

A crystal ball sits on a dark, textured rock. Inside the crystal ball, a sunset scene is reflected, showing a bright orange sun low on the horizon over a dark sea. The sky is filled with soft, orange and yellow clouds. The background of the entire image is a blurred version of this sunset scene.

RE:

SOURCE

RE:Agenda

**The Innovation Agenda
for Sustainable Use of Resources**

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VINNOVA
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THE RE:AGENDA

The RE:Agenda lays out Sweden's need for research and innovation within the area of sustainable resource use. It describes how knowledge-building and new solutions can be achieved.

1. The innovation area

Sustainable use of resources is an innovation area that focuses on how we can better manage nature's resources. The solutions developed in this area should reduce the need for new raw materials as well as optimise the lifespan and use of materials, services and products.

In most cases, this entails preserving value over an extended period of time through long or multiple life cycles, maximised utilisation rate and low material use. In some cases, it can mean short and fast life cycles. Social and economic sustainability are also vital elements in the pursuit sustainable use of resources. Preserving biodiversity will be crucial to ensuring that we stay within the planetary boundaries.

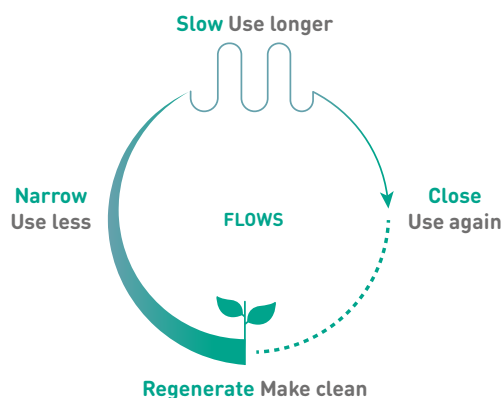
Of the 17 sustainable development goals in the 2030 UN Agenda, sustainable use of resources have the greatest impact on goal 12, "Sustainable consumption and production". New technological solutions, circular business models and shifting consumption patterns are necessary to reduce our negative impact on the climate, environment and human health.

In the RE:Agenda, we have chosen the model from Konietzko et al.¹ to define the innovation area of sustainable use of resources.

"We have a lot to learn from nature. Nature already works in cycles and has refined the processes for billions of years. In nature, we see a diversity of different functions and lifespans, everything fits and is connected in complex ecosystems and no waste is created."

This model includes the strategies Narrow (use less material and energy), Slow (use things longer), Close (use material again) and Regenerate (make non-toxic). If we use these four strategies, we will reduce the use of primary raw materials to meet the same amount of consumer needs for products and services. However, in a system of sustainable resource use we will always have certain material losses. These can involve materials that end up in the "wrong" place, like in nature or landfills; bio-based waste that is deliberately converted into nutrients and energy products; or materials that are incinerated to neutralise hazardous substances. But the more efficient we become and the higher we value the materials, the smaller these losses will be.

In this agenda, we have chosen not to focus on the actual extraction of resources because there are other agendas that describe these innovation areas, such as the Agenda for the Swedish Mining and Metal Producing Industry and Sustainable Harvesting of Raw Materials.



¹Circular Ecosystem Innovation – An Initial Set of Principles; Journal of Cleaner Production, April 2020, 253:119942

2. Introduction to sustainable use of resources

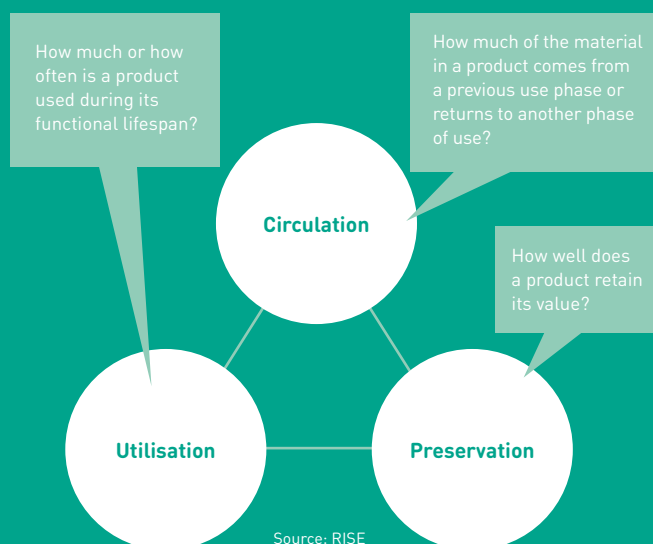
Today, resource extraction and processing account for nearly 50 per cent of global carbon dioxide emissions and cause almost 90 per cent of biodiversity loss. In order to stay within the planetary boundary for sustainable resource use, Sweden must reduce its use of virgin raw materials by 75 per cent by 2050.

The circular economy is an essential part of the solution for achieving sustainable use of resources. But it's not just about closing the loop through recycling. The most important first steps include reviewing whether the need can be met without beginning producing a product; designing the right way from the outset; taking a look at which materials we choose, how we produce the products, how we use them longer and which business models we apply; and optimising the product's value in different phases before it is recycled. For some sectors, such as construction, the greatest positive impact on sustainable resource use is not achieved through material circulation,

but by maintaining and efficiently using existing buildings and infrastructure.

RISE has developed a model for sustainable product and service design which can be used as positive guidance. In short, it involves three broad dimensions: making a product from recycled or renewable materials, using it as often as possible post-manufacture, and having it retain value for as long as possible. In reality, it is difficult to maximise all three dimensions. But by simply trying to maximise them, we help resources maintain their value while reducing linear flows. Here are examples of products where only two of the dimensions are fulfilled:

- A product made only from recycled materials with a high utilisation rate that breaks down quickly (has a short lifespan).
- A product with a high utilisation rate, which has a long lifespan but requires stronger, virgin materials.



"Today, resource extraction and processing account for almost 50 per cent of global carbon dioxide emissions and cause almost 90 per cent of biodiversity loss."



