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End-of-life tire (ELT) management Toolkit

Tire Industry Project

Contents

About the Tire Industry Project

Formed in 2005, the Tire Industry Project (TIP) is the tire industry's primary global forum on sustainability topics. Operating under the umbrella of the World Business Council for Sustainable Development (WBCSD), TIP is a voluntary CEO-led initiative that brings together 10 leading tire companies, representing more than 60% of the world's tire manufacturing capacity.

TIP aims to be a leading and trusted source of knowledge on the potential human and environmental impacts of tires through their life cycle, and proactively drives research to where it is most relevant and where findings can have the most impact.

TIP works on a range of topics relevant to the key stages of the life cycle of tires: from the sourcing of raw materials, through the manufacturing and use phases, to the management of end-of-life tires.

Our members

BRIDGESTONE Solutions for your journey

Continental

GOODYEAR

HANKOOK driving emotion

KUMHO TIRE

MICHELIN

PIRELLI

SUMITOMO RUBBER INDUSTRIES

TOYO TIRES

YOKOHAMA

TIP at a glance

A CEO-led project founded in 2005 by member CEOs

Primary global forum for the tire industry on sustainability issues

Focus on health & environment aspects of tire life cycle

1 Introduction

The drive behind improved ELT management

Globally, an estimated one billion tires reach the end of their useful lives every year. Various regional efforts by government authorities, the tire industry and individual manufacturers are currently underway to improve ELT management and good progress is being made. The management of ELTs in environmentally sound and productive ways continues to be a high priority of TIP members. TIP has supported extensive research on ELT management systems globally and has published its findings at www.wbcsd.org/tip.

ELTs have a variety of uses and stakeholders are increasingly viewing them through the lens of the circular economy as a resource instead of waste. Environmental issues continue to be a driving force behind ELT recycling. As the recycling industry develops with legislative and infrastructure support, it is becoming clear that there can be significant benefits.

ELT recovery can provide cost-effective and environmentally sound energy for several industries. ELTs can also replace the need to use limited natural resources and provide innovative materials for new products and civil engineering projects.

What is ELT Management?

ELT management refers to the collection, transport and treatment of tires that can no longer serve their original purpose on a vehicle. The objective of ELT management is to recover material or energy from the tires or to properly dispose of them to avoid negative impacts.

ELT management contributes to the circular economy because ELTs and their constituent materials offer valuable resources.

What occurs in the absence of ELT management?

The mismanagement of ELTs is a missed opportunity for the circular economy. Tires and their materials can provide an inexpensive, yet valuable, resource for a variety of applications.

Further, the absence of appropriate ELT management can lead to the unregulated dumping of tires that might present risks to human health and the environment. For example, unmanaged tire piles are a fire risk, they are also a potential breeding ground for mosquitoes which can be vectors for disease. There is also risk that unmanaged ELTs are reused illegally in conditions that do not meet safety standards.

What are the benefits of ELT management?

In addition to helping minimize some of the risks associated with the absence of ELT management described above, good ELT management delivers a range of sustainability benefits, including:

Economic benefits

- Increased industrial activity (waste collection, tire retreading, tire material and tire-derived fuel (TDF) processing, etc.)
- Improved infrastructure for cities and regions (deposit, collection, transportation, supply chains, energy supply)
- Better allocation of funds destined for ELT management to enable long-term planning (e.g., investment in infrastructure and technology, developing new markets)

Social benefits

- Job creation in ELT-related industries
- The avoidance of exposure of local communities to potential health or environmental impacts linked to the absence of proper ELT management
- Better coordination of stakeholders in the value chain (common collection of data, multi-actor awareness campaigns, coordinated treatment of issues, etc.)

Environmental benefits

- Contribution to the circular economy through a more efficient use of the natural resources associated with tire manufacturing

What enables successful ELT management systems?

