



Fire



Economic crisis



Climate change



Rapid urbanisation



Unemployment



Resourceful



Integrated

Building resilient industries: Applying industrial symbiosis to support wood recycling in Cape Town, South Africa



Purpose

This case study highlights how the [City of Cape Town](#) has partnered with GreenCape's [Western Cape Industrial Symbiosis Programme \(WISP\)](#) to explore ways in which **wood recycling can build economic resilience and help preserve natural resources**.

Natural resources are under increasing pressure due to multiple complex factors, including rapid urbanisation and climate change, leading to the threat of depletion. The search for viable and sustainable substitutes is imperative, and wood is no exception to this.

Circular economy solutions can support cities to be resourceful and resilient. This helps industries to become **less reliant on virgin material**, and **reduces waste streams and associated environmental impacts, whilst addressing social issues like unemployment without compromising business profitability**.

This case study uses Cape Town, a city which is largely reliant on other provinces in South Africa (SA) for its wood supply, as an example to discuss:

- how industrial symbiosis is a mechanism that can be applied to ensure that **wood is recycled and remains in the manufacturing economy as long as possible**, and is not lost to landfills.
- how **wood value-add activities, focussing on secondary and tertiary manufacturing, can help build resilience to certain and uncertain future shocks** (resource depletion, natural disasters etc.) to ensure business continuity; and
- how **one industrial sector can serve as a vehicle to build and support resilience in other industrial sectors**.

This provides an opportunity for the City of Cape Town to meet some of its resilience goals through the application of industrial symbiosis.

What is resilience?

100 Resilient Cities (100RC) describes resilience as "the capacity of individuals, communities, institutions, businesses and systems within a city to survive, adapt and grow, no matter what kind of chronic stresses and acute shocks they experience".

Chronic stresses "weaken the fabric of a city on a day-to-day or cyclical basis" while acute shocks are "sudden sharp events that threaten a city". Building resilience to these stresses and shocks will require individuals, communities, institutions, and all spheres of government, to play a variety of roles and develop effective partnerships.

What is industrial symbiosis?

A resource efficiency approach where unused or residual resources (material, energy, water, waste, assets, logistics, expertise etc.) of one company are used by another. This results in mutual economic, social and environmental benefits.

Cape Town aspires to be a resilient city and is working in partnership with 100 Resilient Cities (100RC), pioneered by the Rockefeller Foundation. Cape Town is developing a roadmap to enable the city to become more resilient to the growing physical, social and economic challenges. This case study is part of a series highlighting how Cape Town is building resilience.





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Context

Wood utilisation and consumption spans entire value chains and can be found in almost all industrial sectors, from primary to tertiary. The wood production sector is primarily supported by the forestry (plantation) industry. The sustainability of the forestry and wood production sectors is of prime importance for economic development and job security, especially for developing countries like SA. **The sector is integral to the success of many other support industries.**

Wood is primarily used for structural, industrial and domestic purposes, for example:

- Wood products find widespread use in the construction industry in building material like beams and trusses, roofing material, shuttering, flooring, doors, windows, frames and shuttering even as support for structures in the form of poles and slippers.
- Every industry utilises wood mostly in the form of packaging as crates, wooden pallets, wooden boxes (including coffins), stationary and furniture.
- Wood is widely used as a fuel in most industries, including at a domestic level.



Problem

Multiple industries are reliant on wood resources and wood is technically a renewable resource as trees can be sustainably grown. However, there are other factors to consider which may make the expansion of plantations unviable. These include:

- the availability of land; and
- local climatic conditions (i.e. whether the area receives enough rain, since irrigation is never used on plantations).

Furthermore, the structure of plantations is problematic due to exposure to risks related to a loss of biodiversity. Natural forests are diverse ecosystems, while plantations are 'monocultures' made up of alien plants such as pine and gum trees that are planted to produce timber. Eucalyptus and pine trees, for example, compete with indigenous trees and plants for water and sunlight, and also change how the ecosystems function. This is one of the key reasons why the environmental impact of forestry activities has to be assessed and regulated as a single threat has the ability to wipe out the whole artificial forest (e.g. pests and/or drought).

This is particularly problematic for wood-intensive businesses, considering that total plantation area in SA is shrinking due to planned (i.e. decommissioning; as some of the areas are being exited and handed over for rehabilitation to forestry management

agencies as Sanpak when they become uneconomical to run) and unplanned disruptions (i.e. fires and natural disasters etc.). Every time plantations are exited, the availability of wood and fibre resources also decrease. **This presents risks that impact the entire supply chain.**

Demand increase and waste generation

There is a positive correlation between population growth and wood product utilisation, as production has to increase to meet demand for wood products. More construction activities, for example, directly translate into increased demand for wood in the construction industry.