- A product that has a high recycled content and long lifespan but remains unused in a storage room could have avoided being made in the first place.

Source: RISE

We should be careful not to equate circular economy with sustainability and sustainable use of resources. Circular economy does not necessarily lead to sustainability in all applications. Circular solutions might also lead to worse social conditions, so it is important to keep all aspects of sustainability in mind when transitioning to a more sustainable use of resources.

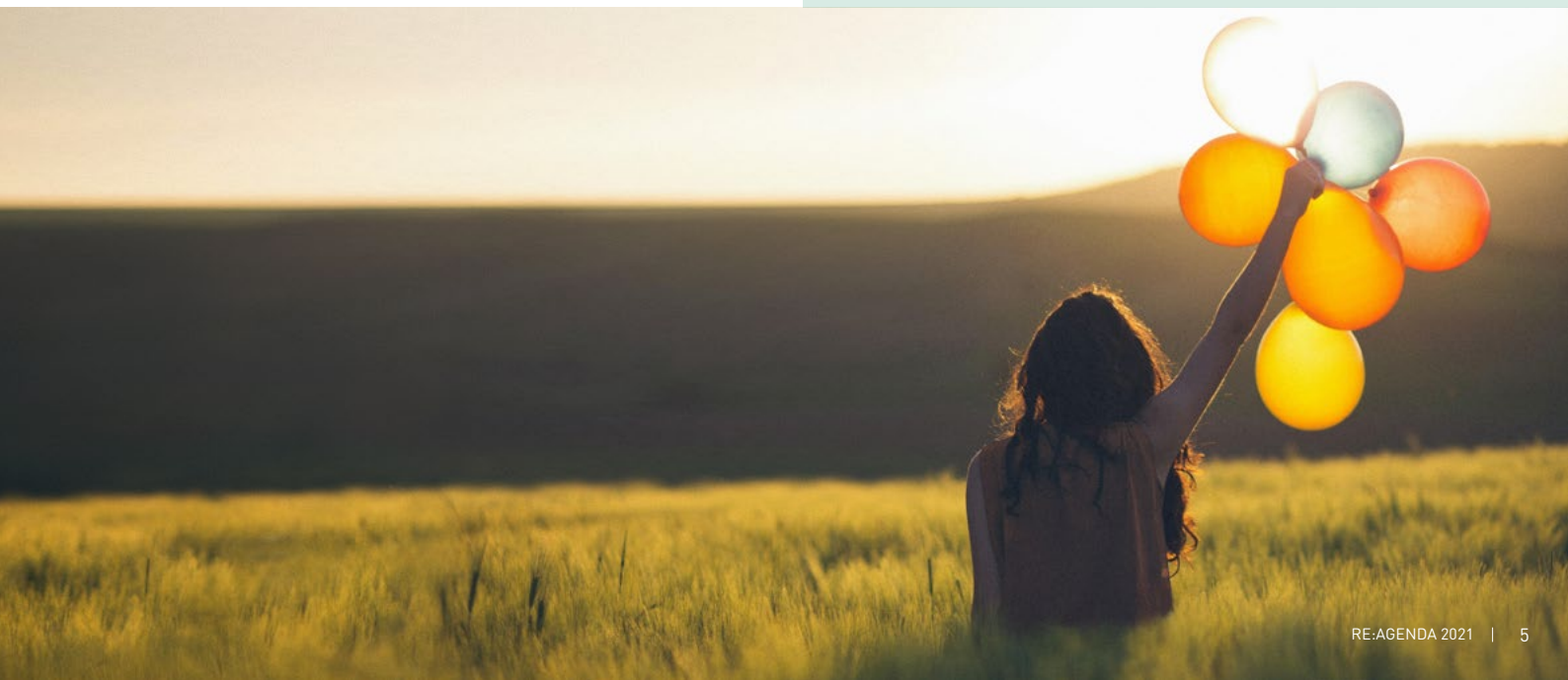
Whatever circular economy model you use, it will require an endless supply of renewable energy. So, it will be crucial for a sustainable energy supply to be in place.

Business opportunities and competitiveness are key drivers for creating the change. We can and should make demands on