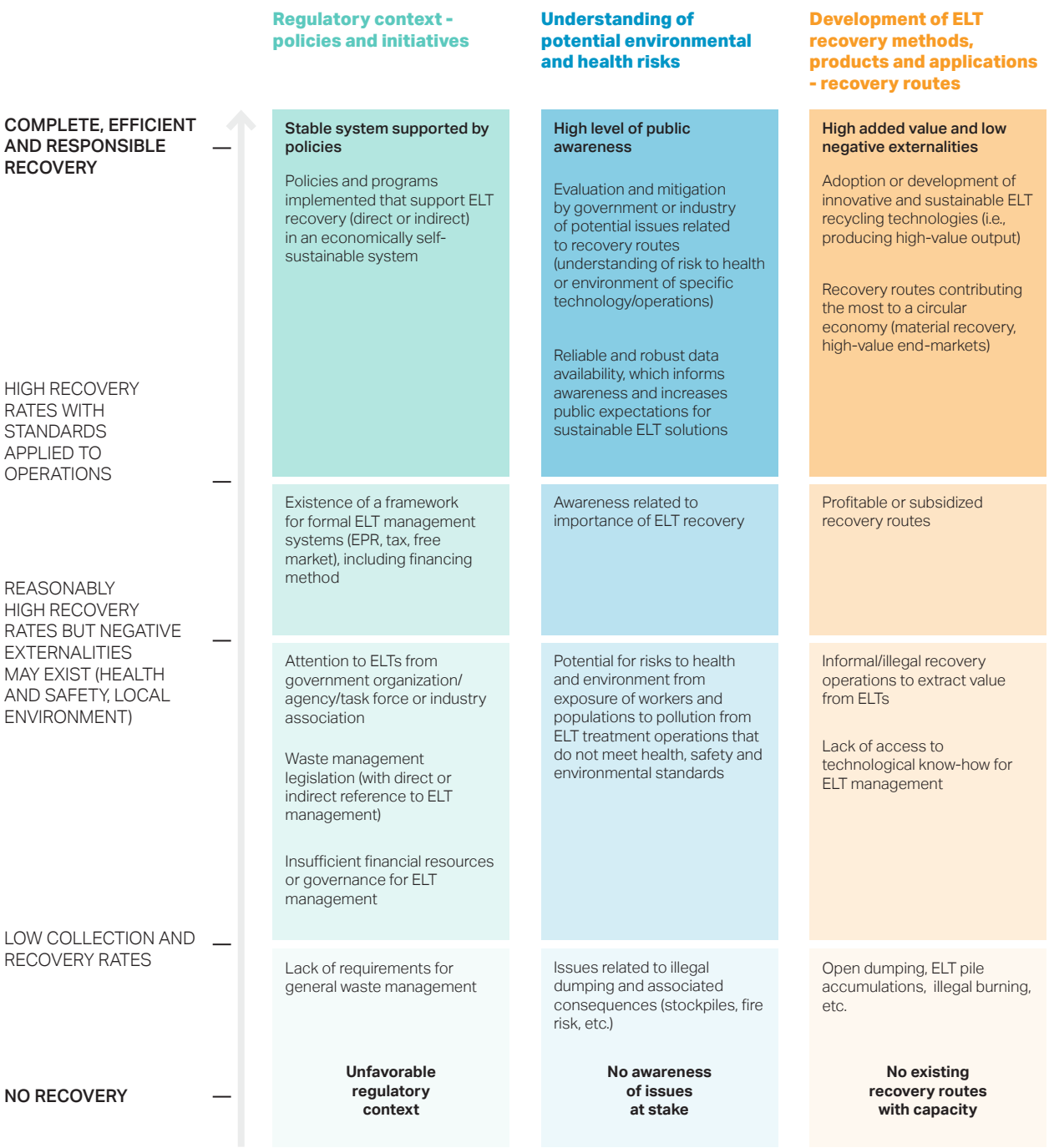
Extended producer responsibility (EPR), tax systems and a free market are all elements of successful ELT management systems. We cover this aspect in detail on page 15.

This toolkit lays out key steps in establishing and enhancing ELT management systems.

2 System development

A maturity scale for ELT management

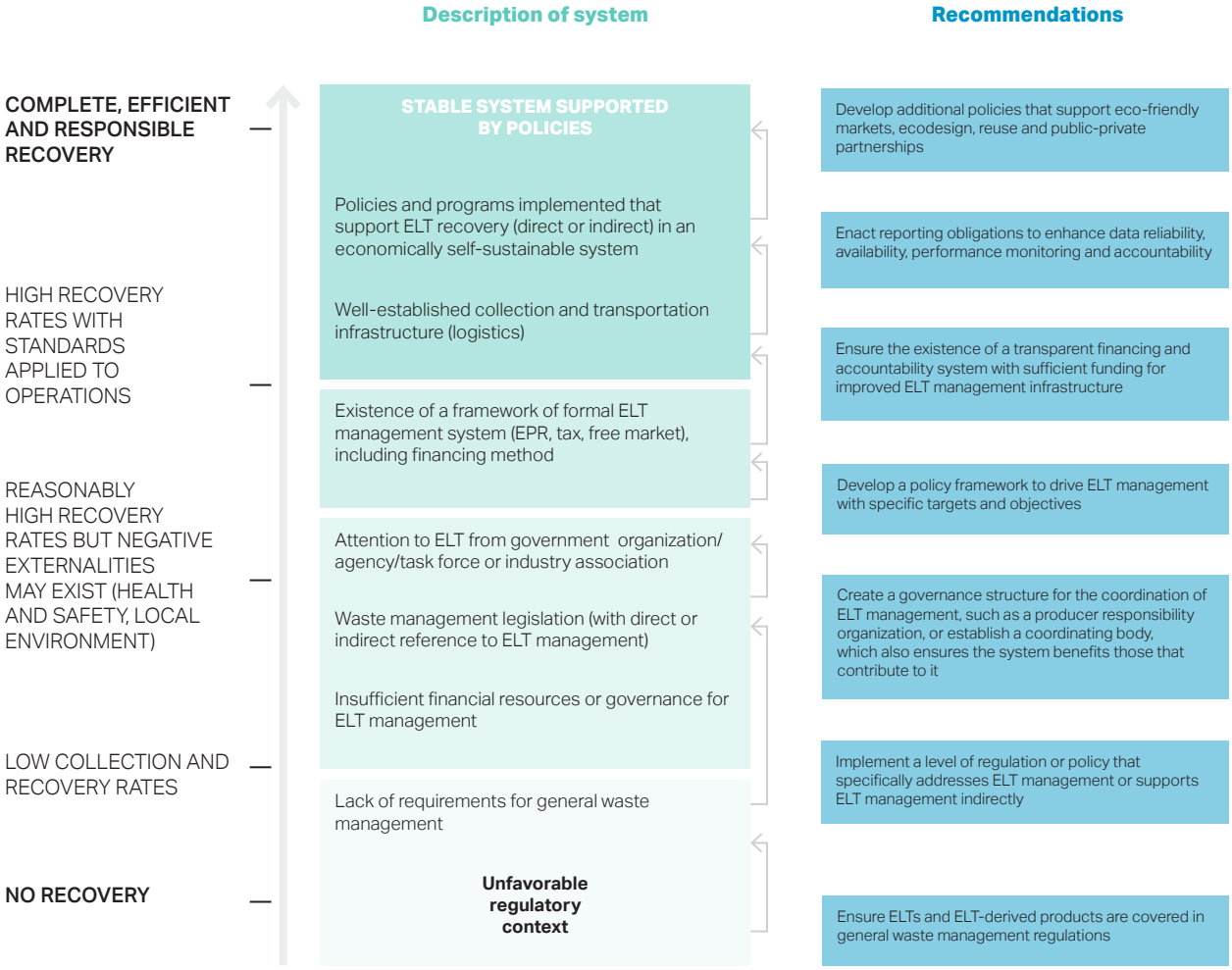
The scale below enables the positioning of a given system in terms of its maturity in three broad categories that identify circumstances as checkpoints in further development.



