RISE Research and innovation strategy

Part 1 Strategic Initiatives for Knowledge Development

Content

Summary

This is the second edition of RISE Research and Innovation Strategy (R&I strategy). It describes the context in which RISE serves as a research and innovation partner. Furthermore, the strategy describes how we build knowledge and innovation-supporting expertise, along with our ability to respond to the accelerating pace of global change and the challenges facing trade and industry and society. RISE, as Research and Innovation Leader for Sweden, is ready to lead the way in the transition to a sustainable society for future generations.

The R&I strategy is divided into two parts:

- Part 1 – Strategic Initiatives for Knowledge Development (this report)
- Part 2 – Strategy Landscape, Research and Innovation Processes

At present, we have 16 defined Group-wide research areas. The strategic research portfolio exists in multiple organisational dimensions, such as divisional strategic initiatives and Group-wide initiatives such as B&I Areas and their Collaborative Initiatives, Knowledge Platforms, Development Projects and Strategic Reinforcement Areas. The different project types have different characteristics and together contribute to filling the needs of RISE's strategic knowledge development and the development of new offers. In this, Strategic Competence (SC) funds serve as a control instrument to ensure progress in a strategic direction.

RISE, in its capacity as Research and Innovation Leader, plays a role in both strengthening the utility of research and actively contributing to the increased adaptability of trade and industry and the public sector. Essential expertise and capabilities in this context include developing solutions from a systemic perspective, employing a holistic view, interconnecting skills and competences, and having proficiency with regard to systems analysis and the functioning of the innovation system.

The future direction of strategic initiatives is described in the R&I strategy. Based on identified needs for future strategic initiatives, there are two major new initiatives that must be realised:

- Investigating the possibility of a suitable mechanism for mobilising the Social Resilience area.
- Strengthening capacity and capabilities to apply and externally implement research. We will examine the appropriate ways of working related to this.

In addition, strategic initiatives will be implemented for the seven areas highlighted in RISE's contribution to the Swedish Research Bill. One recent measure involves ramping up the Applied AI Strategic Reinforcement Area in order to establish a RISE Centre. Preparations will also be made to form a RISE Maritime Centre.

1 Introduction

RISE is a polytechnic research institute with considerable expertise and competency in the field of social sciences. There exists a large number of areas of expertise incorporating both generic and topical perspectives. Our work is challenge-oriented in relation to global and local trends such as boundary conditions, and we facilitate the use of new technologies as an important aspect in our projects.

RISE works with over 15,000 customers across Swedish trade and industry and in multiple areas in the public sector. Major societal challenges and rapid global development not only present complex challenges and the need for interdisciplinary solutions, but also significant market opportunities for market participants. Our development is driven by a challenge-oriented innovation process where the actions of operators are increasingly characterised by interdisciplinarity with the interconnection of expertise and the adoption of new roles in an innovation system.

RISE is no longer solely a technical research institute. Social sciences entered the previous Group structures in the early 2000s, driven by a need for the requisite skills and competences to effectively engage complex challenges and the capacity to provide the right value in an interdisciplinary perspective. Our testbeds have forged ahead in both virtual environments and real-world laboratories. In addition, we work with approaches to society's institutional boundary conditions by means of, for example, policy labs. Our ability to work in value chains from lab or component level to simulated reality environments is essential for the business community's competitiveness and society's capacity for transition.

At the time of writing this R&I strategy, we are in the midst of the coronavirus pandemic and much is difficult to predict, except that there will be changes following the pandemic compared to before the pandemic. The prevailing situation necessitates an agile approach and we should be prepared for the fact that additional measures may be required at a later stage.

1.1 Purpose

The purpose of the RISE Research and Innovation Strategy (R&I Strategy) is to lead the way forward to achieve our long-term goals, i.e. to be an internationally leading innovation partner (RISE vision) by identifying strategic initiatives of priority for RISE. The strategy is a prerequisite for continuously developing our offer with an impact over a 1-3 year period at the shortest. The R&I strategy clarifies the priority areas. That is, to develop capabilities for which we deem a need to exist.