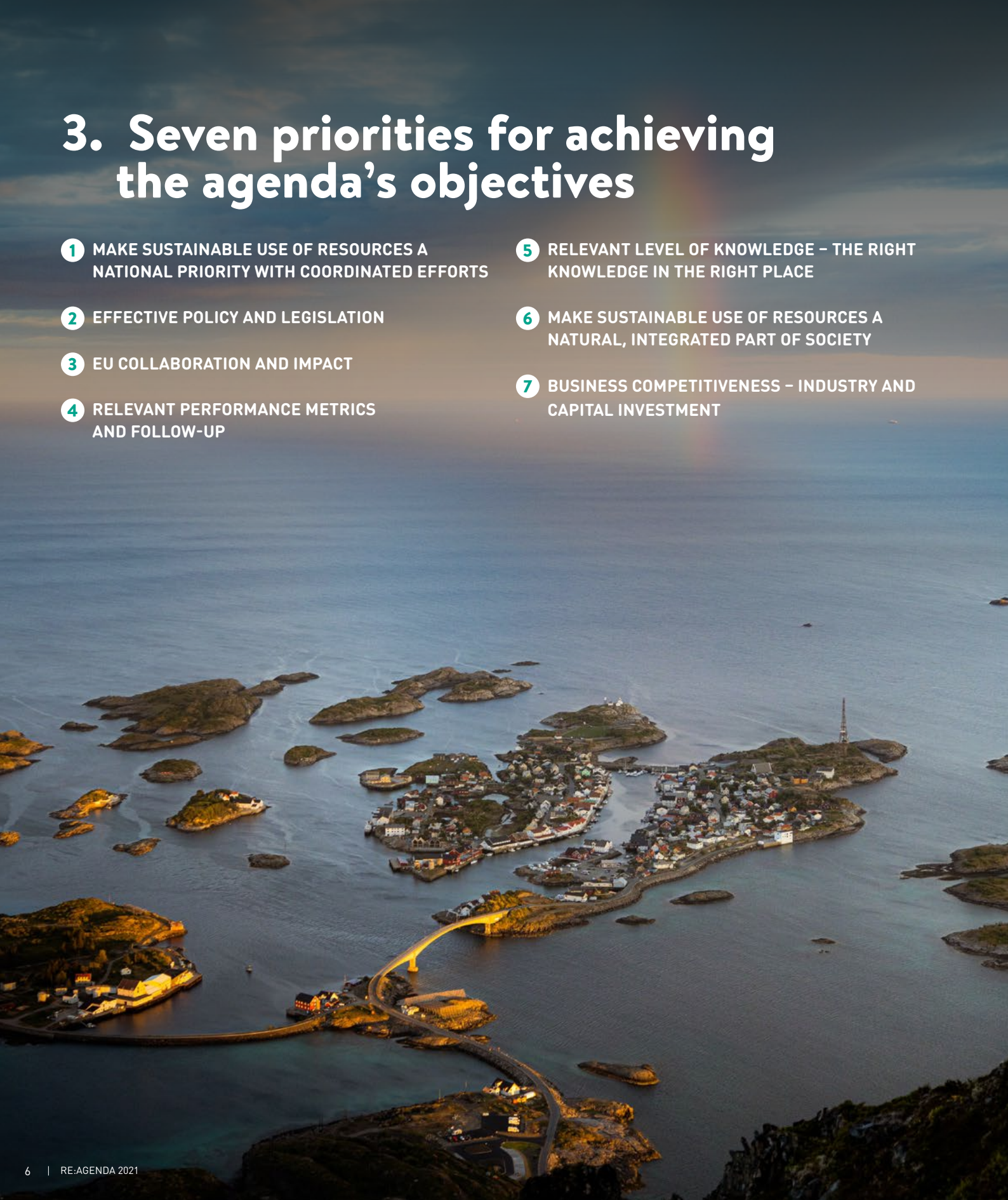
private companies and the public sector to drive the transition, but we should also acknowledge that policy instruments, regulations and financial incentives will be needed whenever market forces do not suffice. A stable political situation combined with predictable rules and legislation make organisations willing to invest in innovation and transformation. Only then can we reach a critical mass that takes us beyond the tipping point needed to create a system change.

"By 2050, we will live well, within the planet's ecological limits. Our prosperity and healthy environment stem from an innovative, circular economy where nothing is wasted and where natural resources are managed sustainably, and biodiversity is protected, valued and restored in ways that enhance our society's resilience. Our low-carbon growth has long been decoupled from resource use, setting the pace for a safe and sustainable global society."

Vision from the European Green Deal



3. Seven priorities for achieving the agenda's objectives

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- An aerial photograph of a coastal town, likely in Norway, featuring a prominent bridge connecting several islands. The town is built on a series of small, rocky islands surrounded by deep blue water. The architecture is traditional, with many white buildings and red roofs. A tall radio tower is visible on one of the larger islands. The sky is a mix of blue and white, suggesting a clear day with some clouds.
- 1 MAKE SUSTAINABLE USE OF RESOURCES A NATIONAL PRIORITY WITH COORDINATED EFFORTS
 - 2 EFFECTIVE POLICY AND LEGISLATION
 - 3 EU COLLABORATION AND IMPACT
 - 4 RELEVANT PERFORMANCE METRICS AND FOLLOW-UP
 - 5 RELEVANT LEVEL OF KNOWLEDGE – THE RIGHT KNOWLEDGE IN THE RIGHT PLACE
 - 6 MAKE SUSTAINABLE USE OF RESOURCES A NATURAL, INTEGRATED PART OF SOCIETY
 - 7 BUSINESS COMPETITIVENESS – INDUSTRY AND CAPITAL INVESTMENT

3.1 Sustainable use of resources is a national priority supported by coordinated efforts

This priority of the innovation agenda requires knowledge about the kind of coordination needed and how it is best managed. For example, we need to generate knowledge in these areas:

- The national strategy for a circular economy, with related action plans, is a good first step. Applied research and innovation (R&I) will be crucial to realise the strategy. It is vital that the national strategy covers several dimensions, for both business-to-business and business-to-consumer organisations.
- The road to the goal: targets have been set for what we should achieve in the shorter and the longer term. Sweden's climate neutrality by 2045 and Europe's by 2050 are two overarching targets. But research is needed to understand how to get there and how to stay on track during the journey.
- We need a systems perspective. We need to bring together existing agendas for the climate and circular economy (as the EU Commission does). It is impossible to solve the climate challenge without addressing the resource challenge. The



potential to recycle is impacted by regulations on chemicals and other topics.

- Are we doing the right things? Are we working with the right material streams? Which material streams could risk that we go beyond the planetary boundaries, today and in 10–20 years? Regular studies of the environmental impact of material streams, substances and products are needed from a systems perspective.

We need to know when circularity is sustainable, and when our pursuit of circularity can instead result in a negative environmental impact. We should also prioritise areas showing great potential so that we transition from individual business initiatives to sustainable system solutions. Research and new knowledge enable a clear picture of the present, the future and the need for priorities and coordination to achieve impact. But generating a clear picture requires innovative solutions, like ones for product and material traceability, so that we can understand in real time where, how and how much material and products are used in society. This would give us an indication of where and how actions should be prioritised and coordinated for a more sustainable use of resources, thereby enabling us to develop more effective measures.

3.2 Effective policy and legislation

To ensure that we have policies and legislation in place that stimulate and support sustainable use of resources, it is crucial that we in Sweden:

- Understand the transition's obstacles and drivers, potential policy measures but also make impact analyses in order to avoid contradictory policy measures.
- Develop innovative policy instruments that create incentives for the transition.
- Develop instruments that can promote a circular transition in all or many sectors.
- Develop instruments that can solve specific problems in certain sectors.
- Spread the knowledge and solutions we produce around the world.
- Are active at the EU level, influencing and participating in policy decisions.