3 Solutions to establish a successful ELT management system

Regulatory context policies and initiatives

The scale below provides recommendations for steps to activate according to the level of maturity of a given system. Good practices from a variety of geographies and systems accompany the recommendations.



EXAMPLES

Germany (100% recovery rate[1]) has an effective legislative framework to support a free market that allows for ELT recycling to thrive.

France (99% recovery rate[1]) places responsibility on tire producers for most of the ELT management chain, including for collection, transport, stock, recycling and treatment of ELTs, as well as on reporting, which ensures completion of the full recovery cycle. It also allows for limitations on volumes treated through energy recovery.

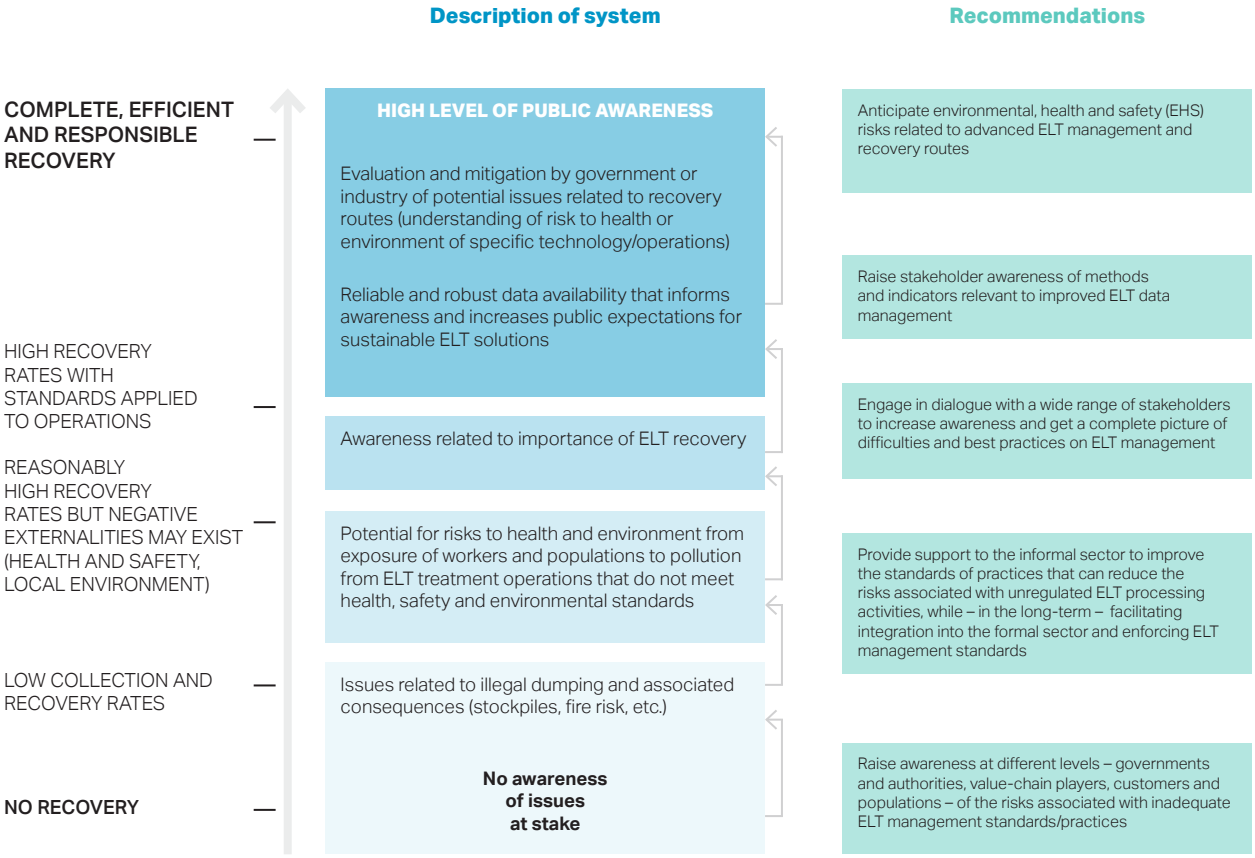
Italy (94% recovery rate[1]) has issued an End to Waste Decree that regulates the use and status of tire-derived products to boost circularity.