This subsequently results in the **increased generation of wastes during production and construction phases simultaneously**. Traditionally, these wastes have ended up at landfills, especially for the downstream wood and support industries. The City of Cape Town has an imminent problem with landfills running out of space.

Diverting woody material to industries that can benefit and add value to them extends the life of landfills, avoiding the need to construct costly new landfills in the short term.

Primary industry wood businesses (sawmills, pulping etc.) have long embraced resource efficiency and have put efforts in place to **try and extract the full value of the wood material**. For example, bark, wood chips and sawdust generated at mills are used to supplement energy requirements by directly combusting them in boilers and furnaces for heat recovery. Some businesses even convert pulp into liquid fuels like ethanol, especially at the virgin pulp and paper mills.

The picture changes as the wood material moves down the value and supply chain, with less value-add activities being applied to wood-related waste streams. This is thought to be due to the industries not being as mature and integrated as their counterparts upstream, as well as the increased relative costs, since the businesses (e.g. wooden fence manufacturers) are typically smaller.

Storage of biomass also comes with some risks. Besides taking up space, and the need to be transported and discarded at a suitable place (which is costly), biomass potentially poses an explosion and fire hazard, as well as ecological hazards related to the spread of disease through the transport and storage of insect-infested firewood e.g. the recent outbreak of the invasive Polyphagous Shot Hole Borer beetle (PSHB).



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Solution

The City of Cape Town strives to look for opportunities to provide sustainable resource solutions with minimal impact on the environment and people. This is one of the reasons that the City partners with GreenCape's WISP. The programme seeks to **improve resource efficiency through industrial symbiosis solutions for under-utilised resources like wastes and by-products**. This is done by matching these businesses to other businesses that can make use of them as resources. This can unlock opportunities to harness the energy locked up in the biomass, to unlock the value of waste wood for economic gains.

Driving resource efficiency through circularity

Ensuring that wood remains in the manufacturing economy post utilisation and not lost to landfills is imperative. Industrial symbiosis (IS) one mechanism that can be applied to achieve this.

Secondary wood value-add activities play a vital role in boosting the economy through creation of jobs and reducing negative environmental impacts, as individual businesses and entire economies move towards implementing more circular models of business operation. This is only possible through elimination of disposal, which is the final stage in a linear economy. Circularity can be created by closing more material loops through reintegrating material back into the economy.

By-products and waste streams from businesses that use wood can be incorporated into other products as substitute raw materials, refurbished into newer products or used as alternative fuels to power processes.

The ethos behind creating circularity in economies is to decrease the over reliance on virgin raw materials and not to completely replace them, but rather to make sure that they are sustainably consumed. The best solutions are usually a mix of virgin and recycled material, to produce products with optimal properties perhaps until such a time as when technology permits us to mimic nature's processes perfectly.

Generation of wood by-products and wastes

Wood by-products can broadly be categorised under treated wood products and untreated wood products. The materials include wood resources that are approaching or have reached end-of-life and need to be replaced because they are no longer safe to use or have lost functionality due to aging or physical damage.

The processing of trees in the pulp and paper industry generates a lot of by-products and wastes like saw dust wood chips/shavings, bark from debarking and green waste (leaves and small branches). Saw dust and wood chips are continually generated in all downstream beneficiation processes, even though the quantities might decrease as you move down the value chain. There are also off-cuts from the construction industry as well

contaminated wood from demolition activities in addition to the cleanable material that can be salvaged for reuse.

There is still a lot of work to be done with secondary wood resources, especially when it comes to treated wood. Because of the glues and chemicals used to treat them, they are environmental and health concerns for combustion type of solutions for this stream.

As technology advances the development of suitable solutions is foreseeable, whether in the form of better post combustion scrubbers or more environmentally friendly glues and wood treatment chemicals.







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Industrial symbiosis in action

Using fit-for-purpose/application thinking can improve resource efficiency by ensuring that resources have multiple reuse options before they finally have to be discarded or down-cycled e.g. lower quality wood for uses that do not require high quality wood. A salvaged wooden truss, for example, can be converted into furniture or pallets, which can in turn be converted into fuels for heating purposes. The ash can be used for pH control in soils.

The Western Cape imports all its coal requirements from further North in the country. There is a major logistical financial implication that Western Cape businesses have to incur, compared to businesses

up north. This is one of the major reasons why the Athlone power plant became increasingly infeasible to operate. To counter this, waste biomass and wood resources that are available can be used as fuel in boilers and other heating operations, offsetting the cost of the substituted coal. Any interventions implemented to cut costs build resilience.