RISE's research and innovation strategy consists of two parts:

Part 1: "Strategic Initiatives for Knowledge Development" describes the organisation and structure for research and innovation-supporting offers, the choice of initiatives as an engine in our strategic work, and how SC funds serve as a control instrument to achieve the desired effect.

Part 2: "Strategy Landscape, Research and Innovation Processes" maps out our different strategies. It constitutes a process-related part that safeguards work methods to identify key areas and the development of other parts of relevant innovation infrastructure, i.e. our other internal innovation processes, in order to secure the right skills and competences within services and infrastructure (testbeds) and how these interact with the research initiatives.

Part 2 also includes Planning and Analysis, which describes how we ascertain needs by means of intelligence studies and our own planning, and how we analyse and describe the benefits of our work.

Target audience

The R&I strategy is aimed at all employees working with the research and development of RISE's services. It is designed to be used as a basis for strategic choices in the development of operations, e.g. in our internal business planning, in the Board's annual strategy work, in dialogue with RISE Research Council, and as support when deciding on Group-wide strategic initiatives and work methods as well as divisional strategic initiatives.

1.2 Primary focus of RISE research

Traditionally, the main focus has been on developing cutting-edge expertise in various subject areas. RISE has multifaceted and broad operations that span diverse subject areas. It is estimated that there are approximately 200 different research environments within RISE, each with around 10-15 people. Many of the environments have a basis in the same Focus Area in terms of fundamental expertise, but with different domain competences and application experience.

Our unique position lies mainly in developing capabilities to solve complex challenges or problems that require collaboration involving multiple areas of expertise. Our situation is also unique in that we have a dominant experimental organisation. This necessitates continuous method development, such as skills and competences for the (socio-) technical evaluation of components or systems. It can be illustrated by representative methods of ensuring ageing properties or how global modelling with regard to material selection affects sensors in active safety systems. In addition, we can analyse system conditions and effects.

Operations in RISE are mainly geared towards the competitiveness of trade and industry and the transition of society through sustainable technology development. Our development of social science expertise aims to support the use of suitable technological measures and place the right focus on technical possibilities. An important concomitant segment deals with functionality in products, processes and services, i.e. expertise related to service innovation or service research.

Functionality refers to the actual purpose of a technological solution, which can be exemplified by “safety” versus “alarm function” in a solution for a fall prevention medical device.

RISE collectively uses this fundamental basis in diverse roles and offers.

1.3 Roles and offers as a research and innovation partner

RISE has a multifaceted portfolio of roles and offers as a research and innovation partner. In essence, there are three main branches comprising:

A. Strategy and Analysis
   - Innovation partnerships
   - Future scenarios and roadmaps
   - Innovation support services

B. Research and Development
   - Applied research for innovation
   - Service innovation and design processes
   - Method development
   - Professional education
   - Innovation support for SMEs
   - Expert support

C. Industrialisation and Quality Assurance
   - Industrialisation and verification
   - Quality assurance
   - National metrology institute

For a more detailed description, please refer to Part 2.

1.4 Strategic investments

Our way of developing capabilities as a research and innovation partner is to implement priority or strategic resource initiatives in order to:

- initiate research or service areas,
- change (including strengthening or decommissioning) research or service areas, and
- establish working methods for interdisciplinarity

We are required to continuously reaffirm development and needs (and thus adjust investments) in a large number of areas. Figure 1 illustrates the process of developing and changing our offer in an area.

