTATIONAL MOLDING		X
5. PRESSURE THERMOFORMING		X
6. COMPRESSION MOLDING		X
7. PLASTER MOLDING		X
8.PLASTIC RESIN CASTING	X	
9. PLASTIC EXTRUSION		X
10. PLASTIC POLTRUSION		X
11. BLOWN FILM EXTRUSION	X	
CERAMICS		
12. FLOAT GLASS		X
13. GLASSBLOWING		X
METAL CASTING		
14. ALUMINIUM SAND CASTING	X	
15.SHELL MOLDING		X
16. PERMANENT MOLD CASTING		X
17.LOW PRESSURE CASTING		X
18.SLUSH CASTING		X
19.DIE CASTING		X
20. DIE CASTING DIES		X
21.CENTRIFUGAL CASTING		X
22. SHEET METAL STAMPING	X	
23. SPRAY FORMING		X
POWDER METALLURGY/POWDER COMPACTATION		
24. ISOSTATIC PRESSING		X
25. DIE PRESSING		X

FORMING	HIGH SCRAP RATE	LOW SCRAP RATE
26. NEAR NET SHAPE		X
27. HOT FORGING		X
28. ROLL SLITTING	X	
29. BLANKING AND PIERCING	X	
30. SHEARING	X	
31. PUNCHING	X	
32. BENDING	X	
33. SWAGING		X
34. METAL SPINNING		X
35.ROLL FORMING	X	
MACHINING		
36. TURNING OPERATIONS	X	
37.DRILLING	X	
38. WATER JET CUTTING		X
39. LASER DRILLING		X
40.PLASMA CUTTING		X
41.ABRASIVE JET MACHINING		X
42.SAWMILL	X	
43. GRINDING	X	
44. LASER CUTTING	X	
RAPID MANUFACTURING		
45. STEREOLITHOGRAPHY (RA	X	
46. LAMINATED OBJECT MANUFACTURING	X	
47. SELECTED LASER SINTERING (SLS)		
48. FUSED DEPOSITION MODELLING		X
49. LASER ENGINEERED NET SHAPING		X
50. THREE-DIMENSIONAL PRINTING	X	

CHART 4.4. SELECTION AMONG THE DIFFERENT PROCESSES FOR CASE STUDY ACCORDING TO HIGH SCRAP RATE

NONMETALLIC MATERIALS
1. TRANSFER MOLDING

METAL CASTING
2. ALUMINIUM SAND CASTING
3. SHEET METAL STAMPING

FORMING
4. BLANKING AND PIERCING
5. SHEARING
6.PUNCHING

MACHINING
7. DRILLING
8. SAWMILL
9. LASER CUTTING

RAPID MANUFACTURING
10. STEREOLITHOGRAPHY (RA).
11LAMINATED OBJECT MANUFACTURING
12. THREE-DIMENSIONAL PRINTING

* Some case study which had indicated high scrap rate have been excluded inasmuch as many of them don't leave a scrap material suitable for being reused

4.2. Business Directory

Companies who work with these processes (Lombardy region- Italy)

Transfer Molding ***(Translation into Italian: Stampaggio per trasferimento) Italian Companies, Lombardy***

1. VIPLEX DI RADAELLI MASSIMO
Lombardia, v. Tantardini Antonio. 14, 20136 Milano | telefono : +39-(02)-89409128
2. TECNOPOLIMERI (SRL)
Lombardia, v. Solferino. 6, 20038 Seregno | telefono : +39-(0362)-224101
3.TESSITURA SCALABRINI DI SCALABRINI ARTURO NINO
Lombardia, v. Serio. 836, 21050 Marnate | telefono : +39-(0331)-367206
4.STELLA PLAST (SRL)
Lombardia, v. Guerrazzi. 9, 20052 Monza | telefono : +39-(039)-2000516
5. ST.IVAN SNC DI PERGOLA GIUSEPPE E C.
Lombardia, v. Ovidio. 14, 20093 Cologno Monzese | telefono : +39-(02)-2532452
6. SILAGO (SRL)
Lombardia, v. Brescia. 0, 26010 Pozzaglio ed uniti | telefono : +39-(0372)-55053
7. SERRAINO TECNOPOLIMERI S.N.C.
Lombardia, v. Enrico fermi. 41, 25020 Flero | telefono : +39-(030)-3583984
8. RADDRIZZANI ANGELO E FIORENZO SNC
Lombardia, v. Ugo Foscolo. 18, 20010 Arluno | telefono : +39-(02)-9015916
9. PUNTO T. SRL
Veneto, Loc. Talpone'. 4, 31030 Cison Di Valmarino | Telefono : +39-(0438)-975281
10. ARTPLAST 88 (SRL)
Lombardia, V. Garibaldi. 255, 25013 Carpenedolo | Telefono : +39-(030)-9965441
11. BIO POLYMER SRL
Lombardia, V. Bazzani. 4, 46040 Guidizzolo | Telefono : +39-(0376)-847046
12. BOSCHETTI MICHELE
Lombardia, V. Guarneri Zanetti. 5, 26033 Pescarolo Ed Uniti | Telefono : +39-(0372)-836329
13. BRANCA RACHELE
Lombardia, V. Induno. 11, 20020 Busto Garolfo | Telefono : +39-(0331)-569222
14.BREVI PLAST (SRL)
Lombardia, V. Passerera. 9, 24060 Bolgare | Telefono : +39-(035)-4423488
15. CESAPLAST (S.P.A.)
Lombardia, V. Novara. 62, 20031 Cesano Maderno | Telefono : +39-(0362)-501163
16. COMI OSCAR E C. (S.N.C.)
Lombardia, C. Europa. 240, 23801 Calolziocorte | Telefono : +39-(0341)-634707
17. COMIP SRL
Lombardia, V. Guerciotti. 33, 20025 Legnano | Telefono : +39-(0331)-544724
18. VISMARA ATTILIO SRL
Lombardia, V. Annoni. 14, 20037 Paderno Dugnano | Telefono : +39-(02)-9103501

19. ESSE - TI SRL
Lombardia, V. Sebastian Bach. 3, 20092 Cinisello Balsamo | Telefono : +39-(02)-6185432
20. ESSE FI SRL
Lombardia, V. Caronno Varesino. 2, 21040 Morazzone | Telefono : +39-(0332)-462090
21. FE.RO PLASTICA SRL
Lombardia, V. Campo Di Maggio. 42, 21022 Brunello | Telefono : +39-(0332)-875911
22. G.M.G. DI GIUSEPPE GATTINONI
Lombardia, V. Tesio Federico. 19, 20151 Milano | Telefono : +39-(02)-48205580
23. INVERNIZZI ARMANDO
Lombardia, V. Udine. 12, 27023 Cassolnovo | Telefono : +39-(0381)-92690
24. LA PLEXAST SRL
Lombardia, V. Salvo D'acquisto. 12, 20037 Paderno Dugnano | Telefono : +39-(02)-9103015
25. MAGNOLI MARIO
Lombardia, V. Dei Canarini. 1, 21050 Lonate Ceppino | Telefono : +39-(0331)-844028
26. NUOVACRILL DI GIORGIO SCOLARI & C. (S.N.C.)
Lombardia, V. Mecenate. 79, 20138 Milano | Telefono : +39-(02)-5060905
27. PERUCCA DANIELA SALDATURA MATERIE PLASTICHE
Lombardia, Pl. Lugano. 31, 20158 Milano | Telefono : +39-(02)-39310428

Aluminum Sand Casting ***(Translation into Italian: Colata in sabbia di alluminio) Italian Companies, Lombardy***
1. FONDERIA TAGLIAFERRO SRL
A/1, Via Zucchi 20095 Cusano Milanino (Mi) / Telefono: +39 026 133 670
2. SCILLA MECCANICA SRL
1, V. Borgosatollo 25016 Ghedi (Bs) / Telefono: +39 0309 032 850- Fax: +39 0309 032 253
3. FORELLI PIETRO SNC DI FORELLI GIACOMO & C.
115, V. Industriale 25020 CAPRIANO DEL COLLE (BS) / Telefono: +39 0309 971 898
4. UNIVERSAL PRESS DI BIANCHETTI ALBERTO SNC
Via Provinciale 25050 Ome(BS)
5. UNITED TECHNOLOGIES
Via Benedetto Marcello 5 20124 Milano (MI) / +39 (0)2 29514387, fax +39 (0)2 29518187
6. FONDERIA VIRGINIO BOTTARINI S.P.A.
116/A, Via Giovanni XXIII Papa 21015 Lonate Pozzolo (Varese)/ Telefono: +39 0331301
7. FONDERIA E. RIPAMONTI di RIPAMONTI ENRICO & C. srl
38/40, V. Baracca - 20099 Sesto San Giovanni (Mi) | Tel: 02 22470083 - Fax: 02 2620621

Aluminum Sand Casting ***(Translation into Italian: Colata in sabbia di alluminio) Italian Companies, Lombardy***
1. FONDERIA TAGLIAFERRO SRL
A/1, Via Zucchi 20095 Cusano Milanino (Mi) / Telefono: +39 026 133 670

2. SCILLA MECCANICA SRL
1, V. Borgosatollo 25016 Ghedi (Bs) / Telefono: +39 0309 032 850- Fax: +39 0309 032 253
3. FORELLI PIETRO SNC DI FORELLI GIACOMO & C.
115, V. Industriale 25020 CAPRIANO DEL COLLE (BS) / Telefono: +39 0309 971 898
4. UNIVERSAL PRESS DI BIANCHETTI ALBERTO SNC
Via Provinciale 25050 Ome(BS)
5. UNITED TECHNOLOGIES
Via Benedetto Marcello 5 20124 Milano (MI) / +39 (0)2 29514387, fax +39 (0)2 29518187
6. FONDERIA VIRGINIO BOTTARINI S.P.A.
116/A, Via Giovanni XXIII Papa 21015 Lonate Pozzolo (Varese)/ Telefono: +39 0331301
7. FONDERIA E. RIPAMONTI di RIPAMONTI ENRICO & C. srl
38/40, V. Baracca - 20099 Sesto San Giovanni (Mi) | Tel: 02 22470083 - Fax: 02 2620621

Sheet Metal Stamping ***(Translation into Italian : stampaggio lamiere) Italian Companies, Lombardy***
1.TMV srl
Via Matteotti, 311 Gardone Val Trompia (Bs) / Tel. + 39 030 832812 - Fax +39 030 8911039
2. 18 srl
Via Stezzano 87, 24126 Bergamo / Tel +39-035-233337 – Fax: +39-035-217837
3. ROYAL TOYS snc
Via Meucci Antonio 12 - Corsico (Mi) / Tel. 02 45869893 Fax. 02 45869836

Blanking ***(Translation into Italian: Tranciatura) Italian companies , Lombardy area***
1. OTIM srl
V. Gattamelata 2/4 - Pedrengo (Bg) - Tel. 035 661234 - Info@Otim-Srl.It
2. OLMEC srl
Via Padergnone 13 - 24050 - Grassobbio (Bg) / Tel: 035 525130 - Fax: 035 526287
3. ROYAL TOYS snc
Via Meucci Antonio 12 - Corsico (Mi) / Tel. 02 45869893 Fax. 02 45869836
4. ABEL sas
Vl. Gramsci 242 - Sesto San Giovanni (Mi) - Tel. 02 2426144 - Fax. 02 2426144
5. STAMPINOX PADERNO S.r.l.
Via Ruffini, 22 Angolo Via Rosati - 20037 Paderno Dugnano (Mi)- Tel. 02.91.01.518 – Fax 02.91.05.294
6. AMPER srl
3, V. Nanetti - 20090 Buccinasco (Mi), Tel: 02 48840561
7. METAL snc
6, v. Volta - 20060 Gessate (MI), tel: 02 95743726 - fax: 02 95745662
8. MARINONI SRL
33, vl. Lombardia - 20013 Magenta (MI) | tel: 02 9791533
9. FUROS SNC1
6/18, v. Giotto - 20060 Mediglia (MI) / tel: 02 9067153 fax: 02 90687183
10. TIESSE di SIMONTACCHI ANGELO & C. snc
7, v. Toscanini - 20020 Magnago (MI) / tel: 0331 657818 fax: 0331 309710

10. TIESSE di SIMONTACCHI ANGELO & C. snc
7, v. Toscanini - 20020 Magnago (MI) / tel: 0331 657818 fax: 0331 309710
11. COBI PRECISION SRL
29, v. Del Parco - 20064 Gorgonzola (MI) | tel: 02 95304434 fax: 02 95300454
12. EFFEDUE SNC
28/b, v. Goito - 20851 Lissone (MB) / tel: 039 2143152 - fax: 039 2452118
13. ATTREZZERIA LOMOLINO – VINCENZO LOMOLINO
9, v. Angiolieri - 20834 Nova Milanese (MB) / tel: 0362 40401 fax: 0362 40401
14. T.M.G. SRL
13/15, v. Abruzzi - 20056 Grezzago (MI) / tel: 02 90960573 fax: 02 90968389
15. FERIN SNC
16/20, v. Lombardia - 20841 Carate Brianza (MB) / tel: 0362 804848 fax: 0362 992036
16. ALVIMA SRL LAVORAZIONE LAMIERE
9, v. Martiri Resistenza - 20090 Pieve Emanuele (MI) / tel: 02 90422273
17. MALVESTITI ERNESTO SPA
205, v. Risorgimento - 20092 Cinisello Balsamo (MI) tel: 02 618731 fax: 02 6128300
18. LA TRANCIA di FRANCO FERRARI
27/29, v. Fortuzzi - 20813 Bovisio Masciago (MB) / tel: 0362 590744 fax: 0362 559054
19. T.G.N. PLAST SRL
4, p. Volta - 20873 Cavenago Di Brianza (MB) / tel: 02 95339642
20. ATTREZZERIA DUE ESSE SRL
34, v. Alessandro Volta - 20088 Rosate (MI) / tel: 02 90849735, 02 90849732
21. SATI SRL
5/7, v. G. Donghi (zona artigianale) - 20811 Cesano Maderno (MB) / tel: 0362 506153 fax: 0362 574451
22.TENCONI TECNOLOGIE MECCANICHE SRL
33, v. Buozzi Bruno - 20097 San Donato Milanese (MI) tel: 02 5275149 fax: 02 5231686
23. G.S.G.di SPERANDIO ETTORE
8, v. Dell' Artigiano - 20020 Solaro (MI) / tel: 02 9690428 fax: 02 9690428
24. BLUZUR di MAPELLI PAOLO
v. Brughetti - 20813 Bovisio Masciago (MB) / tel: 0362 592130

Punching ***(Translation into Italian: Punzonatura) Italian companies , Lombardy 1. A.T.S. srl***

109, v. Sampietro - 21047 Saronno (VA) / tel: 02 9609465 - fax: 02 96700497
2. DIMENSIONE LASER srl
4, v. Della Tecnica - 20864 Agrate Brianza (MB)/ tel: 039 6058345 - fax: 039 6057523
3. DUE M INOX SNC
5.1 km 23, v. Donatori di Sangue - 20010 Santo Stefano Ticino (MI)
4. BAI CAR DI PAOLO CARAMORE & CARAMORE DANTE snc
11, vl. Dell' Industria - 20020 Dairago (MI) / tel: 0331 436230 - fax: 0331 431222

5. BLUZUR di MAPELLI PAOLO
v. Brughetti - 20813 Bovisio Masciago (MB)/ tel: 0362 592130

Shearing (Translation into Italian: fustellatura) Italian companies , Lombardy
1. BIPIEMME S.r.l.
Via Trento, 22 - 22060 Mariano Comense (CO) - Italy - Tel. +39 031-751.745 - Fax +39 031-751.399
2. AGIT S.a.s. di Brolo rag. Lugi & C.
Via Montanari, 25, 20100 Milano, MI - 02 39310737- 02 375691
3. CAVALLERO GOMMA
59, V. CAVOUR, N 20026 MILANESE, LOMBARDIA - Telefono: 02 39100019 / Fax: 02 39100252
4. CABO DI BOTTINELLI
Via Palestina -20083 VIGANO DI GAGGIANO (Milano) Telefono :+39/02.90.84.10.84

Drilling (Translation into Italian: Foratura) Italian companies , Lombardy
1. Eridian srl
Via E.Majorana, 825020 FLERO (Bs) (Strada Provinciale per Quinzano) Tel. +39 030 35.82.520
2. P.G. MECCANICA srl
Via Greppi 20 - Cologno Monzese (Mi) - Tel. 02 2543381 Fax. 02 27300807
3. SO.MA. srl
5, v. Gobetti - 25086 Rezzato (BS) - tel: 030 2590296 - fax: 030 2590296
4. MECCANICHE MAURI di GIAMPIETRO MAURI & C. snc
77, v. S. Fiorano - 20852 Villasanta (MB)
5. OFFICINE MECCANICHE FOINA & ARIENTA SRL
9, v. Lombardia - 26854 Cornegliano Laudense (LO)
6. GBM SRL LAVORAZIONI ALLUMINIO E LEGHE
A. Caggioli - PISOGNE (BS) - Tel. 0364.880271
7. OFF. MEC. CAR.di GALIMBERTI GIOVANNI & C. snc
9/b, v. Baselone - 23862 Civate (LC)

Sawmill ***(Translation into Italian: Segheria) Italian companies , Lombardy***
1. FAGLIA LEGNAMI di ENNIO FAGLIA & C. snc
6, v. Speri - 25032 Chiari (BS) / tel. 030.711204 fax. 030.7001769
2. SEGHERIA GHILOTTI GIUSEPPE & FIGLI SRL
v. Alla Polveriera - 23037 Tirano (SO) / tel: 0342 701 319 fax: 0342 701 319
3. MERIGO IMBALLAGGI di MERIGO ANDREA & RICCARDO snc
V. Arrotini 1/3 - 25016 - Ghedi (Bs) / Tel: 030 901039 | Fax: 030 9057772
4. GIUPPONI SEVERINO SRL
24, p. Europa - 24019 Zogno (BG) / tel: 0345 91028 - fax: 0345 50901
5. GUERRA IMERIO srl
6, loc. Vrange - 25070 Barghe (BS)/ tel: 0365 84171 - fax: 0365 894926
6. SEGHERIA COLOSSI snc
151, v. Manzoni - 25040 Esine (BS) / tel: 0364 46012 - fax: 0364 46012

7. SEGHERIA LEGNAMI MARCHESI SRL
61/63, v. Montale - 25018 Montichiari (BS) / tel: 030 9658951 - fax: 030 9652201
8. IMBERTI LEGNAMI SRL
2, v. Roma - 24020 Fiorano Al Serio (BG) / tel: 035 711067
9. SEGHERIA TOGNELLA ALESSANDRO
8, v. Macchi - 21010 Arsago Seprio (VA) / tel: 0331 768273 - fax: 0331 290197
10. FRANCHINI LEGNAMI SRL
137, v. Alzaia Sin. Naviglio - 27100 Pavia (PV) / tel: 0382 467941
11. SEGHERIA ANGELO SARTORIO di P. & G. SARTORIO & C. snc
706, v. Vallerini - 21020 Cadrezzate (VA) / tel: 0331 953246 - fax: 0331 953292
12. IMBAL LEGNO di SCALFI & C. snc
67, v. Gardesana - 25080 Prevalle (BS) / tel: 030 603301 - fax: 030 6801185
13. MONTAGNOLI EVIO SRL
20, v. Garzonio - 21010 Arsago Seprio (VA) / tel: 0331 768081 - fax: 0331 767110

Laser Cutting (Translation into Italian: Taglio Laser) Italian companies , Lombardy
1. GIUSTINA & MONFERRINI SR
Via S. Eufemia, 24/A / Novara - Http://Www.Giustina-Lavorazione-Lamiere.It/Taglio-Laser/Contatti.Html
2. BOTTEON SRL
http://www.botteon-lavorazione-lamiere.com/index-.php#sidebar
3. MECOM s.n.c
Via Dell'industria, 8/10, 35012 Camposampiero, Padova – Italy / Telefono: 049 5793615
4. INCISIONI MILANO S.R.L.
Sede Operativa: Via Martiri Triestini, 5 20148 Milano Tel. 02/36514991 - Fax: 02/36514992
5. METALTECNICA snc
V. Adda 7 - 20032 - Cormano (Mi) / Tel: 02 6152738 | Fax: 02 6152205
6. EUROMEC S.A.S
Via Carducci, 221 . 20099 Sesto S. Giovanni (Mi) / Tel. 02. 2404243 – Fax 02.24414007
7. LASERWELD
http://www.tagliolaseritalia.it/taglio-laser-lamiere/milano.asp / Numero verde 800 960 411
8. MERKUR S.R.L.
Via Voghera, 52 - Retorbido (Pv) - Italy / Tel. (+39) 0383.74021 - Fax (+39) 0383.74369
9. SALVINI GIOVANNI SRL.
Salvini Giovanni Srl via Avris 7 21032 Caravate (VA) / Tel. 0332 602342 -Fax 0332 617000

Stereolithography (Translation into Italian: Stereolitografia) Italian companies , Lombardy
1. SINTHESI ENGINEERING
Via San Giorgio, Parabiago (Milano) / Tel: 0331 556 557 - Fax: 0331 495 010
2. RIGAMONTI
23846 Garbagnate Monastero Lecco/Italia via Provinciale, 57 / tel. +39 031 853439 - fax +39 031 853509

3. ARRK LCO Protomoule
Milano Tel : 0039 023 65 52 774 Cell : 0039 347 132 64 47
Email : lco@lco-protomoule.com
4. ONEOFF
Via Luigi Nono, 7 / 20154 Milano / tel: +39 02 36517890- fax +39 02 342290
5. MAURO IPPOLITO
Via E. Gola n° 27 20143 Milano / Tel: 335.8363492 - Fax: 02.91971559 E-mail: info@mauroippolito.it
6. SKORPION PROTOTYPING
Via dello Sport, 5 20068 Peschiera Borromeo Loc. San Felice (MI). Italy
7. INGEO Snc
Via Stazione 80 28040 Varallo Pombia (NO) / Ing. Luigi Paracchini numero di telefono 0321.921654

Laminated Object Manufacturing (LOM) ***Italian companies , Lombardy***
1. HEIDENHAIN ITALIANA S.R.L.
Via Asiago, 14 - 20128 Milan (Mi) - Lombardytel: 02 27075210, 02 270751
2. PARTEC
Via campignano 9 . 24020 PARRE (Bg)/ tel: +039 035 705820 – Fax: +039 035 705 820
3.18 srl
Italy, Bergamo, 24126, Bergamo, Via Stezzano 87

Three-Dimensional Printing ***(Translation into Italian :Stampante 3D) Italian companies , Lombardy***
1. PROTOREAL
http://www.protoreal.it/contatti.htm
2.ABCS RICERCHE Srl
Via Rubens, 28 - 20148, Milano - Telefono : 02.36.52.29.62 - Fax : 02.36.52.29.68
3. SPRING S.r.l.
Sede Legale E Operativa: Via Del Carpino Nero, 14 - 36050 Monteviale (Vi) - Italy Tel. +39 0444 557570

5. IN SEARCH OF A SUSTAINABLE PRODUCTION SYSTEM

The object made with scrap and the approaches to sustainable product

5. SCRAP NETWORK FOR A SUSTAINABILITY FUTURE

The object made with scrap and the approaches to sustainable product

Manufacturing firms in nowadays have various challenges and are under many pressures, both financially and competitive, economical models and new polices push them to improve their manufacturing processes to adapt themselves into the new world order, moreover companies have raised new challenges such as sustainable production and consumption which has made not only an important change in the way in which an object is manufactured and produced but also in the way an object is consumed. But to meet these challenges it is necessary a change in the way of thinking both producers and consumers, redirecting their gazes to sustainable products to provide on both sides environmental and social benefits.

A new order is growing up and many manufacturing companies have realized that develop sustainable products generate a competitive advantage as well as offering economic profits, however, to achieve these aims, manufacturing sector needs to do more in terms of sustainable manufacturing to overcome the potholes inside the system and also to close the life cycles, making it necessary to focus the product creation within a Holistic view of the whole process (Life Cycle) rather than focus the product creation just by the hands of manufacturers who are restricted in scope to the creation of the product, Disregarding the user stages and end stage as shown on the right Side (21).

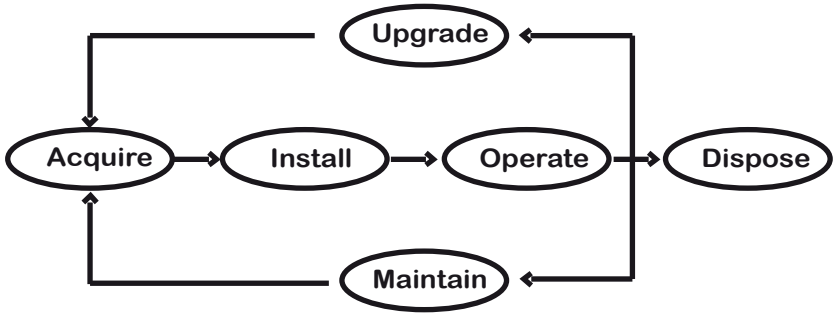


Chart 5.1: LIFE CYCLE STAGES

The current mode of operation is that product usage by users consists of purchasing an item and then using it until such a point where it typically is replaced (22), In this current mode there is an open cycle where lifetime of products end after these are used, which create a postconsumer problem because material goods become to be useless and therefore waste, that is to say an unsolved problem to manufacturing industries and above all to the environment, Thereby becomes urgent develop sustainable Strategies, not solely to extend the life of products but also to improving their environmental performance but to get this goal manufacturing firms must comprise firstly, product provision and secondly manufactur-

21. Figure 1: Life Cycle stages; Coster Rebecca De,Rchard Bateman and Alexander Plant " Sustainable Development Strategies for Product Provision and Manufacturing Approaches" School of Engineering and Design, Brunel University, accesed July 19, 2013.

22. Coster Rebecca De,Richard Bateman and Alexander Plant " Sustainable Development Strategies for Product Provision and Manufacturing Approaches" School of Engineering and Design, Brunel University, accesed July 19, 2013, page 2.

ing process configuration as shown in the next chart (23)

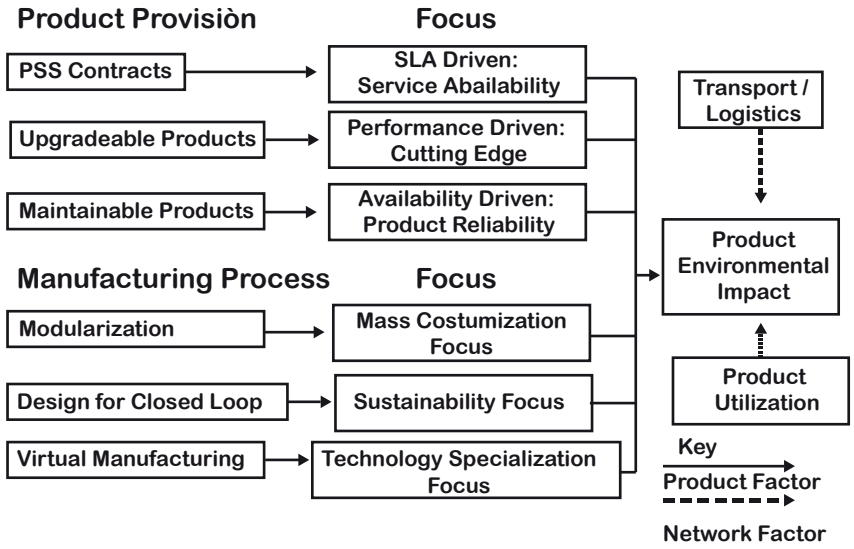


Chart 5.2. Sustainable Development strategies

This method recognizes that different sustainable development strategies are required for different types of products . The first strategy for product provision is where equipment is leased rather than purchased; The second one is focused on high performance products and this is achieved by providing products which are upgradeable. In contrast the third and last strategy for product provision is focused on products where their availability is so important and accordingly product

23. Figure 2: Sustainable Development strategies Coster Rebecca De,Rchard Bateman and Alexander Plant " Sustainable Development Strategies for Product Provision and Manufacturing Approaches" School of Engineering and Design, Brunel University, accessed July 19, 2013, page 7.

reliability is the major concern to the user and this is achieved by providing products which are maintainable. However to Convince manufacturing firms to consider for adoption thesesustainable product development strategies will require an examination of the implications to the business case particularly the cost aspect, there is necessary analyze the benefits and disadvantages of implementing these strategies.

5.1 Closing life cycle loops

In the ongoing to find a way to close the life cycle loop, a number of concepts and ideas for sustainability have been developed like green design for manufacturing, design for the environment (DFE), Design for Recycling (DFR) or environmentally conscious design and manufacturing, which consider all environmental aspects of the materials, products operations and processes with the intention to penetrate the very earliest stages of design and manufacture. The Design for Recycling Model(DFR) for example is a huge idea for sustainability, given that the method uses processes from the natural world to conceptualize recycling activities. For instance, the (DFR) take as model the biological cycle and transform the basic principle in a model applied to Industry where materials in the product are recycled and reused continuously. Other important idea for sustainability which helps to close the life cycle loop and that in addition has been having a positive impact to environmental performance is the "Sustainable product development" given that has a wider scope than reducing materials and other resources in the product design, furthermore its large impact is due to recent interest to including ecological aspects into product development

highlighting a number of tools such as an “Eco-Roadmap” which is comparable to the roadmaps but with a focus on sustainability, Environmental life cycle assessment (LCA) as a method to enable environmental product informational needs, allowing quantification of product specifications in terms of the ecological impact by characterizing product attributes and key elements. (24) The model proposed that utilizes life cycle assessment has a number of key “decision points” for product planning as shown bellow. The three “circles” described into the figure use LCA to assess the potential environmental impact at different levels of detail to support product planning decisions (25)

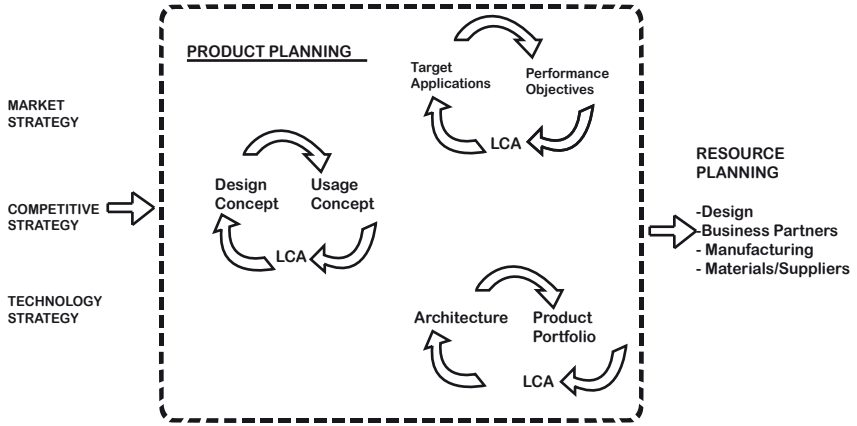


CHART 5.3: SUSTAINABLE PRODUCT DEVELOPMENT PROCESS

24. Coster Rebecca De,Rchard Bateman and Alexander Plant “ Sustainable Development Strategies for Product Provision and Manufacturing Approaches” School of Engineering and Design, Brunel University, accessed July 19, 2013, page 16.
25. Figure 3: Sustainable Development strategies Coster Rebecca De,Rchard

The model perform life cycle assessment has three key decision points during the product planning phase which provide opportunities for environmental improvements. The use of life cycle assessment will provide a structured way to enhancing the decision. As shown above, The first LCA assesses the attributes of a product, here the alternatives are identified, This is a less detailed life cycle assessment which use categories making a “relative” assessment rather than an “absolute” (quantitatively based) assessment, however, although it may seem a simple assessment system has the advantage of provide a wider scope into the early design stage. The second LCA, instead takes the proposed product and makes a more detailed assessment of the environmental impact from production ahead which may comprise first the production of the product, then the user phase and finally the end of life environmental costs.

The third and last, addresses the strategic aspects relating to technology management related with architecture decisions and product portfolio planning. Architecture decisions provide a competitive advantage to firms whilst product portfolio decisions should support a firm’s market plans. These decisions can either support or restrict a firm’s position to carry out sustainable initiatives. Clearly defined modules or components and their interfaces support equipment upgrades embodied by the computing sector and the design of personal computers which anticipated the need to upgrade disk drives and other key components.

5.2. *Sustainable product design, Overall standards, product oriented standards and sustainable product policies*

Sustainable product Design

Conventionally, environmental management systems have always addressed the impacts of products on local surroundings. ISO 14001 for example (ISO 14001:3) provides a formalized framework for managing significant environmental aspects and improving environmental performance through a "Plan, Do, Check, Review" continual improvement cycle (26). During the phase of product planning, consumer demands and market opportunities are evaluated during this time a product description and execution plans for a successful program launch are developed and product requirements are defined. During the phase of product development, specific design specifications are finalized, models are built, and designs are reviewed and released for manufacture planning. Once manufacturing begins, the product is commercially launched for general availability and volume deployed to the marketplace. Once a prototype is available, LCA (Life cycle assessment) is used as a fundamental standard to identify significant social and environmental aspects and quantify environmental impact. Once the product is launched into market and becomes commercialized, it enters the maturity phase, which means that the sales and the profits both reach the peak.

26. Coster Rebecca De,Rchard Bateman and Alexander Plant " Sustainable Development Strategies for Product Provision and Manufacturing Approaches" School of Engineering and Design, Brunel University, accessed July 19, 2013, page 54.

The maturity phase contains two stages: during the first stage of maturity, the customer is utilizing the product (Modifications may still be made to the product to enhance or change it), then the product enters the second stage of maturity when it approaches near to the decline phase, where applicable, end-of-life products are taken back and subsequently reused or recycled efficiently. The take back of end-of-life products offers the chance to review the final life cycle stage of a product through direct contact with recyclers. This knowledge can then be applied to future designs and product improvement.

Overall standards

Nordic Swan Ecolabel

The standard of Nordic Swan Ecolabel (27) is Managed in Norway, Sweden, Denmark, Finland and Iceland), is aimed to mainly products which have a positive effect on the environment. Products such as household chemicals, paper products, office machinery and building materials have been issued with this label. The criteria represent environmental factors through the product's life cycle, starting from raw material extraction, production and distribution, use and refuse. Therefore the most important parameters are emissions into air, consumption of natural resources and energy, generation of waste , water and soil and noise.

Global Reporting Initiative (GRI)

GRI enacts and disseminates global sustainability reporting

27. "The official Ecolabel in the Nordic countries", Nordic Ecolabeling, accessed August 22, 2013, http://www.nordic-ecolabel.org/

guidelines for voluntary use by organizations reporting on the economic, the social and environmental dimensions of their products services and activities(28). The Guidelines developed by GRI reporters take into consideration stakeholders interests and use the social indicators and others that more accurately depict the social and ecological performance of the organization.

Life Cycle Assessment (LCA)

LCA evaluates and expose the environmental benefits of products over their full life cycle, from raw materials extraction to final disposition (as mentioned previously). Since 1997 the LCA process has been standardized by the International Organization for Standardization (ISO) (29).

Product-oriented standards

Organic Food Labeling

Basically the Organic food are produced using methods involving no agricultural synthetic inputs, such as, synthetic pesticides, chemical fertilizers, irradiation, industrial solvents, chemical food additives and genetically modified organism, among others (30). Currently, the European union, the United States, Japan, Canada and many other industrialized countries require food producers to acquire special criteria or certification to market their products as "organic". Apparently, organic food producers emphasize sustainable conservation of the social-ecological attributes such as soil, water and the whole ecosystem. (In the US, a voluntary green-and-white seal on foods packaging denotes that a product is at least 95% organic) (31).