All the value-add activities (separation, drying, briquetting, pelletising etc.) to get the biomass into a suitable fuel can add to job creation in the City. Cape Town has seen the proliferation of tech start-ups that are doing biomass-to-liquid fuels (pyrolysis), biomass-to-solid fuels (charcoalising), and biomass-to-gaseous fuels (gasification). Not only do these fuels serve the wood

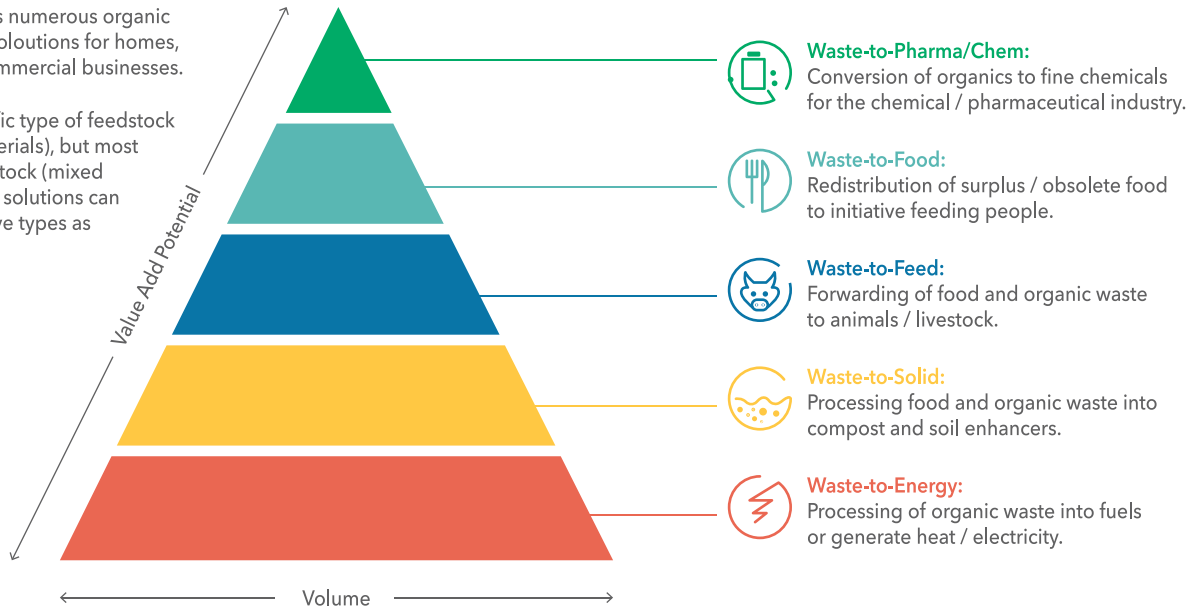
sector, but it can also be channelled to other industries to ensure that businesses are not overly reliant on traditional solid and liquid fuels.

It also contributes to job creation through the setting up of new enterprises. Many social issues can be alleviated like poverty, access to education, access to health, decrease in the prevalence of crime etc.

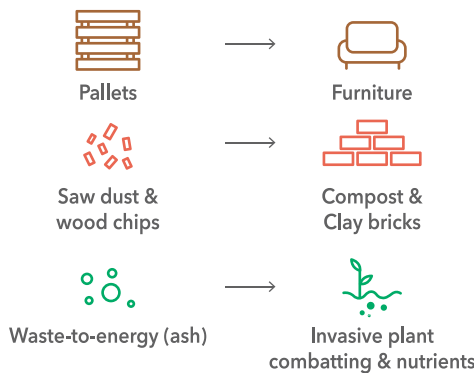
Using the bio-economy hierarchy, which tries to move value-add activities up the hierarchy, the WISP programme has managed to find viable solutions for wood reuse.

The western Cape has numerous organic waste management solutions for homes, and industrial and commercial businesses.

Some require a specific type of feedstock (e.g. plant-based materials), but most allow for varied feedstock (mixed organic waste). These solutions can be broken down to five types as illustrate on the right:



Below are some of the resources that have been identified across all sectors that can be fed back into the secondary stage of the wood value chain.





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1. Pallets

Most of the broken and used wooden pallets are being taken by companies that are able to refurbish the wood into new pallets or convert them into new furniture. One particular case is of a pallet manufacturer that completely changed their business model after realising, through a WISP engagement, the vast amounts of under-utilised wood. They have since substituted the use of virgin wood with old and broken pallets which they can source at a cheaper price from the various industrial sectors. This has led to creation of new jobs and diversion of waste wood from going to landfill. By-products and waste streams from businesses that use wood can be incorporated into other products as substitute raw materials, can be refurbished into newer products or used as alternative fuels to power processes.