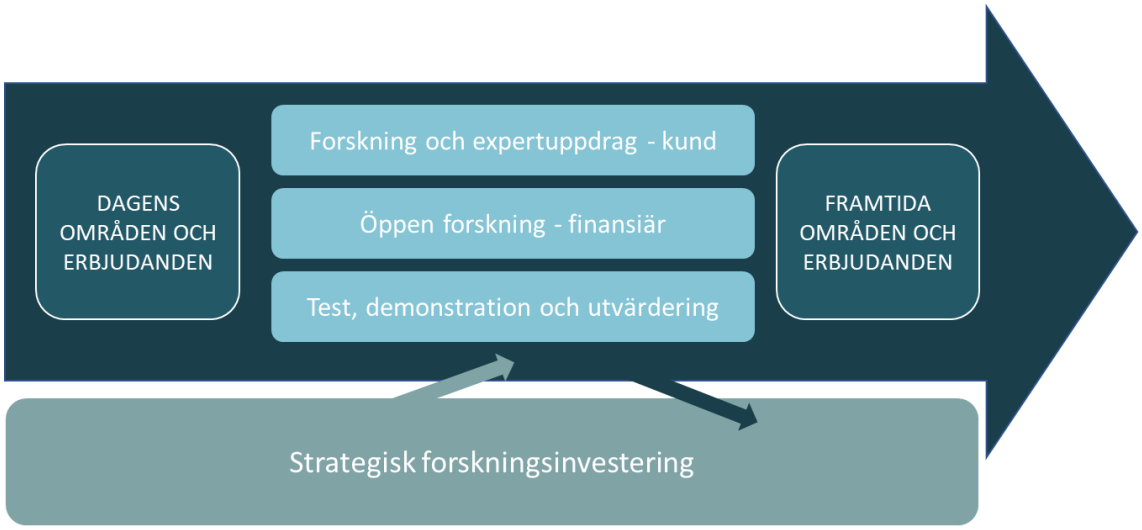

Figure 1. To invest in a changed offer or in a changed capability, we use strategic investment into research and expertise development.

When it comes to a need for change, we utilise intelligence studies, which include interaction with customers and stakeholders. These are carried out on three levels:

- superordinate intelligence studies at Group level (large-scale trends in society, trade and industry, technology development, markets, and in the national and European innovation system),
- intelligence studies according to Business and Innovation Area (including sub-areas), and
- intelligence studies according to division.

Carrying out intelligence studies on the same trend from numerous perspectives (B&I Area, division) provides us with a better basis for determining the strategic importance of a trend.

The investment opportunities RISE has with respect to expertise development (enhancing capabilities or offers) are essentially as follows:

1. Research investments comprising
- investments of proprietary Strategic Competence (SC) funds, and
- external R&I funds,

including skills development of employees and strategic recruitments.

2. Investments consisting of

- capital investment into infrastructure, equipment or systems, and
- acquisition of existing competence environments and/or infrastructure.

3. Lessons learned and analysis by means of our ability to
- identify relationships among technology, service, research interconnection, needs for change and our
- competence to analyse both sub-areas and higher system levels.

The expertise and capabilities built up in this way – and later employed in contract research and services – lead in turn to new insights and experiences, thereby also contributing to further expertise and capabilities.

1.5 Strategic Competence funds

The annual contribution to operations that RISE receives from the State is referred to as Strategic Competence funds (SC funds). The purpose of this contribution is to facilitate forward planning to ensure RISE's international success and participation in the innovation of Swedish trade and industry.

In general, SC funds are used for investments in the strategic research portfolio with competence development and strategic collaborations. Examples of initiatives include the cooperation initiatives in the B&I Areas, Knowledge Platforms, EU strategic funds and other prioritised strategic initiatives.

In RISE, the allocated SC funds are distributed among strategic Group initiatives and divisional strategic initiatives in a proportion determined by the Board of Directors.

Appendix 1 provides a more detailed description of SC funds, how they are used, and for what they may or may not be used.

1.6 From long-term knowledge development to the development of new offers

The strategic research portfolio exists in multiple organisational dimensions, such as divisional strategic knowledge development and Group-wide initiatives in the form of Knowledge Platforms, Strategic Reinforcement Areas, and Development Projects, as well as in B&I Areas in the form of Focus Areas and Collaborative Initiatives.