South Korea (88% recovery rate[2]) has an EPR system that succeeds by defining roles and responsibilities for actors, as well as a framework for recycling plans, where one organization manages the system end-to-end. The policy also limits ELTs sent to energy recovery to encourage material recovery markets.

Japan (92% recovery rate[3]) regulates ELTs through a specific waste act, where the main ELT management organization conducts the monitoring and promotion of ELT recovery. The ELT free market is in high demand, particularly for TDF, supported by favorable legislation exempting TDF from rules imposed on fossil fuels.

Understanding of potential environmental and health risks

The scale below provides recommendations for steps to activate according to the level of maturity of a given system. Good practices from a variety of geographies and systems accompany the recommendations.



EXAMPLES

The indicators used to monitor the success of an ELT management system should match the objectives of the country. The recovery rate is a principal indicator, putting into perspective ELTs recovered with the quantity generated.

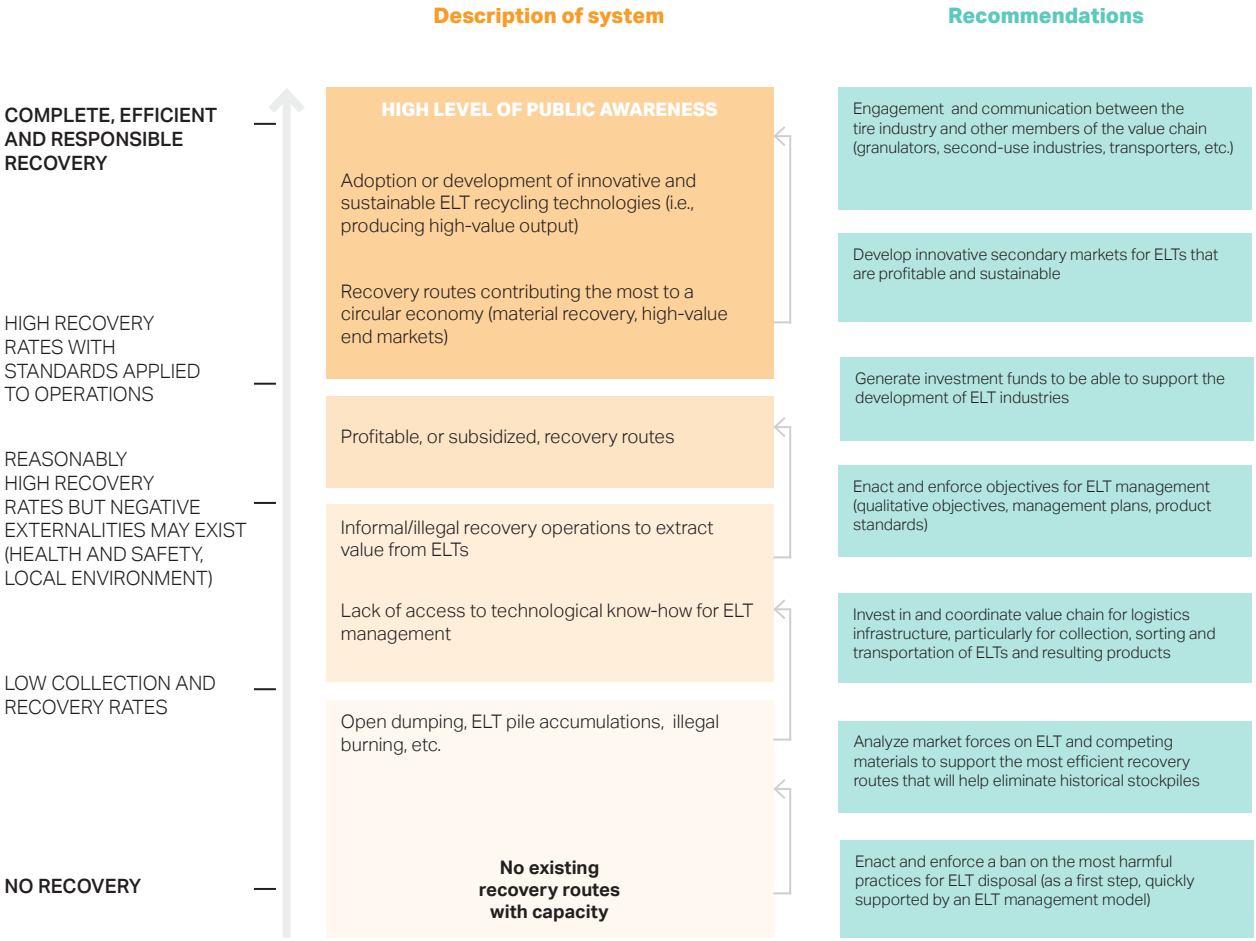
Argentina organized a Tire Recycling Day to raise awareness of ELT-related issues and promote recycling, research and innovation through the value chain, while also helping create links between tire and rubber industries and customers.