- Work towards policy decisions that create long-term stability so that the stakeholders know what will apply over a relatively long period of time so that they dare to make investments for in the transition.
- Ensure consistent implementation and interpretation of directives and policy instruments for fair rules of play.
- Can understand and mitigate the negative consequences of a circular transition that some companies, industries and stakeholders will face.

Much research is needed in this area so that we can secure the knowledge needed to make informed policy decisions, including decisions to abolish obstructive policies.

This could for example be new ways to measure the circularity or improve the traceability of products and materials that in turn would make it possible to use differentiated policies, governance and standardization in support of more resource efficient and sustainable business offers.

3.3 EU collaboration and impact

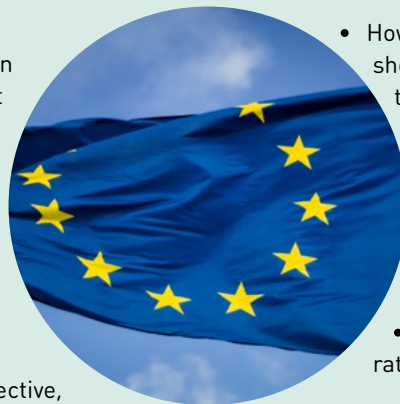
Sweden must collaborate more with Nordic countries, the EU and the world. We need legislation that allows used materials to flow between countries so that these materials can be recycled in an environmentally sound way, wherever the drivers, the energy or the economic incentives are the most suitable.

Removing the barriers for cooperation between countries requires collaboration and impact at a global level. We also need to make it easier for industry to create global value chains, since products are likely to be produced in one place and then enter multiple cycles of use elsewhere. Recycling and upcycling are also likely to take place in a country other than the country of production.

From both a knowledge and a solutions perspective, we see a need for increased global collaboration in research and innovation. In this context, we must understand the following:

- How materials flow worldwide and how to manage this flow in order to promote a more sustainable use of materials.
- How to support the transition to more sustainable material flows in other countries and which successful initiatives and approaches Sweden can adopt and apply.

- The obstacles and drivers for achieving sustainable material flows in global value chains. Most Swedish players are part of global value chains, and the progress of different countries in the transition varies greatly, as does the degree of legislation and innovation maturity. Research is needed to identify the areas requiring increased collaboration and joint efforts around harmonisation.



- How international directives and agreements should be formulated and implemented in order to achieve the desired impact.

There is also a huge need for innovative solutions in order to enable global collaboration and thus achieve circular product and material flows. Examples are:

- Thinking in terms of value, utility and function rather than products and materials.
- Open, transparent and quality-assured processes for characterising, controlling and transferring waste between countries for more efficient recycling or trading marketplaces in, for example, major secondary material flows and discarded products. Here, solutions that enable traceability and quality assurance in a simple, reliable way are essential enablers.
- Cooperation arrangements and business models across national borders that justify the joint development of more circular business offerings and sustainable resource use by entire value chains.

3.4 Relevant performance metrics and follow-up

How far have we come, and are we headed in the right direction? There is a great need to accurately measure how we can shift to sustainable use of resources. There is also a need to question the metrics we use today to measure success for society and nations. Furthermore, we need to understand how a circular economy can promote growth and improve people's lives. We see a great need for research and development around the following:

- How we live in relation to planetary and social boundaries and how we can measure it.
- Alternatives to the GDP for measuring success, that not only focus on productivity and profitability, but also include sustainability and well-being.
- How to include the true value of natural resource in a national, or even global, balance sheets in order to complement the use of the GDP measure of monetary flows to ensure a sustainable balance in the extraction and use of natural resources.
- How to move beyond only having a price on carbon emissions to supplementing it with a price on all resources included in a product or service.



- The pace of transition, so we can follow up on where we are succeeding or failing.
- The type of metrics and methods that can provide an accurate picture.
- The goals and indicators that should be available at both the EU and national levels.

The knowledge generated can be translated into solutions, such as smart design tools in which different product options or business offerings can be evaluated and compared with respect to their impact on planetary boundaries. Or metrics, analytical tools and services that continuously measure and control the resource use of entire operations for increased circularity and sustainability.

Furthermore, the Internet of Things (IoT) and coordinated traceability systems can create clarity and business opportunities regarding how products and materials are used, how they circulate or if they are superfluous. Examples are devices that can communicate – or even order – spare parts when something is about to break, or gaining better control of material streams to encourage reuse and recycling.

3.5 Relevant level of knowledge – the right knowledge in the right place

There is a need to both generate and communicate knowledge to different stakeholders within the innovation area. With an increased level of knowledge, more informed decisions can be taken and behaviours changed, and sustainable resource use can become an integrated part of society. It is important to understand how the target groups absorb information in this context, such as how politicians understand results and facts from research in the field and how it affects decisions.

- Politicians have the power to take decisions that affect the field. But because they come under pressure from different interests, they need to have access to objective studies and research results in an understandable, specific form. Understanding the impact of future policy decisions and instruments would be valuable, and possible, through access to information such as impact assessments.
- The public sector, a substantial part of the national economy, should translate political decisions into action. Knowledge and skills are urgently needed to lead the transition and

secure citizens' commitment and acceptance. It is essential to collaborate with other stakeholders on R&I projects related to social change, who can provide both relevant expertise and solutions needed for the transition. The public sector can serve as an important test bed for implementing solutions such as public procurement as a tool for the transition.