MSC Labeling

The Marine Stewardship Council (MSC) is an independent non-profit organization which was established in 1997 in order to cope with the overfishing problem. Fisheries that are assessed and meet the standard can use the MSC blue Ecolabel. The mission is to 'reward sustainable fishing practices'. As of the end of 2010, more than 1,300 fisheries and companies had achieved a Marine Stewardship Council certification.(32)

Figure 5.1 National Organic Program (seal of approval)
Source:http://www.-maine.gov/agriculture/pi/images/nationalorganicseal.jpg

Figure 5.2 Marine Stewardship Council (MSC Ecolabel)
Source: http://www.msc.org/get-certified/use-the-msc-ecolabel

28. "GRI. Reporting" Global reporting initiative, accessed August 22, 2013, https://www.globalreporting.org/Pages/default.aspx
29."Life Cycle Assesment" International Organization for standardization, Accessed August 22, 2013, http://www.iso.org/iso/home.html
30. Allen, Gary J. & Albala, Ken, business of food: Encyclopedia of the food and drink industrie (Westport: Published by. Greenwood press,2009), 288.
31."National organic program", United States Department of agriculture, accessed August 22, 2013, http://www.ams.usda.gov/AMSv1.0/nop
32. "Certified products and companies at ekobai.com",Ekobai.com, accessed August 22, 2013, http://www.ekobai.com/

FSC Labeling

The Forest Stewardship Council (FSC) is an international non-profit organization established in 1993, which promotes, forest management that is environmentally appropriate, socially beneficial and economically viable. Its main responsibilities for achieving the goal are standard framing, independent certification issuing and labeling. The FSC enable business and consumers to make informed choices about the forest products they buy, and create positive change by engaging power of market dynamics besides this non – profit organization define best practices for forestry that addresses social and environmental issues.(33) .

Fair Trade Labeling

Fair trade is an alternative approach to conventional trade based on a partnership between producers and traders, businesses and consumers, offering to producers a better deal and improved terms of trade, Besides Fair Trade Labeling contribute to sustainable development by offering better trading conditions to, and securing the rights of, marginalized producers and workers (34).

Figure 5.3 FSC labeling
Source:http://oecotextiles.files.wordpress.com/2010/01/fsc-logo3.jpg

Figure 5.4 Fair Trade Labeling
Source: http://www.-fairtrade.net/-standards.html

33. "Association and certification; make small forests profitable" Forest stewardship council, accessed August 22, 2013 https://ic.fsc.org/
34. "About Fairtrade", Fairtrade International, accessed August 24, 2013, http://www.fairtrade.net/about-us.html

U. S. Green Building Council LEED Rating System

The LEED Green Building Rating System assesses environmental performance of all buildings over their life, providing the definitive standard for what constitutes a "green" building, persuading the consumer and building industry to develop products that are more environmentally and economically viable. (35)

EKOenergy label

EKOenergy is a network of European environmental NGOs that promotes the use of sustainable electricity. Besides this label is also an Ecolabel for electricity which is managed by the EKOenergy network. The purpose of the organization is to assist consumers in navigating the complex European electricity market.(36)

Figure 5.5. U.S. Green Building Council
Source: http://www.usgbc.org/initiatives

Figure 5.6. EKOenergy Label
Source: http://www.aib-net.org/portal/pls/portal/docs/1/26541192.JPG

Sustainable Product Policies

International

Since 1998, The United Nations Environment Programme (UNEP) has begun several national programs on sustainable

35. "Association and certification; make small forests profitable" Forest stewardship council, accessed August 22, 2013 https://ic.fsc.org/
36. "About Fairtrade", Fairtrade International, accessed August 24, 2013, http://www.fairtrade.net/about-us.html

consumption and production, moreover, the program, provide leadership and encourage partnership in caring for the environment by informing, inspiring and enabling nations and peoples to improve their quality of life without compromising that of future generations(37). Further the United Nations is responsible for administrating the Marrakech Process and developing the ten-year Sustainable Consumption and Production Framework through Regional Marrakech Process Consultations, whose goal is to accelerate the shift towards sustainable consumption and production (SCP). Besides these international
Organizations, there is also other organization which has also done comprehensive work on the environmental impacts of sustainable consumption and production, this organization is best known as the Organization for Economic Cooperation and Development (OECD) which currently is reviewing measures for sustainable manufacturing production.(38)

Regions and Countries

European Union: The European union presented on July 16, 2008, the Sustainable Industrial Policy (SCP/SIP). Such action Plan included a series of proposals on sustainable consumption and production to target EU goals for environmental sustainability, economic growth and public welfare. (39)

United States: Currently in U.S.A , The government does not have a standardized national policy or strategy for sustainable consumption and production. nonetheless, the U.S. Environmental Protection Agency (EPA) develops extensive sustainability programs on water, energy, agriculture and ecosystem. At the same time, the U.S. Department of State's Sustainable Development Partnerships web page provides considerable information about the U.S. government's sustainable development initiatives to help other countries set up and implement their own development strategies in social and ecological terms.(40)

Figure 5.7. United States-Environmental Protection Agency
Source: http://www2.epa.gov/laws-regulations/policy-guidance

United Kingdom: In United Kingdom, The actual government considers Sustainable Consumption and Production like one

37. "About UNEP: The organization", United Nations Environment Programme, accessed August 24, 2013, http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=43
38. "The Organization for Economic Co-operation and Development (OECD)" OECD Better Policies for Better Lives, accessed August 24, 2013, http://www.oecd.org/redirect/document/58/0,2340,en_2649_34331_2397498_1_1_1_1,00.html
39. " Sustainable Development" European Commission, accessed August 25, 2013, http://ec.europa.eu/environment/eussd/escp_en.htm
40. "Sustainable Materials Management: Sustainable Consumption and Production: European Union Policy" Environmental Protection Agency, accessed August 25, 2013, http://www.epa.gov/oswer/international/factsheets/200810-sustainable-consumption-and-production.htm#UNEP

of the four priority sectors identified. On the other hand the UK government is carrying out a series of actions to achieve goals of sustainable consumption and production in public and private areas respectively.(41)

Norway : The Norwegian Ministry of the Environment founded Norway's Green in Practice (GRIP), which is a public-private foundation established in 1996 to promote sustainable consumption and production. At the same time, Norway's Ministry of Finance has primary responsibility to fund the strategy of sustainable development.(42)

Australia: As regards sustainable policies, the Australian government has demanded, that certain electrical products for sale should contain mandatory energy-efficiency labeling to provide consumers with information that helps reduce energy use and green house gas emissions.(43)

Figure 5.8. Energy Rating Australia - Equipment energy efficiency
Source: http://www.energyrating.gov.au/

41. "Encouraging businesses to manage their impact on the environment" GOV.UK, accessed August 25, 2013, https://www.gov.uk/government/policies/encouraging-businesses-to-manage-their-impact-on-the-environment
42. "Green public procurement in practice — The case of Norway" IDEAS, accessed August 25, 2013, http://ideas.repec.org/a/aka/soceco/v33y2011i1p183-198.html
43. "The E3 Program – Improving Our Energy Efficiency", E3 Equipment Energy Efficiency , accessed August 25, 2013, http://www.energyrating.gov.au/

5.3. An approach to sustainable product

Through History, human economy activity has been characterized by an open and linear system of materials flows where materials are taken in, transformed, used, and thrown out. Worn – out goods and materials left over from the production process has been flooding our territories, poisoning and disabling too many areas; It is also evident that spaces destined to store the waste generated by humans (landfills) are oversaturated, and discarding waste material is becoming increasingly problematic, in fact, today there are more of us and fewer new places to which to move. However over the last decades the approaches to environmental sustainability has gained relevance in many countries which has allowed the inclusion of new practices, moreover the idea of create sustainable products within industries has taken significance , opening new alternatives not only for firms but also for consumers. Regulatory pressures and shifting public opinion have spurred the industrial and engineering community to initiate efforts aimed at closing the materials loops more effectively and improving energy – use efficiencies (44) ;in fact some companies have been designing new products with reuse, remanufacture and recycling in mind, because they have realized the multiple benefits not only on the market but also in cost savings. Besides ecology perspective is beginning to influence designers of manufacturing processes to seriously **c**onsider waste streams, which has led many to develop

44. National academy of engineering. The Industrial Green game – Implications for environmental design and management. (Washington: National academy press, 2013) page 38

sustainable products, unfolding a new way for industry to be more self –sufficient and whilst improving the efficiency of material use that is to say, the whole industrial process can be thought of as a closed cycle in which the manufacturer has overall monitoring for the material used considering the entire material and energy stream, thereby improving methods and processes.

On the other hand to understand the sustainable product, there is necessary also comprehend the various phases of Life cycle (traditional phases of product system) to thereby define with precision the moment at which the method to reuse wastes could be apply. The life cycle process named above is divided in different stages; the first one, which comprises this cycle, basically summarizes comprehend the raw material obtaining which basically is achieved through the extraction of resources in nature, once obtained the material is transported in special installations where undergoes various processes of transformation physical – chemical through the use of energy in order to obtain raw materials and the semi-finished starting on which is based the subsequent design phase. Some examples of raw materials for the polymer industry are constituted by the pellets for molding processes while as regards the semi-finished products of reference, can be taken into consideration, the slabs, the panels and profiles with variable section. The three moments just described constitute the beginning of life cycle of a product (45). as can be appreciated in Figure 4.

Chart 5.4: Early stages of life cycle of a product

The raw materials provide, the starting point to begin the design stage, this is one of the most important moments of life cycle, given that it is here where are determined in industries the 80% of actual costs, therefore, always during this phase will be determined the end of life of product and consequently the environmental impacts that processes and materials would cause. The design phase (which sees as key players, the technical department and the eventual designers / external collaborators) is very Important; precisely at this stage could be improved and optimized the environmental efficiency performance and the production of material goods; In today's context where it is possible to use computer tools, the performance can be improve, facilitating the steps to achieve the principle of overall product system optimization. Today's design relies itself on sophisticated tools evolution such as CAD modelers, thus enabling the executive project definition, and consequently the beginning of the stage production, besides parametric modelers bring with them ignificant benefits in economic and environmental terms (46)

45. William B. F., Warren E. H. Ullmann's Encyclopedia of Industrial Chemistry. New Jersey: Ed. Wiley&Sons, NJ, 2011.

46. 46. Pacelli Francesco "Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali" (Master of science thesis); Politecnico di Milano University, 2013), accessed august 20, 2013.

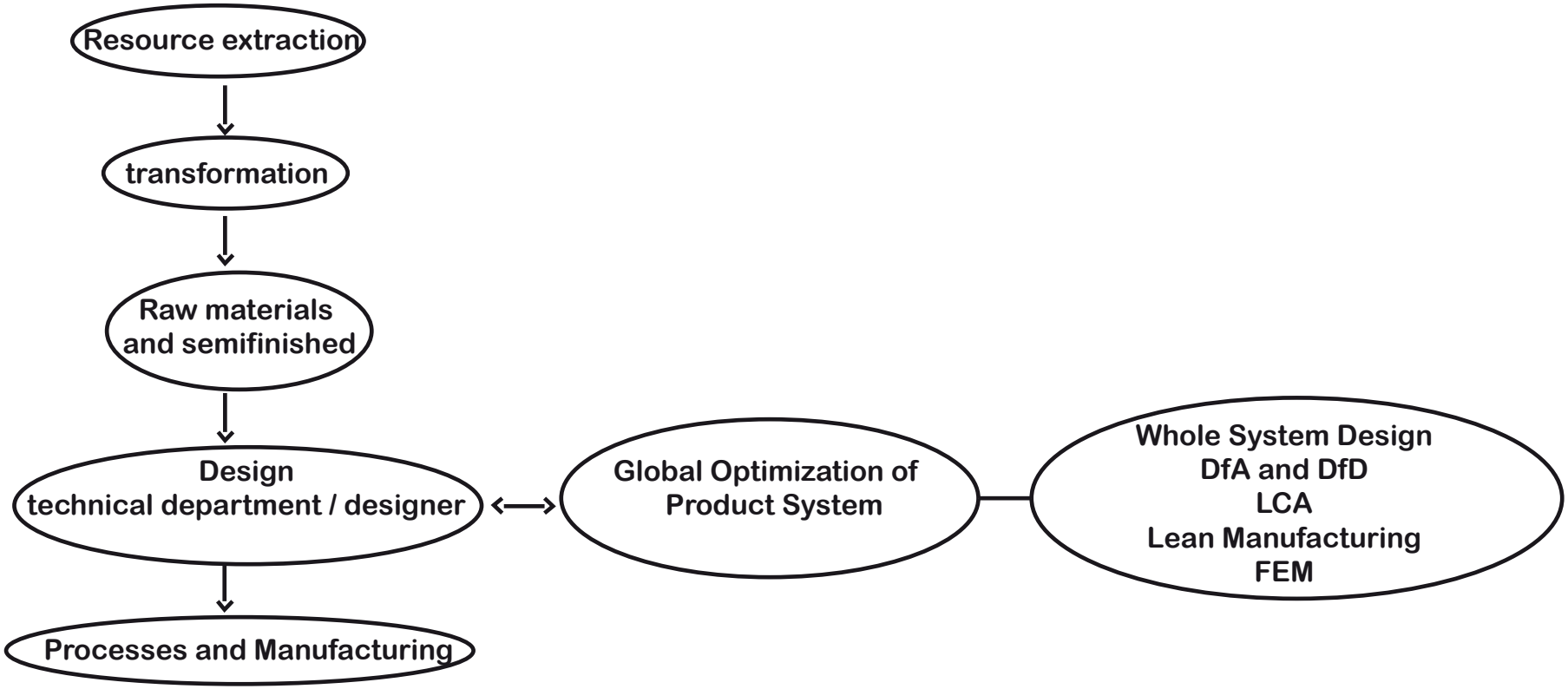


Chart 5.5: Life cycle until processes definition stage and processes involved into production phase

Afterwards next stage consist in a preliminary connection of individual components to perform the pre – production prototype thus testing safety, load strength and ergonomics in compliance with relevant regulations for marketing product. During testing and prototyping, modifications are made to product until final project approval thus determining the starting point of real production. Once production stage is reached, begins for a company the actual costs, at this point it becomes necessary the project optimization assessing at the same time the system criticalities to prevent changes in the pipeline.

The production phase is determined by three principal moments. First of all is the implementation of all the individual components that make up the product-system, secondly the firm industry proceeds to connect the different parts and pieces which compound the product, and the last one comprises the eventual finishing process, worth noting that, last two steps can change the execution order, (depending on product features) without affecting the result. Once finished the production phase, the product must be packed, this successive step is of utmost importance to prevent breakage or damage to product structure; it should be noted that packaging stage and distribution stage constitute a decisive step from the environmental sustainability perspective, because since these stages can be developed and promoted the reuse and recycling activities, not only of product components but also of packaging in order to reduce the environmental impacts once those are used. In chart 5.6(on the next sheet) is represented the life cycle flow until delivery(47).

Next stage, after delivery consists in the use of the "good" which represents in essence the reason why is activated all the whole productive mechanism. The time a product may remain at this stage depends of its features and also on the way that people use the product, the quality product depends very much of Product settings, in turn the product architecture and connections between different components (determined in design stage) provide the information to facilitate any disassembly practice for reuse and material recovery. At the time in which a product is corrupted, deteriorates, irreversibly breaks or simply does not respond to customer demands it can be said that product has reached the life's ending. This is the main moment of waste production and also the exactly moment wherein users can decide the future of their useless products, at this stage are presented to users four main options (48) , to decide what they should do with their discarded products:

1. Reconditioning for reuse: this modality is only possible through a preliminary design of product life's ending, such that through disassembly outright operations be allowed the repairing, replacement and reconditioning of damaged components in order to extend the product life cycle and bring it up in trade. Such a mechanism, set correctly can potentially

47. Pacelli Francesco "Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali" (Master of science thesis); Politecnico di Milano University, 2013), accessed august 20, 2013.
48. Gambarelli L., Froldi P. Termovalorizzazione e raccolta differenziata di RSU. Rimini: Ed. Maggioli, 2009.

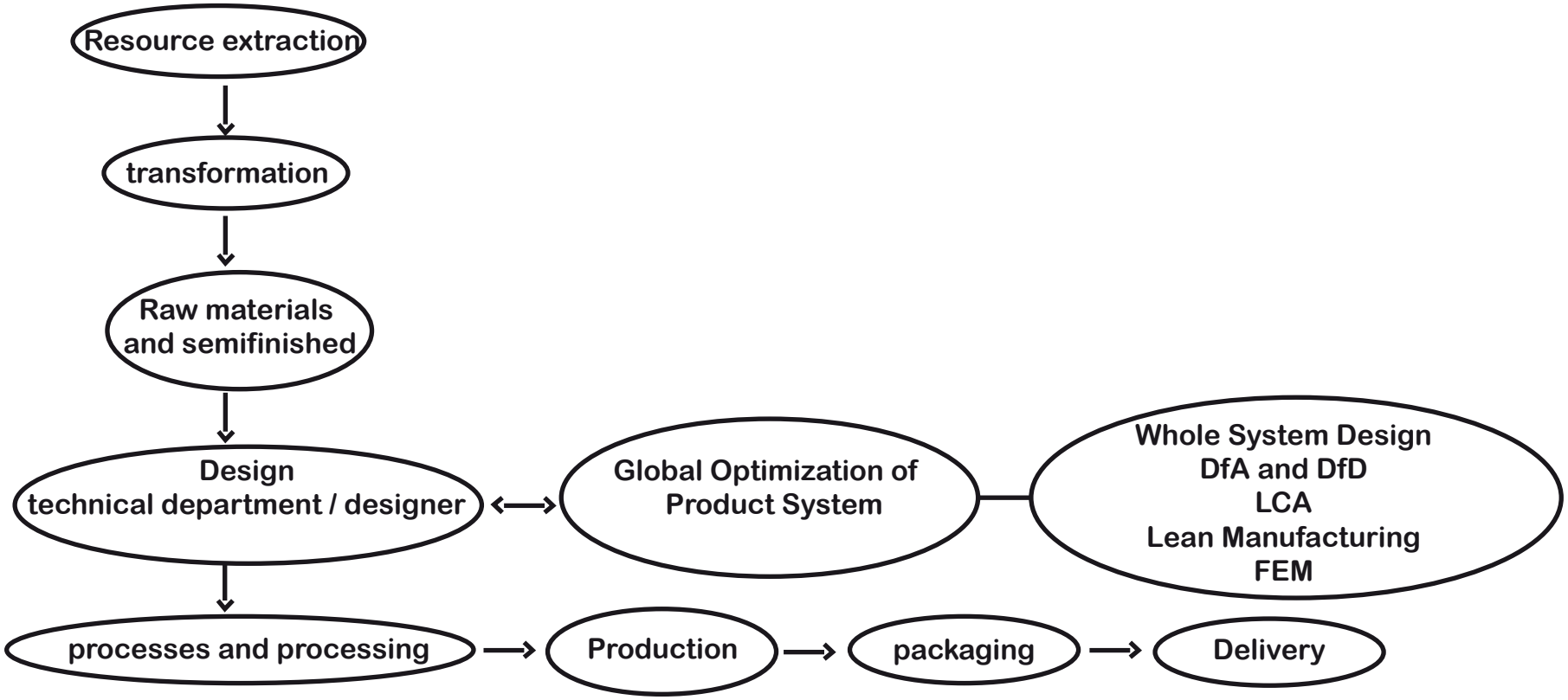


Chart 5.6: Life cycle until product delivery stage.

make reusable a product a number of times very high, obtaining significant advantages in environmental terms.

2. Material recovery: recycling is today's practice which is spreading with greater strength in the industry, properly used may be an advantage not only from the standpoint of environmental but also from the economic point of view given that are reduced the raw material costs. On the other hand from the environmental point of view, recycling is advantageous compared to not implement it, but only applies this premise , just if the amount of recovered materials fraction is equivalent to ninety percent of the total. Besides the recycling qualities mentioned above , it is also possible to obtain new raw materials from recycled materials, creating for industries a competitive advantage, not only by the fact of using a new material but also for using renewable material resources.

3. Energy recovery: Is a procedure in which it is possible to transform waste into thermal or electrical energy through appropriate structures of WTE (waste to energy), however is a mode only applicable to a
certain type of waste, that is to say fuels from waste (or CDR), which require special chemical and physical
pretreatment in order to make suitable the material for energy recovery.

4. Waste disposal: Is the disposal mode which now is more discouraged at legislative level as it provides the deposit of products and materials on the territory which are no longer usable, remains, however, a solution still very adopted because there are many product configurations and materials which don't allow other type of management if not that of landfill.

The product life cycle just described at a general level, is completely shown (schematically) on the next page, in figure seven , and serves as the basis for classification and placement of waste reusing method.

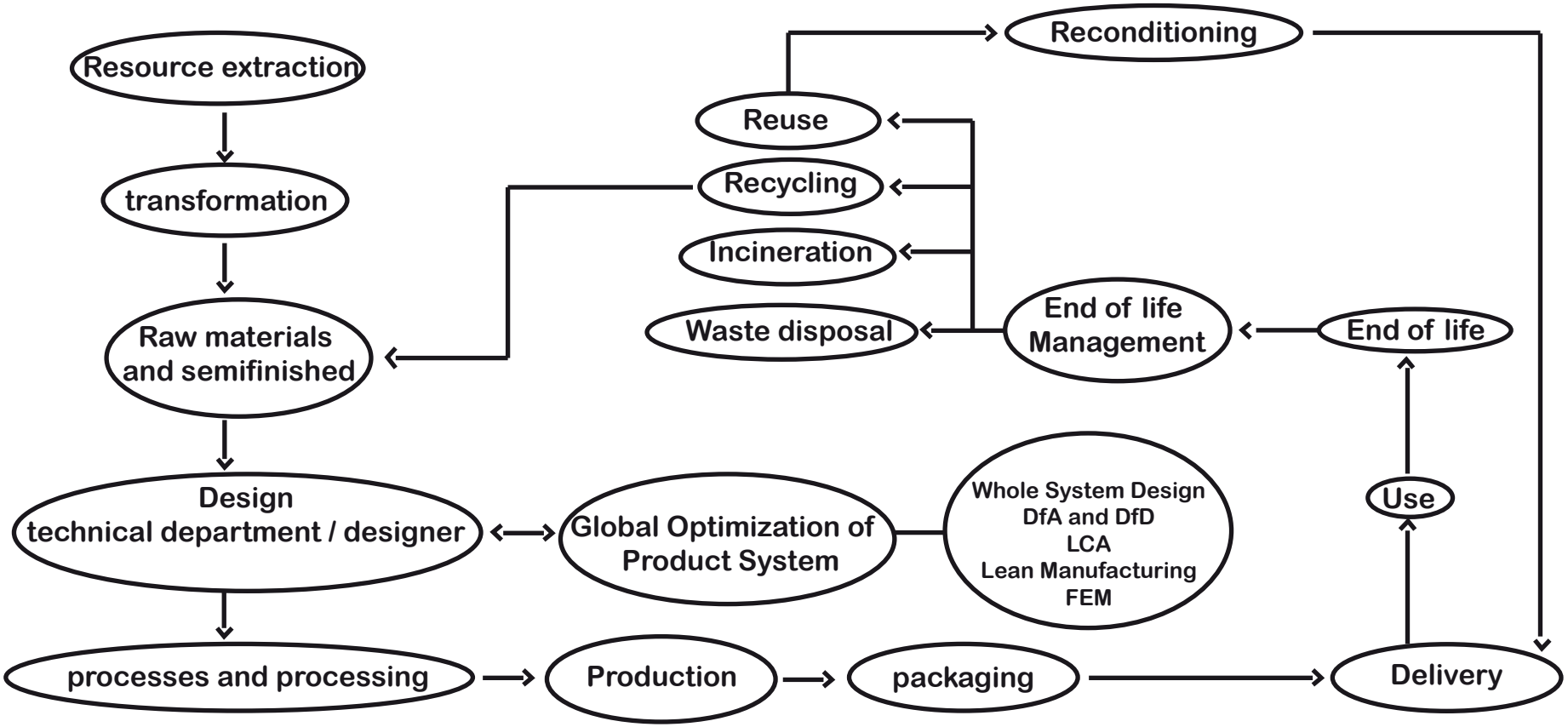


Chart 5.7: Full product life cycle

5.4. The object made with scrap as a vision of sustainable product

Wastes are a serious problem that should lie to everybody not only to governments and ecological societies but also to firms and people in general . For instance, in industrial scale can be demonstrated that different manufacturing companies and firms related with product development generate a huge amount of wastes, which so many times end up in landfills or in worst cases end up getting thrown in unknown places. However in recently years have been treated and divided according with legislative standards and Industrial policies, for example wastes from industrial processes belong to a special waste category and are identifiable by a strict reference code of CER, useful to their tracking and also to determine the correct mode to handling them. Also into Industrial waste categories , it is possible to find other two kinds of, called scrap and discard which are very different from each other making it necessary to create a distinction between them (as described in chapter 3).

The scrap is a kind of waste which can be predictable from design stage (49) can be originated as a result of a semi-finished processing (e.g. further to sheet punching) or more in general of a component machining
derived from a particular production process (e.g. the residue generated after milling a component obtained by rotational molding). In both cases occurs a serial process and besides presents after each machining, always the same formal and qualitative characteristics in a concordant way and directly proportional with production quantities. In terms of "good design" the correct design of a component can greatly reduce the scrap amount, however, although scrap generation is optimized in design phase, it is not practically possible to eliminate it.

Discard instead is a product which does not comply with design specifications and Its production cannot be quantified exactly during design stage. In contrast with scrap, discard's formal connotation is not serial, due to its high variability, in fact a piece can be discarded because it does not meet the requirements in terms of size (as regards to geometric tolerances) or for a formal defect caused by an incorrect machine setting. Therefore discards are products which do not meet the parameters of acceptability established by designer.
.
In chart 5.8 (50) are summarized the main industrial chain passages in which the scraps are produced, as can be appreciated, the starting point (as previously defined) is the extraction of resources and raw materials, after that, on the basis of physico-chemical properties linked to the different materials, can be exploited the forming processes which exist in the industrial field, making possible to obtain a first useful part and scrap and discard material. The useful parts derived from the forming processes may constitute, on one hand a finished

49. Ashby M., Shercliff H., Cebon D. Materials: Engineering, science, processing and design.Oxford: Ed Elsevier, 2009.

50. Pacelli Francesco "Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali" (Master of science thesis); Politecnico di Milano University, 2013), accessed august 21, 2013.

component ready to be launched on the market, or , on the other hand can be obtained intermediate components where it is necessary further processing in order to obtain the final component.

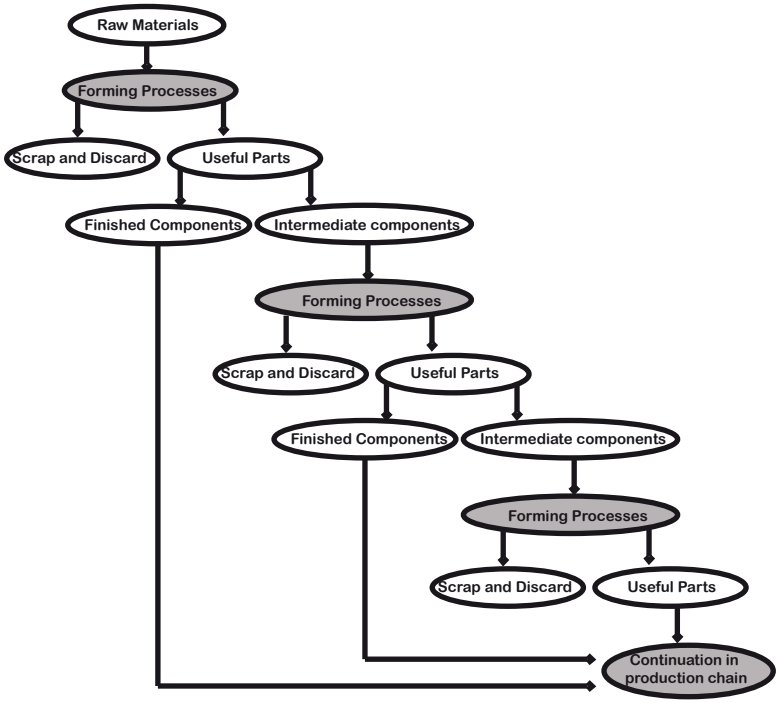


Chart 5.8: Consequential processes of scrap generation in succession to forming processes

When is obtained the finished component, the scrap production can be defined as complete, whereas in the case of intermediate components, the process goes on, performing subsequent forming processes up to the time, product reach the finished component stage

Within the sustainable product vision which is the most important issue into this chapter, it is possible to find four methods to scrap management (51), thus offering four strategies to maximize a resource which was considered useless so far. The first option to evaluate, which lies within these categories, consists in "scrap recovery through reuse" in order to bring it up in production chain, preventing its landfills disposal and opening a place to analyze and assess the possibility if waste material derived from processing can be reused for a further productive purpose, therefore taking on a precise functionality. This method is placed immediately after design stage and project definition.
In the event that this step is not possible to perform, the second practice to consider is "recycling", proceeding in the same way for energy recovery (the third method), until get to the less desirable solution, namely landfill disposal.

Therefore the idea to create a sustainable product made with scraps finds its plausibility in the subsequent phase at design stage thanks to the "scrap management strategies", at this point , if product planners start up the first of all the strategies (scrap recovery through reuse),would deal with a new dynamic in product designing based on a sustainable product philosophy. According to Belz, Frank-Martin; a sustainable product can be accomplished through six strategies (that will be seen

51. Pacelli Francesco. "Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali" (Master of science thesis); Politecnico di Milano University, 2013), accessed august 21, 2013

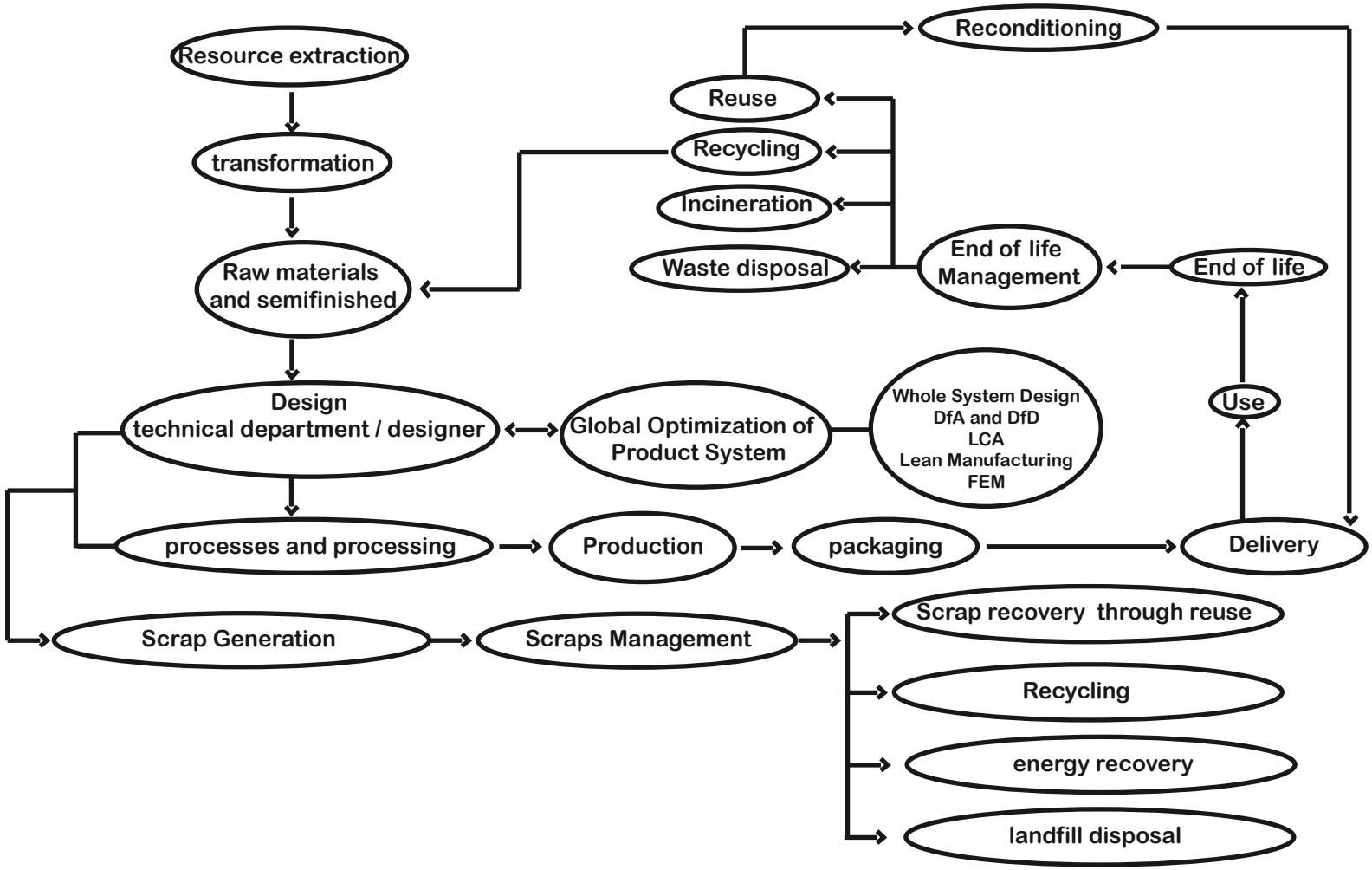


Chart 5.9: scrap management and intervention area of recovery method.

on the next page) , which open the way and the possibility to develop products with manufacturing residues (52).

1. Customer satisfaction: The products or services created that don't meet customer needs will not survive in the market in a long term.
2. Dual focus: Basically the sustainable products focus both on ecological and social significance.
3. Life-cycle orientation: sustainable product is environmental-friendly during its entire life. That is, from the moment the raw materials are extracted to the moment the final product is disposed of, there must be no permanent damage to the environment.
4. Significant improvements: sustainable products have to contribute to dealing with socio-ecological problems on a global level, or provide measurable improvements in socio-ecological product performance.
5. Continuous improvement: since the state of knowledge, technologies and societal expectation keep on developing, so sustainable products should also be continuously improved regarding social and environmental variation.
6. Competing offers: sustainable products may still lag behind competing offers, therefore, the competing offers may serve as a benchmark regarding social and ecological performance.

As can be appreciated, these categories are aimed on sustainability and competitive improvements, offering substantially a new perspective in product development, worth noting that such strategies find market endorsement when they are accompanied by overall standards, product oriented standards, sustainable product policies and sustainable product design, latter being, as highlighted above, the subject of interest in this chapter.

When speaking of products made with scrap, it should be understood that these products have their own dynamic; born from an ecological perspective and grow up in a economic sphere. On the other hand such products are fed by three different kinds of scraps, the first one belongs to the category of up- cycling, that is to say , the final product is made up of waste materials from old, obsolete and useless products for better environmental value which prevent wasting potentially useful materials by making use of existing ones. At the same time is reduced the consumption of new raw materials when creating new products, which results in energy usage, air pollution, water pollution and even greenhouse gas emissions.

Figure 5.9. Rack made with fan grilles (Colombian Design Company) Source: ://www.blaster.com.co/?portfolio=styloide-mes-de-la-tierra

Figure 5.10. Lamp made with Washing Machine Drum (Colombian Design Company) Source: http://www.energyrating.gov.au/

52. Frank-Martin B. and Peattie, K. "Sustainability Marketing: A Global Perspective". United Kingdom: ed Wiley, 2009.

In developing countries, where new raw materials are often expensive, Upcycling is commonly practiced, largely due to impoverished conditions. Besides Upcycling has seen an increase in use due to its current marketability and the lowered cost of reused materials.

The second category is called Downcycling, this kind of, involves converting materials and products into new materials of lesser quality. Most recycling involves converting or extracting useful materials from a product and creating a different product or material [53](e.g. many different types of plastics are mixed, resulting in a hybrid. This hybrid is used in the manufacturing of plastic lumber applications.)