In **Australia** (69% recovery rate[4]) the strength of Tyre Stewardship Australia, a government-initiated industry initiative, has promoted awareness and cooperation. The research institution of the University of New South Wales (UNSW) has developed technology that uses ELT as an alternative carbon source for "green steel", allowing for reduced costs for steel manufacturers and greater circularity in ELT management.

Since 1990, in the **United States,** over 94% of stockpiled scrap tires have been cleaned up.[5] This significant reduction in stockpiles was achieved by USTMA, the regional trade association, working in partnership with states to abate the stock piles and prevent their reoccurrence. The cleanup of these stockpiles helps to prevent many dangers including fire and disease risk.

Development of ELT recovery methods, products and applications - recovery routes

The scale below provides recommendations for steps to activate according to the level of maturity of a given system. Good practices from a variety of geographies and systems accompany the recommendations.



EXAMPLES

The **German** free market system (100% recovery rate[1]) combines expertise and engagement among value chain players with well-developed, high-value end-markets to achieve a high recovery rate while also having large quantities of ELTs to manage.

The **United States** (81% recovery rate[6]) regulates ELTs at the state level, where each decides independently of the fees charged for new tires and subsidies for ELT recovery. This efficient system makes active research into new recovery technologies possible.

The **Brazilian** EPR system (99% recovery rate[7]) with reverse logistics facilitates the technical and operational aspects of ELT recovery, which allows for the smooth delivery to the energy recovery sector, particularly cement kilns and granulators.

The **European Union** (92% recovery rate[1]) implemented a landfill ban in 2001 which bans certain types of waste, including ELTs, from landfills.

Recovery route options and their positioning in the waste hierarchy

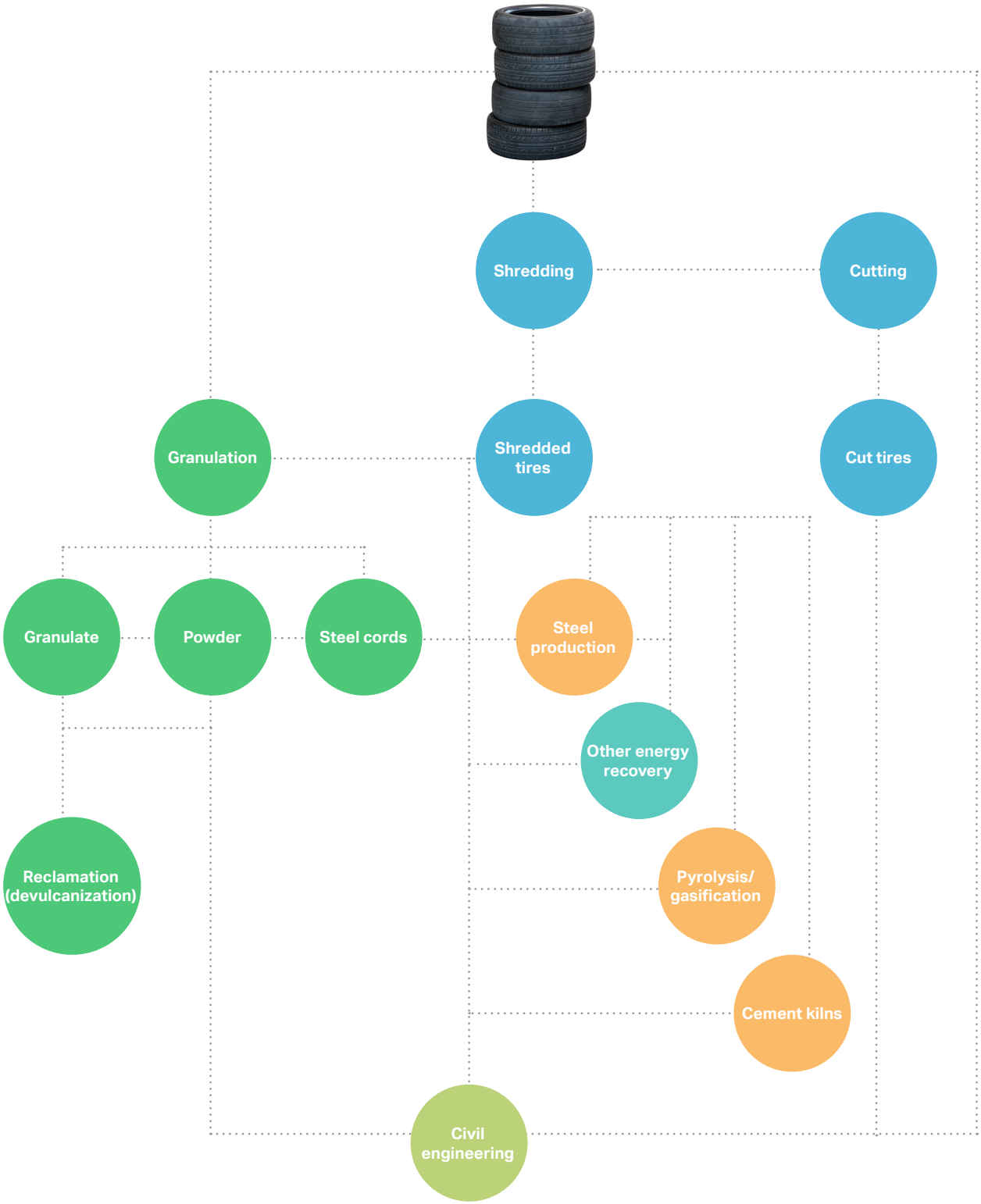
A large variety of recovery routes exist. We have positioned a selection of methods, products and applications in the waste hierarchy below. Moving from right to left along the table, the long-term contribution to a circular economy increases through the more efficient use of material resources to create higher value products aiming to close the loop to the greatest extent possible.