2. Saw dust and wood chips, green waste

WISP's facilitation has seen the increased uptake of saw dust, wood chips and green waste by composters. Some of the saw dust is taken up by clay brick manufacturers who need it for its energy value and the fact that it improves the quality of the brick by making it lighter and more porous, improves the insulation properties of the bricks. The saw dust is collected from mostly furniture manufacturers.

WISP has also sourced saw dust and wood chips for biomass boiler operators which

either briquette or pelletise the saw dust into refuse derived fuel (RDF). The RDF or chips are used as substitute for dirtier, more expensive coal which has to be shipped from inland. Use of wood in waste-to-energy activities improves the business cases for the applied technologies. There are cost reductions for the companies using the alternative fuels and additional revenue for the companies supplying the biomass fuels. The carbon footprint of the companies implementing the synergy is reduced.

Saw dust can also be used in the making of bricks, resulting in light weight bricks that have excellent insulation properties. This saves the brick companies money as they use less raw material (for the constituents that would have substituted). Transporting lightweight products with the same volume as the heavy products saves on fuel. These bricks can be used to fire kilns, for drying, and for heating purposes in industry.

3. Waste-to-energy to deal with invasive plants

Waste-to-energy initiatives are also effective for dealing with alien invasive plants as they completely take them out of the environment. Alien invasive plants are a serious threat to biodiversity and water resources as they consume more water than indigenous plants and can have a significant negative impact on fresh water and wetland systems. The residues from waste-to-energy, mostly ash, can be used in the agricultural sector for the nitrogen, potassium and sodium value, whilst chars can be used as

soil conditioner and fuels can be made via gasification depending on application.

4. Work in progress: Treated wood

Reuse is the current solution for wood that is still intact and has retained its aesthetic qualities. As technology advances, waste-to-energy technologies will be able to deal with treated wood in the same manner as untreated wood. WISP is currently working with various stakeholders on solutions to treated wood disposal. On another front there are advocates that are working with chemicals companies to develop more environmentally friendly wood preservation chemicals for wood as initiatives like product stewardship and extended producer responsibility take more centre stage going into the future.

Observed trends

There is widespread acceptance of the use of saw dust and wood chips used to supplement energy resources. This waste stream can be used as boiler fuel to substitute coal, especially for businesses in Cape Town where the cost of transporting coal from up North can be expensive. In cases where the material cannot be used as it is, there are other businesses that convert the saw dust into briquettes and pellets, so called refuse derived fuels.





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Impact

People

There are opportunities for enterprise development which comes with job creation and this has many social benefits. As technology advances and more research and development is done, value-add companies which previously did not exist will germinate, for example businesses that will be able to deal with treated wood which is currently a nuisance waste stream in SA.

There is a lot of potential to reduce some of the social stresses currently experienced by people coming from impoverished communities. There can be increased access to proper housing, if houses can be built from alternative cheaper materials i.e. recovered wood panels reused in building projects.

Employment empowers communities, and there is greater access to health and educational facilities. Reduction of these

stresses helps reduce prevalence of some social ills like crime. This leads to both resilient industrial sectors and resilient communities.

Profit

Resource efficiency measures enable businesses to improve their financial bottom-line. There are opportunities to increase revenue through selling by-products and wastes and reducing costs through avoiding disposal and use of alternative substitute raw materials.

Planet

There is reduced dependency on the primary sector by utilising the secondary sector, as some of the wood coming from tertiary and other industrial value chains can complement virgin material. The less the Earth is worked, the greater the welfare and balance of natural eco-systems.

Impact in action

Through the assistance of WISP one company that used to make wooden pallets from virgin timber completely changed their business model to one where they manufacture pallets using broken and used pallets resulting in major cost savings.

Due to easier access to broken and used pallets the company expanded their business and employed 3 more permanent employees to accommodate for the additional manufacturing capacity.

The company does not use virgin timber anymore. Offcuts that cannot be used are supplied to the informal market for the production of kennels and fire starters.

Lessons learned

WISP has demonstrated how a holistic approach to increase the efficient and effective use of material (in this case wood) can increase the resilience of the wood sector. Through application of industrial symbiosis, and by learning from one other, WISP is supporting businesses to proactively implement strategies to adopt and mitigate against known and future resource constraints.



For more information and support contact GreenCape's Western Cape Industrial Symbiosis Programme (WISP): WISP@greencape.co.za or call (021) 811 0250. Additional resources are available from: <https://www.greencape.co.za/content/sector/wisp>
Images in this case study are courtesy of Pxhere.