Figure 5.11. Ecological Toothbrush (Kids Toothbrush)
Source: http://www.preserveproducts.com/products/personalcare/-jr-toothbrush-4.html

53. " Wastes - Resource Conservation, Reduce, Reuse, Recycle" , Environmental protection agency, accessed August 22, 2013, http://www.epa.gov/osw/conserve/rrr/recycle.htm

In the third and final category , can be found the secondary materials, basically are those derived materials (scraps) from forming processes which are discarded previously in the design stage , ergo, this make reference at those materials discarded from feedstock with the qualitative characteristic of being predictable and calculated , (e.g. when is sheared a sheet steel in order to obtain a piece of steel with define dimensions, left as scrap other amount of steel)

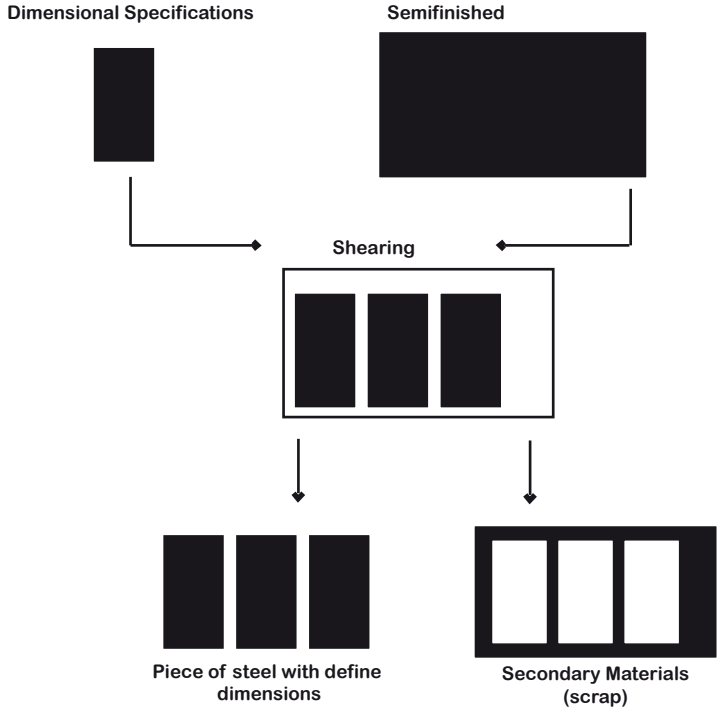


Chart 5.10: Obtainment of a piece of steel through the sharing process

5.5. Method: Design approach to validate the Scrap's Network.

Through this treatise has been covered several issues related to waste, emphasizing especially on the scrap topic. In the previous chapters was discussed how the scrap in nowadays could be a design opportunity rather than a nuisance, moreover the thesis have dealt with topics such as environmental sustainability making reference to process optimization methods such that, can be reduce the negative impacts associated with industrial processes. worth noting, that one of the stages on which the research has been mainly focused is the phase related to the end of life products management and above all in recycling, reuse practices and sustainable products, given that the method becomes achievable through these topics.

On the other hand, there is a lack of intervention and many opportunities from the viewpoint of the industrial waste materials reuse, and is here, inside this context where the method lies. Therefore, the method is presented itself as a useful tool for designers, manufacturing companies and the public at large to find, reuse and transform industrial residues in new design solutions, taking as a main resource the waste materials which by their nature are accepted as sequential and intrinsic to the productive process.

Therefore, as previously stated, the method finds its applicability in the next phase, right after the design stage, that based on the project specifications and taking into consideration the involved technologies can be guaranteed the possibility to predict the exact amount of scrap produced. According to Francesco Pacelli (M.Sc. Design and Engineering) is possible to apply a method to assess and analyze what procedures should be followed to handle the scrap amounts produced by a manufacturing company.

In the following chart (chart 5.11, on the next page), Pacelli presents in a general way the intervention area of the method and a first definition of its procedural steps (54) , furthermore, presents the optional hierarchy of the activities related to scrap management which is mainly divided into 4 types, so the first option to evaluate consist of waste recovery through reuse, in order to bring it up in the production process, avoiding the landfill disposal in accordance with national legislation and European directives , the scrap management options are in order:

1. Scrap Recovery through reuse
2.Recycling
3. Energy Recovery
4. Landfill Disposal

Therefore, The recovery method through scrap reuse as shown in the next chart (area highlighted in gray) is placed immediately after design stage and design definition, moment in which it is possible to determine with exact precision the scrap production linked to manufacturing processes,

54. Pacelli Francesco. "Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali" (Master of science thesis); Politecnico di Milano University, 2013), accessed august 21, 2013.

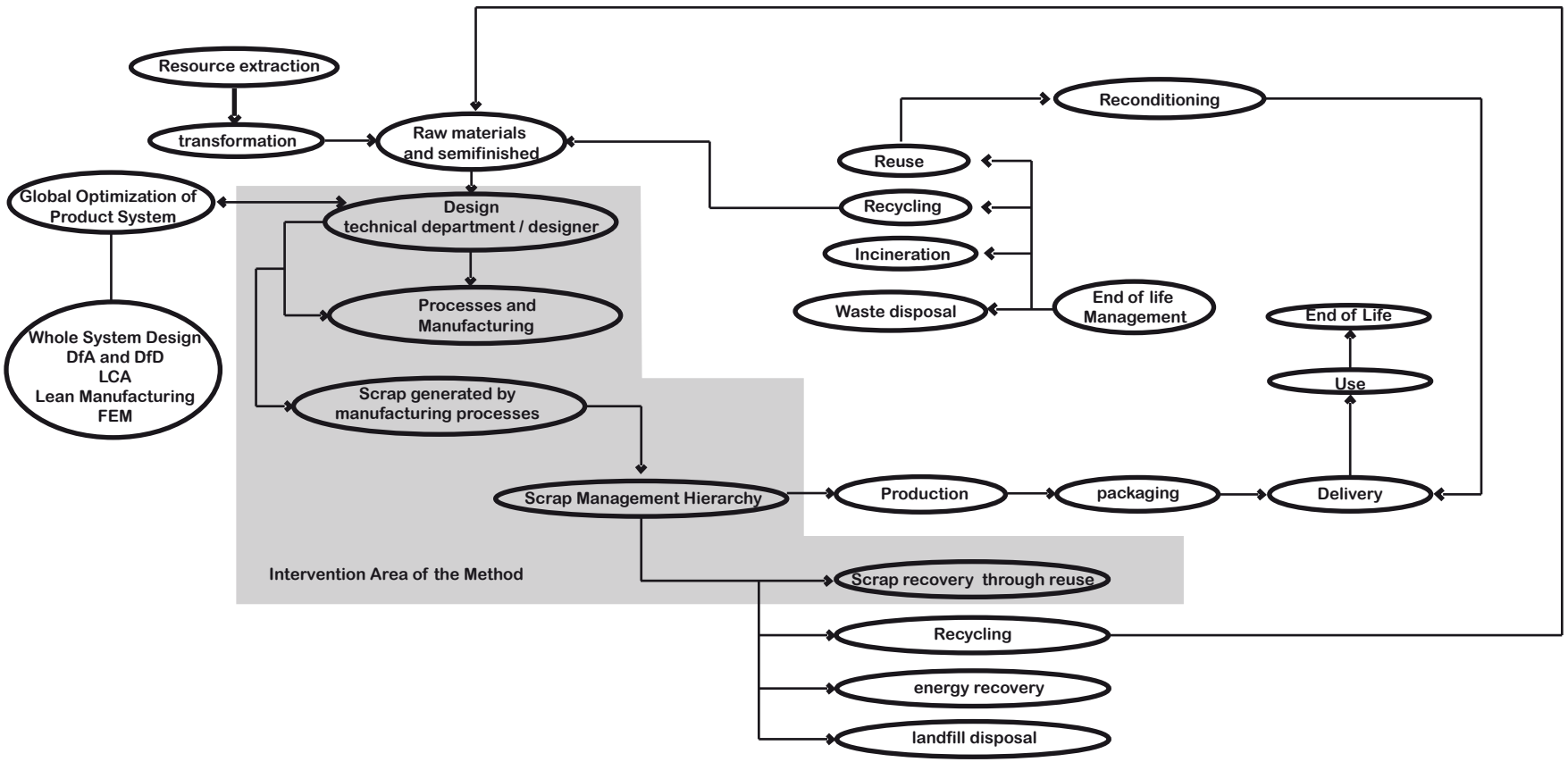


Chart 5.11: Optional Hierarchy of scrap management and intervention area of the recovery method

thereby the method corresponds to the first of the four possible management options, in order to assess if the waste material derived from the manufacturing processes can be reused for a further productive purpose, thus assuming a precise functionality. In the event that this step, can not possible to perform, the second
practice to be considered is the recycling, and so forth, until arrive at last step (considering landfill disposal as the least desirable)

As can be seen in the diagram, the objective of this method is to provide a tool for designers and companies to evaluate the possibility of getting, starting from the processing scraps, marketable products to be included in a new production and distribution chain.

5.6. Method steps

In figure number twelve (55) found on the next page, are the method steps represented, which are applicable when a component is designed. the first operation to carry out is the processes optimization (Stage 1) such that can be reduce the scrap amount material. Once the processes related to scrap have been optimized, and its quantity has been reduced in order to extent the project compatibility, is inevitably reached the scrap generation condition, therefore, next step consists of analyzing the characteristics and properties of scraps (Stage 3), useful to the subsequent phase which is based on reuse. Thereby if from the scrap analysis emerge a possible project development (Stage 3), this must be defined in the concept Stage to later validating it on the basis of economic and environmental assessments so that it can pass eventually to the approval of the subsequent production step.
The three blue squares (1. Scrap optimization, 2. scrap analysis 3. Designing with scrap) represent the three key steps of the method which now need further explanation to understand the actual applicability within the design/productive context.

55. Pacelli Francesco. “Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali” (Master of science thesis); Politecnico di Milano University, 2013), accessed august 21, 2013.

Figure 5.12. Scrap Lab, founded in 2007, is a design & research center run by academic staff and students of the Faculty of Architecture at Kasetsart University, Bangkok, Thailand. It aims to develop an innovative ecological based approach towards re-processing and re-circulating industrial solid waste, construction debris and community wastes. It was found that for 1 tonne of consumer waste more than 30 tonnes of waste are generated during the production process. Clearly, these 30 tonnes of scraps represent an abundant resource, a.k.a. raw materials, for further design and production. Scrap Lab pursues comprehensive actions: research, analysis, design, prototyping and eventually product distribution- Source: http://www.cbit.arch.ku.ac.th/home/index.php?option=com_content&view=frontpage&Itemid=1

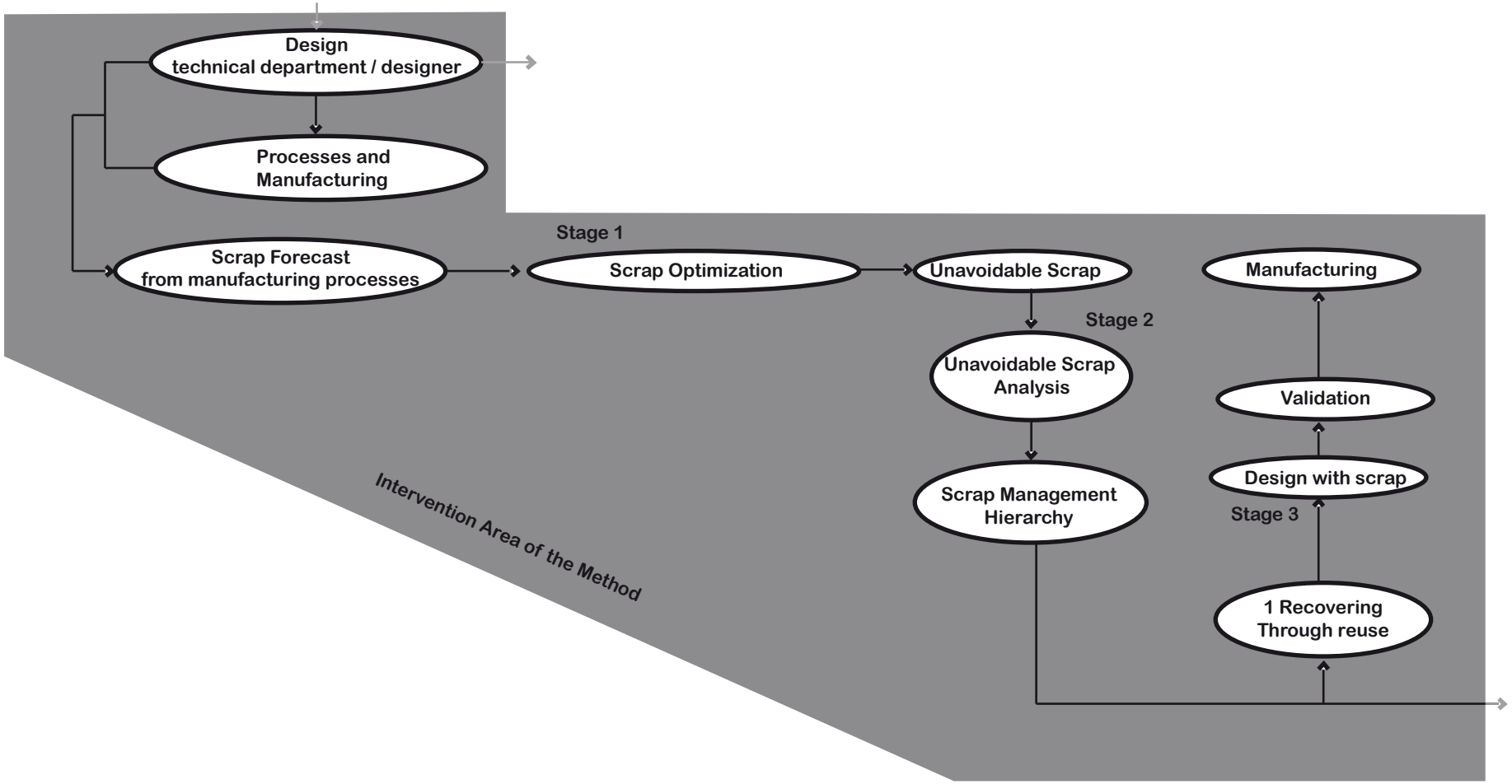


Chart 5.12: Intervention area and main steps of Method

Before proceeding with the analysis of the scrap produced by the different manufacturing processes is necessary to evaluate at the design stage the possibility of reducing the residual material quantity through optimization procedures. The Stage number 1 (figure 5. 13, on the next page) therefore, regards to the design and definition of processes, besides, it is possible to establish and provide, thanks to the seriality characteristics of scraps, the exact amount of material in excess derived from. This aspect is very important, as it means that through appropriate operational solutions is possible to improve the efficiency of processes and reduce the amount (Pacelli defines the surplus material which is produced after Phase 1 as unavoidable scrap) .Worth noting that the scrap production is intrinsically linked to the product and process engineering; according with Pacelli, the most influential parameters are of two types, geometric and formal which in view of optimizing the scrap and improving manufacturing efficiency, must be applied simultaneously from the design phase. For geometrical parameters Pacelli refers to the adaptation of the component, within the dimensions of the semifinished product (or vice versa), taking into account the design requirements and the technological feasibility. On the other hand the efficient use of semifinished, determines a reduction of the cutting waste quantity, providing potential benefits in environmental and economic terms. The geometrical parameters also include the review and refinement of volumetric geometry of the sequential scrap, or in any case the best possible use of the raw material with the purpose of obtaining a finished component, reducing its scrap as much as possible in mass and volume, without obviously worsen worsen the functionalities or make it more complex, difficult and expensive the component realization.

in the second instance, Pacelli in terms of formal parameters refers to the overall component and architecture product simplification that is to say, simplify and reduce the components which go together to define an assembly, thus simplifying at an overall level the entire system /product preserving the functionality.

The assessment and the application of these two parameters related to the product and process engineering are inherent practices in the industrial design field, and are a valuable tool to reduce the sequential scrap amount of machining processes , nonetheless these practices often do not allow for the physic and technological nature's limits the total elimination of.

Figure 5.13. nth/Works' Process Engineering
Source: http://www.nth-works.com/process_engineering.html

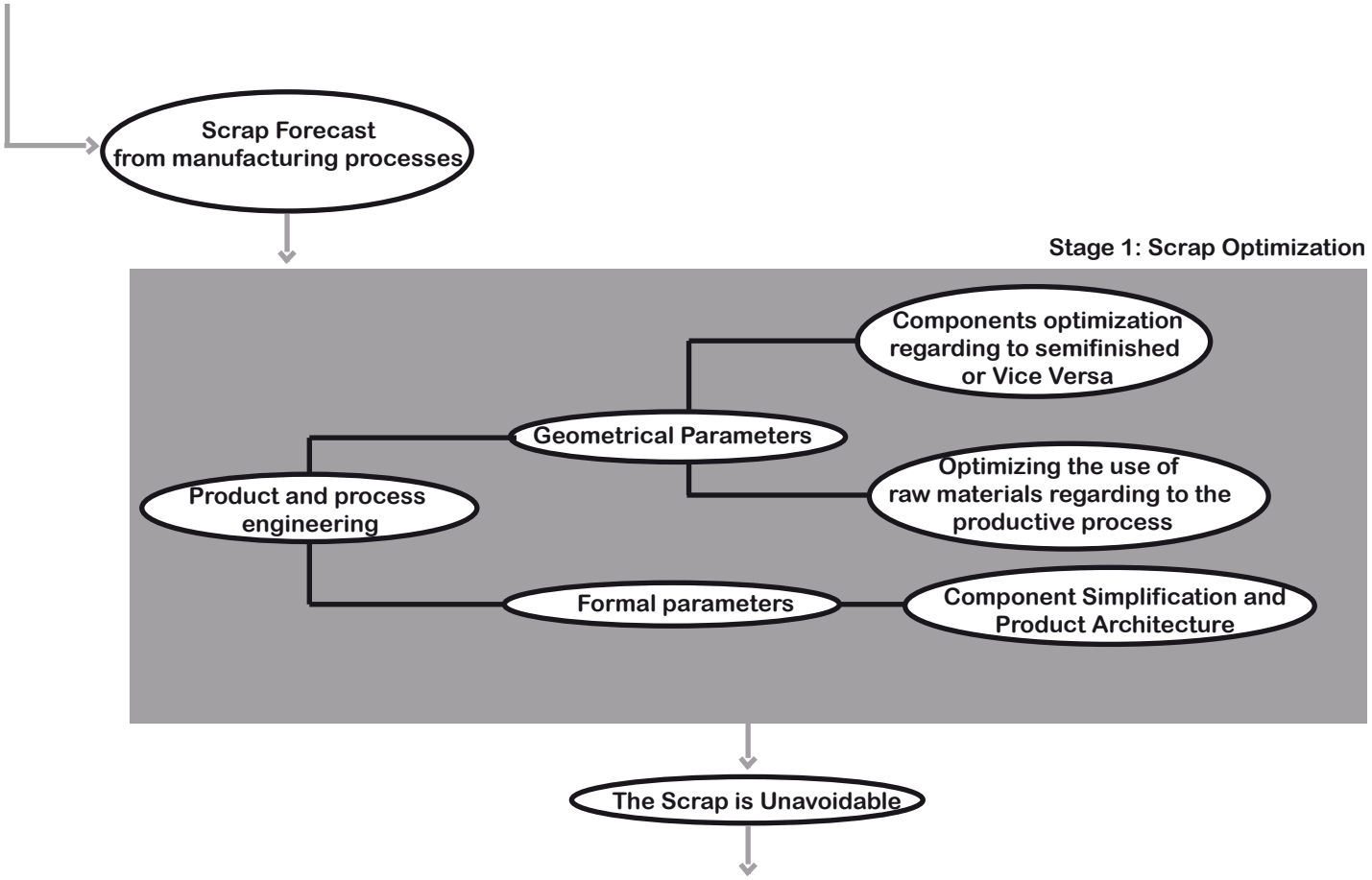


Chart 5.13. Positioning and definition of stage 1 of the method

Next step, after stage 1, is the unavoidable scrap analysis (stage 2), which is applied once the scrap has been reduced through product and process engineering and there is no more than the unavoidable scrap. During stage 2 (56) it is possible to define the potential of the unavoidable scrap, produced after stage 1, through an analysis which involves the different characteristics that describe it. The survey to be carried out on the unavoidable scrap consists of an analysis of a productive, functional, dimensional, mechanical, physical and sensory type.

The productive type analysis: Is closely related to those aspects linked to the process typology of the intermediate component, at this moment shall be identified, the typology of the material from the scrap component, the production process from which it has its origin, the quantities in terms of units produced and the masses and volumes involved in relation to a certain period of time, an eventual management mode of the scrap used by the company.

The functional Analysis: The functional analysis instead helps to define those formal attributes of qualitative character from the scrap which can provide a first stimulus of project planning to designers to devising a possible use in another application. At this time should be analyzed aspects of scrap as:
1. The general form of the single unit of scrap, or of the whole volumetric in the case the scrap couldn't be regarded as a single unit.
2. Surfaces, walls and details, their progress, their continuity, quantities, the eventual presence of curved or irregular surfaces.
3. The eventual presence of cavities, their type, the distribution on the scrap and the quantities
4. Edges and extremities, highlighting possible irregularities for matters relating to the use and safety in view of a potential application.

Dimensional Analysis: serves to define precisely the scrap component at geometric level and provides the measurement of aspects such as:
1. The volumetric dimensions into the three dimensions of the single unit of scrap and the measurement at the level of detail and dimensional thickness
2. the possible range of dimensional variability
3. the resistant section of the component, criticality areas of possible breakage / damage

The mechanical analysis: Is quite relevant because from it depends on the possible applications at design level of the scrap, at this moment of analysis must therefore be defined aspects such as:
1. The mechanical properties of the component's scrap material, such as Young's modulus, the behavior in compression, tension, bending, torsion and hardness
2. The possibility of the material and the component to be post-worked and the machining type applicable on it.

56. Pacelli Francesco. "Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali" (Master of science thesis); Politecnico di Milano University, 2013), accessed august 21, 2013.

The physical Analysis: Regards to those properties closely linked to material in order to provide, on the one side stimuli for the development of potential applications, on the other side delimitation and definition of the field of applicability. In this case are defined issues such as:
1. Thermal properties such as the minimum and maximum temperature of use, the coefficient of thermal expansion, the thermal conductivity.
2. Electrical properties such as the resistivity and the dielectric behavior.
3. Durability properties such as the Oxidizability, corrosion resistance, flammability, resistance to acids and bases, the Photodegradability.
4. Optical properties such as refractive index and transparency.
5. Magnetic properties such as permeability and polarizability.
6. Environmental properties such as toxicity, biodegradability, recyclability and the energy impacts in connection with, and besides the availability and renewability of the raw materials

Sensory Characteristics: The last point in the analysis, but not of less importance than the others to determine the possible applications of scrap, these characteristics are:
1. tactile aspects such as surface roughness and eventual three-dimensional textures which may affect the stage of interaction with the user.
2. Visual aspects such as Color, Brightness, and opacity
3. Olfactory aspects like the smell, relevant characteristics to residual components derived of industrial processes.

once the various analyzes have been carried out, The designer will be capable of applying the method implementation, third and last stage (In chart 5. 15 is shown its location within the intervention area and the steps of which it is composed (57)), which basically can be started when companies are in presence of scraps and special waste to discard. The central aim of the method consists of defining those steps which are required to determine whether it is possible to obtaining byproducts from the scraps, while including environmental and economic benefits compared to produce the same product in the conventional manner or compared to other possible forms of waste management.

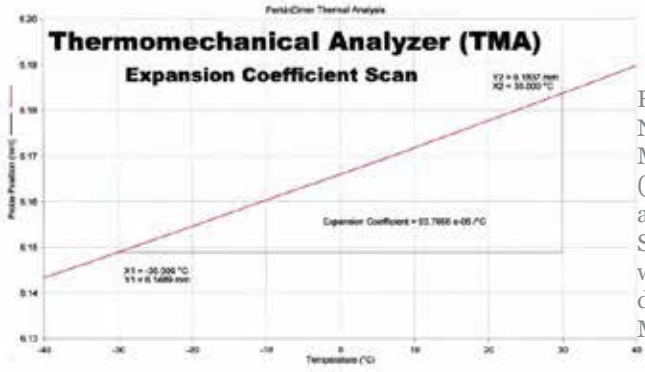


Figure 5.14. PERKINELMER THERMAL ANALYSIS (Thermomechanical analyzer (TMA))
Source: http://www.ptli.com/testlopedia/subs/TMA-CTE.asp

57. Pacelli Francesco. “Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali” (Master of science thesis); Politecnico di Milano University, 2013), accessed September 7, 2013.

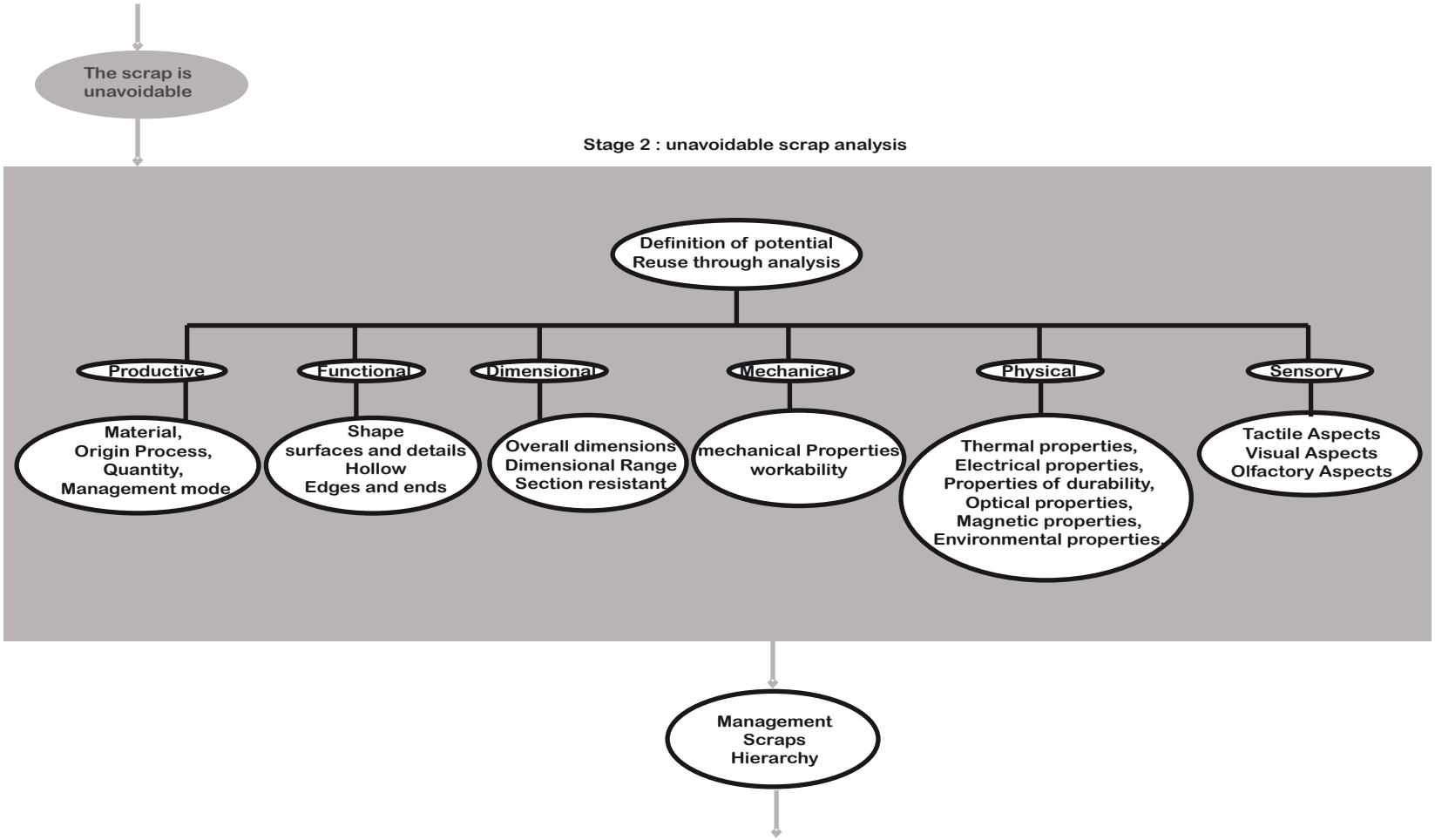


Chart 5.14: Placement and definition of Stage 2 of the method

after reaching the above passages (Illustrated in figure 5. 15 on the next page) begins the real stage of "designing with the scrap", Michael Ashby has divided the procedural steps, in three sequential passages , corresponding to:

1. Concept Design: In Concept Design are defined and analyzed the processing principles of and the possible design options, in terms of overall composition of the product in relation to a particular market demand.
2. Rough Draft: During this step the dimensions of the components that constitute the product are defined in more specific terms.
3. Detailed Design: In this step, it is necessary to achieve an overall review to optimize the shape, the manufacturing process and the assembly, or more in general all those aspects related to the realization of the finished product. The aim of this last point (the overall synthesis of the three stages), is the project specifications' definition , which once approved permit proceeding with the next steps of production chain.

Furthermore, Ashby proposes a schematization model, useful to designing, and above all to choose the most suitable material for a component according to the definition of functions, constraints, objectives, and free variables:

1. The Component functions define what the component should do.
2. The constraints indicate what are the essential conditions that must be satisfied, so that the component can respond to the function. The characteristics that must be analyzed correspond to properties of mechanical, physical or productive type (stiffness, strength, fracture toughness, thermal conductivity, electrical resistivity, residual magnetic induction, transparency, cost, mass, etcetera).
3. the objectives define which aspects will attempt to minimize (cost, mass, environmental impact, heat loss, etcetera) or maximize (energy storage, thermal flow) in relation to the specific production requirements.
4. the free variables are those parameters open to the designer that can be modified to optimize the objective.

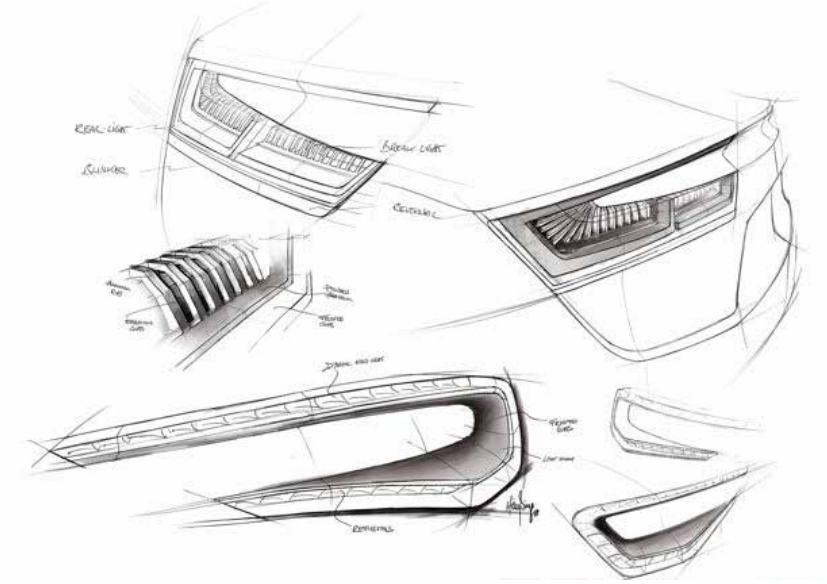


Figure 5.15. Audi e-tron Concept - Design Sketches, 2009 Source: http://www.netcarshow.com/audi/2009-e-tron_concept/1600x1200/wallpaper_49.htm

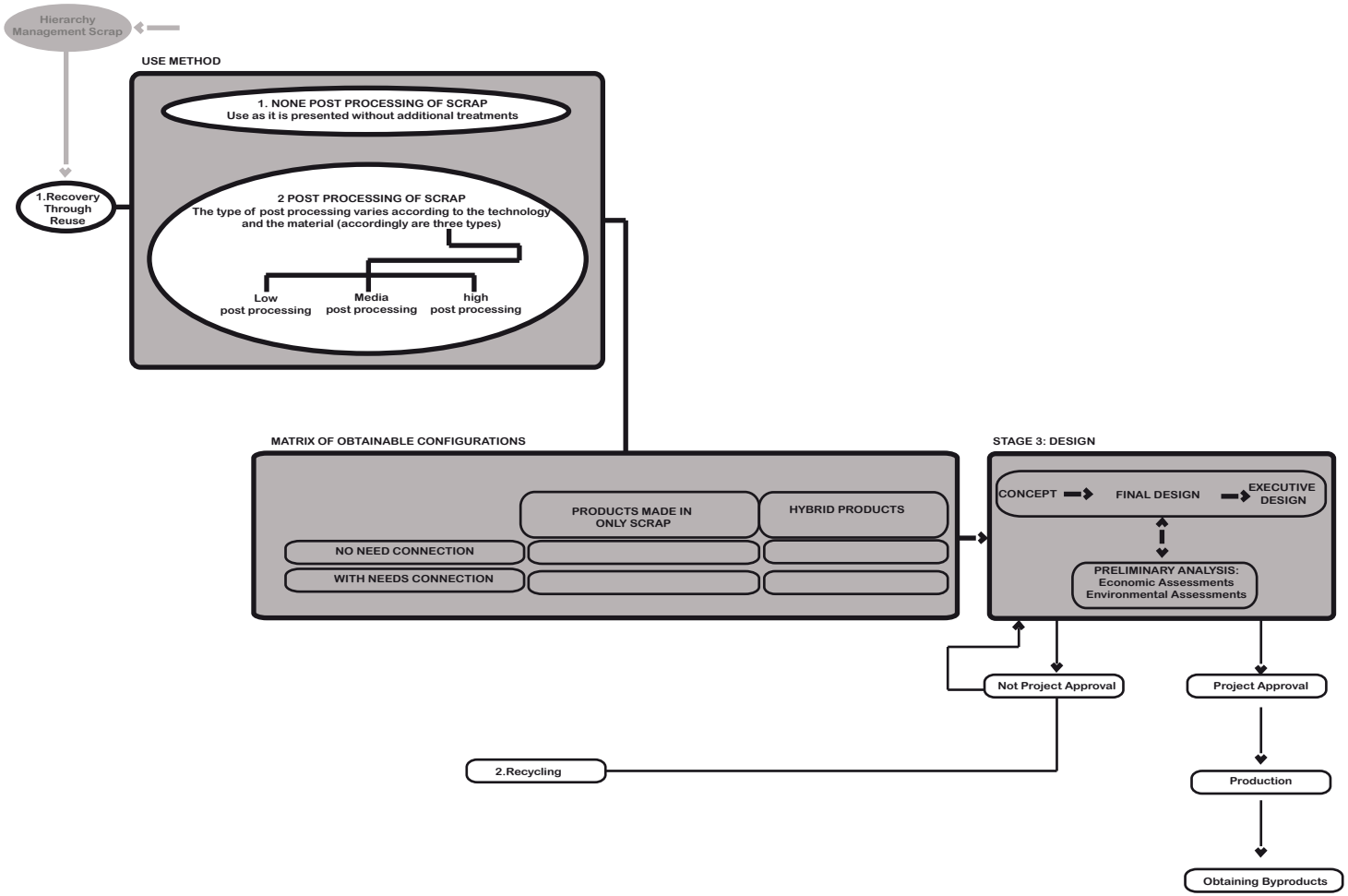


Chart 5.15: Placement and definition of stage 3 of the method

The chart 5. 16 described on the next page, represents the starting point of the design process (58) (Stage 3 of the method). The design model and the schematization for the materials selection according to constraints, goals, and free variables, making reference to an original product. On the other hand In chart 5. 17 is shown the expansion of the design method (59), The design process also in this case is divided into three sequential moments, corresponding to the concept's phases, Final design and Executive design.

The first moment of concept is perhaps the most delicate step of all the project process because the analysis of the scrap properties must suggest to the designer the mode in which scrap can be exploited through an activity of reworking and creativity, opening the possibility to outline formal scenarios which define the general architecture of product. Likewise It is crucial and important during the concept phase, ask yourself the next questions:
1. Which kind of functions perform the product obtained from scrap? and how does it
respond to that function?
2. Do products made with scrap, perform similar functions and have similar connotations and formal / material features comparable to regular products on market ?
3. According to a primary design evaluation, Does it make make sense in terms of industrial and commercial feasibility, develop such an idea?
Although these three general questions may seem obvious, they are necessary to define the operational limits, in order to provide a support tool to distinguish which ideas could have a real potential, and which ones would be a simple creative exercise for its own sake.

On top it is worth saying that concept stage, ultimately, is characterized by the complementary combination of two activities such as the general definition of product architecture and the market research which can validate the sense of a further project development.

Final Design: During this moment is defined the final product architecture coming to get a greater level of detail than the previous phase of concept. At that, It is important to specify with a greater level of definition those aspects related to the overall dimensions, the possible post-processing procedures and how to connect the components involved thus delineating the final product architecture which is the result of the final design stage.

Furthermore, during final design moment are evaluated some products which are made up from scraps and "New" Materials/ Components, they are termed as hybrid for their compositional characteristics. These products are assessed based on the relationship between the scraps and the new design components will therefore be a constraint during the materials selection.

58 Pacelli Francesco. "Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali" (Master of science thesis); Politecnico di Milano University, 2013), accessed September 9, 2013.
59 Pacelli Francesco. "Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali" (Master of science thesis); Politecnico di Milano University, 2013), accessed September 10, 2013.