Figure 1: Waste hierarchy and recovery route matrix*

WASTE AND RECOVERY ROUTE HIERARCHY	REUSE	RECYCLING		OTHER MATERIAL RECOVERY	RECOVERY HYBRID			ENERGY RECOVERY	DISPOSAL
ELT INPUT	**Whole tires**	Whole or shredded tires	Rubber granulate	Whole or shredded tires, rubber granulate, crumb rubber and powder	Whole or shredded tires	Whole or shredded tires	Steel cords, whole or shredded tires	Textile, whole or shredded tires	**Whole tires**
MANAGEMENT METHODS	**Repairing Regrooving Retreading**	**Granulation and associated applications**	**Reclamation**	**Civil engineering**	**Pyrolysis and gasification**				**Landfill Incineration**
PRODUCTS (OUTPUT)	N/A	Granulate and powder	Reclaimed rubber	N/A	Oil, gas, carbon/ char, steel			**Other energy recovery** Alternative or additional fuel for energy generation in:	N/A
APPLICATIONS	N/A	Artificial turf infill Athletic tracks Molded rubber products Playgrounds Roofing material Rubber-modified asphalt	Inner tubes Insulation tiles used in public transportation to reduce noise levels Tiles for pedestrian areas (concrete) Tubeless tire liners	Agricultural use Breakwaters Coastal protection Erosion barriers Ground improvement Landfill construction operations Slope stabilization Sound barriers, insulation applications	Carbon black: industrial gaseous effluents treatment (e.g., mercury, sulfur dioxide) Char: water and purification Oil and gas: tire-derived fuel	Cement kilns	Steel production	- Brick production - Industrial boilers - Power plants - Pulp and paper mills - Waste-to-energy plants	N/A
EXAMPLES OF ADVANCED TECHNOLOGIES	N/A	Absorption of phenol and oil in water Composites Concrete Micronized rubber powder Porous pipes from recycled ELTs	Reclamation by depolymerization by nitrous oxide	Retaining walls Soft clay reinforcement	Use as anodes in lithium, potassium and sodium-ion batteries	N/A	N/A	N/A	N/A

*The waste hierarchy category "reduce" is not in the scope of this analysis. In addition, while we have included "reuse" , it is not applicable to all tires and would depend on the condition of the product in relation to the appropriate safety standards.

The links between different ELT processing technologies



- Recycling technologies
- Hybrid recycling and energy recovery technologies
- Other management method
- Energy recovery technologies
- ELT material after initial transformation

Features of the three main ELT management systems

The three main approaches to ELT management we present below are currently in use around the world. However, it is necessary to adapt each system according to the given context and objectives. Hybrid forms exist that include aspects taken from two or more systems.

Table 1: Extended producer responsibility (EPR) system

WHO IS RESPONSIBLE?	HOW IS IT GOVERNED?	HOW IS IT FUNDED?	WHAT ARE THE KEY FEATURES?
• Producer of tires (manufacturer or importer) • They have recovery volume targets based on the quantities of tires distributed in the country	• Through a producer responsibility organization (PRO) • The PRO is generally set up by a group of producers. Sometimes each producer sets up an individual management system. The PRO manages the collection and recovery of a volume of ELTs defined by regulation	• An eco-fee where manufactures and importers of tires pay and usually pass on to consumers • The amount of the eco-fee depends on the cost related to ELT management and secondary markets	• Cost incurred but optimization enabled by the creation of a PRO • Data traceability through reporting obligations • Transparency on the eco-fee's use • PRO has the flexibility to determine the most cost-effective solutions to recover ELTs or to favor the most sustainable options. There is therefore effective control over management methods