- The general public is one of the key target groups for knowledge and information outreach. This should be done already at school age, so that all citizens get a basic understanding and awareness of circular economy and sustainability. Municipalities and government agencies, as well as private employers, should take responsibility for educational outreach and training. Citizens have a major role to play in the transition through lifestyle choices, such as how we consume and invest our savings and pension money in a sustainable way. With increased awareness, we can take the right decisions.
- The financial sector and access to capital must be part of the transition to a more circular and sustainable world, since it will require enormous investments both in infrastructure and for the development and commercialisation of new circular business solutions. As in fintech and gaming industry, Sweden could become a global success in the circular economy if the financial sector had a firmer grasp of the challenges and potential in the field. Implementing efforts to

further raise the skill levels in this sector and involving this group in the early stages of business development should have a major impact.

- The business community needs to maintain a high level of expertise in the field, and this can be achieved by hiring talent, training existing staff further or collaborating with research organisations on R&I projects. There is a clear need to integrate circular economy courses in higher education, vocational training, folk high schools and more across all disciplines so that students of economics and engineering at universities, trade schools and business schools can gain a deeper understanding of the topic. To attract people to the field, it is vital to raise awareness of its challenges and opportunities among experts and aspiring entrepreneurs in entrepreneurship programmes.

Outreach of research results, knowledge and information to the target groups can increase awareness, commitment and decision-making input through a variety of innovative communication solutions. Examples include innovation competitions, games, informational campaigns, online training, and nudging based on digital solutions. Tools like web-based digital twins, AI, AR and VR can spark interest and provide people with access and information in the right way. Although the application of research is central, the willingness to pay falls short. So, we need to look at how we can support developments by using public resources.



"The general public is one of the key target groups for knowledge and information outreach. This should be done already at school age, so that all citizens get a basic understanding and awareness of circular economy and sustainability."

3.6 Make sustainable use of resources a natural, integrated part of society

In preparing the innovation agenda, a need was identified to make the circular economy and sustainable use of resources part of a culture – a natural part of society and our lifestyle. The transition requires commitment and acceptance on the part of citizens.

With an increasing share of the population located in urban areas, cities are ideally positioned to become transition engines for the circular economy. Because cities are primarily where resources are used or consumed, they play a key role and must take on a greater responsibility in the transition. In parallel, rural areas can serve as test beds for circular solutions on a smaller local scale and lead the way for the major urban transition. Under the heading “Relevant level of knowledge” above, we mention the importance of the public having an awareness and understanding of the circular economy and how each of us can do our part in using resources within the planetary boundaries. In this context, politicians and the public sector (which, of course, represents the citizens) must also have a relevant level of knowledge. But besides knowledge, we also need relevant and effective ways of reaching out to people with information, getting them involved and raising awareness.

Research and innovation can contribute to this objective, by generating knowledge and solutions. This involves:

- Making it easy for people to make the right choices and support the transition (and make their contribution visible).
- Studying consumer behaviours and identifying the drivers for sustainable consumption.
- Stimulating and involving non-profit organisations so they can contribute to the transition through local initiatives.
- Clarifying the consequences, both positive and negative, of the transition to circular use of resources.
- Defining sustainability and transition metrics that include social sustainability and gender equality.

A success factor here is close collaboration among all parties in society, including private businesses.



3.7 Business competitiveness – industry and capital investment

The business community clearly demonstrates growing insight and a better understanding of the need for a circular economy, its potential, and the role businesses play in the transition. If Sweden intends to become a leader in sustainable resource use and create competitiveness and attractiveness, we need a business community that actively collaborates with other stakeholders in society.

Accomplishing this requires a high level of knowledge, awareness of what is taking place beyond Sweden's borders and an understanding of the challenges. Furthermore, the business community must invest in research and innovation in the field, take strategic decisions and implement them so that circular economy becomes a part of its core business.

Since circular economy is a relatively new concept and the current economic system is not adequately adapted to a circular business model, the transition can't take place overnight. Most companies need to gradually transform their business models by doing things like first complementing existing business model with circular services. This is best done in cooperation with contracted providers of solutions, such as infrastructure and platforms for functional sales, that enable an efficient transition to circular business offerings.

To put Sweden in the driver's seat and realise the potential of new business models for a circular economy and sustainable resource use, we need to attract talent, entrepreneurs and capital to the innovation area in order to develop disruptive solutions, businesses and new companies that challenge the linear economy, preferably in collaboration with researchers. Government initiatives thus need to go hand in hand with the needs identified and ensure that funding mechanisms are available for transition and expansion. Since digitalisation is a key driver of the transition, we need to leverage it and secure a tight interplay between digitalisation and circular economy.

Accomplishing this requires a comprehensive need for research and new knowledge to:

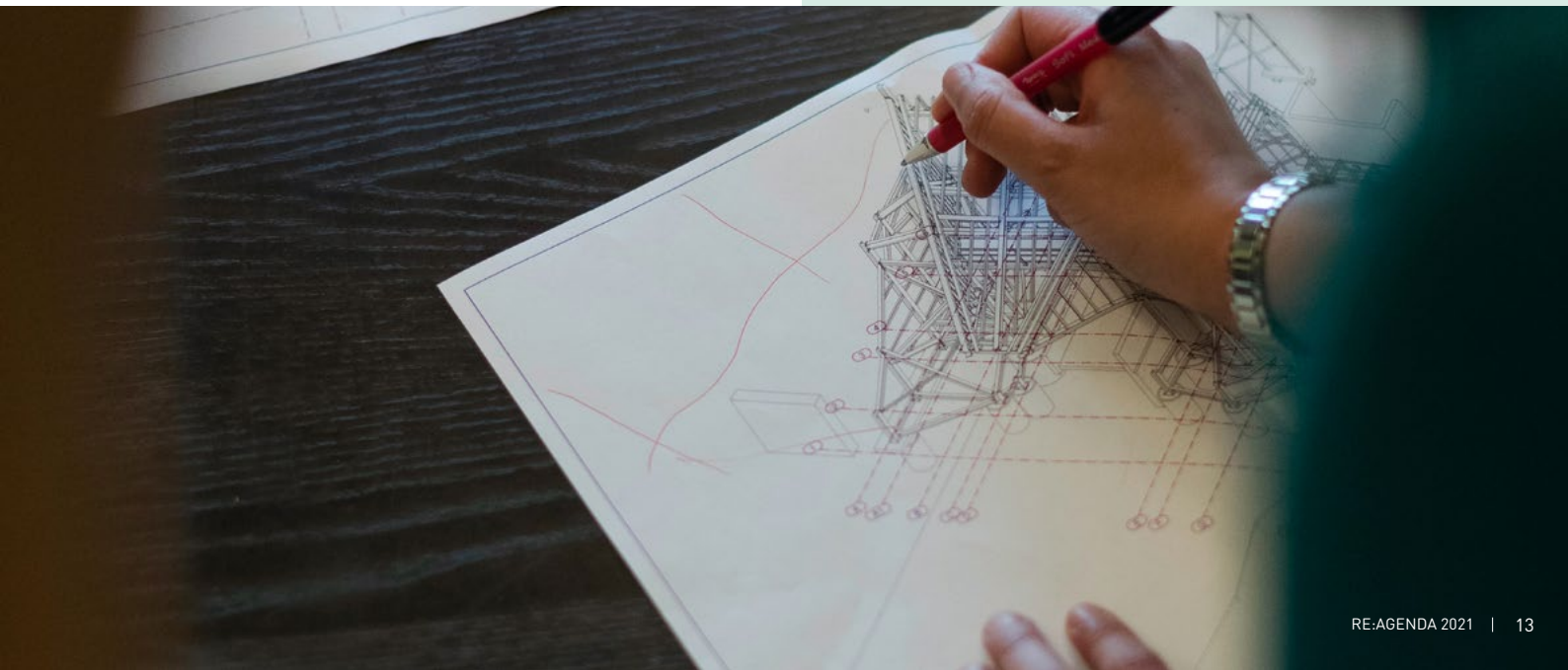
- Understand how the current financial system either supports or works against the transition to circularity and sustainable resource use, and what changes are necessary and viable for promoting the transition.
- Develop new financial and economic metrics, such as investment capital.
- Test and demonstrate scalable solutions.
- Develop new methods for risk analysis of investments in a sustainable circular business.
- Identify and analyse the major challenges and ways that companies can meet them, and not shy away from describing how changes in entire production and consumption systems (business ecosystems) will produce both winners and losers.
- Clearly demonstrate when and how circularity and sustainability can boost competitiveness.
- Showcase positive, profitable cases within industry.



To create a competitive advantage, there is a great need for new solutions in sustainable resource use in all industrial sectors. For many years, in Sweden as in many other countries, the focus has been on solutions for managing waste and contaminated products. We must now shift our focus to designing products, services and business offerings that both increase customer benefit and extend service life as well as enable an efficient circular use of products and components. Some overarching areas that demand innovative solutions:

- Digitalisation as an enabler for sustainable solutions and circular models.
- Traceability of products, components and materials enables quality assurance and a circular use of products and materials. It can also generate user data for products that in turn can enable new services from the product owner.
- The concept of production will need to change fundamentally and turn its focus to remanufacturing processes as a complement to manufacturing processes.
- Value-added processing of manufactured products and materials must be as efficient as new production and use standardised tests, automation optimisation, and decision support based on artificial intelligence indicating a product's future use.
- Development of a sharing economy for companies, which can enable a more efficient use of resources including infrastructure, investments and workforces.
- Industrial symbiosis, by which a company not only leverages its own by-products but collaborates to benefit others within business clusters.
- New business models and business offerings that meet growing demand and needs by delivering functions instead of products, thus extending the value and the customer-supplier relationship.

"Most companies need to gradually change their business models by doing things like complementing existing business model with circular services."





4. Focus areas for research and innovation

In the work on the RE:Agenda, the field's stakeholders identified key research and innovation areas where Sweden needs to invest in order to create competitiveness and attractiveness and contribute to the transition to sustainable resource use.

Some R&I directions were identified as essential for enabling crucial solutions for sustainable use of resources: education, funding, digitalisation and artificial intelligence. For example, digitalisation plays a major role in enabling traceability systems for products, components and materials, which is vital for the development and success of the innovation area. Developing a functioning traceability system requires research and innovation related to:

- Policies (also covering data processing laws), standards and organisational solutions that function across national and industry boundaries.

- Reliable technical solutions.
- Methods and systems for the generation, processing, application and management of data.

However, investments in developing policies, technical solutions and data management systems are not only crucial to well-functioning traceability systems, but are vital for re-launching the three main research and innovation areas identified by the RE:Agenda. Achieving sustainable use of resources requires sustainable products and services that optimise usage, a sustainable closed loop, and an interconnected resource system that rewards efficiency and proper resource management.



1. SUSTAINABLE PRODUCTS, SERVICES AND USE



2. SUSTAINABLE CLOSED LOOPS



3. SYSTEM PERSPECTIVES AND DRIVERS



Sustainable products, services and use

Achieving sustainable production and use requires research and innovation that focuses on:

- Digitalisation as a tool for achieving circular material flows.
- Circular business systems, meaning the prerequisites and infrastructure for circular business. This includes business models, marketplaces, production, reverse logistics, value chains, sharing economy and industrial symbiosis.
 - Innovative business models, production systems and forms of collaboration across value chains.
 - Conversion of production lines in terms of automation, functional sales, and flexibility for volume and geographical location.
 - Reverse logistics and supply chains.
 - Solutions that match supply with demand for circular business offerings in both the public and private sectors and between B2B and B2C companies.
 - A sharing economy for business and industry clusters where resource use is shared and coordinated locally, including infrastructure, workforce, materials and energy (extended industrial symbiosis).
 - Functional sales – Product-as-a-Service.
- Product and service design.
 - Products and services developed using a holistic, circular design that takes into account the entire life cycle early on in the design phase.
 - Products designed with an adaptive or modular design so that they can be more easily updated, repaired and disassembled.
 - Products designed for using less material, without hazardous substances, as well as recycled materials and components, multifunctionality, upgrading, remanufacturing and reuse.
 - Services that reduce the need for products and that stimulate and support efficient product use, functional sales, maintenance, repair, replacement and resale, and that reduce waste and unnecessary disposal and waste generation in the supply chain and use phase.
 - Utilisation of unstructured product and user data and generation of structured product data for new business offerings and greater customer value (based on digitalisation and AI).
 - Product and service development harmonised with criteria for circular, sustainable procurement and purchasing.
- More efficient use of existing buildings and infrastructure, including maintenance, restoration and preservation of buildings and infrastructure that are functionally intact.
 - Multifunctional buildings and solutions for the efficient use of buildings.
 - Methods and materials for durable long-term structures and their sustainable maintenance and renovation.
- Renewable, sustainable materials, including new bio-based materials, biomimetic materials and materials produced from secondary raw materials or greenhouse gases.
- Value-added processing and productification of by-product and residual streams from the raw material handling, food and manufacturing industries.



Sustainable closed loops

To achieve sustainable closed loops, research and innovation is needed that focuses on:

- Regenerative solutions and systems, greater use of biomimetics and include biodiversity as a key factor.
- Closed loop systems for higher recycling rates and quality of recycled (secondary) materials.
 - Sustainable collection systems (sustainable in all respects) and reverse logistics that preserve the value of discarded products and materials, even across national borders, and enable high-quality reuse and recycling as well as reliable flow statistics.
 - Automated and smart dismantling, sorting and recycling processes.
 - Methods and processes for the purification and removal of hazardous substances from waste and secondary material streams.
- Methods for quick, easy and reliable quality assurance with regard to material properties and the health and environmental effects of recycled materials.
- Standards, certification and insurance solutions for risk management in the recycling system.
- A circular and sustainable use of textiles, plastics, food products, materials in the construction and real estate sectors, and innovation-critical metals. A holistic approach and system solutions that take a global perspective on sustainable cycles for these materials.
- Developing incentives for sustainable closed loops to secure circular systems.
- Processes and methods for reducing material losses and leakage, specifically from the above-mentioned material cycle.



System perspectives and drivers

To achieve the radical changes we need for the transition, research and innovation is needed to:

- Create a common goal for what the future sustainable society looks like.
- Ensure a clear picture of resource use and material flows in society.
- Identify the biggest problems and challenges for resource use within planetary boundaries and reduce waste in value chains.
 - Mapping and system analyses for material flows.
- Understand which drivers can change behaviours, both in how we create sustainable businesses and how we use products and services.
- Identify obstacles to the transition, and from that develop and evaluate measures to minimise or remove the obstacles.
 - Impact assessments for proposed policy measures.
- Analyse and leverage positive cases from developments outside Sweden.
 - Identify good cases and scale them up.
 - Evaluate them for Swedish conditions.

- Develop and apply metrics for sustainable use of resources (including impact on all aspects of sustainability) that can measure and compare individual solutions and overall progress.
 - New ways of looking at and measuring growth (competitiveness), well-being and success.
 - Key performance indicators for business operations and accounting.
 - Develop asset-based accounting models that factor natural resource assets into the balance sheet so that we charge for what resources actually cost.
 - Development of life cycle assessments and allocation rules for circular use. Embrace a life cycle perspective to ensure that actions driving a circular economy do not create a negative environmental impact at any stage. By maintaining research on life cycle assessments with relevant system boundaries, this can be achieved.
 - Circularity measures for comparing sustainable resource use for products, services and business solutions.
 - Key performance indicators for sustainable resource use at the community and system levels that also include gender equality, diversity and other social sustainability considerations.
- Ensure relevant national strategies, roadmaps and follow-up for a circular transition.
 - Regular follow-up of Sweden's progress and performance, like by using a circularity gap report.
 - Continuous external analysis.
- Develop circular procurement, including organizational needs and processes for this.
 - Aligned supply and demand for circular, sustainable business offerings.
 - Better opportunities for innovation procurement.
 - Upskilling and organisational development.
- Understand the needs and possible ways to finance the transition.
- Risk models and key figures for investments in sustainability and the circular economy, as well as investment risk in terms of material shortages.

We need research-based innovation that focuses on addressing needs, not just solving problems, so we can make sure we are driving development in the right direction. Achieving a transition requires behavioural changes and more sustainable solutions that need to offer a better alternative – for people, for businesses and for the planet.

5. How we should conduct research and innovation

Sweden currently has several different initiatives and R&I funders that announce funding calls aimed at the innovation area. These calls come from public funding agencies (Formas, Vinnova, the Swedish Energy Agency, Mistra) as well as private investors (Wallenberg Foundations, Kamprad Family Foundation, Lidl).

We have discussed the need for coordinating Sweden's commitment to the circular economy and sustainable use of resources. This also applies to research and innovation, the idea being to avoid overlapping efforts and enable complementary efforts and thus provide comprehensive support, from basic research to the implementation and industrialisation of research and solutions. The initiative should include more mission-oriented R&I programmes with a clear cross-disciplinary approach and a requirement to achieve systemic solutions and changes. These programmes should require the involvement and interaction of all stakeholders – industry, the financial sector, the public sector, civil society and citizens.

A carefully considered structure is needed for different types of financing based on factors like high and low TRL levels, and for different levels of governance and connection to stakeholder needs. Research funding takes time, and we're running out of it. We need to discuss how to reach out to support all companies in Sweden.

The step of translating results into business competitiveness and real-world impact requires thoughtful and coordinated support, since Sweden traditionally excels at R&I activities but falls short in terms of achieving competitiveness and exchange for the country, based on its initiatives and results. In the end, it is vital for industry to be involved and for the financial sector to be engaged and recognise the opportunities to contribute and achieve success.