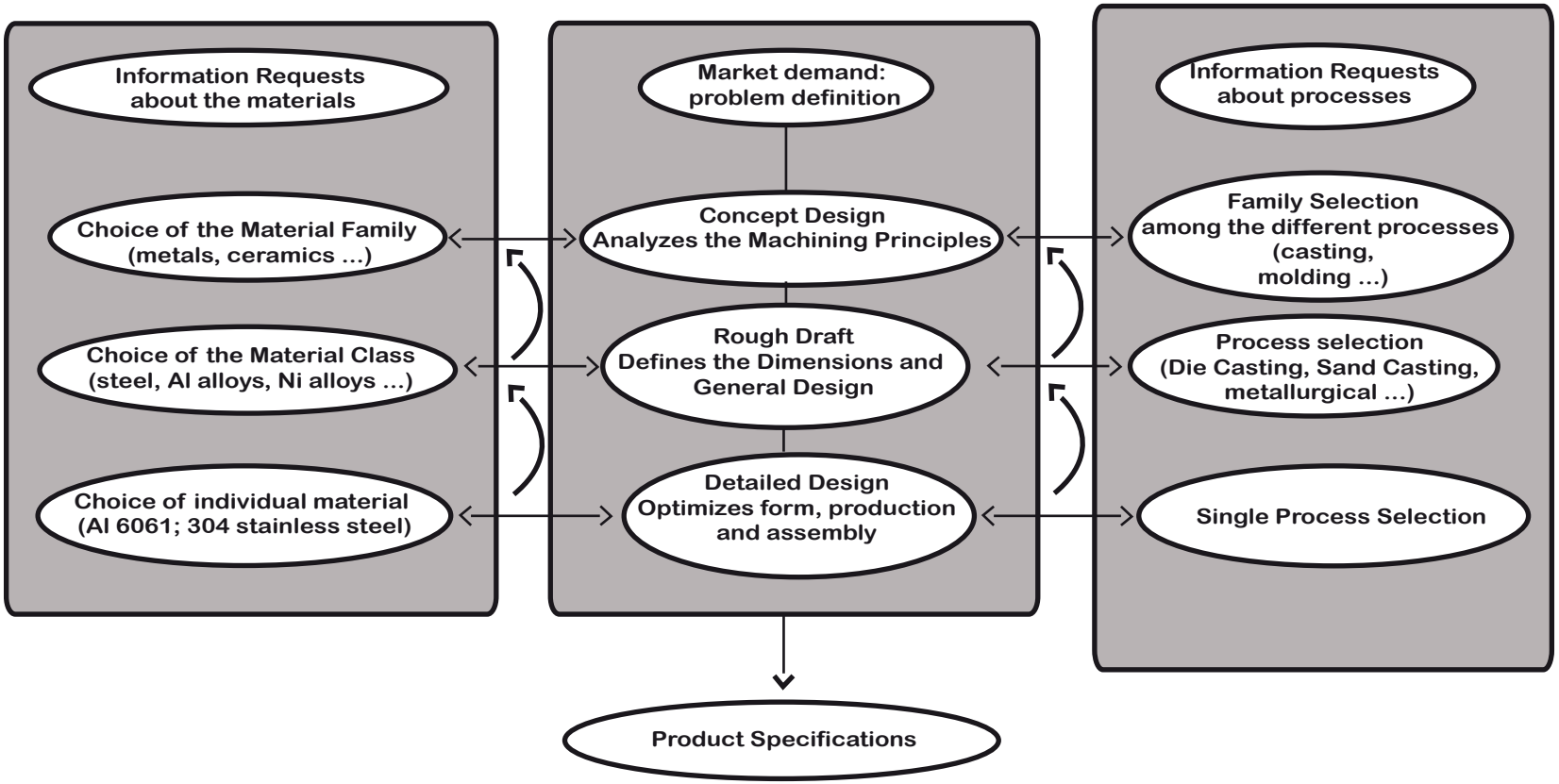


Chart 5.16: Flow chart of design stage and inclusion of materials and processes selection

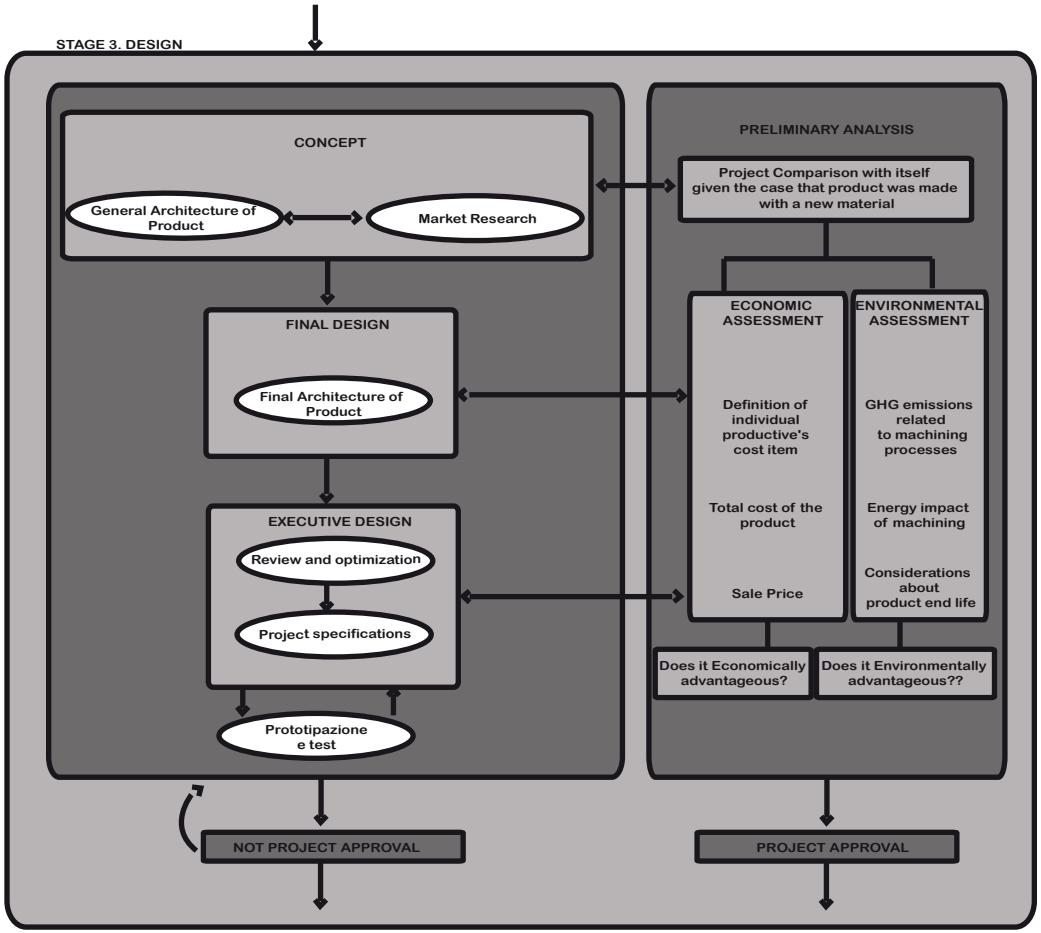


Chart 5.17: Expansion of the concept phase, the final design and the executive design to develop in parallel with the pre - production analysis for a correct designing with scrap

Executive Design: Is the third moment of the design process, basically during this moment is carried out a work of revision and optimization of the product architecture, defining in detail dimensions, machining, assembly sequence and all those aspects required to the formulation of the project specifications and to the realization of the finished product.

At the time when the design specifications have been drawn up, can be started the prototyping and product testing phase. Tests may include load tests, ergonomic considerations or other assessments, for example, of an aesthetic nature, which may involve changes and corrections and define new project specifications. This circular pattern goes on until prototype and project modifications are deemed no longer necessary and finally they be accepted as definitive, thus allowing the production phase ignition.

In chart 5. 18 (60) is shown the method's intervention area diagram which describes its three main stages (Stage 1 Scrap Optimization, Stage 2 Unavoidable scrap Analysis, Stage 3 Design). Instead In chart 5. 19 (61) is presented once again as a final synthesis of chapter, the method placement within product life cycle.

Just to conclude, worth saying that chapter's aim, is to present the method's placement (recovery method through scrap reuse) within product life cycle and explain the various steps that comprise such a method. Moreover have been illustrated the product lifecycle steps from the resources and raw materials' extraction phase to end of life management. Among other things the method has defined its current placement within the traditional chain to make clear the operational moment in which the designer can apply it. Subsequently they were illustrated all of the procedural steps of method's intervention area, the three main stages of which it is composed, the manner in which the scrap can be used and the main product's configuration that can be obtained.

The main reason of method's drafting is to provide a support instrument so that the designer can evaluate the possibility to develop products from scrap material, through which could be obtained advantages from the economic point of view (for a company) and environmental (for human health and the planet). Therefore the goal of method is to provide a new perspective with which to confront itself at the project level with the waste material, in order to evaluate in a conscious way if its reuse in the products definition indeed involve the potential benefits and if the operating mode adopted for its management is actually the correct choice or not.

60. Pacelli Francesco. "Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali" (Master of science thesis); Politecnico di Milano University, 2013), accessed September 9, 2013.
61. Pacelli Francesco. "Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali" (Master of science thesis); Politecnico di Milano University, 2013), accessed September 10, 2013.

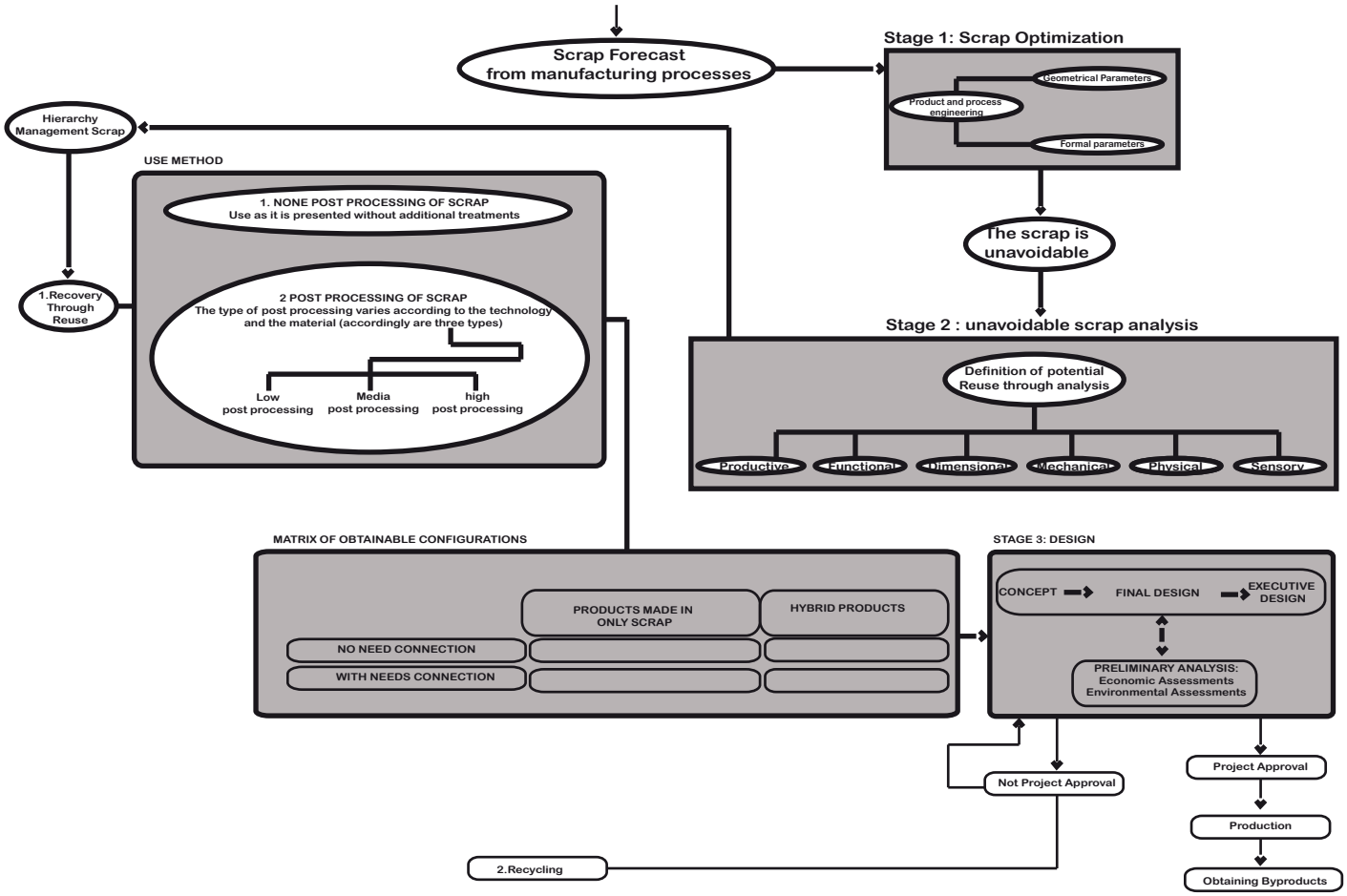


Chart 5.18: Complete Scheme of the entire intervention area of method and its three main stages

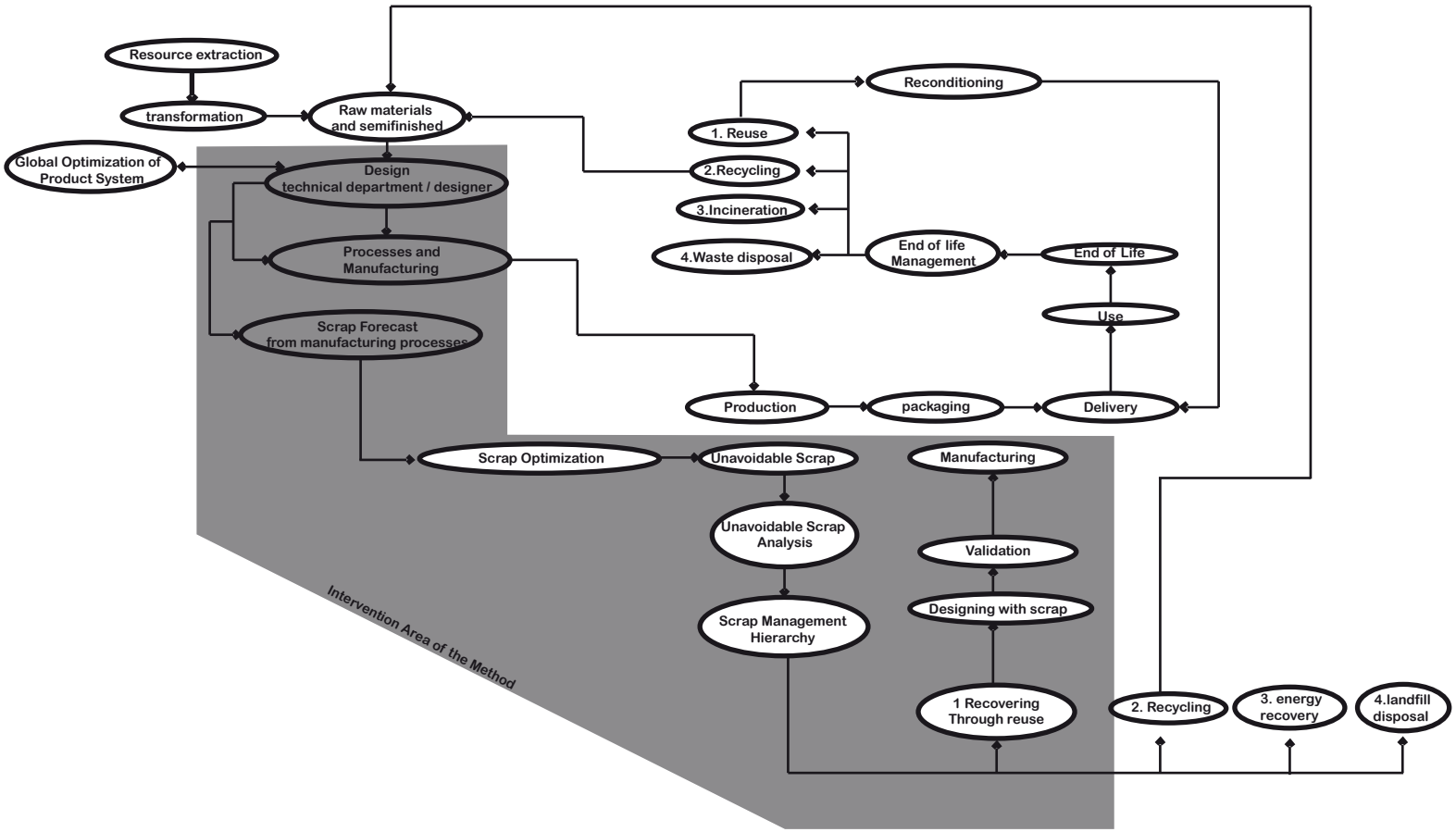


Chart 5.19.Product Life Cycle's Scheme within the supply chain and placement of the Method's intervention area

6. SCRAP NETWORK FOR A SUSTAINABLE FUTURE

The Atlas Material as a new way to see the scrap.

6. Scrap Network For A Sustainable Future: The atlas material as a new way too see the scrap

The world today is facing the reality of the impacts of over-consumption and environmental abuse. This realization will hopefully result in a shift from environmentally detrimental business practices to those that minimize environmental impact. The benefits of component reuse can be described not only by their environmental and economic benefits, but also by their social and historical benefit.
In the larger economy, outside the firm, where waste and scrap materials may be transferred and used, information is needed about potential customers and suppliers of these materials and also a method to control this informational network. On the other hand In materials sectors (including secondly materials) where traditional networks of recycling do not exist, information may be difficult to find, especially if users and providers are in very different geographical areas of different parts of the industrial system (62) , which has allowed only create local networks with waste exchanges and brokerage systems generally small, ineffective, of course on a large scale.

Moreover one of the biggest problems which may difficult the information exchange and the large scale networks is the internal organization of a firm, because most of the times change the whole concept of a product or adding new criteria for environmental compatibility to the design concept represents an inconsistency with the ideas on which the firm operates and also with its internal incentive system. However in spite of the existing vicissitudes, external to a firm, the idea that anything second hand must be second rate has become institutionalized in the distinction between dealers in new and those who work with used materials and products, which would allow in a near future the creation of networks which fill out the network's information lack, thus allowing the waste exchange with a large scale impact and offering more possibilities not only to companies but also to the general public.

Scrap Network for a sustainable future is an attempt to create a large scale's network, which allows the exchange of information between the different affiliated companies and also with the general public, arranging and providing in a data –base, the secondary materials' information and above all their availability.

Figure 6.1. Creative reuse - scrap & recycling art. Green Zebra Environmental Action Center: reMake Lounge Launch Party & SCRAP (Scrounger's Center for Reusable Art Parts) Third Annual Art Exhibition - ReVisions, New Creations from Scrap. copyright Alan Bamberger 1998-2009
Source: http://www.artbusiness.com/1open/121109.html

54. Pacelli Francesco. "Il valore del rifiuto: Un metodo di progettazione per ideare prodotti basati sul riutilizzo degli sfridi industriali" (Master of science thesis); Politecnico di Milano University, 2013), accessed august 21, 2013.

6.1. The scrap Network : The Atlas Material Project

Scrap Network for a sustainable future, is a project which faces new solutions, either in economic matters on the availability of economic resources or in terms of artistic and cultural practices (art , design , architecture, fashion) and its project - based method including productive horizons (eco – business). This innovative idea is presented Under the name of Atlas material and focuses on the drafting of an Atlas Material through a web platform 2.0, integrated to a laboratory project which interacts with new operational realities (like Fablab, Techshop e ToolLending (63)) which develops a creative and cultural context highly Experimental and performative in which are involved, companies, producers, public bodies, designers, artists, makers and craftsmen .

6. 2. The Scrap Network: Definition of Atlas

An atlas is a collection of maps, cards and tables which transmits structured and organized information, flexible and non-hierarchical. It uses a mixed language of images, symbols, codes and colors. Besides, the atlas, allows to perform different shots and cuts enlarging and shrinking, to bringing out this or that detail.
The word 'atlas' comes from Latin “Atlante” and from Greek “Atlas” and it was the name of the Titan who in Greek mythology was forced to stand on his mighty shoulders the celestial vault, He was sentenced to this task after the war between the Titans and the Olympians . From the myth of Atlas were pulled out many metaphors, For example, the architectural term, or that anatomical, where 'atlas' indicates the cervical vertebra which supports the skull. Notwithstanding, Surely the name had its main fortune and recognition for the map collection created during the time.

The atlases are generally made up of cards, maps and boards. The first one (the card) is the result of a projection of what must be represented. The second one (The map) is a representation on a plane through a system of symbols, graphic strokes, verbal and numerical which can be understood in many different ways, normally these used to represent virtual and imaginary territories or are adapted to represent complex phenomena, difficult to think and see in their entirety. The maps Can reproduce the thought in its dynamics, in its unfolding, in its associations, in its rational, deductive, inductive, associative, and imaginative activities, forming itself as the crystallization of a process. The third and last concept, (the board) is a writing surface made with the aid of different materials, to the naked eye may seem a simple explanation however the description undertaken a bove is very punctual

63 Fablab: A fab lab (fabrication laboratory) is a small-scale workshop offering (personal) digital fabrication/ http://www.openp2pdesign.org/2011/fabbing/business-models-for-fab-labs/
Techshop: TechShop is a vibrant, creative community that provides access to tools, software and space. Besides is a playground for creativity, part fabrication and prototyping studio, part hacker space and part learning center / http://www.techshop.ws/
ToolLending: non-profit organization that works to preserve and revitalize homes and communities non-profit organization that works to preserve and revitalize homes and communities, also makes available over 4,500 tools free of charge to both individuals and non-profit organizations/ http://en.wikipedia.org/wiki/List_of_tool-lending_libraries

and synthetic (64).

The Atlas information is deepened in relation to the needs and there is no obligation of sequencing and completeness. In contrast to a manual, the atlas is a element in which can be collected the information that at any given time are deemed like more suited to explaining any idea. The atlas does not contribute exclusively to spread a knowledge, but also want to participate to found it culturally, in broad strokes the atlas is defined as a tool to design, either at the moment of its actual realization, or at the time of its consultation and interpretation.

This thesis is mainly interested on atlas concept as a personal collection of cards, maps and boards that can be added, deleted, replaced, processed or reworked. The development of an atlas, carries a contribution to the culture of design assisting the designer and the general user in the translation of the complex picture of the phenomenological aspects considering at the same time the perceptual and sensory properties of scrap materials and their surfaces. With this atlas made of secondary materials is intended to establish a conscious use of those materials that are available inside the scrap network allowing the creation of projects with a high environmental impact, consequently generating an alternative system of manufacturing and production which use as raw materials the secondary ones. On the other hand as a tool, the atlas is aimed primarily at teaching the area of the scrap materials and the design, and is also dedicated to the user concerned and sensitive about environmental issues.

Among other features the atlas of secondary materials set up a new dynamic within the production cycle of companies as a result of the new way to handle the scraps generated by, adding a new method to treat the discarded materials into their processes. Among other benefits the “atlas” generates new relationships between enterprises where wastes are the connection factor, which allows have greater knowledge about the services and business offered by the companies on the territory. Moreover the atlas project attracts new members, and creates a new niche of users interested on environmental issues , users concerned about giving new life to discarded materials, which create at the same time new products with interesting sensorial and visual qualities.

6.3. The Atlas material project

Basically the atlas material is a map relating to a given territory where are reported the availability of company’s discarded materials, scraps from industrial and artisanal production and unused materials and semi-finished products in order to recirculate matter resources for the benefit of all stakeholders of a collectivity (New chain). An atlas assumes that this mass of matter does not consist of waste, but rater of secondary materials which when are placed in a highly creative ambit, may be considered as new raw materials. The practical reason is simple. Any resource is previously taken, thereby avoiding the logistical costs of waste collection centers. Will users to

64. Rognoli Valentina; Marinella Levi. “Materiali per il design: espressività e sensorialità”. Milano: Polypress, 2005

decide, consulting the on-line map, the possible pickup and conveying, according to their technical and economic needs. The Atlas Material Lab should be based on two complementary entities, an agency with which to coordinate the drafting, the updating, the implementation of map, and spreading of the model (reproducibility in another productive context) and a workshop which provides scenarios, simultaneously developing and producing projects with materials from the atlas, for internal production and commercial purposes or on behalf of others (prototypes, products, installations, etc.) which carries out research and experimentation through workshops, courses and cooperation with universities, schools, foundations, studios , etc.

The particular vocation of Atlas is therefore the development of projects with a strong public interest: Urban design, design of public spaces, public art, theater, more (works of design or art open to the public and viewable by the general public). This is to ensure visibility both for companies that provide the materials and subjects who produce things with them, in addition to extending the dissemination of knowledge and a different creative and professional environment.

The Atlas calls for a cultural and creative growth more inclusive and horizontally between designers, manufacturers and clients, proposes different material supply methods and riding towards a contemporary "to do" that includes advanced technologies (printing and 3D scanning, laser cutting).

researches in recent years . For a long time were seen in design, architecture and art magazines projects and productions made with reused materials. Among other phenomena which are latent and evident can be highlighted the fact that in the back of many industries and construction sites every day are left exorbitant amounts of scraps and discards , which makes clear that there is a problem which needs to be addressed, an address which lead us to a new productive state, a new way of thinking.

6.4. The scrap Network: A Social Network Analysis

The scrap network as system is constructed on the basis of the social network theory. The notion of a social network and the methods of a social network analysis have attracted considerable interest and curiosity from the social and behavioral science community in recent decades, should be noted that social network analysis is now one of the major paradigms in contemporary sociology, and is also employed in a number of other social and formal sciences. Together with other complex networks, it forms part of the nascent field of network science. The social network perspective encompasses theories, models and applications that are expressed in terms of relational concepts or processes , furthermore social network analysis attempts to solve analytical problems that are non – standard. The data analyzed by networks methods are quite different from the data typically encountered in social and behavioral sciences (65) .

65. Wasserman Stanley; Katherine Faust . Social Network Analysis: Methods and Applications. Cambridge: Cambridge University Press, UK, 1999

On the other hand The social network perspective provides a set of methods for analyzing the structure of whole social entities as well as a variety of theories explaining the patterns observed in these structures.(66) The study of these structures uses social network analysis to identify local and global patterns, locate
influential entities, and examine network dynamics.

There are several key concepts at the heart of network analysis that are fundamental to the discussion of social networks and above all to explain the scrap network. These concepts are Actor, relational tie, dyad, triad, subgroup, group, relation and network. The first of this concepts (Actor) is concerned to discrete individual, corporate, or collective social units, in our case study, the actors are the companies which make available to network the different scrap materials and the users who participate into.
The second key concept is “relational tie”, this one relates to the link which exist between the different actors; the most common examples of ties employed in network analysis are:

1.Evaluation of one person to another (For example expressed friendship, liking or respect)
2. Transfers of material resources. For example business transactions, lending or borrowing things. In our study case this network example fits perfectly with our network, given that, the scrap network creates a relational tie between companies and users through the scrap materials transferred .

66. Wasserman Stanley; Katherine Faust . Social Network Analysis: Methods and Applications. Cambridge: Cambridge University Press, UK, 1999. Pp 1- 27

3. Association or affiliation (For example jointly attending a social event, or belonging to the same social club). This principle is applicable to our network, inasmuch as companies and users may be part of our group, by joining the network and making the affiliation to.
4. Behavioral interaction (Talking together, sending messages)
5. Movement between places or statuses (migration, social or physical mobility)
6. Physical Connection (a Road, a river or bridge connecting two points)
7. Formal relations (For example authority)
8. Biological relationship (kinship or descent)
After understanding the concept of “relational tie” it is possible to address the third concept (dyad) which refers to the ties among pairs, that is to say, the possible bonds between a pair of actors, here is analyzed the properties of pairwise relationships, such as whether ties are reciprocated or not (67). Furthermore these relational ties allows to build the concept denominated triad which arises when a third individual is added to a dyad. Research at this level may concentrate on factors such as balance and transitivity, as well as social equality and tendencies toward reciprocity/mutuality.

The last four terms, initially set (subgroup, group, relation and network) are complex to explain synthetically because each of them is a system that encompasses a wide spectrum of analysis. Nonetheless are considered of great importance within the levels of analysis and will be treated in one way or another during this chapter .

Levels of analysis

In general, social networks are self-organizing, emergent, and complex, such that a globally coherent pattern appears from the local interaction of the elements that make up the system (68) . These patterns become more apparent as network size increases. However, a global network analysis of, for example, all interpersonal relationships in the world is not feasible and is likely to contain so much information as to be uninformative. Practical limitations of computing power, ethics and participant recruitment and payment also limit the scope of a social network analysis (69). The nuances of a local system may be lost in a large network analysis, hence the quality of information may be more important than its scale for understanding network properties. Thus, social networks are analyzed at the scale relevant to the researcher's theoretical question. Although levels of analysis are not necessarily mutually exclusive, there are three general levels into which networks may fall: micro-level, meso-level, and macro-level.

Structural Holes

In the context of networks, social capital exists where people have an advantage because of their location in a network. Contacts in a network provide information, opportunities and perspectives that can be beneficial to the central player in the network (in the scrap network case, the central player is the network itself and the players who provide information, opportunities and perspectives are the companies affiliated with). Most social structures tend to be characterized by dense clusters of strong connections (70).

Information within these clusters tends to be rather homogeneous and redundant. Non-redundant information is most often obtained through contacts in different clusters. When two separate clusters possess non-redundant information, there is said to be a structural hole between them.(71) Thus, a network that bridges structural holes will provide network benefits that are in some degree additive, rather than overlapping. An ideal network structure has a vine and cluster structure, providing access to many different clusters and structural holes (72).

Information benefits

Networks rich in structural holes are a form of social capital in that they offer information benefits. The main player in a network that bridges structural holes is able to access information from diverse sources and clusters (73). This is beneficial to an individual's career because he is more likely to hear of job openings and opportunities if his network spans a wide

68. Newman, Mark, Albert-László Barabási and Duncan J. Watts The Structure and Dynamics of Networks. Oxford: Princeton University Press, 2006.
69. Kadushin, C. Understanding Social Networks: Theories, Concepts, and findings. Oxford: Oxford University Press, 2012.
70. Burt Ronald. "Structural Holes and Good Ideas." American Journal of sociology, accessed September 30, 2013.
71. Burt, Ronald. Structural Holes: The Social Structure Of Competition. Cambridge, Ma: Harvard University Press, 1992.
72. Burt, Ronald. Structural Holes: The Social Structure Of Competition. Cambridge, Ma: Harvard University Press, 1992.
73. Burt, Ronald. Structural Holes: The Social Structure Of Competition. Cambridge, Ma: Harvard University Press, 1992.

range of contacts in different industries/sectors. This concept is similar to Mark Granovetter's theory of weak ties, which rests on the basis that having a broad range of contacts is most effective for job attainment.

Social capital mobility benefits

In many organizations, members tend to focus their activities inside their own groups, which stifles creativity and restricts opportunities. A player whose network bridges structural holes has an advantage in detecting and developing rewarding opportunities (74). Such a player can mobilize social capital by acting as a "broker" of information between two clusters that otherwise would not have been in contact, thus providing access to new ideas, opinions and opportunities. A social capital broker also reaps control benefits of being the facilitator of information flow between contacts. In the case of consulting firm Eden McCallum, the founders were able to advance their careers by bridging their connections with former big 3 consulting firm consultants and mid-size industry firms.(75) By bridging structural holes and mobilizing social capital, players can advance their careers by executing new opportunities between contacts.

74. Burt, Ronald. Structural Holes: The Social Structure Of Competition. Cambridge, Ma: Harvard University Press, 1992.
75.Gardner, Heidi; Eccles, Robert (2011). "Eden McCallum: A Network Based Consulting Firm" Harvard Business School - Organizational Behavior Unit, accessed November 30, 2013, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1963909

6.5. The Social Networking service: Analyzing the Phenomenon

A social networking service is a platform to build social networks or social relations among people who, for example, share interests, activities, backgrounds, or real-life connections. In our case study the scrap network platform will allow a social relation with real – life connections, because the scraps are tangible goods which enable a real contact between companies and users . On the other hand a social network service consists of a representation of each user (often a profile), his/her social links, and a variety of additional services. Most social network services are web-based and provide means for users to interact over the Internet, such as e-mail and instant messaging. Online community services are sometimes considered as a social network service, though in a broader sense, social network service usually means an individual-centered service (is important to highlight this feature because the scrap network shall be defined as an individual – centered service) whereas online community services are group-centered. Social networking sites allow users to share ideas, pictures, posts, activities, events, and interests with people in their network.
Popular methods now combine many social networking services with American-based services such as Facebook, Google+, tumblr and Twitter widely used worldwide; furthermore There have been attempts to standardize these services to avoid the need to duplicate entries of friends and interests A 2011 survey found that 47% of American adults use a social networking service. Several websites are beginning to tap into

the power of the social networking model for philanthropy (76) . Such models provide a means for connecting otherwise fragmented industries and small organizations without the resources to reach a broader audience with interested users.(77) Social networks are providing a different way for individuals to communicate digitally. These communities of hypertexts allow for the sharing of information and ideas, an old concept placed in a digital environment.

Typical Features

Social networking sites share a variety of technical features that allow individuals to: construct a public/semi-public profile, articulate a list of other users that they share a connection with, and view their list of connections within the system. The most basic of these are visible profiles with a list of "friends" who are also users of the site. On the other hand a profile can be generated from answers to questions, such as age, location, interests, etc. Some sites allow users to upload pictures, add multimedia content or modify the look and feel of the profile (78).

Some social networks have additional features, such as the ability to create groups that share common interests or affiliations, upload or stream live videos, and hold discussions in forums. Geosocial networking co-opts Internet mapping services to organize user participation around geographic features and their attributes. There is a trend towards more interoperability between social networks led by technologies such as OpenID and OpenSocial. In most mobile communities, mobile phone users can now create their own profiles, make friends, participate in chat rooms, create chat rooms, hold private conversations, share photos and videos, and share blogs by using their mobile phone. Some companies provide wireless services that allow their customers to build their own mobile community and brand it; one of the most popular wireless services for social networking in North America is Facebook Mobile.

76. FOAF. “The friend of a friend”. FOAF Project, November 2013. Web. 10 January 2013 http://www.foaf-project.org/
77. Silverman Rachel Emma. “A New Generation Reinvents Philanthropy”. The Wall Street Journal, August 2007. Web October. 2013 http://online.wsj.com/public/article/SB118765256378003494.html
78. Boyd, D. M., & Ellison, N. B. (2007). “Social Network Sites: Definition, History, and Scholarship”. Journal of Computer-Mediated Communication, 13(1), article 11, accessed October 1, 2013.

6.6. The scrap Network: The Networking Trend

While the popularity of social networking consistently rises,(79) new uses for the technology are frequently being observed. At the forefront of emerging trends in social networking sites is the concept of "real-time web" and "location-based." Real-time allows users to contribute contents, which is then broadcast as it is being uploaded - the concept is analogous to live radio and television broadcasts, e.g. Twitter set the trend for "real-time" services, wherein users can broadcast to the world what they are doing, or what is on their minds within a 140-character limit. Facebook moreover followed suit with their "Live Feed" where users' activities are streamed as soon as it happens.

Companies have begun to merge business technologies and solutions, such as cloud computing, with social networking concepts. Instead of connecting individuals based on social interest, companies are developing interactive communities that connect individuals based on shared business needs or experiences. Many provide specialized networking tools and applications that can be accessed via their websites, such as LinkedIn.

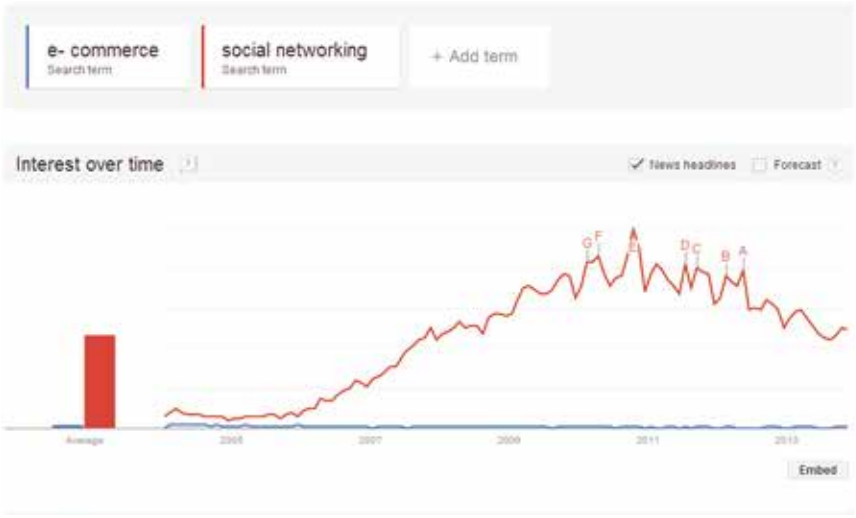


Figure 6.2. Google Trends, E commerce and Social Networking
Source: http://www.google.com/trends/explore#q=e-%20commerce%2C%20social%20networking&cmpt=q

Business Applications

One popular use for this new technology is social networking between businesses. Companies have found that social networking sites such as Facebook and Twitter are great ways new technologies and competitors, and as a lead generation tool to intercept potential prospects.(80) These companies are able to drive traffic to their own online sites while encouraging their consumers and clients to have discussions on how to improve or change products or services.