Based on intelligence studies and input from customers and partners, long-term needs can be ascertained. By means of the annual strategy process, these allow needs for activities in initiative

areas to be identified along with knowledge gaps that must be filled in order to meet the needs of trade and industry and other partners in the short and long terms. Figure 2 illustrates our process for long-term knowledge development and the development of new offers.

Long-term knowledge development is accomplished in part through Group-wide initiatives in Knowledge Platforms as well as through long-term strategic initiatives within the Divisions. A typical timeframe is 5-7 years. The purpose of a Knowledge Platform is to build new knowledge in the long term or strengthen existing research and innovation operations. In general, these activities are research-oriented and collaboration often takes place with both universities and other partners. Collaboration with other partners is conducted both nationally and in the EU arena, where current research-oriented programmes mainly lie within Horizon 2020 and the new HEU framework programme. The starting point is that the Knowledge Platform will become nationally leading and internationally competitive in its provision of innovative services to society and trade and industry, thereby supporting the strategic development of new offers.

Another long-term strategic initiative recently decided on is a RISE Centre, which can be seen as a powerful ramp up of other strategic initiatives, with regard to both the scope of the budget and length of time. A RISE Centre constitutes the mobilisation of a research and innovation platform able to respond to needs from a larger societal perspective with the aim of facilitating acceleration in an area to strengthen Sweden's competitiveness and position. A RISE Centre is based on something that already exists but which requires mobilisation and coordination at an overall strategic and tactical level. For example, it can be formed from a Strategic Reinforcement Area which, in that case, becomes integrated. A RISE Centre covers a wide scope, from basic knowledge development to applied research, and, in addition to funding from internal SC funds, there are also requirements for external private funds from trade and industry at the corresponding level.

The strategic development of new offers is carried out similarly through various strategic initiatives with a timeframe of 1-3 years. Various Group-wide initiatives of different natures and purposes can be found here. They include Focus Areas and project portfolios in the B&I Areas in the form of Collaborative Initiatives, along with 3-year Group-wide Development Projects with a focus on applied research. Moreover, the development of new offers is driven by the divisions' strategic initiatives. In general, these innovation-oriented activities correspond more to industrialisation and implementation in a testbed environment in collaboration with customers and partners. Collaboration with other partners can be carried out both nationally and in the EU arena, where the innovation-oriented programmes are within EIT KICs.

It will be increasingly important for trade and industry and the public sector to be able to implement research results and new knowledge in applications as swiftly as possible after results and knowledge have been generated and to also accelerate the development of new knowledge that becomes necessary. In order to strengthen this capability, over the past year we have introduced the Strategic Reinforcement Areas, which are tasked with accelerating knowledge related to application, responding to needs from the perspective of trade and industry, and

accelerating implementation of knowledge in industrial environments based on a 3-year perspective. The aim of a Strategic Reinforcement Area is to strengthen ongoing activities and knowledge development in Group-wide research areas and B&I Areas and to focus on application-oriented research and knowledge development. In addition, over the next few years we plan to introduce activities in projects, the main focus of which will be to support more effective implementation.

By conducting research and innovation-oriented activities in collaboration with partners as described above, RISE continuously develops its multifaceted portfolio of roles and offers as a research and innovation partner. We create a circular knowledge process by enabling knowledge, experiences and insights to flow both upstream and downstream. Furthermore, this is complemented with needs analysis and by identifying measures and initiative areas for long-term knowledge development and the development of new offers. The process is structurally reflected in RISE's strategic annual wheels (RISE Research and Innovation Strategy Part 2 Strategy Landscape, Research and Innovation Processes).