Increased collaboration and synchronisation among Sweden's public R&I funders (local, regional and national), private R&I funders, industry and the financial sector are necessary for

Sweden to build national capabilities and competitiveness and to help solve the global challenges of a life lived within the planetary boundaries. Here, national coordination initiated by the government through domestic strategy and action plans and the formation of its Delegation for Circular Economy play a key role.

In summary, Sweden must take into account and implement the following action proposals when planning R&I funding:

- The implementation and follow-up of research and innovation that is set out in national strategies and action plans.
- Establishing public-private partnerships for national R&I funding as well as synchronisation with joint Nordic and European R&I funders.
- Research funding adapted for implementation.
- Increased investment in larger mission-oriented R&I programmes aimed at systemic solutions and changes that thus require interdisciplinary approaches and broad collaboration, such as the research foundation Mistra's efforts.
- Requirements for the involvement and interaction of all stakeholders, such as the business community, the financial sector, the public sector, civil society and citizens. Comprehensive support, from basic research to implementation and industrialisation.
- Stimulation and support of Swedish players' involvement in international R&I collaborations, especially within the Nordic region and the EU.
- Development and upscaling of innovation procurement and use of innovation funds.

6. How we translate research and innovation into real-world impact for people and businesses

Research and innovation aims to produce new knowledge and solutions. These can be roughly categorised as follows:

- Knowledge that empowers the target group to take the right actions.
- Non-commercial solutions, such as regulations and policies.
- Commercial solutions, such as products, services and business models.

Translating more research results into real-world impact within a short timeframe might require different types of interventions depending on the type of impact.

Normally, higher education is viewed as a resource that is available and capable of translating new research into real-world impact. But this approach requires time: students first need to get an education and then a job at a private company or public organisation that can then benefit from the new knowledge. It is not certain, either, that their degrees are relevant to the task or that formal education is required, for that matter. Traditionally, entrepreneurship, leadership qualities and drive are rarely topics that students are specifically taught, although good examples exist. Although education is an important route, it must be complemented by targeted courses, such as professional training programmes or short learning programmes for specific groups, like policymakers. Moreover, new knowledge must be passed on to the general public through information outreach, which itself requires knowledge on the part of the people heading such efforts.

In the area of innovation, there is a need to develop forms of public-private partnerships in education and knowledge dissemination, such as partnerships between academia and private professional education providers with business

developers, industry organisations and public-sector organisations in order to identify needs and target groups.

To translate non-commercial solutions like regulatory frameworks into real-world impact, R&I projects that aim to develop these types of solutions must be able to verify approaches and application together with the organisations that need such new regulations and the organisation that will be responsible for regulatory oversight. Research funders should thus require including or planning this type of activity as a continuation of an R&I project, for example by retaining part of the project's funding until relevant activities have been completed. These solutions require public funding and commitment to enable real-world impact. Maintaining a close dialogue with the Delegation for Circular Economy and policy forums is vital for providing policymakers and other key stakeholders with a broadened knowledge base.

For commercial solutions that offer verified technology and business potential, much capital is needed to scale up and establish a for-profit business. At the early stages, the risk is high and public funds or guarantees are needed. As an innovation evolves and approaches market maturity, public funding should increasingly be supplemented by private funding and be phased out when full commercial maturity is reached. Venture capital providers assess risk, and in the early stages the risk is too high, prompting the need for public funding, grants, loans and guarantees. Sweden would need to develop mechanisms for involving operative combinations of public and private funding focused on specific businesses.

Needs for increasing real-world impact throughout society:

- Give research funders a clear mandate to promote real-world impact and enable quick decision-making in terms of verifying promising results as well as models for earmarking project funds for real-world impact.

- Develop more forms for giving new businesses access to early-stage funding. Sustainable resource use can also require new business models with more capital tied-up, such as for companies that focus more on reuse, functional sales or completely untested logistics chains. This makes these companies more difficult to assess from a risk perspective than those with traditional business models.
- Support the development of new innovation partnerships and collaborations that bridge today's linear flows and help create new value chains that support sustainable use of resources.
- Strive to increase the focus on entire value chains in which the chain's participants work together to meet a need. Highlight positive cases.
- Support educational initiatives in which academia, the public sector and the business community work together to raise society's level of knowledge with the aim of achieving the Agenda 2030 goals.
- Funders should be bold enough to deny funding to seemingly promising innovations and projects that lack market potential or value chains.



Developing the RE:Agenda

The RE:Agenda aims to reveal pressing issues of the future, not just today's concerns. And to make the transition, we need to move from words to deeds, working towards implementation and impacts.

The RE:Agenda has been developed in collaboration with innovation area stakeholders who participated in two workshops and discussions with RE:Source's strategic council members and with experts from RISE. RE:Source's programme office was responsible for the design and print production of the RE:Agenda.

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2030 – SWEDEN IS A ROLE MODEL FOR CIRCULAR AND SUSTAINABLE USE OF RESOURCES

- 1 Products are designed for optimal life and efficient use.
- 2 There is a well-functioning market for secondary materials, and platforms for sharing, recycling and reuse.
- 3 Repairing things is the new normal again.
- 4 We succeed in minimising waste.
- 5 Knowledge and solutions from research and innovation reach politicians and producers through close collaboration.
- 6 National data are available indicating how we succeeded in transitioning to a more sustainable use of resources, with key figures for the economy, environment and social impacts (all planetary and social boundaries).
- 7 We have instruments that work well, providing true circularity and sustainability.
- 8 Swedish companies are more competitive, having shifted from product sales to functional sales.
- 9 Circular activities and operations in Sweden attract global investment – and generate returns.
- 10 Sweden cooperates to a greater extent with Nordic countries, the EU and the world, and material flows and systems are coordinated to manage them.
- 11 Circular economy challenges attract talents, entrepreneurs and capital – it's cool to go circular and contribute to the transition.
- 12 We have created more jobs and new business opportunities.
- 13 It has become easy to live in a circular way and be a part of nature.

RE:

SOURCE

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