Social networking services have also become a mainstream topic of academic study in various disciplines. For example, social networking services are highly relevant to techno-self studies which focus on all aspects of human identity in a technological society The use of social networking services in an enterprise context presents the potential of having a major impact on the world of business and work (Fraser & Dutta 2008).

Social networks connect people at low cost; this can be beneficial for entrepreneurs and small businesses looking to expand their contact bases. These networks often act as a customer relationship management tool for companies selling products and services. Companies can also use social networks for advertising in the form of banners and text ads. Since businesses operate globally, social networks can make it easier to keep in touch with contacts around the world.

Applications for social networking sites have extended toward businesses and brands are creating their own, high functioning sites, a sector known as brand networking. It is

80. Nimetz, Jody. "Jody Nimetz on Emerging Trends in B2B Social Networking". Marketing Jive, November 18, 2007, accessed 01 October 2013, http://www.marketing-jive.com/2007/11/jody-nimetz-on-emerging-trends-in-b2b.html

the idea that a brand can build its consumer relationship by connecting their consumers to the brand image on a platform that provides them relative content, elements of participation, and a ranking or score system. Brand networking is a new way to capitalize on social trends as a marketing tool.
The power of social networks it beginning to permeate into internal culture of businesses where they are finding uses for collaboration, file sharing and knowledge transfer. The term Enterprise Social Software is becoming increasingly popular for these types of applications.

6.7. The Networking trend : "Materia" a global network in the area of innovative materials

The networking trend related to social web and online databases which gather, exchange and provide data has grown in recent years. The trend becomes more evident with the advent of online social networks, which allowed a rapid growth of this phenomenon. Furthermore in regard to online database management, have been emerging online libraries which allow access to extensive catalogues of organized and hierarchical information.

A phenomenon similar to this project of Scrap Network has occurred in Holland, where not so long ago was born "Materia" is the global network in the area of innovative materials. This global network encourages joint innovation on the road to a more beautiful, sustainable and high-quality built environment. Around an independent and continuously growing collection of 2,000 materials, this big network has been connecting professionals through exhibitions, trade shows, conferences, the Inspiration Centre in Amsterdam and online media. Furthermore Materia brings people into contact with architects, interior designers and other creative professionals. As the leading network in the field of innovative materials, this network continually connect people with thousands of creative professionals in the Netherlands and far beyond.

In a few words this global network is an international platform of architects and material developers, around an independent materials collection, with the focus on meeting, inspiring and co-creating, bringing together construction professionals; daily via materia.nl and the Materia Inspiration Centre, annually for "Material Xperience" and periodically on current topics and events. The network encourages innovation towards a better, more sustainable and high-quality built and furnished surroundings besides For the past 15 years, has been guiding its partners to achieve greater brand awareness, successful material and product introductions, market expansion and strong brand positioning. Through a clever mix of distinctive strategies. (81)

It's main function is as a materials' network. By showcasing the most innovative new materials, bringing people together to be inspired, to meet like-minded professionals and to share ideas. This works best at specially organized events. Besides the well-known trade shows, such as "Material Xperience" and " Material Experience On Tour ", also have tailored

81. Materia. " Welcome to Materia", Materia. nl, accessed 01 October, 2013,http://materia.nl/

exhibitions around the world and customized seminars in the Materia Inspiration Centre, in the headquarters in Amsterdam. These events include exhibitions of the most suitable materials for a specific theme.

Each themed period lasts 3 months, and focuses on an important current trend in materials, such as healthcare, 3D printing, or smart materials. New materials present opportunities for fascinating innovations, stimulating and inspiriting architects, designers and producers to apply these materials to their designs. This network is a knowledge centre for developments and innovations in materials, and their applications for architecture and design.

According to this trend, the Atlas Material or scrap network presented in this thesis, would engage the emerging trend, given that has operational characteristics very similar to Materia.nl, since it is presented as a material library which operates online, which provides an overview of all materials that are in the database and in turn, showing up the contact details in order to obtain the materials exhibited. Besides it is fascinating to think that the scrap network would born as a local network which operates in the Lombardy region but that with the passage of time this phenomenon can be reproduced, expanding itself into other regions and cities even in other countries, therefore creating more coverage, also new contacts which would give greater strength to the network, and mainly a significant environmental impact.

On the other hand the scrap network would strengthen the already existing trend of using secondary materials to create new products, encouraging the use of these and simultaneously conferring new projective features to scrap materials, thus creating a new list of materials in libraries of architects designers, artists and craftsmen, a new list to create new objects and creative projects.

6.8. The scrap Network: Network intervention point within the product life cycle scheme

Inside the Product life cycle scheme within the supply chain, the scrap network can find a possible intervention area, the method's placement presented in figure number 19, chapter 5 , shows that companies can implement within their product life cycle system, the recovery method through scrap reuse which would leave an open space to start up the network which would work as a support instrument for designers, architects, companies artist and general public allowing them, to evaluate the possibility of product development from scrap materials, giving at the same time advantages to involved companies from the economic (reducing disposal costs) and environmental (for human health and planet which consequently would give a positive image for the company) point of view, providing a new perspective in product design where scraps are the new raw materials and network users the transformers of a new productive reality that find a new design opportunity in that which is considered as waste. As shown in chart 6.1 the atlas material is placed during scrap optimization exactly in the scrap management hierarchy phase, is highlighted 2 important steps, first the recovering

SCRAPNETWORK: Intervention Point

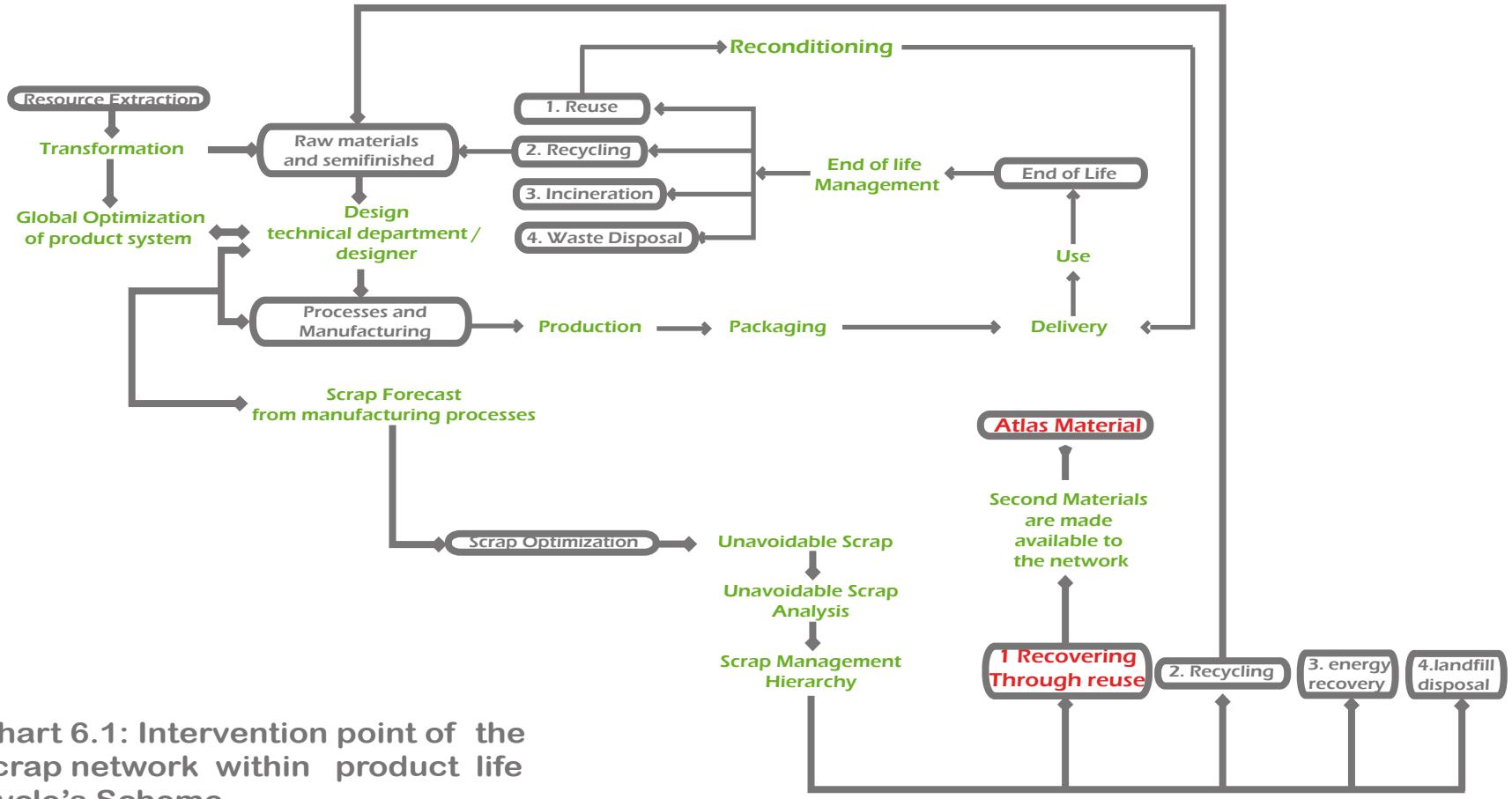


Chart 6.1: Intervention point of the scrap network within product life Cycle's Scheme

Chart 6.1

through reuse which is an important category of scrap management hierarchy and secondly the atlas material that pointed the exactly place where it is placed.

6.9. Atlas Material's information input and output

Once a company has implemented the recovering through reuse method and become to be an active member of the scrap network, it is necessary to make available their scraps to the atlas materials, this process leads to an information management for both the company and network, where information input is strictly compiled in next chart (Chart 6.2) where secondary materials are catalogued into. In addition to, will be required further information such as secondary material availability and how to get them in order to organize the information systematically .

As shown in chart 6.3 the information input once filtered by network becomes synthesized information which is the information output of system, this output data represents the entire information to which the user accesses inside the network.

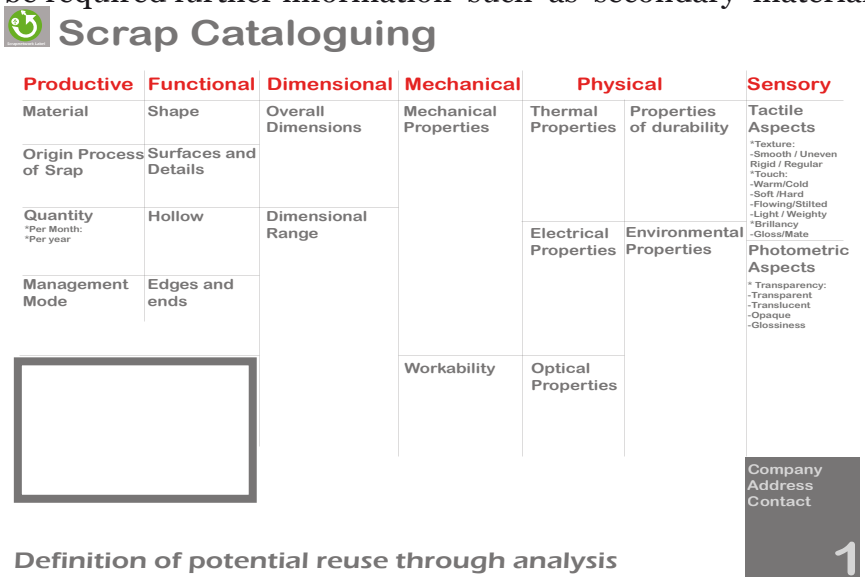


Chart 6.2 Scrap Cataloguing chart

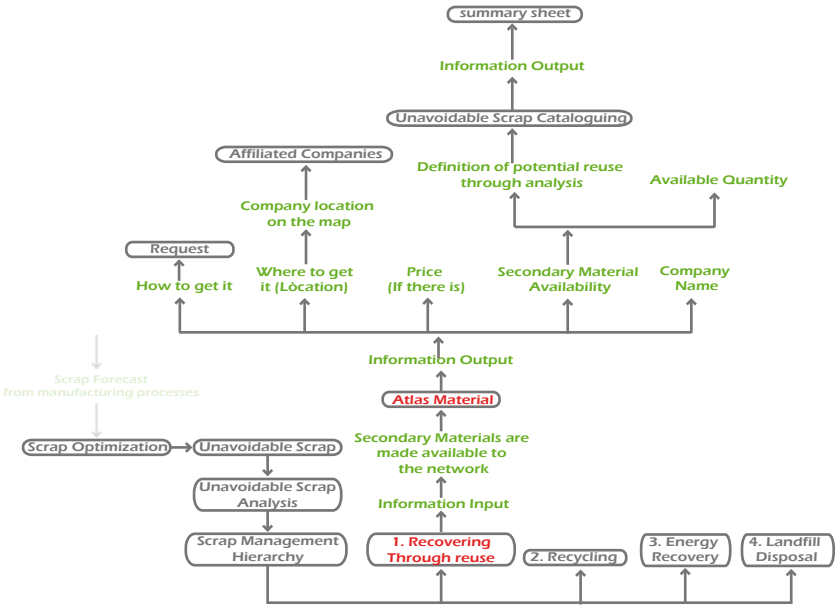


Chart 6.3: Information Output From recovering Through reuse

Nonetheless the way that companies exchange information with network has a special dynamic that will be shown in figure 22. Inside the chart is briefly described this exchange. In first place, the company that wants to belong to the Atlas' material network, must send a request through the website or sending an e-mail to the contact addresses which are shown on it. Upon receipt of requests, the website operators will sent back a chart which must be filled out whit information of the available scraps and of company itself . Once filled out the application the company should deliver online the completed chart (Chart 6.2, page 108) which will be meticulously analyzed then.

When the application is approved, The company must make available its secondary materials for affiliated users and at the same time the network will provide users of useful information about these .The contribution made by the company will be remunerated with the "scrap label" which basically is the network's certification which hereby stated that the company is contributing to a sustainability program involved with scrap reuse.

6.3 Illustration in Investment Advisor magazine. Article about sustainable business (Why you need to build a Sustainable Business: If clients want to put their money in socially responsible investments, wouldn't they want to invest with a socially responsible advisor, too?), From the june 2011 Source: http://www.thinkadvisor.com/2011/06/01/why-you-need-to-build-a-sustainable-busines

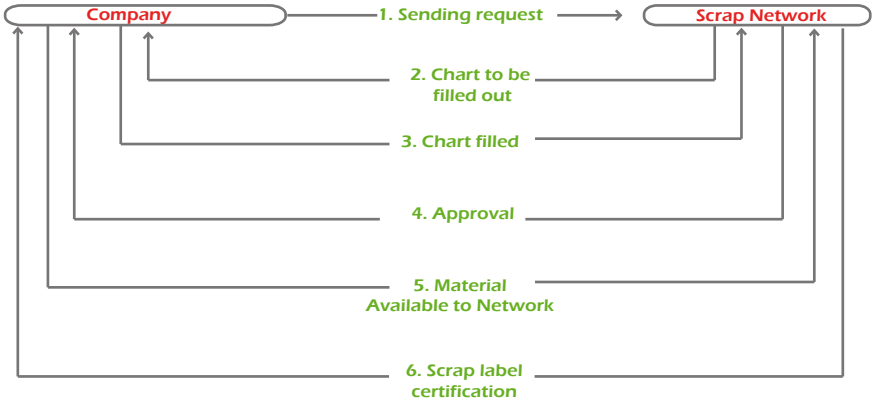


Chart 6.4. How to Join the Network

6.10 The scrap network : How the Atlas material work on the web?

The Atlas material as stated above, is a useful tool to search, locate and obtain various types of scrap materials. This useful instrument has been designed to operate on a web platform2.0, indicating that the database can be accessed from any electronic or mobile device with internet access from anywhere in the world, among other features has hypothesized that atlas' map search would be powered by Google maps such that not only would be located the place where materials are but also may be possible to plot Mapping route's with Origin and Destination. On first slide (Chart 6.5) we can see a graphical hypothesis on how to begin the search for these scrap materials. Basically the webpage contains two

search tools, the first of them is the materials search engine with which can be located the various scraps included in the database, therefore can be seen in the upper left four search bars, which contain: Search by Type, by Name, by code by company. The second search tool is the maps locator where it is possible to trace a material or in the best case, the possibility to plot a mapping route in order to obtain the material from the source. The option “get directions” gives the user the possibility of add destinations, calculate time to travel in different means of transport and show companies on map simultaneously.

On the second slide (Chart 6.6) it can be appreciated the search by type, during this step , 3 bars are shifted to the right which show in descending order the classification of materials in the data base, basically this search model has been divided into 3 main families: Metallic materials, Ceramic materials and Polymeric materials. These three major groups contain all the materials included into the Scrap network which have been divided in turn in other subgroups.

In charts 6.7, 6.8 and 6.9 are shown these subdivisions. For example in chart 6.7 metallic materials has been divided into three categories: Ferrous materials, non ferrous materials and all metallic materials, this latter category is actually not a classification, is merely a program function which deploys all metallic materials included into. This way to categorize is also applied in the other two larger families included (Ceramic Materials, Polymeric Materials) , chart 6.8 for instance, shows the ceramic materials subdivision (crystalline ceramics, non crystalline ceramics, all ceramic materials) which are other groups very different from metallic materials, with the exception of the last one, because as in the first categorization, this option enables display all ceramic materials, simply clicking on. Finally , as last categorization of materials, we find the polymeric group (chart 6.9) , divided in thermoplastics, thermosetting and all polymers, this subdivision has the same interface features of metals and ceramics, given that, the last toolbar allows us to access to the entire polymeric family (in chart 6.10 there is a simulation when all polymeric materials toolbar is displayed).

Moreover, the more detailed information of a specific material appears at the time when a user clicking on the thumbnail of a specific scrap which displays a chart with further information of (Figure 29), showing up data such as Origin Process of scrap, quantity, Management Mode, Shape, Surface and details, Hollow, Edges and ends, Overall dimensions, Dimensional Range, Mechanical Properties , Workability, Thermal Properties, Electrical properties, Optical Properties, Properties of durability, Environmental properties, Tactile aspects, Photometric Aspects, among other things this section allows the user to search on map the material and the currently location of, which can be explored in detail on the map powered by Google maps, one very particular detail on this map which makes it very useful is the “get directions option” where user can add a point of departure and one arrival (the point of arrival is usually the company) figure 31, or in the best case several points of arrival that indicate the location of the various companies, tracing a path between them, thus facilitating

the gathering of the selected materials. In figure 30 can be observed, how the map points out the material location whit a red color, indicating also on it , the company name, the material name and the Item code.