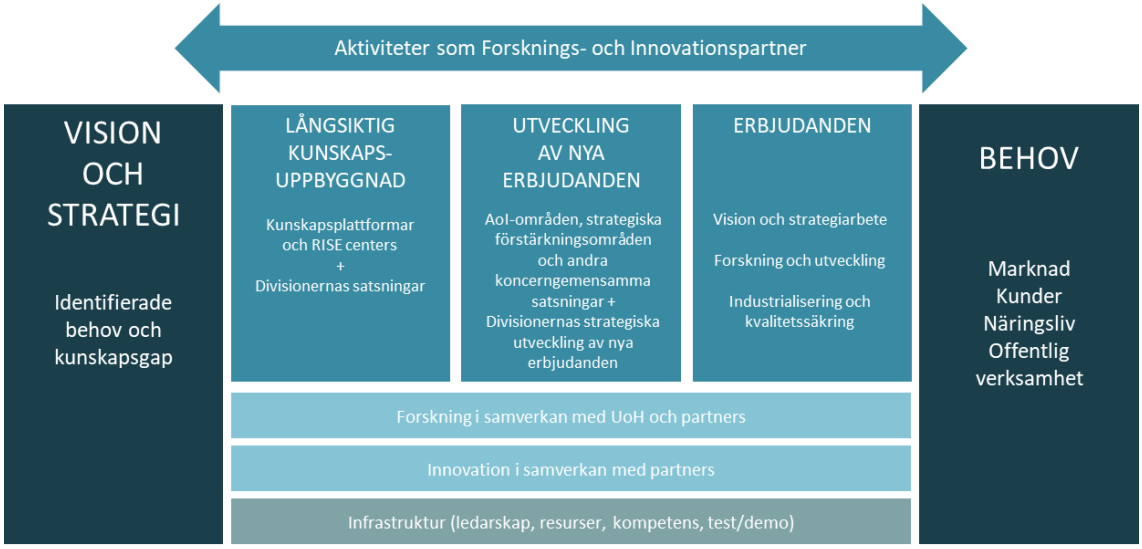

Figure 2. RISE's role as a research and innovation partner in relation to long-term knowledge development and the development of new offers.

1.7 The value chain from research to business acumen

As described in the current section, RISE Research and Innovation Strategy has a role to play in long-term knowledge development and the development of new offers. In this way, it is closely linked to RISE's business development. Different research projects strengthen expertise and capabilities, which can be utilised in other contexts, for example, in collaboration with other partners within frameworks for publicly funded projects or in collaboration with trade and industry in direct assignments. It is therefore important to ensure that research projects have

an effect throughout the value chain, so that knowledge generated through basic knowledge development can be used upstream at a later stage and thus contribute to revenue for RISE. In turn, this revenue enables continued investment into strategic initiatives as a complement to SC funds, thereby generating further new knowledge. There is important interplay between strategic knowledge development, expertise and capabilities, future revenue and utility. The long-term goal is to strengthen the implementation of research into applications in trade and industry and the public sector, which also means that the total project portfolio within RISE will move towards a higher TRL. To be able to work effectively in order to manage operations from this perspective, the project portfolio can be categorised into different portfolios depending on the type of funding – ranging from SC funded projects to pure contract projects. Maintaining balance between these portfolios and having a clear picture of the need for strategic progress will become an increasingly important element of business management going forward. A link can therefore be attained between research projects and strengthened opportunities for revenue, profitability and utility. See Appendix 2 for an illustration of different project portfolios in this regard.

Research-oriented projects (R&I) create value through a dual effect: internally by strengthening revenue opportunities in the commercial part of the business (R&I+D) and in collaboration with external partners, which also contributes to strengthening competitiveness and innovation in trade and industry and the public sector. As a whole, this means that RISE, in its role as Research and Innovation Leader for Sweden, can make a difference by

- strengthening competitiveness, innovation and sustainable growth
- creating impact in the innovation system
- supporting societal development from a broader perspective

2 Group-wide research areas

RISE carries out challenge-oriented work across trade and industry and in multiple areas in the public sector. This necessitates that we must continuously develop and maintain our expertise in the technical and social sciences in which we operate.