Table 2: Free market system

WHO IS RESPONSIBLE?	HOW IS IT GOVERNED?	HOW IS IT FUNDED?	WHAT ARE THE KEY FEATURES?
• No direct responsible parties • Legislatures enact objectives to meet (e.g., recovery rate targets, having an ELT management plan)	• No mandatory dedicated organization • However, most often a tire industry association takes charge of promoting responsible ELT management. More general waste-related regulations cover ELT issues	• The market self-funds the system. There is no collection of a mandatory regulated eco-fee • However, there might be a management fee at some point in the value chain	• Limited state intervention but a policy/legal structure for ELT management • Limited producer involvement where companies cooperate on a voluntary basis • Market forces are the main driver for ELT management (i.e., the most mature and cost-effective recovery routes representing the biggest share of the market) • Funds from government often used to raise public awareness in order to respect the competitiveness of the market • More difficult for more sustainable recovery routes to develop if not economically interesting at the beginning

Table 3: Tax system

WHO TAKES RESPONSIBILITY?	HOW IS IT GOVERNED?	HOW IS IT FUNDED?	WHAT ARE THE KEY FEATURES?
• The State (i.e. local government, territory, or nation)	• The state ensures the governance of the ELT management system • The state will take charge of organizing the system and remunerating relevant operators in the recovery chain	• The state levies a tax on tire manufacturers, importers and/or consumers	• The state guarantees a level playing field by enforcing the same product standards on all tire producers • The taxes often favor more sustainable recovery routes (e.g., materialrecovery over energy recovery) and prohibit landfilling

4 ELT data collection, consolidation, monitoring and reporting

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The periodic collection of global data on ELT management provides a snapshot of the current state-of-affairs and a view of the evolution of the regional performance of ELT management systems. This information provides a baseline against which to measure progress and identify opportunities for improvement.

ELT management systems are usually contained within jurisdictions such as regional territories or countries. When conducting a statistical analysis of ELT management for a given zone, the approaches taken are often varied in terms of scope, definitions used and detail.

The global state of knowledge would benefit from a more standardized approach to the monitoring of ELT management systems.

However, there is sufficient commonality in regional data collection to support global-level knowledge sharing that can inform improvements in the effectiveness of regional management systems or, indeed, the establishment of systems where none were previously in place.

Data on ELT management comes from multiple sources, including state regulators, ELT management coordinators, processors and end-users. Reliable consolidated sources may not exist for the entire scope and certain figures may require estimations such as extrapolations. ELT-generation statistics are often based on the number of tires per tire type that enter the market over a defined period. Additional sources of ELT-generation data include declarations on tire production and imports, and the quantity of tires dismounted.

The tires present on end-of-life vehicles or stored in historical stockpiles are generally not counted for. Illegally imported tires or unreliable primary source data cause other potential gaps.

Consistency checks can help validate the accuracy of the ELT data collected. For example, it is possible to apply the tire consumption per vehicle per year as a coefficient of the number of registered vehicles on the road.[8]

One of the most advanced practices is the measurement of ELT distribution across end applications, which is particularly useful when evaluating recovery routes, understanding the significance of the range of uses and forecasting future developments. It is possible to make improvements here by tracking data that can validate tire recovery and combining this, where necessary, with end-market surveys.

Figure 2: Indicators of the reliability and granularity of ELT data

Levels 1, 2 and 3 in the following figure indicate how advanced data management can be in terms of reliability and granularity (from level 1 being a basic level of data management to level 3 being detailed and complete).

INDICATORS

1	Total ELTs generated	3	Sub-totals for recovery methods, products & applications	2	Sub-total civil engineering and backfilling
1	Total ELTs recovered	2	Sub-total for energy recovery	3	Sub-totals for recovery methods, products & applications
1	Domestic recovery rate: recovery/generation	3	Sub-totals for recovery methods, products & applications	1	Total ELTs not recovered/ unknown
2	Sub-total for material recovery				

To calculate the approximate mass of ELTs generated per year, multiply the number of ELTs generated in one year by the average weight of a tire (based on local norms), then multiplying this by the expected percentage of a tire's mass remaining at end-of-life (often around 90% of tire mass remains).