Chart 6.5 Scrap Network: Scrap Materials Map

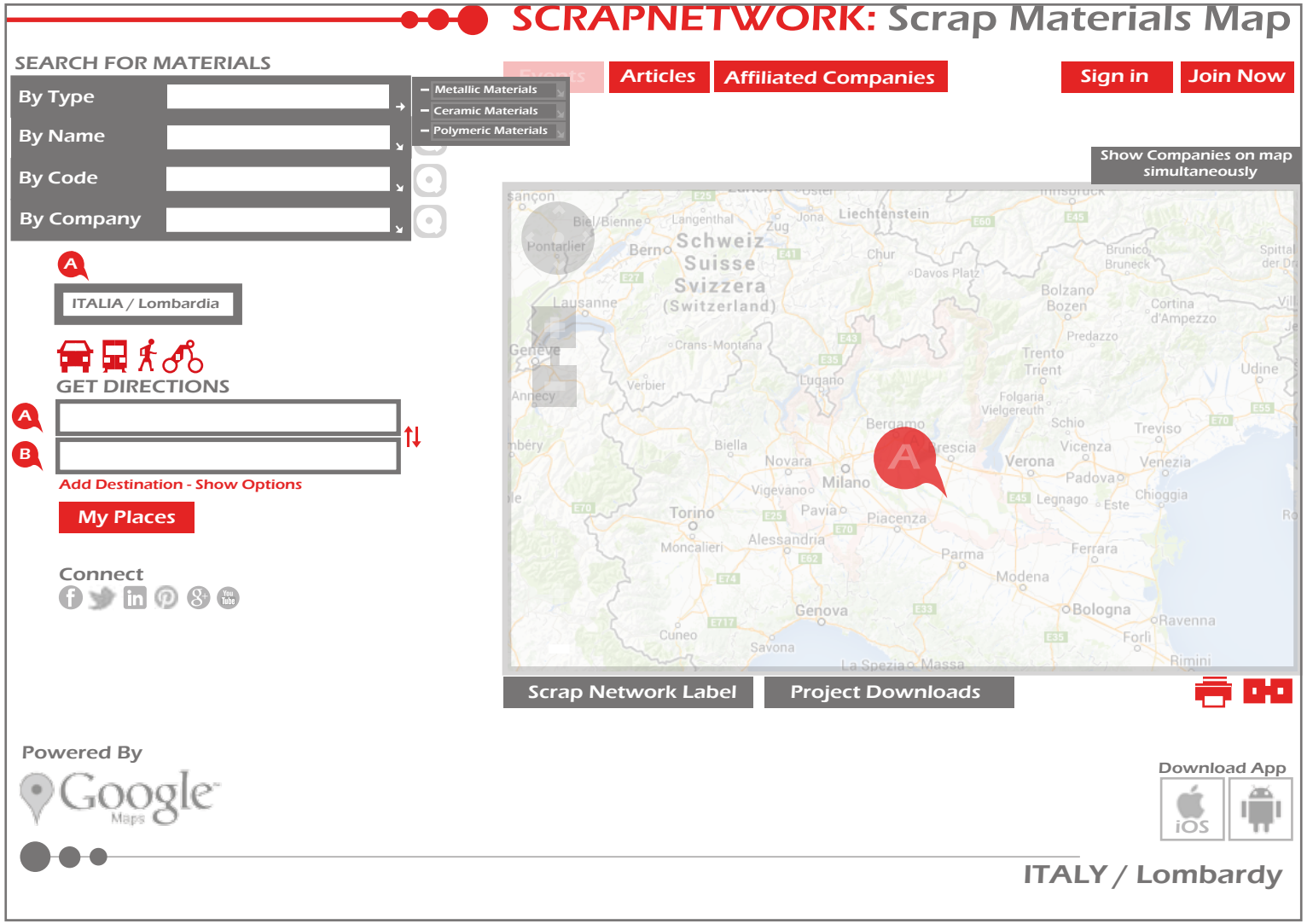


Chart 6.6 Scrap Network: Scrap Materials Map

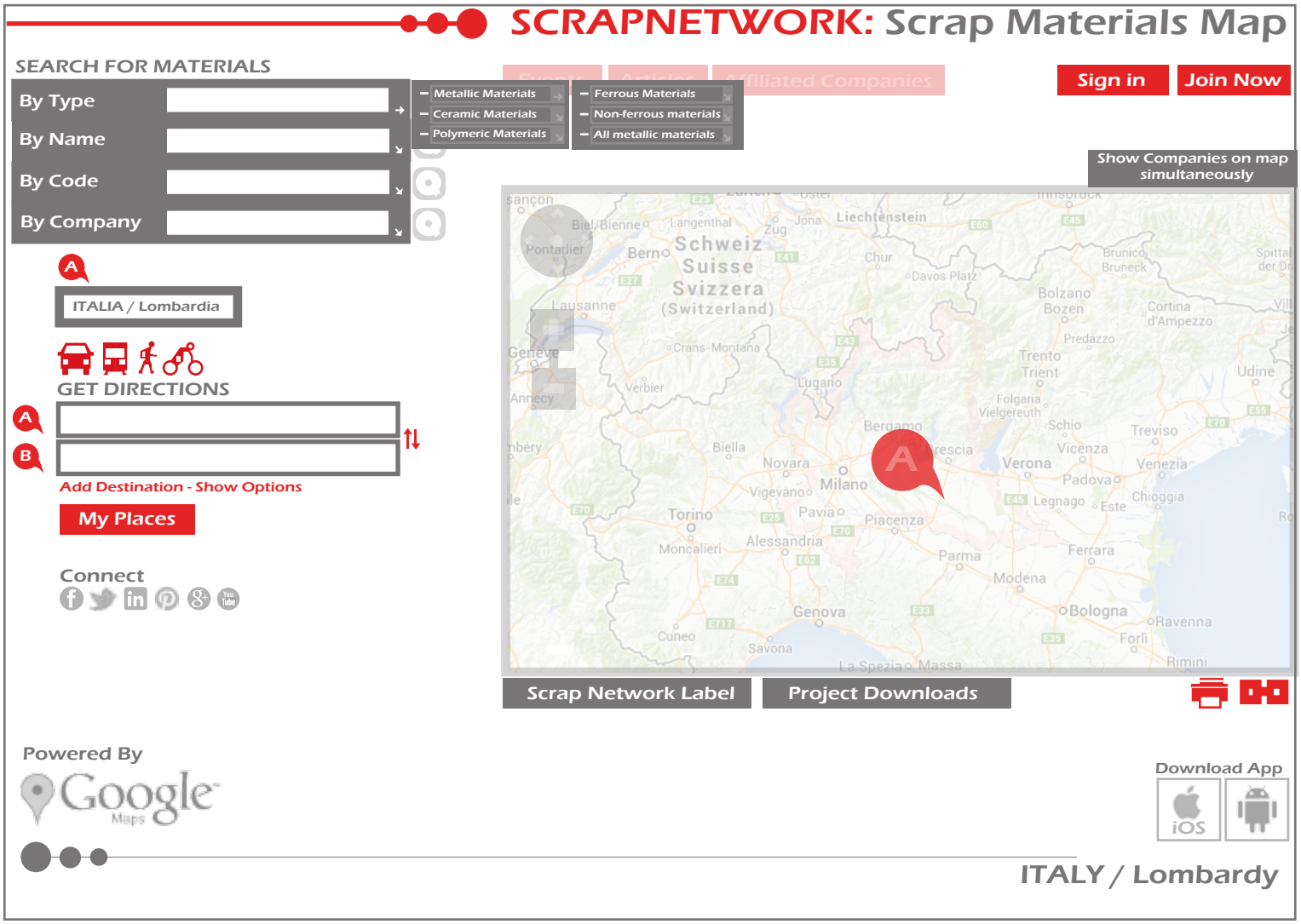


Chart 6.7 Scrap Network: Scrap Materials Map

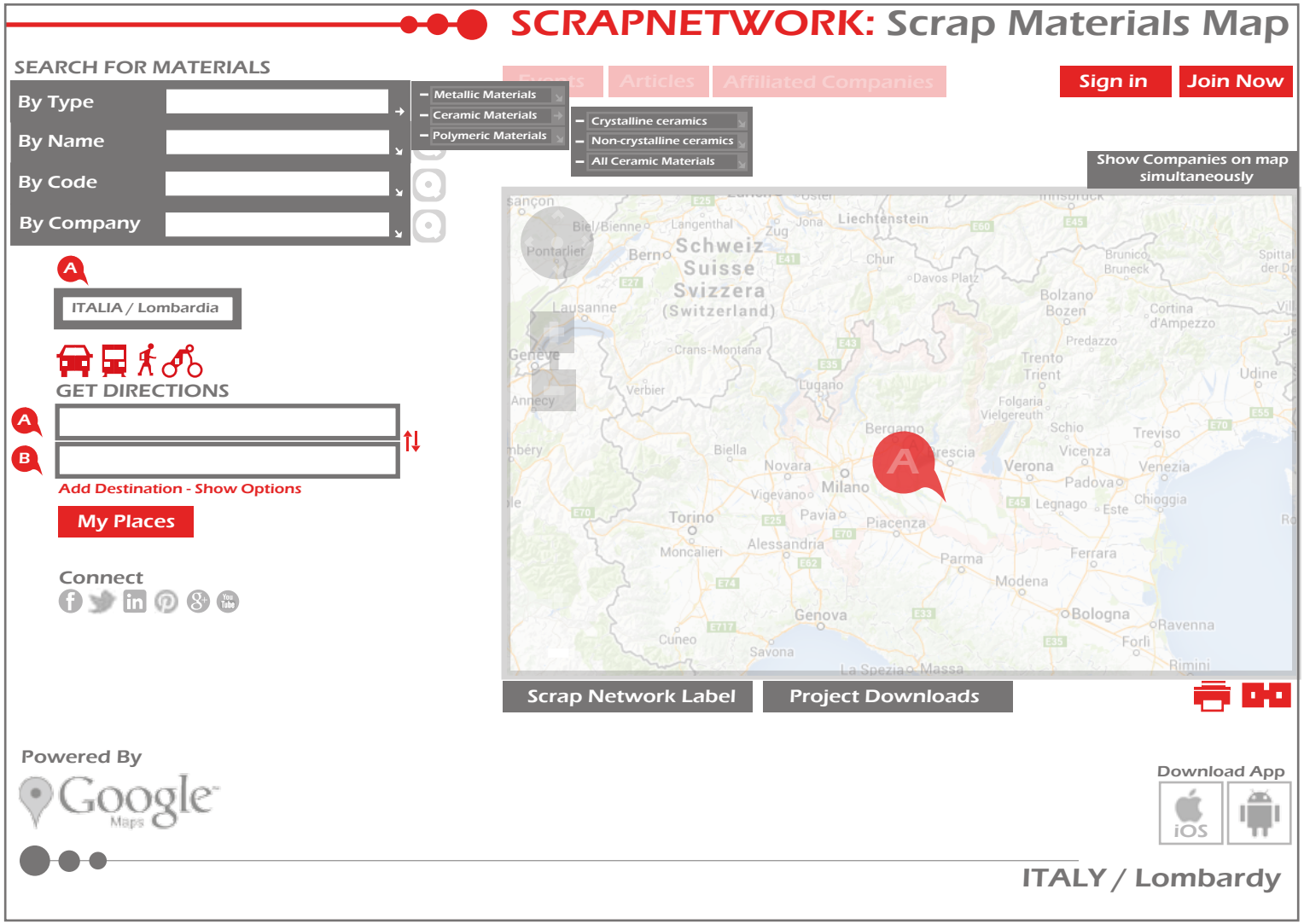


Chart 6.8 Scrap Network: Scrap Materials Map

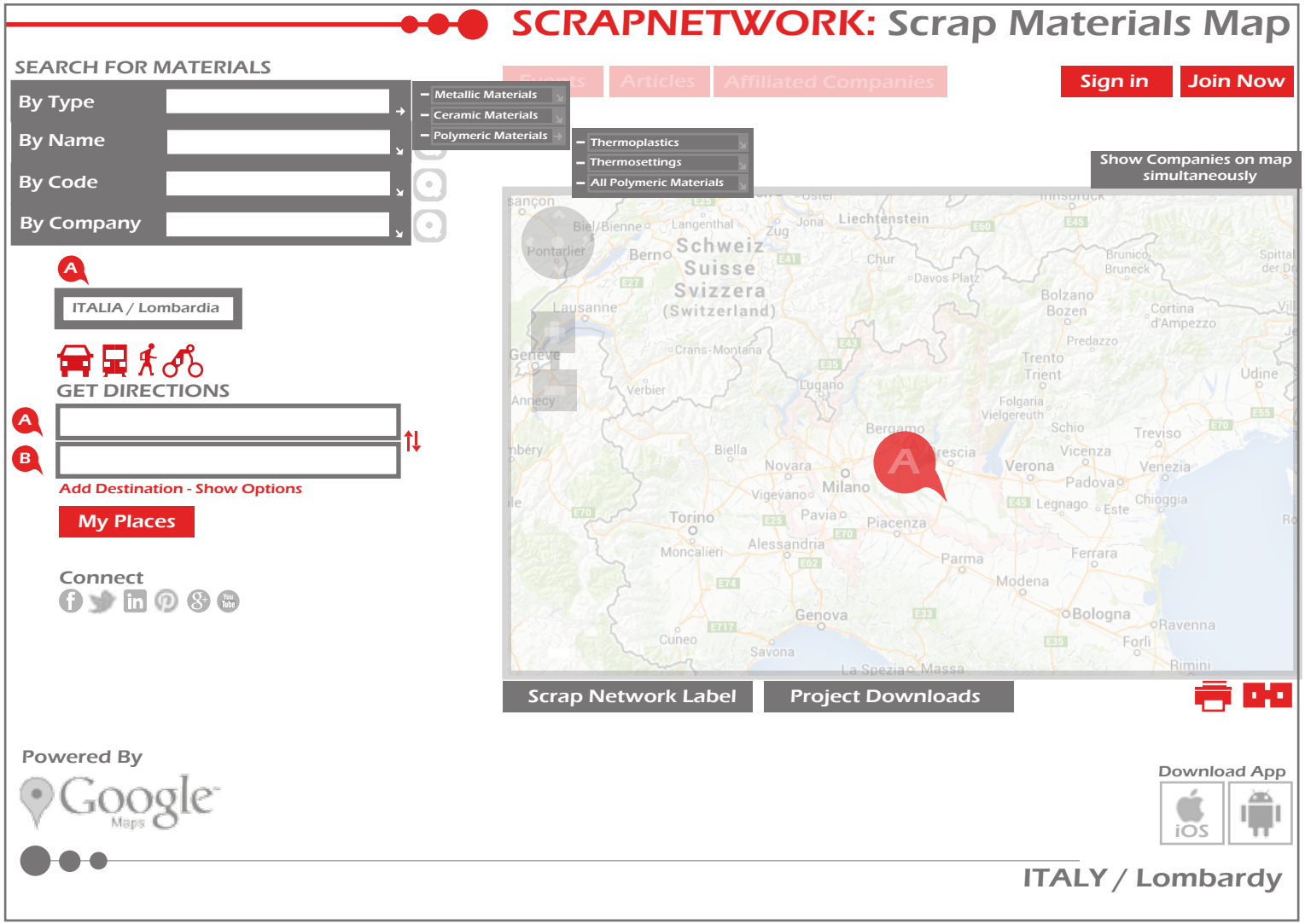


Chart 6.9 Scrap Network: Scrap Materials Map

Chart 6.10 Scrap Network: Scrap Materials Map

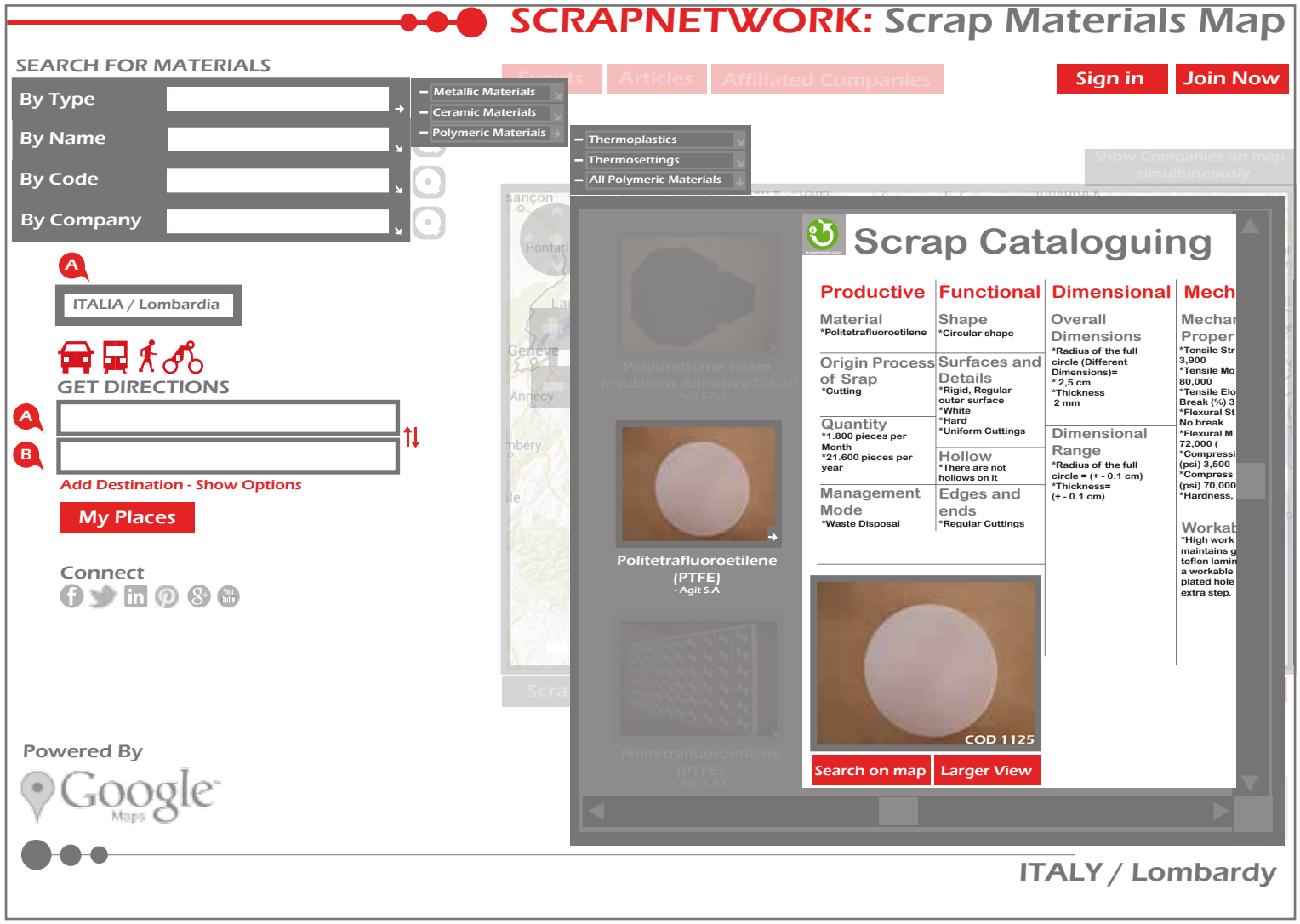


Chart 6.11 Scrap Network: Scrap Materials Map

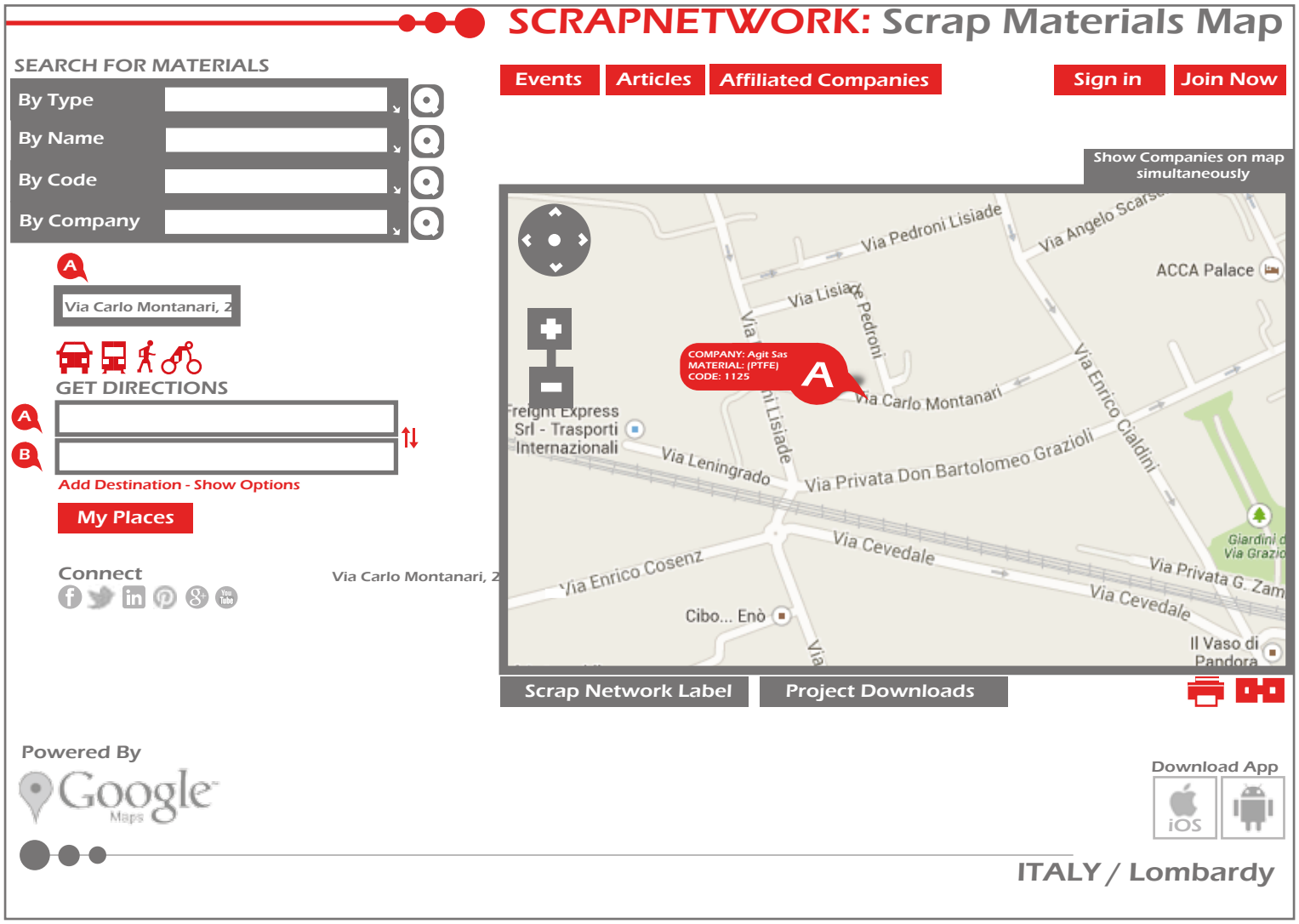


Chart 6.12 Scrap Network: Scrap Materials Map

Chart 6.13 Scrap Network: Scrap Materials Map

6.11. Scrap label certification

The scrap label certification is a graphic certified which is aimed to encourage the business involvement into network, therefore in somehow this logo encourage undertakings and at the same time foster industries to implementing a sustainable product life cycle. Moreover the label offers companies an image of credibility and trust towards users and even more, it can highlight their commitment to the environment.

The label colors are associated with emblematic tones culturally related with ecology and environmental care, inside, there are icons like an arrow in the form of a cyclic flow that symbolize "reuse", in the upper left, the arrow's tail hold up a circle which contains seven circles triangularly arranged close to a semi-oval vertically disposed which when are placed together make up the form of a tree. The tree form means ecology, but beyond that, the true meaning of the white circle and the green tree is "transformation", which can only be read in that way, observing at the same time the upper right which contains the white pieces thrown away by the white circle (that in turn form a white tree) to become a pierced circle with internal holes that displays the green background at which overlaps this circle. This symbolically representation means, the transformation of the raw material for obtaining an object and simultaneously the reusing of pieces that were thrown out by this transformation to create new objects. Finally it should be noted that the entire set of images create the sensation of seeing a face which blinks an eye

Regarding the right to use the scrap label once a company has gotten it, exist some requirements in order to hold it, Before all else the user has to submit to network an updating of its scrap cataloguing chart every 3 months, giving notice of changes and possible novelties as far as scrap is concerned. On the other hand, there is necessary that company demonstrates that it has received requests by users where simultaneously prove that has shared with them their scrap material output, likewise if companies haven't receive requests in the span of three months, doesn't mean that don't have to do updates of its scrap cataloguing chart.

Figure 6.4. Scrapnetwork Label

6. 12. Scrap Network : Economical Support

According with “Fundazione Cariplo” (Cariplo Foundation) it is necessary to give value to goods and cultural activities in order to promote new and creative ideas to encourage entrepreneurs to develop and sustain cultural and creative enterprises. However, Italy in recent years has invested little on it, stopping innovation processes at the internal of cultural institutions. For this reason “ Fundazione Cariplo” has launched the contest “Progetto iC-innovazione cultural - Bando di idée” (IC project - cultural innovation - call for ideas) in order to foster economically the cultural institutions, boosting at the same time innovative ideas for the valorization of goods and cultural activities. Currently (04/11/2013) The scrap network project has entered to compete under the name of “Atlante Materico” hoping to get financial aid to start up this idea, giving to project the opportunity to growing up and evolving quickly itself, thus obtaining a formula for its financial autonomy thereby feeding other cultural realities and new business opportunities.

Figure 6.5. Fondazione Cariplo Logo, Fondazione Cariplo is a resource that helps social and civil organizations better serve their own community.

Figure 6.6. Fondazione Cariplo, IC Project of cultural innovation, context image

7. DESIGNING AND PROJECTING WITH SCRAP MATERIALS

7. Designing and projecting with scrap materials

Designing with scrap materials was an initiative launched during the month of November, The main purpose of this idea was to reuse the materials donated by the companies interested in the project " Scrap Network for a sustainable future" in order to see the diverse relations which may arise between the various collected materials. To successfully carry out this initiative, was created a design workshop at politecnico di Milano University (+ LAB laboratory) on November 15th – 2013, attended by several participants from different professions, wherein they had the opportunity to interact with scraps, transforming them into objects of use or merely like decorating elements, giving a second life to these elements considered useless, using some tools and additional components it was possible to give life to the different creations of participants

The activity was coordinated by Massimo cutini from "Tomake studio", Francesca Ostuzzi member of Politecnico Di Milano, and Ricardo Conde design and engineering student, who carried out this great activity. The various proposals that emerged are shown on the following pages where one can appreciate the results of this activity which lasted nearly 5 hours, worth noting that few of them were showed up in cascina cucagna one of the oldest farmsteads in Milan where was held onthe event " Giacimenti Urbani, turning waste into a resource" on November 22, 23 24, during the event, the attendees could appreciate the work developed during the workshop and furthermore the goals and scopes of scrap network project.

Figure 7.1 . Workshop Ricreando (Invitation) / Politecnico di Milano- Laboratorio + LAB / November 18th - 2013

7.1.Workshop: Ricreando

Nome del prodotto
Topolino
Oggetto Fatto
Elemento Ornamentale
Materiali Riutilizzati
Polibutadiene
Aziende coinvolte in questo Oggetto
Agit S.A.S
Descrizione dell'oggetto
Topolino in gomma piegata che serve come elemento ornamentale
Sfridi Utilizzati

Trancio di Polibutadiene

Workshop: Ricreando

Nome del prodotto
zachte juweel
Oggetto Fatto
Portagioielli
Materiali Riutilizzati
Feltro Bianco
Aziende coinvolte in questo Oggetto
Agit S.A.S
Sfridi Utilizzati
Portagioielli in feltro bianco Il quale è composto da 6 pezzi che contengono i diversi gioielli
Sfridi Utilizzati

Cerchio in Feltro

Nome del prodotto

Penhouder

Oggetto Fatto

Portapenne

Materiali Riutilizzati

Poliuretano Colore Nero (PU) , Poliuretano Colore Blu (PU), Polibutadiene

Aziende coinvolte in questo Oggetto

Agit S.A.S, Extravega Milano , Macri

Descrizione dell'oggetto

Portapenne in poliuretano nero attaccato a un ritaglio in poliuretano blu , con una base in acciaio inossidabile AISI 304 L

Sfridi Utilizzati

Ritagli in Poliuretano

Cubo in Poliuretano

Trancio in Acciaio Inossidabile (AISI 304 L)

Nome del prodotto

Bekerhouder

Oggetto Fatto

Portabicchieri

Materiali Riutilizzati

Poliuretano Colore Blu (PU), Poliuretano Colore rosso (PU), Polibutadiene, Acciaio inossidabile (AISI 304)

Aziende coinvolte in questo Oggetto

Agit S.A.S, Extravega Milano, Macri

Sfridi Utilizati

Portabicchieri in acciaio inossidabile con rivestimenti in Poliuretano

Sfridi Utilizzati

Ritagli in Poliuretano

Trancio di Polibutadiene

Quadrato in acciaio Inossidabile

Nome del prodotto
Wieg Mobiele

Oggetto Fatto
Giostrina sospesa

Materiali Riutilizzati
Feltro Bianco, Acciaio inossidabile (AISI 304) Acciaio inossidabile (AISI 304) Finitura a specchio

Aziende coinvolte in questo Oggetto
Agit S.A.S, Extravega Milano.

Descrizione dell'oggetto
Giostrina sospesa, fatta con acciaio e pezzi di feltro, ha come base un pezzo in acciaio inossidabile con finitura a specchio che riflette le immagini dei cerchi sospesi

Sfridi Utilizzati


Cerchio in Feltro


Pezzi ovali in Acciaio Inossidabile


Rettangolo con bucchi in Acciao Inossidabile con finitura a specchio

Nome del prodotto
Kettingen

Oggetto Fatto
Linea di Collane

Materiali Riutilizzati
Feltro Bianco, Acciaio inossidabile (AISI 304 L), Polietilene tereftalato (PET)

Aziende coinvolte in questo Oggetto
Agit S.A.S, Extravega Milano.

Descrizione dell'oggetto
Collane fatte in feltro, con accessori in acciaio inossidabile e pezzi in polietilene tereftalato

Sfridi Utilizzati


Cerchio in Feltro


Striscia in Polietilene Tereftalato


Cerchio in Acciaio Inossidabile

Nome del prodotto

De fondue

Oggetto Fatto

Fonduta per Cioccolata Calda

Materiali Riutilizzati

Acciaio inossidabile (AISI 304)
Alluminio anodizzato

Aziende coinvolte in questo Oggetto

Extravega Milano.

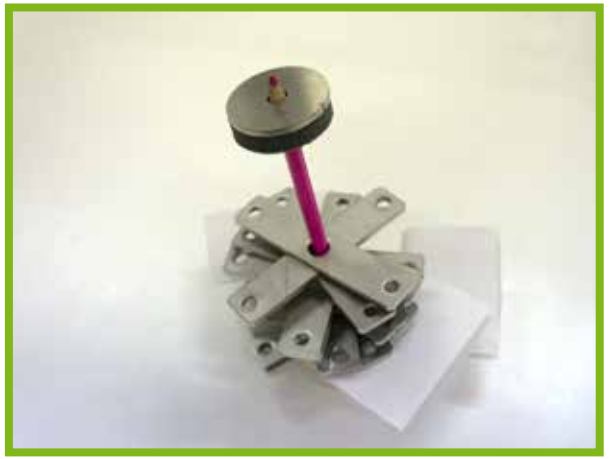
Descrizione dell'oggetto

Mini fonduta per cioccolato fatta in acciaio inossidabile e lastre in Alluminio anodizzato colore Grigio

Sfridi Utilizzati

Lastra in Alluminio Anodizzato

Quadrato in acciaio Inossidabile



Nome del prodotto

Paperweight

Oggetto Fatto

Fermacarte, Note organizer

Materiali Riutilizzati

Feltro Bianco, Acciaio inossidabile (AISI 304),

Aziende coinvolte in questo Oggetto

Agit S.A.S, Extravega Milano.

Descrizione dell'oggetto

Fermacarte realizzato con pezzi di acciaio inossidabile che permettono di dividere delle note scritte sui piccoli fogli, ha una base in feltro bianco.

Sfridi Utilizzati

Cerchio in Feltro

Pezzo Rettangolare in Acciaio inossidabile

Nome del prodotto

Kleefstof

Oggetto Fatto

Portapenne Adesivo

Materiali Riutilizzati

Polietilene tereftalato (PET) , Schiuma di Poliuretano adesiva SR-20

Aziende coinvolte in questo Oggetto

Agit S.A.S

Descrizione dell'oggetto

Portapenne in Polietilene Tereftalato, Il quale ha una base in schiuma di poliuretano adesiva, quello che le permette di attacare delle penne, sulla base anche quando è rovesciato

Sfridi Utilizzati

Striscia in Polietilene Tereftalato

Pezzo Rettangolare in Schiuma di Poliuretano

Nome del prodotto

Mandje

Oggetto Fatto

Cestino di plastica per i vestiti sporchi (Portatile)

Materiali Riutilizzati

Polietilene tereftalato (PET), Politetrafluoroetilene (PTFE)

Aziende coinvolte in questo Oggetto

Agit S.A.S

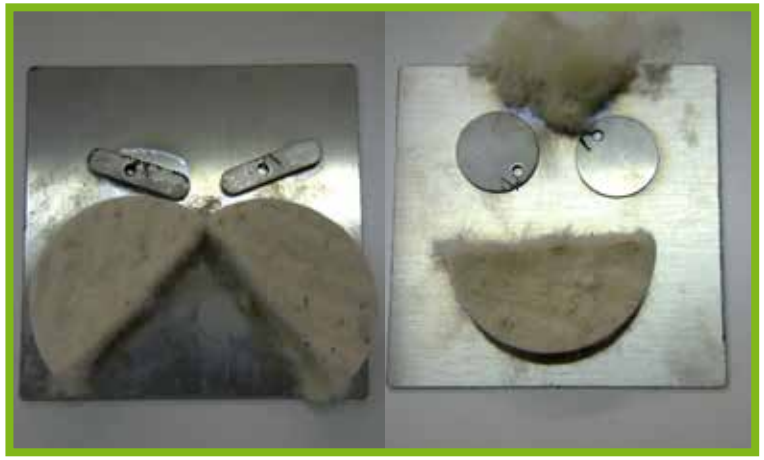
Descrizione dell'oggetto

Cestino di plastica per i vestiti sporchi, a forma di zaino, con due imbottiture per portarlo ovunque.

Sfridi Utilizzati

Lastra in Politetra_ fluoroetilene (PTFE)

Striscia in Polietilene Tereftalato



Nome del prodotto

Gezichten

Oggetto Fatto

Facce Decorative

Materiali Riutilizzati

Feltro Bianco, Acciaio inossidabile (AISI 304)
Acciaio inossidabile (AISI 304 L)

Aziende coinvolte in questo Oggetto

Agit S.A.S, Extravega Milano.

Descrizione dell'oggetto

Facce decorative fatte in Acciaio inossidabile, con dettagli decorativi in feltro Bianco e pezzi di Acciaio Inossidabile.

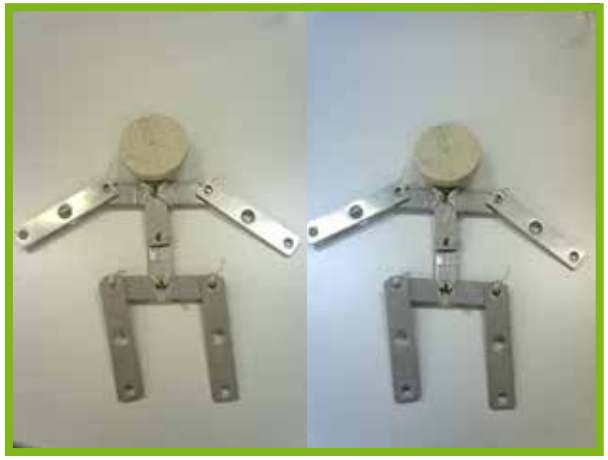
Sfridi Utilizzati

Cerchio in Feltro

Quadrato in acciaio Inossidabile

Pezzi ovali in Acciaio Inossidabile

Cerchio in Acciaio Inossidabile



Nome del prodotto

Poppen

Oggetto Fatto

Bambolo

Materiali Riutilizzati

Feltro Bianco, Acciaio inossidabile (AISI 304),

Aziende coinvolte in questo Oggetto

Agit S.A.S, Extravega Milano.

Descrizione dell'oggetto

Bambolo fatto con pezzi rettangolari in acciaio inossidabile legati tramite una corda, la testa è stata fatta in feltro bianco

Sfridi Utilizzati

Cerchio in Feltro

Pezzo Rettangolare in Acciaio inossidabile

Nome del prodotto

Fles

Oggetto Fatto

Portabottiglie

Materiali Riutilizzati

Poliuretano Colore Blu (PU), Poliuretano Colore rosso (PU)

Aziende coinvolte in questo Oggetto

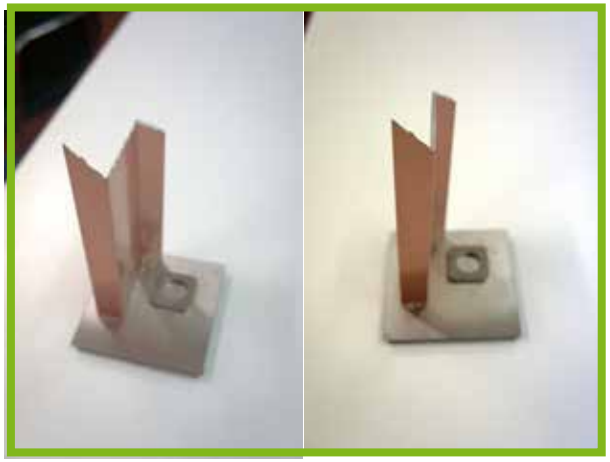
Macri.

Descrizione dell'oggetto

Portabottiglie in poliuretano, di due colori diversi

Sfridi Utilizzati

Ritagli in Poliuretano



Nome del prodotto

Luchter

Oggetto Fatto

Candelabro

Materiali Riutilizzati

Acciaio inossidabile (AISI 304) Finitura a specchio, Acciaio inossidabile (AISI 304), Alluminio Anodizatto (Colore Rame)

Aziende coinvolte in questo Oggetto

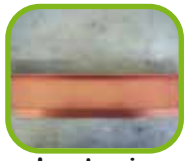
Extravega Milano.

Descrizione dell'oggetto

Candelabro a una candela in acciaio inossidabile e in alluminio anodizatto colore rame

Sfridi Utilizzati

Quadrato in acciaio Inossidabile



Lastra in Alluminio Anodizatto (Colore Rame)

quadrato perforato in Acciao inossidabile (AISI 304) Finitura a specchio)

7.2 Workshop Ricreando "Designing with scrap"

Ricreando was an interdisciplinary workshop of co-design led by Ricardo Conde (Design and engineering – student at Politecnico di Milano university) and the architect Massimo Cutini From Tomake Studio, with the active participation of Giulio Natta department from Politecnico di Milano, with the aim of creating a self –made activity, where participants could design everyday objects using as raw material the industrial scraps donated for companies involved in the project "Scrap Network for an Industrial sustainability at the Lombardy region". The activity was carried out at Politecnico di Milano University, on November 15 , it began at 13:30 pm and conclude at 18:30. This event was attended by people from different professions (related with design) , was predominated by design and engineering students, nonetheless there was an architect and an interior designer which got a different perspective to activity. The total number of participants were 8.

During activity, Participants had at their disposal different scrap materials with a predominance of plastics and metals which were donated by 3 important companies, Macry, Extravega Milano and AGit S.A.S, which kindly helped us to carry out this great activity, the first one has an extensive experience in the plastic form sector it creates items for home, sports, cars, free time, construction and general industry , the second one design and create floors, partition walls, furniture, lighting, coverings, technical locks, stairs, windows, doors, façade, plasterboards and ceilings among other architectural type things and the last one manufactures gaskets, mechanical parts and components design according to costumer request . Such materials were made available on the work tables along with several instruments for their transformation, the work with all these elements was frequently monitored and after the event was performed a small exhibition of products.

As mentioned earlier, the workshop Ricreando was an activity which had as its fundamental principle the reuse of discarded materials in order to give them a second life, in this line of thought the fundamental exercise of this activity consisted in projecting everyday objects or merely decorative elements using as feedstock, the scraps donated by participating companies. Among other things, this activity was aimed for encouraging people to reuse materials already thrown away but above all encouraging participants to designing freely using as inspiration the default textures and forms of scraps . It is evident that shapes, colors, textures and inherent properties printed on these scraps, fostered creativity this proven by the large number of objects created during "self – made" exercise.

This activity carried out on November 15, allowed the project to correlate different types of scraps, furthermore became evident the scope that may have the reuse of scraps generated by different companies inasmuch as it opens the range of material choices for designers. Thereby this workshop is a verification method of network performance, where has been tested the positive impact that can be obtained when are performing design projects, using scrap materials of various types and from various companies.

Between the achievements of this activity worth noting that workshop products were exhibit at Cascina Cucagna, at the invitation of “+ Lab" from Politecnico di Milano , some products, some scrap samples and project guidelines were showed up, obtaining very positive reviews and a quite pleasant acceptance by the public, moreover, during conferences on Sunday 24th (November) was possible to establish dialogues with individuals and entities directly involved with this issue, who made interesting unbiased reviews which has strengthened the project and besides have provided viewpoints that would allow become a reality this project in the near future.

Figure 7.2 . Event Poster / “ Giacimenti Urbani, turning waste into a resource”/ Cascina Cucagna/ 22, 23 24 November 2013

Figure 7.3 . “Scrap Network for an Industrial sustainability at the Lombardy region”/ Cascina Cucagna/ 22, 23 24 November - 2013

As mentiones earlier, Cascina Cucagna Is a multifunctional centre dedicated to culture, the environment, food and social activities, a new public space for the city of Milan and its sustainable development. during the days 22, 23 24 November 2013, took place the event “ Giacimenti Urbani, turning waste into a resource” Which had hundreds of participants interested in “reuse of resources”. At this location were shown works and projects involved with reuse of materials, recycling and environmental sustainability. The project “Scrap Network for an Industrial sustainability at the Lombardy region” was exhibited at the stand of + Lab, the various samples and content of project shared space with 3d printings and sustainable projects made by + LAB, through them it was possible publicize the project.

Figure 7.4 . + Lab Exhibition / Cascina Cucagna / Stand where was shown the Project “Scrap Network” / 22, 23 24 November - 2013

Figure 7.5 . “Scrap Network for an Industrial sustainability/ Stand / Cascina Cucagna

Figure 7.6 . Necklaces made at Ricreando Workshop / Cascina Cucagna

Figure 7.7 . + Lab Exhibition / on the left side it can be observed the Stand where was shown the Project “Scrap Network” /Cascina Cucagna /

Figure 7.8 . “Scrap Network for an Industrial sustainability/ exhibition at the stand of + Lab / Cascina Cucagna “Giacimenti Urbani, turning waste into a resource” event / 22, 23 24 November

Figure 7.9 . “Scrap Network for an Industrial sustainability/ Workshop Ricreando Products/Topolino/ Cascina Cucagna “Giacimenti Urbani, turning waste into a resource” event / 22, 23 24 November

Figure 7.10 “Scrap Network for an Industrial sustainability/ Workshop Ricreando Products/Portapenne Adesivo/ Cascina Cucagna “Giacimenti Urbani, turning waste into a resource” event / 22, 23 24 November

7.3. SCRAPNETWORK: Scrap Catalogue

Productive

Material
*Carbon Fiber cloth

Origin Process of Srap
*Cutting

Quantity
*160 pieces per Month
* 1920 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 25 cm
*Width= 20 cm
*Thickness=0,25 mm

Dimensional Range
*Length= 25 cm (+-5mm)
*Width= 20 cm (+-5mm)
*Length and Width vary depending on the lot

Company

Company name
Skorpion Prototyping

Contact Details
Piazza Centro Commerciale , 48 località Mi Felice – 20090 Segrate (MI) Tel.+39 02 36-507589

Functional

Shape
*Rectangle shape

Surfaces and Details
*smooth outer surface
*Axial Orthogonal Fiber Reinforcement

Hollow
*Production of hollow carbon fibers includes baking and carbonization of polymer particles having a specified volume after deformation.

Edges and ends
*Irregular Cutting faces.

Sensory

Tactile Aspects
*Texture:
-Smooth / Regular
*Touch:
-Cold, Soft, Flowing Light
*Brillancy
-Gloss

Photometric Aspects
- Glossiness

Physical

Thermal Properties
*ThermalExp. Co-ef. 0° or 90°= 2.1 Strain/K
* Thermal Conductivity = 0.250 W/m-K
*Specific Heat Capacity = 0.710 J/g-°C

Electrical Properties
*High Electrical Conductivity

Optical Properties
*Black
*Glosiness

Properties of durability
* Lasting durability.

Environmental Properties
-chemically inert
-Non-corrosive

Mechanical

Mechanical Properties
*Young's Modulus 0°= 70 Gpa
*Young's Modulus 90°= 70 Gpa
*In-plane Shear Modulus= 5 Gpa
* Ult. Tensile Strength 0°= 600 Mpa
*Ult. Comp. Strength 0°= 570 Mpa
*Ult. Tensile Strength 90°= 600 Mpa
*Ult. Comp. Strength 90°= 570 Mpa

Workability
* Polymerization
*Spinning
*Oxidation
* Stabilizing
* Carbonization
*Surface treatment and sizing

1

SCRAPNETWORK: Catalogo Sfridi

Productive

Material
Polymethyl- methacrylate

Origin Process of Srap
* Milling

Quantity
*64 pieces per Month
* 768 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 60 cm
*Width= 30 cm
*Thickness=0,25 cm

Dimensional Range
*Length= 60 cm (+-7mm)
*Width= 30 cm (+-7)
*Length and Width vary depending on the lot

Company

Company name
Skorpion Prototyping

Contact Details
Piazza Centro Commerciale , 48 località Mi Felice – 20090 Segrate (MI) Tel.+39 02 36-507589

Functional

Shape
*Irregular Rectangle

Surfaces and Details
*Smooth outer surface
*Transparence
*Uniform Lateral Cuts
*Irregular Internal Cuts

Hollow
*Of a rectangular shape

Edges and ends
*Regular Cutting faces

Sensory

Tactile Aspects
*Texture:
-Rigid
*Touch:
-Cold
-Hard
-Flowing
-Light
*Brillancy
-Gloss

Photometric Aspects
-Transparent

Physical

Thermal Properties
*Coefficient of thermal expansion (x10-6 K-1) 70-77
*Specific heat (J K-1 kg-1) 1400 - 1500
*Thermal conductivity 23C (W m-1 K-1) 0.17-0.19
* Upper working temperature (C) 50 to 90

Electrical Properties
*Dielectric constant 1MHz 2.6
*Dielectric strength (kV mm-1) 15
Dissipation factor 1MHz 0.014
Surface resistivity (Ohm/sq) 1014
Volume resistivity (Ohmcm)2-14 x 1015

Optical Properties
*Transparent

Properties of durability
*Excellent resistance (no attack) to Mineral Oils Good resistance (minor attack) to Dilute Acids, Aldehydes and Aliphatic Hydrocarbons
*The outstanding chemical stability very often ensures a service time beyond 10 or even 20 years.

Environmental Properties
*Excellent resistance (no attack) to Mineral Oils Good resistance (minor attack) to Dilute Acids, Aldehydes and Aliphatic Hydrocarbons
*The outstanding chemical stability very often ensures a service time beyond 10 or even 20 years.

Mechanical

Mechanical Properties
*Elongation at break (%) 2.5-4
*Hardness - Rockwell M92-100
*Izod impact strength (J m-1) 16-32
*Poisson's ratio 0.35 - 0.4
*Tensile modulus (GPa) 2.4-3.3
*Tensile strength (MPa) 80

Workability
*Laser cutting
*Milling
* joined using cyanoacrylate
*trichloromethane to dissolve the plastic at the joint

2

Productive

Material
Polymethyl- methacrylate

Origin Process of Srap
* Milling

Quantity
*124 pieces per Month
* 1488 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 7cm
*Width= 7 cm
*Thickness=0,25 cm

Dimensional Range
*Length= 7 cm (+-1mm)
*Width= 7 cm (+-1)
*Length and Width vary depending on the lot

Company

Company name
Skorpion Prototyping

Contact Details
Piazza Centro Commerciale , 48 località Mi Felice – 20090 Segrate (MI) Tel.+39 02 36-507589

Functional

Shape
*Regular shape

Surfaces and Details
*Smooth outer surface
*Transparence
*Uniform Lateral Cuts
*Irregular Internal Cuts

Hollow
*Of a rectangular shape

Edges and ends
*Regular Cutting faces

Sensory

Tactile Aspects
*Texture:
-Rigid
*Touch:
-Cold
-Hard
-Flowing
-Light
*Brillancy
-Gloss

Photometric Aspects
-Transparent

Physical

Thermal Properties
*Coefficient of thermal expansion (x10-6 K-1) 70-77
*Specific heat (J K-1 kg-1) 1400 - 1500
*Thermal conductivity 23C (W m-1 K-1) 0.17-0.19
* Upper working temperature (C) 50 to 90

Electrical Properties
*Dielectric constant 1MHz 2.6
*Dielectric strength (kV mm-1) 15
Dissipation factor 1MHz 0.014
Surface resistivity (Ohm/sq) 1014
Volume resistivity (Ohmcm)2-14 x 1015

Optical Properties
* Transparent Yellow

Properties of durability
*Excellent resistance (no attack) to Mineral Oils Good resistance (minor attack) to Dilute Acids, Aldehydes and Aliphatic Hydrocarbons
*The outstanding chemical stability very often ensures a service time beyond 10 or even 20 years.

Environmental Properties
*Depolymerisation, is used industrially to recycle PMMA and to produce MMA which can be used again.
*PMMA can also be reground, melted and extruded into new products.

Mechanical

Mechanical Properties
*Elongation at break (%) 2.5-4
*Hardness - Rockwell M92-100
*Izod impact strength (J m-1) 16-32
*Poisson's ratio 0.35 - 0.4
*Tensile modulus (GPa) 2.4-3.3
*Tensile strength (MPa) 80

Workability
*Laser cutting
*Milling
* joined using cyanoacrylate
*trichloromethane to dissolve the plastic at the joint

3

Productive

Material
Polymethyl- methacrylate

Origin Process of Srap
* Milling

Quantity
*130 pieces per Month
* 1560 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 40 cm
*Width= 20 cm
*Thickness=0,25 cm

Dimensional Range
*Length= 40 cm (+-2mm)
*Width= 20 cm (+-2)
*Length and Width vary depending on the lot

Company

Company name
Skorpion Prototyping

Contact Details
Piazza Centro Commerciale , 48 località Mi Felice – 20090 Segrate (MI) Tel.+39 02 36-507589

Functional

Shape
*Irregular Rectangle

Surfaces and Details
*Smooth outer surface
*Transparence
*Uniform Lateral Cuts
*Irregular Internal Cuts

Hollow
*Of a rectangular shape

Edges and ends
*Regular Cutting faces

Sensory

Tactile Aspects
*Texture:
-Rigid
*Touch:
-Cold
-Hard
-Flowing
-Light
*Brillancy
-Gloss

Photometric Aspects
-Transparent

Physical

Thermal Properties
*Coefficient of thermal expansion (x10-6 K-1) 70-77
*Specific heat (J K-1 kg-1) 1400 - 1500
*Thermal conductivity 23C (W m-1 K-1) 0.17-0.19
* Upper working temperature (C) 50 to 90

Electrical Properties
*Dielectric constant 1MHz 2.6
*Dielectric strength (kV mm-1) 15
Dissipation factor 1MHz 0.014
Surface resistivity (Ohm/sq) 1014
Volume resistivity (Ohmcm)2-14 x 1015

Optical Properties
* Transparent Yellow

Properties of durability
*Excellent resistance (no attack) to Mineral Oils Good resistance (minor attack) to Dilute Acids, Aldehydes and Aliphatic Hydrocarbons
*The outstanding chemical stability very often ensures a service time beyond 10 or even 20 years.

Environmental Properties
*Depolymerisation, is used industrially to recycle PMMA and to produce MMA which can be used again.
*PMMA can also be reground, melted and extruded into new products.

Mechanical

Mechanical Properties
*Elongation at break (%) 2.5-4
*Hardness - Rockwell M92-100
*Izod impact strength (J m-1) 16-32
*Poisson's ratio 0.35 - 0.4
*Tensile modulus (GPa) 2.4-3.3
*Tensile strength (MPa) 80

Workability
*Laser cutting
*Milling
* joined using cyanoacrylate
*trichloromethane to dissolve the plastic at the joint

4

Productive

Material
* Felt Gray

Origin Process of Srap
* Turning Operations (Die Cut)

Quantity
*300pieces per Month
* 3600 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 25 cm
*Width= 25 cm
*Thickness=0,25 mm

Dimensional Range
*Length= 25 cm (+-2mm)
*Width= 20 cm (+-2mm)

Company

Company name
Skorpion Prototyping

Contact Details
Piazza Centro Commerciale , 48 località Mi Felice – 20090 Segrate (MI) Tel.+39 02 36-507589

Functional

Shape
*Square shape

Surfaces and Details
*Rough outer surface
*Soft Surface

Hollow
*There are not hollows on it

Edges and ends
*Regular Cutting faces

Sensory

Tactile Aspects
*Texture:
-Smooth / Uneven
*Touch:
-Warm
-Soft
-Stilted
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
*Low thermal conductivity (W/m K)= 0.04
*excellent insulation properties
*Resists Thermal Shock

Electrical Properties
*Low electrical conductivity

Optical Properties
*Gray
*Opaque

Properties of durability
*Felt is a shock absorbing material. It has high resiliency, low compression set, and long life characteristics.

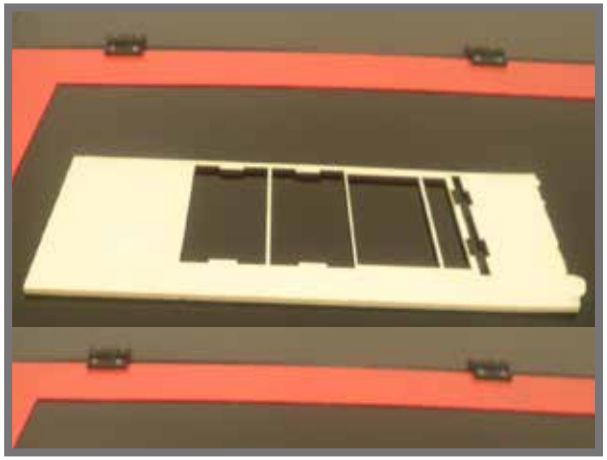
Environmental Properties
*Recyclable

Mechanical

Mechanical Properties
*Tensile Strength ³ psi 300
* Slit Resistance ³ psi 16
* Resiliency is controlled by selected combinations of densities and fibers.
*Low coefficient of friction

Workability
Basically, there are two methods of manufacturing felt fabrics:
Wet felting (traditional felting)
Needle-felting (Dry felting)
It's important to transformate the material:
*soapy water to fleece and agitate
*Cutting instruments

5



Productive

Material
* Balsa wood

Origin Process of Srap
* Cutting

Quantity
*80 pieces per Month
* 960 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 45 cm
*Width= 20 cm
*Thickness=0,20 cm

Dimensional Range
*Length= 60 cm (+-2mm)
*Width= 30 cm (+-2)
*Length and Width vary depending on the lot

Company

Company name
Skorpion Prototyping

Contact Details
Piazza Centro Commerciale , 48 località Mi Felice – 20090 Segrate (MI) Tel.+39 02 36-507589

Functional

Shape
*Irregular Rectangle

Surfaces and Details
*Smooth outer surface
*Rigid
*Cream Color
*Uniform Lateral Cuts
*Regular Internal Cuts

Hollow
*two kinds of

Edges and ends
*Regular Cutting faces

Sensory

Tactile Aspects
*Texture:
-Rigid
*Touch:
-Warm
-Hard
-Stilted
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
*Service temperature -80 . 120 °C
*Thermal conductivity -0.03 - 0.07 W/m.K
*Thermal expansion -40 - 55 e-6/K

Electrical Properties
Dielectric Constant (relative to air) 1.37 @ 1 MHz

Optical Properties
*Cream Color
*Opaque

Properties of durability
*Service temperature -80 . 120 °C
*Thermal conductivity -0.03 - 0.07 W/m.K
*Thermal expansion -40 - 55 e-6/K

Environmental Properties
Dielectric Constant (relative to air) 1.37 @ 1 MHz

Mechanical

Mechanical Properties
*Service temperature -80 . 120 °C
*Thermal conductivity -0.03 - 0.07 W/m.K
*Thermal expansion -40 - 55 e-6/K

Workability
Dielectric Constant (relative to air) 1.37 @ 1 MHz

6

Productive

Material
* Cooper

Origin Process of Srap
* Blanking

Quantity
*18.000 pieces per Month
*216.000 pieces per year

Management Mode
* On Sale
(1,50 €/Kg)

Dimensional

Overall Dimensions
*Radius of the full circle (Different Dimensions)=
* 3.75 cm
*Thickness (Different Dimensions)=
1.4 mm

Dimensional Range
*Radius of the full circle = (+ - 0.75 cm)
*Thickness=
(+ - 0.2 cm)

Functional

Shape
*Circular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*There are not hollows on it

Edges and ends
*Regular Cutting

Sensory

Tactile Aspects
*Texture:
-Rigid/ Regular
*Touch:
-Cold
-Hard
-Flowing
-Weighty
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Company

Company name
AGIT s.a.s

Contact Details
Via Montanari 25
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fax +39 02 375691
http://www.agit.it/

Physical

Thermal Properties
*High Thermal Conductivity

Electrical Properties
*High electrical Conductivity (59.6×106 S/m)

Optical Properties
*Glossiness
*Redish Color

Properties of durability
*Copper is a sustainable material. Its durability offers long service with little maintenance.

Environmental Properties
*100% recyclable without any loss of quality
*Copper does not react with water, but it slowly reacts with atmospheric oxygen forming a layer of brown-black copper oxide. In contrast to the oxidation of iron by wet air, this oxide layer stops the further, bulk corrosion.

Mechanical

Mechanical Properties
*0.2%Proof Strength:
50-340 Mpa
*Tensile Strength
200-400 Mpa
*Elong'n
50-5
* low hardness and high ductility

Workability
Prestigious appearance, and ability to form complex shapes.

7

Productive

Material
* Cooper

Origin Process of Srap
* Blanking

Quantity
*13.000 pieces per Month
*156.000 pieces per year

Management Mode
* On Sale
(1,50 €/Kg)

Dimensional

Overall Dimensions
*Length= 60 cm
*Width= 12 cm
*Thickness=0.3 cm
*Length= 80 cm
*Width= 12 cm
*Thickness=0.4cm
*Length= 100 cm
*Width= 12 cm
*Thickness=0.5 cm
*Length= 60
*Width= 12 cm
*Thickness= 0.6 cm
*Length= 60
*Width= 12 cm
*Thickness= 0.7 cm

Dimensional Range
*Length= (+ -)20 cm
*Width= (+ -) 0 cm
*Thickness=(+ -)
0.1 cm

Functional

Shape
*Rectangle Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*There are circular hollows on it

Edges and ends
*Regular Cutting faces

Sensory

Tactile Aspects
*Texture:
-Rigid/ Regular
*Touch:
-Cold
-Hard
-Flowing
-Weighty
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Company

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Physical

Thermal Properties
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Electrical Properties
*High electrical Conductivity (59.6×106 S/m)

Optical Properties
*Glossiness
*Redish Color

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*Copper is a sustainable material. Its durability offers long service with little maintenance.

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*100% recyclable without any loss of quality
*Copper does not react with water, but it slowly reacts with atmospheric oxygen forming a layer of brown-black copper oxide. In contrast to the oxidation of iron by wet air, this oxide layer stops the further, bulk corrosion.

Mechanical

Mechanical Properties
*0.2%Proof Strength:
50-340 Mpa
*Tensile Strength
200-400 Mpa
*Elong'n
50-5
* low hardness and high ductility

Workability
Prestigious appearance, and ability to form complex shapes.

8

Productive

Material
* Brass
Free-Cutting Brass, UNS C36000

Origin Process of Srap
* Blanking

Quantity
*15.000 pieces per Month
*180.000 pieces per year

Management Mode
*On Sale= (2 €/Kg)
*Waste Dispossal

Dimensional

Overall Dimensions
*Radius of the full circle (Different Dimensions)=
* 2.35 cm
*Thickness
1.2 mm

Dimensional Range
*Radius of the full circle = (+ - 0.15 cm)
*Thickness=
(+ - 0.1 cm)

Functional

Shape
*Circular shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
-Rigid/ Regular
*Touch:
-Cold
-Hard
-Flowing
-Weighty
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Company

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Physical

Thermal Properties
*CTE, linear
250°C
20.5 µm/m-°C
*Thermal Conductivity
115 W/m-K
*Melting Point
885 - 900 °C
*Solidus
885 °C
*Liquidus
900 °C

Electrical Properties
*High electrical conductivity
*% Conductivity
= 28 %

Optical Properties
*Yellow Color
*Glossiness

Properties of durability
Basic brass has approximately 67% copper and 33% zinc, making it stronger and more durable than copper

Environmental Properties
*Available for recycling

Mechanical

Mechanical Properties
*Tensile Strength, Ultimate
338 - 469 MPa
*Tensile Strength, Yield
124 - 310 MPa
*Elongation at Break
53%
*Modulus of Elasticity
97 GPa
*Bulk Modulus
140 GPa
Poisson's Ratio
0.31
Shear Modulus
37 GPa

Workability
*Brass combines good machinability with excellent cold workability

9

Productive

Material
*Aluminum

Origin Process of Srap
*Cutting

Quantity
*19.000 pieces per Month
*228.000 pieces per year

Management Mode
*On Sale=
kg 0,75 Eu/kg

Dimensional

Overall Dimensions
*Radius of the full circle (Different Dimensions)=
* 2 cm
*Thickness
0.5 mm

Dimensional Range
*Radius of the full circle = (+ - 0.15 cm)
*Thickness=
(+ - 0.1 cm)

Functional

Shape
*Circular shape

Surfaces and Details
*Smooth flowing outer surface
*Gloss
* Rigid
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
-Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Weighty
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Company

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Physical

Thermal Properties
*Thermal conductivity of aluminium is about three times greater than that of steel.
244 W/mK for the temperature range 0-1000 C

Electrical Properties
*High electrical conductivity (at 200 C is 63.8%
*High resistivity (at 200 C is 2.69 microohm cm)

Optical Properties
*Gray
Translucent

Properties of durability
*Aluminium is extremely durable in neutral and slightly acid environments. In environments characterised by high acidity or high basicity corrosion is rapid.

Environmental Properties
*Recyclable
*Generates Enviromental and Energy Savings

Mechanical

Mechanical Properties
*Low tensile strength, tensile strength increases with decreasing temperature. 90 Mpa
*Shear Strength
50 (MPa)
*Elongation A5
42(%)
*Hardness Vickers
20 (HV)

Workability
*Aluminium is easily worked using most machining methods – milling, drilling, cutting, punching, bending, etc. Furthermore, the energy input during machining is low.
-Aluminium's superior malleability
_Features facilitating easy jointing: Fusion welding, Friction Stir Welding, bonding and taping

10

Productive

Material
*Silicone rubber

Origin Process of Srap
*Cutting

Quantity
*5.400 pieces per Month
*64.800 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Radius of the full circle (Different Dimensions)=
* 3,4 cm
*Thickness
2 mm

Dimensional Range
*Radius of the full circle = (+ - 0.15 cm)
*Thickness=
(+ - 0.1 cm)

Functional

Shape
*Circular shape

Surfaces and Details
*Smooth flowing outer surface
*Opaque
*Soft
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
-Smooth / Regular
*Touch:
-Warm
-Soft
-Stilted
-Light
*Brillancy
-Mate

Photometric Aspects
-Glossiness

Company

Company name
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Physical

Thermal Properties
*Low thermal conductivity.
* Thermal stability (constancy of properties over a wide temperature range of −100 to 250 °C)
*Good thermal resistance

Electrical Properties
*Electrical insulation properties

Optical Properties
*Orange
*Opaque

Properties of durability
*Very durable and resilient under extreme conditions and harsh environments
*Are virtually unafected by weather conditions such as sunlight, UV-Radiation, rain snow, atmospheric gases and extreme temperature changes
*are very resilient to water, even at boiling point temperature.

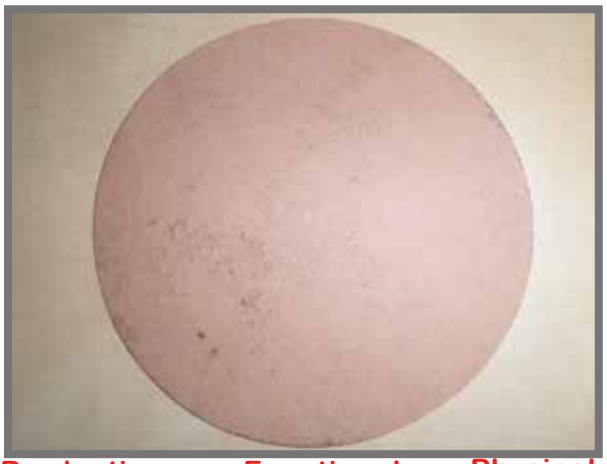
Environmental Properties
*Solid" silicones enter the environment as a component of domestic or industrial waste and will be either land filled or incinerated. In the latter case, they are converted back to inorganic ingredients.

Mechanical

Mechanical Properties
*Hardness, shore A 10–90
*Tensile strength 11 N/mm²
*Elongation at break 100–1100%

Workability
*Die Cutting
* Laser cutting
*Silicone rubber is the most difficult polymer to join to anything using adhesives. a silicone adhesive, such as Devcon adhered well to a %100.

11



Productive

Material
*Cardboard

Origin Process of Srap
*Cutting

Quantity
*2.300 pieces per Month
*27.600 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Radius of the full circle (Different Dimensions)=
* 2.5 cm
*Thickness
0.7 mm

Dimensional Range
*Radius of the full circle = (+ - 0.1 cm)
*Thickness=
(+ - 0.1 cm)

Functional

Shape
*Circular shape

Surfaces and Details
*Smooth, Stilted outer surface
*Opaque
*Rigid
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Uneven
*Touch:
-Warm
-Hard
-Stilted
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Company

Company name
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Physical

Thermal Properties
*Thermal conductivity k
(W.m-1.K-1)= 0.21
*Good insulator because it is a comparatively poor heat conductor

Electrical Properties
*No impairment of electrical properties

Optical Properties
*Cream Color
*Opaque

Properties of durability
* Cardboard is known for its durability. The wood fibers that make up cardboard are strong and resilient. Cardboard is puncture resistant and does not tear easily. The arched design of the interior fluting lends durability to the cardboard as well. The fluting is lined up vertically, so the interior paper forms columns that are able to support a great deal of weight.

Environmental Properties
*Since cardboard is made up of wood fibers, it is recyclable and sustainable.

Mechanical

Mechanical Properties
*Modullus of elasticity 2-20 Gpa
*Max Stress Compression5-10 Mpa
*Max Stress Tension 15-45 Mpa
*Max Strain1.5 - 2.5 %

Workability
*Cutting (manual-electro/mechanical Mechanical)
* Easy to join to anything and between them using adhesives.

12

Productive

Material
*Flexible Poly Vinyl Chloride (Sheets)

Origin Process of Srap
*Cutting

Quantity
*1.500 pieces per Month
*18.000 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Radius of the full circle (Different Dimensions)=
* 3 cm
*Thickness
2 mm

Dimensional Range
*Radius of the full circle = (+ - 0.1 cm)
*Thickness=
(+ - 0.1 cm)

Company

Company name
AGIT s.a.s

Contact Details
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Functional

Shape
*Circular shape

Surfaces and Details
*Smooth, Regular outer surface
*trasparent
*Soft
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Regular
*Touch:
-Cold
-Soft
-Flowing
-Light
*Brillancy
-Gloss

Photometric Aspects
-Translucent

Physical

Thermal Properties
*Thermal conductivity [W/(m·K)]
= 0.14–0.17
*Coefficient of thermal expansion (linear) [mm/(mm °C)]
= 5×10−5

Electrical Properties
*Resistivity [Ω m]
= 1012–1015
* Surface Resistivity [Ω]
= 1011–1012

Optical Properties
*Translucent

Properties of durability
*Resistance to oxidation by atmospheric oxygen.
*Highly resistant to oxidative reactions
*Maintains its performance for a long time.
* Deterioration by oxidation in extended use conditions.
* Is resistant to acid, alkali and almost all inorganic chemicals.
* Is resistant to sunlight, weathering and flame resistant

Environmental Properties
It's not biodegradable or degradable
*Studies of animals show that some of these chemicals are may cause cancer, kidney and reproductive system damage.
*PVC is also difficult to recycle given the presence of additives including heavy metals such such as lead and cadmium; in fact it's considered a contaminant in other recycling streams.

Mechanical

Mechanical Properties
* Tensile Strenght
= 7.5 - 30 Mpa
* Elongation at break
140 - 400 %
Yield strength [psi] = 1450 - 3600
* Flexural strength (yield) [psi]
= 10.500

Workability
*PVC can be machined, cut welded and glued for fabrication versatily

13

Productive

Material
*Politetrafluoroetilene

Origin Process of Srap
*Cutting

Quantity
*1.800 pieces per Month
*21.600 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Radius of the full circle (Different Dimensions)=
* 2,5 cm
*Thickness
2 mm

Dimensional Range
*Radius of the full circle = (+ - 0.1 cm)
*Thickness=
(+ - 0.1 cm)

Company

Company name
AGIT s.a.s

Contact Details
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Functional

Shape
*Circular shape

Surfaces and Details
*Rigid, Regular outer surface
*White
*Hard
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Regular
*Touch:
-Cold
-Soft
-Flowing
-Light
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
*Coefficient of Linear Thermal Expansion (x 10 * in./in./°F) =7.5
*Melting Temp (°F / °C)= 635 / 335
*Max Operating Temp (°F / °C) =500 / 260
*Thermal Conductivity(BTU-in/ft²-hr-°F)=1.7

Electrical Properties
Dielectric Strength (V/mil) short time, 1/8" thick= 285
*Volume Resistivity (ohm-cm)at 50% RH= > 10
*Dielectric Constant at 1 MHz= 2.1

Optical Properties
*White
*Glossiness

Environmental Properties
Teflon Parts Could Cause the Environment Harm. Evidence suggests Teflon is composed of several toxic chemicals

Properties of durability
High performance and Excellent durabi_lity, Outstanding performance at extre_me temperatures, Weather and UV resistance. Resistant to many chemicals This includes ozone, chlorine, acetic acid, ammonia, sulfuric acid and hydrochloric acid. The only chemicals known to affect these coatings are molten alkali metals and highly reactive fluorinating agents.

Mechanical

Mechanical Properties
*Tensile Strength (psi) 3,900
*Tensile Modulus (psi) 80,000
*Tensile Elongation at Break (%) 300
*Flexural Strength (psi) No break
*Flexural Modulus (psi) 72,000 (
*Compressive Strength (psi) 3,500
*Compressive Modulus (psi) 70,000
*Hardness, Shore D50

Workability
*High workability and maintains good shape. teflon laminates have a workable on the plated holes with an extra step.

14

Productive

Material
*Asbestos Free Joint Blue 350 (Cellulose fiber + NBR)

Origin Process of Srap
*Cutting

Quantity
*900pieces per Month
*10.800 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Radius of the full circle (Different Dimensions)=
* 2 cm
*Thickness
1.5 mm

Dimensional Range
*Radius of the full circle = (+ - 0.1 cm)
*Thickness=
(+ - 0.1 cm)

Company

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Functional

Shape
*Circular shape

Surfaces and Details
*Smooth, Regular outer surface
*Blue
*semihard
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Regular
*Touch:
-Cold
-Soft
-Flowing
-Light
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Limiting Temperature
*Maximum
=350 (oC)
Normal Temperature
= 180 (oC)

Electrical Properties
- insulating material
-Dielectric loss factor
=Minimum value 0.05 %
=Maximun Value 0.06 %
Resistivity
=100000000000000
1.00E+015 Ohm.mm²/m

Optical Properties
*Blue
*Glossiness

Properties of durability
* High durability

Environmental Properties
Eco Indicator 95 3.67 mPt
Eco Indicator 99 0.3 Pt
EPS 897 mELU
Ex(in)/Ex(out) MJ/MJ
GER 87 MJ
Raw materials input 59.5kg
Solids 0.03 kg
Copolymer of Acrylonitrile and Butadiene in a 30/70% ratio mixture. Average data from the European industry. Copolymerisation data assumed equal to the polymerisation process of the components.

Mechanical

Mechanical Properties
* Tensile Strenght = 8 N/mm2
* Transverse tensile strength
* Compressibility = 11 %

Workability
*Outstanding Workability.
Very good resistance against oil and other organics

15

Productive

Material
*Asbestos free joint (Fasit OMNIA blue)

Origin Process of Srap
*Cutting

Quantity
*1200pieces per Month
*14.400 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Radius of the full circle (Different Dimensions)=
* 2 cm
*Thickness
1.2 mm

Dimensional Range
*Radius of the full circle = (+ - 0.1 cm)
*Thickness=
(+ - 0.1 cm)

Company

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Functional

Shape
*Circular shape

Surfaces and Details
*Smooth, Regular outer surface
*Blue
*semihard
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Regular
*Touch:
-Cold
-Soft
-Flowing
-Light
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Limiting Temperature
*Maximum
=350 (oC)
Normal Temperature
= 180 (oC)

Electrical Properties
- insulating material
-Dielectric loss factor
=Minimum value 0.05 %
=Maximun Value 0.06 %
Resistivity
=100000000000000
1.00E+015Ohm.mm²/m

Optical Properties
*Blue
*Glossiness

Properties of durability
* High durability

Environmental Properties
Eco Indicator 95
3.67 mPt
Eco Indicator 99 0.3 Pt
EPS 897 mELU
Ex(in)/Ex(out) MJ/MJ
GER 87 MJ
Raw materials input 59.5kg
Solids 0.03 kg
Copolymer of Acrylonitrile and Butadiene in a 30/70% ratio mixture. Average data from the European industry. Copolymerisation data assumed equal to the polymerisation process of the components.

Mechanical

Mechanical Properties
* Tensile Strenght = 8 N/mm2
* Transverse tensile strength
* Compressibility = 11 %

Workability
*Outstanding Workability.
Very good resistance against oil and other organics

16

Productive

Material
*Polybutadiene Rubber

Origin Process of Srap
*Cutting

Quantity
*900 pieces per Month
*10.800 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 19 cm
*Width= 12.9 cm
*Thickness= 4mm

Dimensional Range
*Length= (+-2mm)
*Width= (+-2)
*Length and Width vary depending on the lot

Company

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Functional

Shape
*Rectangle shape

Surfaces and Details
*Smooth, Regular outer surface
*semihard
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Regular
*Touch:
-Cold
-Soft
-Flowing
-Light
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
*Thermal conductivity 0.1 W/m.K
* Thermal expansion 150 10-6/K
*Service temperature 70 °C
*Brittle Point - 100° F
*Low Temperature Range - 150° F to - 100° F

Electrical Properties
- Dielectric Constant 4
*Resistivity 10-8 ohm.m= 1e+014
*Breakdown Potential= 25 MV/m

Optical Properties
*Black
*Glossiness

Properties of durability
*is a hard rubber that's used for things like the soles of shoes, tire treads, and other places where durability is important.

Environmental Properties
*Resistance Factors 1=Poor 5=Excellent
Flammability 1
Fresh Water 5
Organic Solvents 3
Oxidation at 500C 1
Sea Water 5
Strong Acid 3
Strong Alkalis 3
UV 4
Wear 4
Weak Acid 5
Weak Alkalis 4

Mechanical

Mechanical Properties
*Elongation 400 %
*Density 1000 kg/m³
* Tensile strength 15 MPa
*Young's Modulus 0.0022 Gpa

Workability
*the flex resistance is poor,
*Poor Workability
*Difficult to handle

17

Productive

Material
Polyurethane Foam Insulation Adhesive CR-20

Origin Process of Srap
*Cutting

Quantity
* 450 pieces per Month
*5.400 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 25 cm
*Width= 15 cm
*Thickness=2.5 mm

Dimensional Range
*Length= (+-1.5mm)
*Width= (+-1.5)
*Length and Width vary depending on the lot

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Functional

Shape
*Regular Shape

Surfaces and Details
*Smooth, Regular outer surface
*Soft
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Uneven
*Touch:
-Warm
-Soft
-Flowing
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
*exceptional thermal properties
*Thermal conductivity @ 10°C (W/mk)= 0.023
*Temperature Range (°C) = -180°C to +140°C

Electrical Properties
-Polyurethane has excellent electrical insulating properties

Optical Properties
*Black
*Opaque

Properties of durability
*Extremely durable

Environmental Properties
At the end of their service life, polyurethanes can be sent for reuse (e.g., rebonding), chemical recycling, or can be incinerated for energy recovery based on national, regional and local regulations. Today, there are more options than ever for reusing polyurethanes.

Mechanical

Mechanical Properties
*Compressive strength parallel to foam rise 0.64 Mpa
*Compressive stress perpendicular to foam rise 0.41 Mpa
* Compressive modulus parallel to foam rise 19.5 Mpa
*Compressive modulus perpendicular to foam rise 10.1 Mpa
*Tensile strength parallel to foam rise 0.79 Mpa
*Tensile strength perpendicular to foam rise 0.44 Mpa
*Tensile mod parallel to foam rise 26.7 Mpa
*Tensile modulus perpendicular to foam rise 12.3 Mpa
*Poisson`s ratio v12 0.72

Workability
*Excellent workability good mechanical workability provided a small cutting edge angle and large rake face angle

18

Productive

Material
* POLYURETHANE (PU) Foam

Origin Process of Srap
*Cutting

Quantity
* 450 pieces per Month
*5.400 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 25 cm
*Width= 15 cm
*Thickness=2.5 mm

Dimensional Range
*Length= (+-1.5mm)
*Width= (+-1.5)
*Length and Width vary depending on the lot

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Functional

Shape
*Irregular Shape

Surfaces and Details
*Smooth, Regular outer surface
*Soft
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Irregular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Uneven
*Touch:
-Warm
-Soft
-Flowing
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
*exceptional thermal properties
*Thermal conductivity @ 10°C (W/mk)= 0.023
*Temperature Range (°C) = -180°C to +140°C

Electrical Properties
-Polyurethane has excellent electrical insulating properties

Optical Properties
*Black
*Opaque

Properties of durability
*Extremely durable

Environmental Properties
At the end of their service life, polyurethanes can be sent for reuse (e.g., rebonding), chemical recycling, or can be incinerated for energy recovery based on national, regional and local regulations. Today, there are more options than ever for reusing polyurethanes.

Mechanical

Mechanical Properties
*Compressive strength parallel to foam rise 0.64 Mpa
*Compressive stress perpendicular to foam rise 0.41 Mpa
* Compressive modulus parallel to foam rise 19.5 Mpa
*Compressive modulus perpendicular to foam rise 10.1 Mpa
*Tensile strength parallel to foam rise 0.79 Mpa
*Tensile strength perpendicular to foam rise 0.44 Mpa
*Tensile mod parallel to foam rise 26.7 Mpa
*Tensile modulus perpendicular to foam rise 12.3 Mpa
*Poisson`s ratio ν12 0.72

Workability
*Excellent workability good mechanical workability provided a small cutting edge angle and large rake face angle

19

Productive

Material
* POLYURETHANE (PU) Foam

Origin Process of Srap
*Cutting

Quantity
* 350 pieces per Month
*4200 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 25 cm
*Width= 15 cm
*Thickness=2.5 mm

Dimensional Range
*Length= (+-1.5mm)
*Width= (+-1.5)
*Length and Width vary depending on the lot

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Functional

Shape
*Irregular Shape

Surfaces and Details
*Smooth, Regular outer surface
*Soft
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Irregular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Uneven
*Touch:
-Warm
-Soft
-Flowing
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
*exceptional thermal properties
*Thermal conductivity @ 10°C (W/mk)= 0.023
*Temperature Range (°C) = -180°C to +140°C

Electrical Properties
-Polyurethane has excellent electrical insulating properties

Optical Properties
*Black
*Opaque

Properties of durability
*Extremely durable

Environmental Properties
At the end of their service life, polyurethanes can be sent for reuse (e.g., rebonding), chemical recycling, or can be incinerated for energy recovery based on national, regional and local regulations. Today, there are more options than ever for reusing polyurethanes.

Mechanical

Mechanical Properties
*Compressive strength parallel to foam rise 0.64 Mpa
*Compressive stress perpendicular to foam rise 0.41 Mpa
* Compressive modulus parallel to foam rise 19.5 Mpa
*Compressive modulus perpendicular to foam rise 10.1 Mpa
*Tensile strength parallel to foam rise 0.79 Mpa
*Tensile strength perpendicular to foam rise 0.44 Mpa
*Tensile mod parallel to foam rise 26.7 Mpa
*Tensile modulus perpendicular to foam rise 12.3 Mpa
*Poisson`s ratio ν12 0.72

Workability
*Excellent workability good mechanical workability provided a small cutting edge angle and large rake face angle

20

Productive

Material
* Felt White

Origin Process of Srap
* Turning Operations (Die Cut)

Quantity
*9.000 pieces per Month
* 108.000 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Radius of the full circle (Different Dimensions)=
* 3 cm
*Thickness (Different Dimensions)=
*1.1 cm

Dimensional Range
*Radius of the full circle = (+ - 0.1cm)
*Thickness=
(+ - 0 cm)

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Functional

Shape
*Circular shape

Surfaces and Details
*Rough outer surface
*Soft Surface

Hollow
*There are not hollows on it

Edges and ends
*Regular Cutting faces

Sensory

Tactile Aspects
*Texture:
-Smooth / Uneven
*Touch:
-Warm
-Soft
-Stilted
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
*Low thermal conductivity (W/m K)= 0.04
*excellent insulation properties
*Resists Thermal Shock

Electrical Properties
*Low electrical conductivity

Optical Properties
*White
*Opaque

Properties of durability
*Felt is a shock absorbing material. It has high resiliency, low compression set, and long life characteristics.

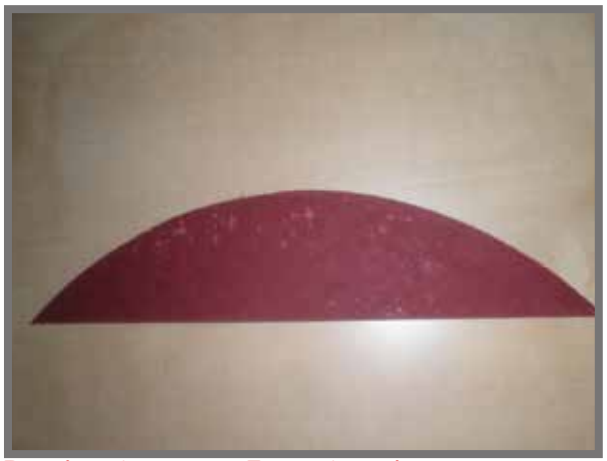
Environmental Properties
*Recyclable

Mechanical

Mechanical Properties
*Tensile Strength ³ psi 300
* Slit Resistance ³ psi 16
* Resiliency is controlled by selected combinations of densities and fibers.
*Low coefficient of friction

Workability
Basically, there are two methods of manufacturing felt fabrics:
Wet felting (traditional felting)
Needle-felting (Dry felting)
It's important to transformate the material:
*soapy water to fleece and agitate
*Cutting instruments

21



Productive

Material
* Vulcanized fibre

Origin Process of Srap
*Cutting

Quantity
* 1100 pieces per Month
*13.200 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 30 cm
*Width= 10 cm
*Thickness=2 mm

Dimensional Range
*Length=
(+-1.5mm)
*Width=
(+-1.5)
*Length and Width vary depending on the lot

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Functional

Shape
*Regular Shape

Surfaces and Details
*Hard, Irregular outer surface
*Hard
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Uneven
*Touch:
-Cold
-Hard
-Stilted
-Light
*Brillancy
-Opaque

Photometric Aspects
-Opaque

Physical

Thermal Properties
*Maximum operating temperature (oC) 105
*Service Temperature up to 110 to 120°C
-Thermal Conductivity, btu/hr/sqft/F/in 3

Electrical Properties
-Dielectric strength (vpm 150 – 400 (high dielectric strength)
-Dielectric Constant 4 – 7
- High insulating value.
-Arc and track resistance

Optical Properties
*Red
*Opaque

Properties of durability
-Highly Durable
*Unaffected by alcohol, ether, ammonia, turpentine, naptha, benzene, and petroleum.

Environmental Properties
chemical free, environment friendly
-Product which contains no resins or bonding agents.
-poses no threat to nature
-easily disposable

Mechanical

Mechanical Properties
* high tear and tensile strength
-Tensile Strength, psi 6,000 – 12,000
-Flexural Strength, psi 12,000 – 20,000
-Shear Strength, psi 11,000-15,000
-Compressive Strength , psi 20,000 – 30,000
-Impact Strength, ft/lbs per in. 4 – 8
-Rockwell Hardness R60 – R100

Workability
* Workable like a metal , is right for cutting, punching, drilling, milling and stretch-forming by steam

22

Productive

Material
PET(polyethylene terephalate)

Origin Process of Srap
*Cutting

Quantity
* 150 pieces per Month
*1800 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 104.7cm
*Width= 11cm
*Thickness=1 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

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Functional

Shape
*Rectangular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
* 36 circular holes

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Regular
*Touch:
-Cold
-Soft
-Flowing
-Light
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
*Heat Deflection, 264 psi = 175 °F
* Melting Point 490 °F
* Coefficient of Linear Thermal Expansion= 3.9 X 10-5 ; units in./in./-°F

Electrical Properties
*Volume Resistivity, 73°F = 1016 ohm-cm
* Dielectric Constant @ 60 Hz, (73°F, 50% RH) = 3.4
*Dissipation Factor, @ 60 Hz, 73°F= 0.002
* Dielectric Strength= 400 V/mil

Optical Properties
*Glossiness
*White Color

Properties of durability
*Polyethylene has excellent heat and chemical resistance as well as a very good impact strength.

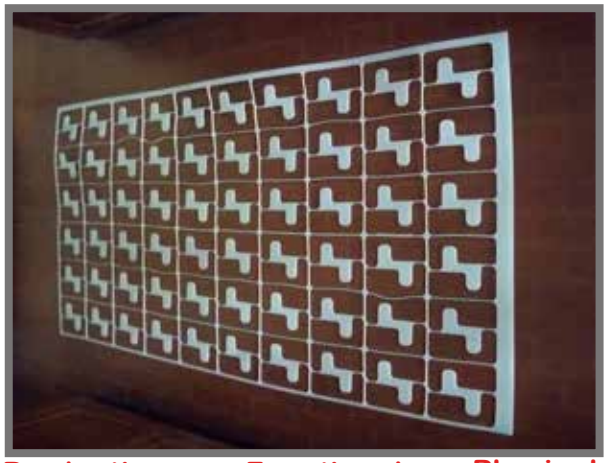
Environmental Properties
*It doesn't biodegrade easily, and can sit in a landfill for hundreds of years. However, recycling may reduce this problem, since PE scrap can be melted down and reused.

Mechanical

Mechanical Properties
*Tensile Modulus, 73°F = 4 X 105 psi
* Elongation at break, 73° F = 70 %
* Rockwell Hardness R117
*Flexural Strength, 73° F = 15,000 psi
* Flexural Modulus, 73°F = 4 X 105 psi
* Tensile Strength at break, 73° F = 11,500 psi
* Izod Impact Strength, Notched, 73°F= 0.7 ft-lbs/in.

Workability
* It is very workable
* It can be processed by the shaping methods used for thermoplastics, such as injection and extrusion.

23



Productive

Material
*Politetrafluoroetilene

Origin Process of Srap
*Cutting

Quantity
*180 pieces per Month
*2160 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 204.1 cm
*Width= 102.6 cm
*Thickness=4 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

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Functional

Shape
*Rectangular shape

Surfaces and Details
*Rigid, Regular outer surface
*White
*Hard
*Uniform Cuttings

Hollow
*symmetrical cuts into

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Regular
*Touch:
-Cold
-Soft
-Flowing
-Light
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
*Coefficient of Linear Thermal Expansion (x 10 * in./in./°F) =7.5
*Melting Temp (°F / °C)= 635 / 335
*Max Operating Temp (°F / °C) =500 / 260
*Thermal Conductivity(BTU-in/ft²-hr-°F)=1.7

Electrical Properties
Dielectric Strength (V/mil) short time, 1/8" thick= 285
*Volume Resistivity (ohm-cm)at 50% RH= > 10
*Dielectric Constant at 1 MHz= 2.1

Optical Properties
*White
*Glossiness

Environmental Properties
Teflon Parts Could Cause the Environment Harm. Evidence suggests Teflon is composed of several toxic chemicals

Properties of durability
High performance and Excellent durabi_ lity, Outstanding performance at extre_ me temperatures, Weather and UV resistance. Resistant to many chemicals This includes ozone, chlorine, acetic acid, ammonia, sulfuric acid and hydrochloric acid. The only chemicals known to affect these coatings are molten alkali metals and highly reactive fluorinating agents.

Mechanical

Mechanical Properties
*Tensile Strength (psi) 3,900
*Tensile Modulus (psi) 80,000
*Tensile Elongation at Break (%) 300
*Flexural Strength (psi) No break
*Flexural Modulus (psi) 72,000 (
*Compressive Strength (psi) 3,500
*Compressive Modulus (psi) 70,000
*Hardness, Shore D50

Workability
*High workability and maintains good shape. teflon laminates have a workable on the plated holes with an extra step.