5 Conclusions

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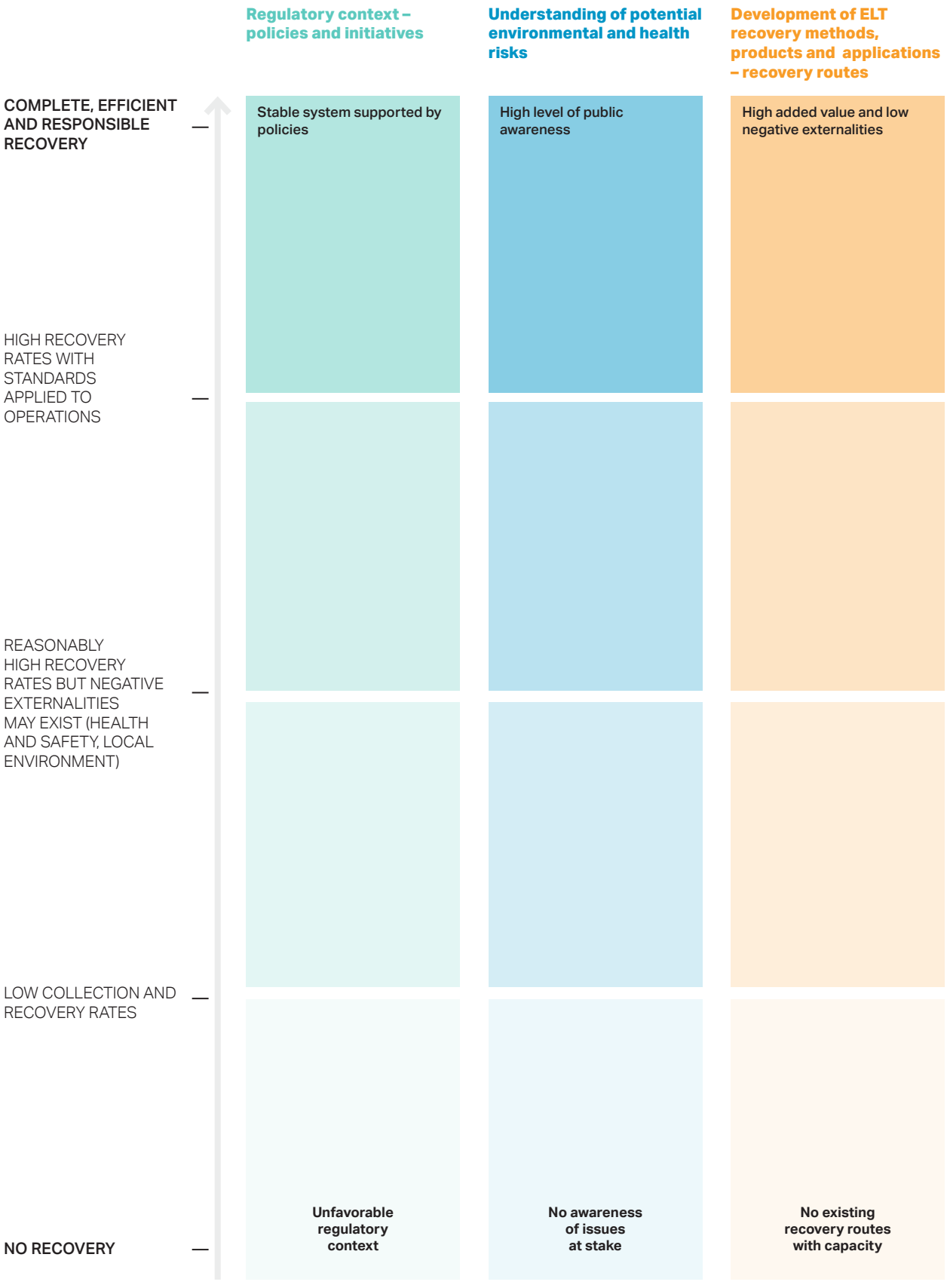
When committing to the sustainable management of resources and efforts to combat climate change, it is necessary to foster a circular economy and to identify substitutes for inputs where it can further the sustainable supply of materials and products. It is evident that ELTs are an abundant and valuable resource that can make significant contribution to a circular economy and provide important social and economic benefits when managed sustainably.

It has been demonstrated at regional and national level that successful ELT management systems can be achieved progressively through the purposeful development of the right conditions. Policies and initiatives that communicate the environmental and socio-economic benefits of circularity can foster high ELT recovery rates, and drive the development of recovery methods and ELT products and applications.

Data management is critical to maintaining and improving successful ELT management systems. Data supports results-driven management by providing a basis for indicators of system performance and informing strategies by helping identify priority areas for improvement.

Start your roadmap
Maturity scale for ELT management



Endnotes

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ABOUT WBCSD

WBCSD is the premier global, CEO-led community of over 200 of the world's leading sustainable businesses working collectively to accelerate the system transformations needed for a net zero, nature positive, and more equitable future.

We do this by engaging executives and sustainability leaders from business and elsewhere to share practical insights on the obstacles and opportunities we currently face in tackling the integrated climate, nature and inequality sustainability challenge; by co-developing "how-to" CEO-guides from these insights; by providing science-based target guidance including standards and protocols; and by developing tools and platforms to help leading businesses in sustainability drive integrated actions to tackle climate, nature and inequality challenges across sectors and geographical regions.

Our member companies come from all business sectors and all major economies, representing a combined revenue of more than USD $8.5 trillion and 19 million employees.

Our global network of almost 70 national business councils gives our members unparalleled reach across the globe. Since 1995, WBCSD has been uniquely positioned to work with member companies along and across value chains to deliver impactful business solutions to the most challenging sustainability issues.

Together, we are the leading voice of business for sustainability, united by our vision of creating a world in which 9+ billion people are living well, within planetary boundaries, by mid-century.

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