24

Productive

Material
*Polybutadiene Rubber

Origin Process of Srap
*Cutting

Quantity
*1200 pieces per Month
*14.400 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 15 cm
*Width= 15 cm
*Thickness= 4mm

Dimensional Range
*Length= (+-0mm)
*Width= (+-0)

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Functional

Shape
*geometrical shape

Surfaces and Details
*Smooth, Regular outer surface
*semihard
*Uniform Cuttings

Hollow
* 2 Rectangular hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Regular
*Touch:
-Cold
-Soft
-Flowing
-Light
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
*Thermal conductivity 0.1 W/m.K
* Thermal expansion 150 10-6/K
*Service temperature 70 °C
*Brittle Point - 100° F
*Low Temperature Range - 150° F to - 100° F

Electrical Properties
- Dielectric Constant 4
*Resistivity 10-8 ohm.m= 1e+014
*Breakdown Potential= 25 MV/m

Optical Properties
*Black
*Glossiness

Properties of durability
*is a hard rubber that's used for things like the soles of shoes, tire treads, and other places where durability is important.

Environmental Properties
*Resistance Factors 1=Poor 5=Excellent

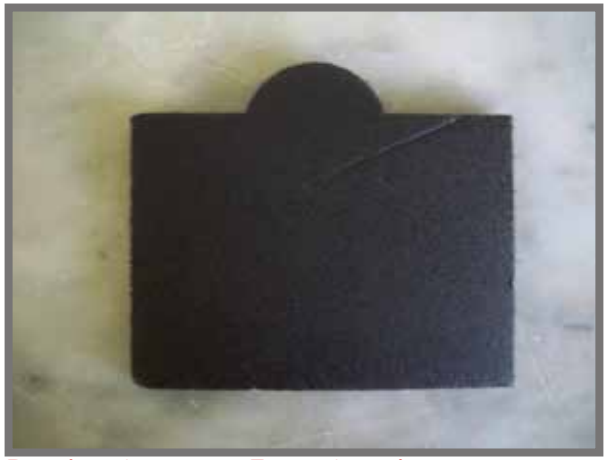
Flammability	1
Fresh Water	5
Organic Solvents	3
Oxidation at 500C	1
Sea Water	5
Strong Acid	3
Strong Alkalis	3
UV	4
Wear	4
Weak Acid	5
Weak Alkalis	4

Mechanical

Mechanical Properties
*Elongation 400 %
*Density 1000 kg/m³
* Tensile strength 15 MPa
*Young's Modulus 0.0022 Gpa

Workability
*the flex resistance is poor,
*Poor Workability
*Difficult to handle

25



Productive

Material
Polyurethane Foam Insulation Adhesive CR-20

Origin Process of Srap
*Cutting

Quantity
*360 pieces per Month
*4320 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 10.3 cm
*Width= 7.4 cm
*Thickness= 8 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

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Functional

Shape
*Regular Shape

Surfaces and Details
*Smooth, Regular outer surface
*Soft
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Uneven
*Touch:
-Warm
-Soft
-Flowing
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
*exceptional thermal properties
*Thermal conductivity @ 10°C (W/mk)= 0.023
*Temperature Range (°C) = -180°C to +140°C

Electrical Properties
-Polyurethane has excellent electrical insulating properties

Optical Properties
*Black
*Opaque

Properties of durability
*Extremely durable

Environmental Properties
At the end of their service life, polyurethanes can be sent for reuse (e.g., rebonding), chemical recycling, or can be incinerated for energy recovery based on national, regional and local regulations. Today, there are more options than ever for reusing polyurethanes.

Mechanical

Mechanical Properties
*Compressive strength parallel to foam rise 0.64 Mpa
*Compressive stress perpendicular to foam rise 0.41 Mpa
* Compressive modulus parallel to foam rise 19.5 Mpa
*Compressive modulus perpendicular to foam rise 10.1 Mpa
*Tensile strength parallel to foam rise 0.79 Mpa
*Tensile strength perpendicular to foam rise 0.44 Mpa
*Tensile mod parallel to foam rise 26.7 Mpa
*Tensile modulus perpendicular to foam rise 12.3 Mpa
*Poisson`s ratio ν12 0.72

Workability
*Excellent workability good mechanical workability provided a small cutting edge angle and large rake face angle

26

Productive

Material
Polyurethane Foam Insulation Adhesive CR-20

Origin Process of Srap
*Cutting

Quantity
*270 pieces per Month
*3240 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 10.2 cm
*Width= 5 cm
*Thickness= 8 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

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Functional

Shape
*Rectangular Shape

Surfaces and Details
*Smooth, Regular outer surface
*Soft
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Uneven
*Touch:
-Warm
-Soft
-Flowing
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
*exceptional thermal properties
*Thermal conductivity @ 10°C (W/mk)= 0.023
*Temperature Range (°C) = -180°C to +140°C

Electrical Properties
-Polyurethane has excellent electrical insulating properties

Optical Properties
*Black
*Opaque

Properties of durability
*Extremely durable

Environmental Properties
At the end of their service life, polyurethanes can be sent for reuse (e.g., rebonding), chemical recycling, or can be incinerated for energy recovery based on national, regional and local regulations. Today, there are more options than ever for reusing polyurethanes.

Mechanical

Mechanical Properties
*Compressive strength parallel to foam rise 0.64 Mpa
*Compressive stress perpendicular to foam rise 0.41 Mpa
* Compressive modulus parallel to foam rise 19.5 Mpa
*Compressive modulus perpendicular to foam rise 10.1 Mpa
*Tensile strength parallel to foam rise 0.79 Mpa
*Tensile strength perpendicular to foam rise 0.44 Mpa
*Tensile mod parallel to foam rise 26.7 Mpa
*Tensile modulus perpendicular to foam rise 12.3 Mpa
*Poisson`s ratio ν12 0.72

Workability
*Excellent workability good mechanical workability provided a small cutting edge angle and large rake face angle

27

Productive

Material
Polyurethane Foam Insulation Adhesive CR-20

Origin Process of Srap
*Cutting

Quantity
*360 pieces per Month
*4320 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 10.3 cm
*Width= 7.4 cm
*Thickness= 8 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
AGIT s.a.s

Contact Details
Via Montanari 25
20161 Milano
+39 02 39310737
fax +39 02 375691
http://www.agit.it/

Functional

Shape
*Circular Shape

Surfaces and Details
*Smooth, Regular outer surface
*Soft
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Uneven
*Touch:
-Warm
-Soft
-Flowing
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
*exceptional thermal properties
*Thermal conductivity @ 10°C (W/mk)= 0.023
*Temperature Range (°C) = -180°C to +140°C

Electrical Properties
-Polyurethane has excellent electrical insulating properties

Optical Properties
*Black
*Opaque

Properties of durability
*Extremely durable

Environmental Properties
At the end of their service life, polyurethanes can be sent for reuse (e.g., rebonding), chemical recycling, or can be incinerated for energy recovery based on national, regional and local regulations. Today, there are more options than ever for reusing polyurethanes.

Mechanical

Mechanical Properties
*Compressive strength parallel to foam rise 0.64 Mpa
*Compressive stress perpendicular to foam rise 0.41 Mpa
* Compressive modulus parallel to foam rise 19.5 Mpa
*Compressive modulus perpendicular to foam rise 10.1 Mpa
*Tensile strength parallel to foam rise 0.79 Mpa
*Tensile strength perpendicular to foam rise 0.44 Mpa
*Tensile mod parallel to foam rise 26.7 Mpa
*Tensile modulus perpendicular to foam rise 12.3 Mpa
*Poisson`s ratio ν12 0.72

Workability
*Excellent workability good mechanical workability provided a small cutting edge angle and large rake face angle

28

Productive

Material
* POLYURETHANE (PU) Foam

Origin Process of Srap
*Cutting

Quantity
* 420 pieces per Month
*5.040 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 125 cm
*Width= 68 cm
*Thickness=4 cm
-Include other pieces with different overall dimensions

Dimensional Range
*Length= (+6cm)
*Width= (+-2cm)
*Length and Width vary depending on the lot

Functional

Shape
*Regular Shape

Surfaces and Details
*Smooth, outer surface
*Soft
*Irregular Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Irregular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Uneven
*Touch:
-Warm
-Soft
-Flowing
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Company

Company name
Tappezzeria Nautica

Contact Details
Via Foppe, 33
25030 Paratico (BS)
Tel: +39 035 910 291
info@tappezzeria nauticasrl.eu

Physical

Thermal Properties
*exceptional thermal properties
*Thermal conductivity @ 10°C (W/mk)= 0.023
*Temperature Range (°C) = -180°C to +140°C

Electrical Properties
-Polyurethane has excellent electrical insulating properties

Optical Properties
*Black
*Opaque

Properties of durability
*Extremely durable

Environmental Properties
At the end of their service life, polyurethanes can be sent for reuse (e.g., rebonding), chemical recycling, or can be incinerated for energy recovery based on national, regional and local regulations. Today, there are more options than ever for reusing polyurethanes.

Mechanical

Mechanical Properties
*Compressive strength parallel to foam rise 0.64 Mpa
*Compressive stress perpendicular to foam rise 0.41 Mpa
* Compressive modulus parallel to foam rise 19.5 Mpa
*Compressive modulus perpendicular to foam rise 10.1 Mpa
*Tensile strength parallel to foam rise 0.79 Mpa
*Tensile strength perpendicular to foam rise 0.44 Mpa
*Tensile mod parallel to foam rise 26.7 Mpa
*Tensile modulus perpendicular to foam rise 12.3 Mpa
*Poisson`s ratio ν12 0.72

Workability
*Excellent workability good mechanical workability provided a small cutting edge angle and large rake face angle

29

Productive

Material
* TESSILMARE - (polyester Thermoplastic Elastomer)

Origin Process of Srap
*Cutting

Quantity
* 350 pieces per Month
*4200 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 175 cm
*Width= 50 cm
*Thickness=0.25 cm
-Include other pieces with different overall dimensions

Dimensional Range
*Length= (+5cm)
*Width= (+-5cm)
*Length and Width vary depending on the lot

Company

Company name
Tappezzeria Nautica

Contact Details
Via Foppe, 33
25030 Paratico (BS)
Tel: +39 035 910 291
info@tappezzeria nauticasrl.eu

Functional

Shape
*Irregular Shape

Surfaces and Details
*Smooth, outer surface
*Soft
*Irregular Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Irregular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Regular
*Touch:
-Warm
-Soft
-Flowing
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
* Melting Point =150 - 223 °C
*Boiling Point = 140 - 230 °C
* Flammability, UL94 = HB - V-0
*Flash Point = 300 - 340 °C

Electrical Properties
*Electrical Resistivity = 2.00e+10 - 2.00e +16 ohm-cm
* Surface Resistance = 5.00e+12 - 2.00e +15 ohm
*Dielectric Constant= 3.30 - 5.70
* Dielectric Strength 11.8 - 30.0 kV/mm

Optical Properties
*Gray and Cream Color
*Opaque

Properties of durability
*Polyester fabrics and fibers are extremely strong.
*Polyester is very durable: resistant to most chemicals, stretching and shrinking, wrinkle resistant, mildew and abrasion resistant.

Environmental Properties
Polyester requires petroleum and other chemicals to produce, as well as energy to heat and power the process. It's not biodegradable, but can be recycled

Mechanical

Mechanical Properties
*Hardness, Shore A = 70.0 - 99.0
* Hardness, Shore D = 25.0 - 82.0
* Tensile Strength, Ultimate= 0.000 - 104 MPa
* Tensile Strength, Yield = 3.90 - 72.2 MPa
*Elongation at Break = 1.20 - 900 %
* Elongation at Yield = 1.20 - 50.0 %
* Modulus of Elasticity = 0.00260 - 13.2 GPa
*Resilience = 40.0 - 81.0
* Shear Modulus = 0.0130 - 0.979 GPa
@Temperature -50.0 - 200 °C
* Compressive Modulus 0.00240 - 0.0392 GPa

Workability
*Excellent workability good mechanical workability provided a small cutting edge angle and large rake face angle

30

Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 380 pieces per Month
*4.560 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Diameter. 20.3 cm
*Tickness. 3 mm

Dimensional Range
*Diameter (+ - 0)
*(Tickness (+ - 0)

Company

Company name
Extravega Milano

Contact Details
Via Pietro Nenni 9
20037 Paderno Dug
Milan | Italy
phone:
+390299043444
info@extravega.com

Functional

Shape
*Circular shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*two L-shaped cuts

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity
10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

31

Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 260 pieces per Month
*3.120pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Diameter. 20.3 cm
*Tickness. 3 mm

Dimensional Range
*Diameter (+ - 0)
*(Tickness (+ - 0)

Company

Company name
Extravega Milano

Contact Details
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info@extravega.com

Functional

Shape
*Circular shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
* a hole close to the edge of circle of 0. 5 centimeters in diameter

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity
10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

32

Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 290 pieces per Month
*3.480 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Diameter. 14 cm
*Tickness. 3 mm

Dimensional Range
*Diameter (+ - 0)
*(Tickness (+ - 0)

Company

Company name
Extravega Milano

Contact Details
Via Pietro Nenni 9
20037 Paderno Dug
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phone:
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info@extravega.com

Functional

Shape
*Circular shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
* 3 holes of 0.3 cm arranged circularly

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity
10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

33

Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 260 pieces per Month
*3.120pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Diameter. 14.2 cm
*Tickness. 3 mm

Dimensional Range
*Diameter (+ - 0)
*(Tickness (+ - 0)

Company

Company name
Extravega Milano

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Functional

Shape
*Circular shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
* a hole close to the edge of circle of 0. 5 centimeters in diameter

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity
10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

34

Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 215 pieces per Month
*2.580 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 6.7 cm
*Width= 4.9 cm
*Thickness=2 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
Extravega Milano

Contact Details
Via Pietro Nenni 9
20037 Paderno Dug
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phone:
+390299043444
info@extravega.com

Functional

Shape
*Semi-Rectangular shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
* a hole close to the edge 0. 5 centimeters in diameter

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conduc-tivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

35

Productive

Material
Stainless Steel 304 L

Origin Process of Srap
*Cutting

Quantity
* 350pieces per Month
*4.200 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Diameter. 2.5 cm
*Tickness. 2 mm

Dimensional Range
*Diameter (+ - 0)
*(Tickness (+ - 0)

Company

Company name
Extravega Milano

Contact Details
Via Pietro Nenni 9
20037 Paderno Dug
Milan | Italy
phone:
+390299043444
info@extravega.com

Functional

Shape
*Circular shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
* a hole close to the edge 0. 3 centimeters in diameter

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conduc-tivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

36

Productive

Material
Stainless Steel 304
No. 8: Mirror finish

Origin Process of Srap
*Cutting

Quantity
* 200 pieces per Month
*2.400 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Diameter. 4.3 cm
*Tickness. 2 mm

Dimensional Range
*Diameter (+ - 0)
*(Tickness (+ - 0)

Company

Company name
Extravega Milano

Contact Details
Via Pietro Nenni 9
20037 Paderno Dug
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info@extravega.com

Functional

Shape
*Circular shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
* a hole close to the edge 0. 5 centimeters in diameter

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conduc-tivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity
10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

37

Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 215 pieces per Month
*2.580 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 10 cm
*Width= 10 cm
*Thickness=2 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
Extravega Milano

Contact Details
Via Pietro Nenni 9
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Milan | Italy
phone:
+390299043444
info@extravega.com

Functional

Shape
* Square Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conduc-tivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity
10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

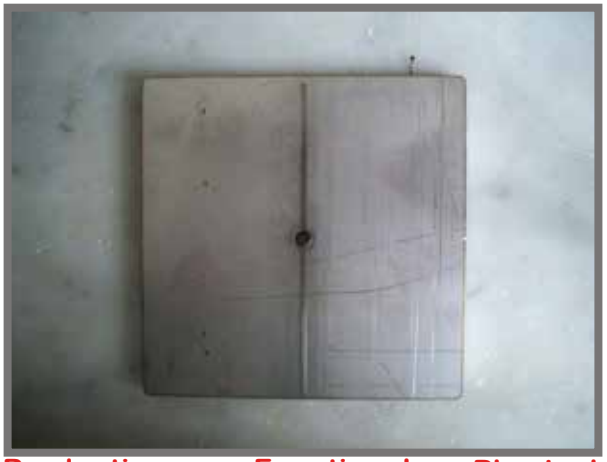
Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

38



Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 235 pieces per Month
*2.820 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 9 cm
*Width= 9 cm
*Thickness=2 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
Extravega Milano

Contact Details
Via Pietro Nenni 9
20037 Paderno Dug
Milan | Italy
phone:
+390299043444
info@extravega.com

Functional

Shape
* Square Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*a hole in the center of 0.5 centimeters

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity
10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

39

Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 435 pieces per Month
*5220 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 9.65 cm
*Width= 2 cm
*Thickness=3 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
Extravega Milano

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phone:
+390299043444
info@extravega.com

Functional

Shape
*Rectangular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*3 Holes, 2 at the ends of 0.7 cm and one in the middle of 1.1 cm

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity
10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

40

Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 530 pieces per Month
*6360 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 2.81 cm
*Width= 0.7 cm
*Thickness=3 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
Extravega Milano

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Functional

Shape
*Oval Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*a hole in the center of 0.3 centimeters

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

41

Productive

Material
Stainless Steel 304 L

Origin Process of Srap
*Cutting

Quantity
* 225 pieces per Month
*2700 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 27.4 cm
*Width= 5 cm
*Thickness=1 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

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Functional

Shape
*Rectangular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

42

Productive

Material
Stainless Steel 304 L

Origin Process of Srap
*Cutting

Quantity
* 125 pieces per Month
*1500pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 27.1 cm
*Width= 6.6 cm
*Thickness=1 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

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Functional

Shape
*Rectangular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

43

Productive

Material
Stainless Steel 304
No. 8: Mirror finish

Origin Process of Srap
*Cutting

Quantity
* 100 pieces per Month
*1200 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 24.7 cm
*Width= 15cm
*Thickness=2 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
Extravega Milano

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Functional

Shape
*Rectangular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
* 12 holes, 2 holes in each corner, and 4 in the middle each measures 0.4 cm in diameter

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

44

Productive

Material
Anodized Aluminum

Origin Process of Srap
*Cutting

Quantity
*170 pieces per Month
*2040 pieces per year

Management Mode
*On Sale=
kg 0,75 Eu/kg

Dimensional

Overall Dimensions
*Length= 36 cm
*Width= 14.1 cm
*Thickness=1 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

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Functional

Shape
*Irregular Shapes

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
-Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Weighty
*Brillancy
-Gloss

Photometric Aspects
*Glossiness

Physical

Thermal Properties
244 W/mK
*Thermal conductivity of aluminium is about three times greater than that of steel.
244 W/mK for the temperature range 0-1000 C

Electrical Properties
*High electrical conductivity (at 200 C is 63.8%
*High resistivity (at 200 C is 2.69 microohm cm)

Optical Properties
*Gray
Translucent

Properties of durability
*Aluminium is extremely durable in neutral and slightly acid environments.
In environments characterised by high acidity or high basicity corrosion is rapid.

Environmental Properties
*Recyclable
*Generates Enviromental and Energy Savings

Mechanical

Mechanical Properties
*Low tensile strength, tensile strength increases with decreasing temperature. 90 Mpa
*Shear Strength 50 (MPa)
*Elongation A5 42(%)
*Hardness Vickers 20 (HV)

Workability
*Aluminium is easily worked using most machining methods – milling, drilling, cutting, punching, bending, etc. Furthermore, the energy input during machining is low.
-Aluminium's superior malleability
_Features facilitating easy jointing: Fusion welding, Friction Stir Welding, bonding and taping

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Productive

Material
Stainless Steel 304 L

Origin Process of Srap
*Cutting

Quantity
* 125 pieces per Month
*1500pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 12.8 cm
*Width= 7 cm
*Thickness=3 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

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Functional

Shape
*Rectangular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*3 hollows on it, two of 0.8 cm, and a hole of 2.3 cm

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

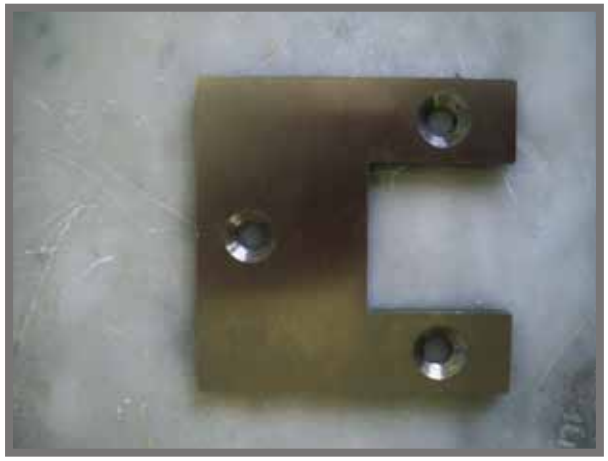
Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

46



Productive

Material
Stainless Steel 304 L

Origin Process of Srap
*Cutting

Quantity
* 300 pieces per Month
*3600 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 6.5 cm
*Width= 6.5 cm
*Thickness=3 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

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Functional

Shape
*Regular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*3 hollows on it, each hole of 1 cm in diameter.

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

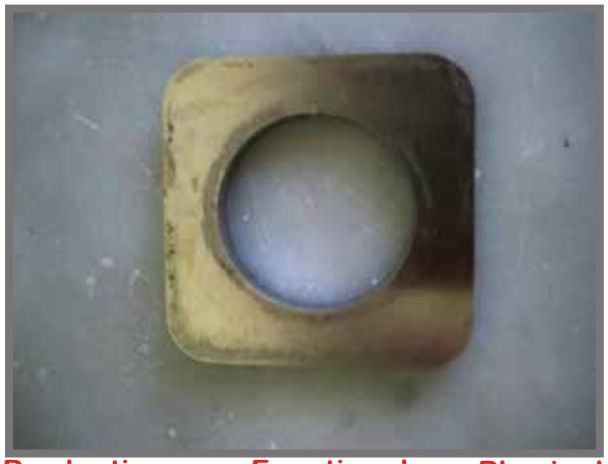
Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

47



Productive

Material
Stainless Steel 304
No. 8: Mirror finish

Origin Process of Srap
*Cutting

Quantity
* 270 pieces per Month
*3240 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 6.5 cm
*Width= 6.5 cm
*Thickness=3 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

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Functional

Shape
*Regular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*1 hollow on it, a hole of 2 cm in diameter

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

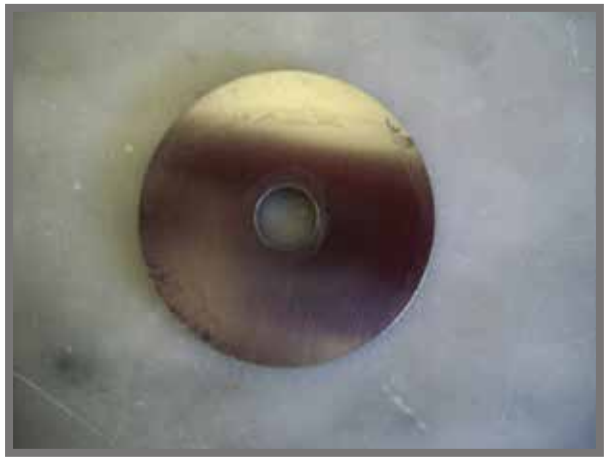
Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

48



Productive

Material
Stainless Steel 304 L

Origin Process of Srap
*Cutting

Quantity
* 320 pieces per Month
*3840 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 6.5 cm
*Width= 6.5 cm
*Thickness=3 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

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Functional

Shape
*Circular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*1 hollow on it, a hole of 0.8 cm in diameter

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conduc-tivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

49

Productive

Material
Stainless Steel 304 L

Origin Process of Srap
*Cutting

Quantity
* 420 pieces per Month
*5040 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 107 cm
*Width= 5.6 cm
*Thickness= 1 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

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Functional

Shape
*Rectangular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*There are 4 hollows on it, each hole of 0.4 cm in diameter.

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conduc-tivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

50

Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 450 pieces per Month
*5400 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 3.9 cm
*Width= 1 cm
*Thickness=23 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
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Functional

Shape
*Regular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*a hole in the center of 0.3 centimeters

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity
10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

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Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 700 pieces per Month
*8400 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 3 cm
*Width= 1.5 cm
*Height = 1 cm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
* Height = (+ - 0) cm

Company

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Functional

Shape
*Volumetric Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*a hole in the center of 0.3 centimeters

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity
10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

52

Productive

Material
Anodized aluminium / Copper vapour deposition

Origin Process of Srap
*Cutting

Quantity
*190 pieces per Month
*2280 pieces per year

Management Mode
*On Sale=
kg 0,75 Eu/kg

Dimensional

Overall Dimensions
*Length= 30 cm
*Width= 9 cm
*Thickness=1 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
Extravega Milano

Contact Details
Via Pietro Nenni 9
20037 Paderno Dug
Milan | Italy
phone:
+390299043444
info@extravega.com

Functional

Shape
*Regular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
-Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Weighty
*Brillancy
-Gloss

Photometric Aspects
*Glossiness

Physical

Thermal Properties
244 W/mK
*Thermal conductivity of aluminium is about three times greater than that of steel.
244 W/mK for the temperature range 0-1000 C

Electrical Properties
*High electrical conductivity (at 200 C is 63.8%
*High resistivity (at 200 C is 2.69 microohm cm)

Optical Properties
*Gray
Translucent

Properties of durability
*Aluminium is extremely durable in neutral and slightly acid environments. In environments characterised by high acidity or high basicity corrosion is rapid.

Environmental Properties
*Recyclable
*Generates Enviromental and Energy Savings

Mechanical

Mechanical Properties
*Low tensile strength, tensile strength increases with decreasing temperature. 90 Mpa
*Shear Strength 50 (MPa)
*Elongation A5 42(%)
*Hardness Vickers 20 (HV)

Workability
*Aluminium is easily worked using most machining methods – milling, drilling, cutting, punching, bending, etc. Furthermore, the energy input during machining is low.
-Aluminium's superior malleability
_Features facilitating easy jointing: Fusion welding, Friction Stir Welding, bonding and taping

53

Productive

Material
Stainless Steel 304
No. 8: Mirror finish

Origin Process of Srap
*Cutting

Quantity
* 150 pieces per Month
*1800 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 26.4 cm
*Width= 6.6 cm
*Thickness =1 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
Extravega Milano

Contact Details
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+390299043444
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Functional

Shape
*Rectangular Shape

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*a hole of 0.5 centimeters

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conductivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity
10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

54

Productive

Material
Stainless Steel 304

Origin Process of Srap
*Cutting

Quantity
* 260 pieces per Month
*3.120pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 55.2 cm
*Width= 2.4 cm
*Height=2.4 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
Extravega Milano

Contact Details
Via Pietro Nenni 9
20037 Paderno Dug
Milan | Italy
phone:
+390299043444
info@extravega.com

Functional

Shape
*square pipe

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*2 hollows on it, each hole of 2.2 cm in diameter.

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conduc-tivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 621
* Yield Strength(Mpa) = 290
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B82

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

55

Productive

Material
Stainless Steel 304 L

Origin Process of Srap
*Cutting

Quantity
* 320 pieces per Month
*3840 pieces per year

Management Mode
*On sale

Dimensional

Overall Dimensions
*Length= 43.2 cm
*Width= 24.9cm
*Thickness=1 mm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
Extravega Milano

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Functional

Shape
*Curved plane

Surfaces and Details
*Smooth outer surface
*Gloss
* Rigid Surface
*Uniform Cut

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Rigid / Regular
*Touch:
-Cold
-Hard
-Flowing
-Heavy
*Brillancy
-Gloss

Photometric Aspects
-Glossiness

Physical

Thermal Properties
Thermal Conduc-tivity 100 °C w/m k = 16.2
* Coefficient of Thermal Expansion (0 - 100 °C um/mm/ °C) = 17.3
* Specific Heat (J/ kg * k) = 502

Electrical Properties
* Electrical ù Resistivity 10 µohm.cm

Optical Properties
*Glossiness
*Gray Color

Properties of durability
* Provides High Durability
* These steels exhibit excellent resistance to a wide range of atmospheric, chemical cal, textile, petroleum and food industry exposures.

Environmental Properties
*Stainless steel can emerge as an excellent recyclable material.

Mechanical

Mechanical Properties
*Ultimate tensile strength (Mpa)= 586
* Yield Strength(Mpa) = 24
* Elongation % in 2" (50.8 mm) = 55
*Hardness Rockwell = B80

Workability
* Very good drawability
* successful forming of complex shapes.
* To relieve stresses produced in severe forming or spinning, parts should be annealed or stress - relief annealed
*Weldable by the common fusion and resistance techniques

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Productive

Material
* POLYURETHANE (PU) Foam

Origin Process of Srap
*Cutting

Quantity
* 150 pieces per Month
*1.800 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 22 cm
*Width= 19 cm
*Height =14.5 cm

Dimensional Range
*Length= (+ - 0) cm
*Width= (+ - 0) cm
*Thickness= (+ - 0) cm

Company

Company name
Extravega Milano

Contact Details
Via Pietro Nenni 9
20037 Paderno Dug
Milan | Italy
phone:
+390299043444
info@extravega.com

Functional

Shape
*Cube Shape

Surfaces and Details
*Smooth, Regular outer surface
*Soft
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Uneven
*Touch:
-Warm
-Soft
-Flowing
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
*exceptional thermal properties
*Thermal conductivity @ 10°C (W/mk)= 0.023
*Temperature Range (°C) = -180°C to +140°C

Electrical Properties
-Polyurethane has excellent electrical insulating properties

Optical Properties
*Black
*Opaque

Properties of durability
*Extremely durable

Environmental Properties
At the end of their service life, polyurethanes can be sent for reuse (e.g., rebonding), chemical recycling, or can be incinerated for energy recovery based on national, regional and local regulations. Today, there are more options than ever for reusing polyurethanes.

Mechanical

Mechanical Properties
*Compressive strength parallel to foam rise 0.64 Mpa
*Compressive stress perpendicular to foam rise 0.41 Mpa
* Compressive modulus parallel to foam rise 19.5 Mpa
*Compressive modulus perpendicular to foam rise 10.1 Mpa
*Tensile strength parallel to foam rise 0.79 Mpa
*Tensile strength perpendicular to foam rise 0.44 Mpa
*Tensile mod parallel to foam rise 26.7 Mpa
*Tensile modulus perpendicular to foam rise 12.3 Mpa
*Poisson`s ratio ν12 0.72

Workability
*Excellent workability good mechanical workability provided a small cutting edge angle and large rake face angle

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Productive

Material
* POLYURETHANE (PU) Foam

Origin Process of Srap
*Cutting

Quantity
* 180 pieces per Month
*2.160 pieces per year

Management Mode
*Waste Disposal

Dimensional

Overall Dimensions
*Length= 125 cm
*Width= 100 cm
*Thickness=2.5 mm
*There are some pieces with different dimensions

Dimensional Range
*Length and Width vary depending on the lot
- It isn't a standard

Company

Company name
Macry S.R.L

Contact Details
Milan - Monza km 15 | Italy
phone:
+390396079629
info@macry.com
info@macry.it

Functional

Shape
*Regular Shape

Surfaces and Details
*Smooth, Regular outer surface
*Soft
*Uniform Cuttings

Hollow
*There are not hollows on it

Edges and ends
*Regular Cuttings

Sensory

Tactile Aspects
*Texture:
- Smooth / Uneven
*Touch:
-Warm
-Soft
-Flowing
-Light
*Brillancy
-Mate

Photometric Aspects
-Opaque

Physical

Thermal Properties
*exceptional thermal properties
*Thermal conductivity @ 10°C (W/mk)= 0.023
*Temperature Range (°C) = -180°C to +140°C

Electrical Properties
-Polyurethane has excellent electrical insulating properties

Optical Properties
*Black
*Opaque

Properties of durability
*Extremely durable

Environmental Properties
At the end of their service life, polyurethanes can be sent for reuse (e.g., rebonding), chemical recycling, or can be incinerated for energy recovery based on national, regional and local regulations. Today, there are more options than ever for reusing polyurethanes.

Mechanical

Mechanical Properties
*Compressive strength parallel to foam rise 0.64 Mpa
*Compressive stress perpendicular to foam rise 0.41 Mpa
* Compressive modulus parallel to foam rise 19.5 Mpa
*Compressive modulus perpendicular to foam rise 10.1 Mpa
*Tensile strength parallel to foam rise 0.79 Mpa
*Tensile strength perpendicular to foam rise 0.44 Mpa
*Tensile mod parallel to foam rise 26.7 Mpa
*Tensile modulus perpendicular to foam rise 12.3 Mpa
*Poisson`s ratio ν12 0.72

Workability
*Excellent workability good mechanical workability provided a small cutting edge angle and large rake face angle

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8. CONCLUSIONS

8. Conclusions

The world today is facing the reality of the impacts of over-consumption and environmental abuse. This realization will hopefully result in a shift from environmentally detrimental business practices to those that minimize environmental impact. The benefits of component reuse can be described not only by their environmental and economic benefits, but also by their social and historical benefit. Scrap Network for an Industrial sustainability at the Lombardy region" is a project which faces new solutions, either in economic matters on the availability of economic resources or in terms of artistic and cultural practices (art , design , architecture, fashion) and its project - based method including productive horizons (eco – business). This new project is an atlas material which basically is a map relating to a given territory where are reported the availability of company's discarded materials, scraps from industrial and artisanal production and unused materials and semi-finished products in order to recirculate matter resources for the benefit of all stakeholders of a collectivity (New chain). An atlas assumes that this mass of matter does not consist of waste, but rater of secondary materials which when are placed in a highly creative ambit, may be considered as new raw materials. Scrap Network for an Industrial sustainability at the Lombardy region is an attempt to create a large scale's network, which allows the exchange of information between the different affiliated companies and also with the general public, arranging and providing in a data –base, the secondary materials' information and above all their availability.

On the other hand, according to Materials Library Trend, the Atlas Material or scrap network presented in this thesis, would engage this emerging trend (creation of materials Library) it is fascinating to think that this library will be fed by a company network who provides the information and the various scrap materials. Initially, the scrap network would born as a local network which operates in the Lombardy region but that with the passage of time this phenomenon can be reproduced, expanding itself into other regions and cities even in other countries, therefore creating more coverage, also new contacts which would give greater strength to this network, and mainly a significant environmental impact. Worth noting that Networks is rich in structural holes, because they are a form of social capital in that they offer information benefits. The main player in a network that bridges structural holes is able to access information from diverse sources and clusters. This is beneficial to an individual's career because he is more likely to hear of job openings and opportunities if his network spans a wide range of contacts in different industries/sectors. This concept is similar to Mark Granovetter's theory of weak ties, which rests on the basis that having a broad range of contacts is most effective for job attainment.

At the same time during the course of the project, it was observed, that companies can implement within their product life cycle system, the recovery method through scrap reuse which would leave an open space to start up the network which would work as a support instrument for designers, architects, companies artist and general public allowing them, to evaluate the possibility of product development from

scrap materials, giving at the same time advantages to involved companies from the economic (reducing disposal costs) and environmental (for human health and planet which consequently would give a positive image for the company) point of view, providing a new perspective in product design where scraps are the new raw materials and network users the transformers of a new productive reality that find a new design opportunity in that which is considered as waste. Among other advantages to companies, worth highlighting the fact that the “Scrap Network” avoiding the logistical costs of waste collection centers, then. will users to decide, consulting the on-line map, the possible pickup and conveying, according to their technical and economic needs.

Between future developments is contemplated the possibility of creating two complementary entities, an agency with which to coordinate the drafting, the updating, the implementation of map, and spreading of the model (reproducibility in another productive context) and a workshop which provides scenarios, simultaneously developing and producing projects with materials from the atlas, for internal production and commercial purposes or on behalf of others (prototypes, products, installations, etc.) which carries out research and experimentation through workshops, courses and cooperation with universities, schools, foundations, studios , etc. Besides is also contemplated the service “File projects download (Do it by yourself)”; Through this service, users would be able to make by themselves, different objects made from scraps. On the network, would be downloadable the files which specify, materials with which these objects were made, dimensions, Joining elements, instructions for building, and everything necessary to build their own objects. Last but not least is important to emphasize the importance of developing the service design of scrap network , developing the whole interface and its design structure.

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