The starting point constitutes current megatrends and complex societal challenges:

- Environmental impact and resource extraction
- Climate change
- Urbanisation
- Risk and safety
- Globalisation
- Digitalisation
- Changing demographics
- Transition of trade and industry

For a more detailed description of these challenges and what they mean for RISE, refer to Intelligence Study 2020, which is presented in a separate report.

2.1 Group-wide research areas

Our strategic research initiatives are based on the above societal challenges and needs related to the transition of trade and industry – both in terms of expertise and capacity for cross-boundary solutions.

As a result, RISE currently has 16 defined Group-wide Research Areas in which both Group-wide and divisional strategic initiatives are underway, funded by SC funds.

Some RISE operations excluded from SC funds are also represented in the 16 areas and help to strengthen our competitiveness, such as contract research directly for customers and EU projects.

Descriptions of our 16 Group-wide Research Areas follow below:

AI and Data Science

Research activities in the fields of applied AI and data science that safeguard expertise in areas such as machine learning, language technologies, autonomous systems and ethical data management. Sustainable digital solutions for trade and industry, the public sector and people.

Blue Growth

Research activities that generate expertise to stimulate sustainable environmental, technological and service development within the maritime and marine economy. Applies to, for example, food, shipping, offshore and biotechnology.

Built Environment

Research activities that generate expertise to support trade and industry and the public sector in building and managing sustainable living environments that can also cope with future needs and changes. Our operations include innovation related to buildings, infrastructure, space between buildings, services related to construction and management processes and construction sector operators, as well as the inhabitants themselves.

Circular Transition

Research activities that generate expertise which contributes to society's transition to a circular economy, such as circular business models, sustainable consumption, resource system analysis, life cycle assessment, reuse and recycling.

Digital Security

Research activities that generate expertise in cybersecurity as regards technical research into new security solutions and methods for risk and incident management, user-related issues such as technologies and policies related to privacy, organisational research such as organisational culture and motivation, and research at community level pertaining to issues such as the law and disinformation.

Energy

Research activities that generate expertise and capabilities for the transition to sustainable and renewable energy systems of the future, including safe, stable and flexible solutions for the supply, conversion, distribution and utilisation of energy. Includes infrastructure, buildings, industry and the transport sector.

Health

Research activities that generate expertise which enables safer and more efficient healthcare processes, therapies, pharmaceuticals and medical technologies such as infection control, precision medicine and preventive healthcare..

Innovation Systems

Research activities that strengthen expertise with regard to the capacity for innovation and reform in organisations and companies. With focus on the adoption of new knowledge and interdisciplinary aspects, more efficient transition processes and understanding of the impact of system effects, in order to then convert this new knowledge into value through efficient innovation processes. The goal is to increase customers' economic, social and environmental sustainability.

Component Manufacturing

Research activities that generate expertise for new resource-efficient and cost-effective production methods and logistics for the manufacture of components. For instance, through digitisation, smart manufacturing, and circular manufacturing methods. Production methods may include, for example, forming, machining, additive manufacturing, and injection moulding. Also covered are joining techniques and the assembly of multicomponent systems.

Food

Research activities that safeguard relevant skills and competences in order to meet the needs of industry, administration and government authorities. Key areas include sustainability, efficiency and resilience, as well as food security. Food also plays a role in health effects, both in terms of diet and product safety. Intra- and interdisciplinary approaches are needed to meet the challenges facing the food system, nationally and globally.

Materials

Research activities that generate expertise and challenge the status quo for future, sustainable materials such as composites, plastics, metals and innovation-critical minerals as well as more bio-based materials, with applications in nanotechnology, construction and building materials, and smart materials for areas of application such as textiles and packaging. At present, the world is only 8.6% circular when it comes to materials, and unless system changes are allowed to evolve and all material streams become significantly more circular, we will not achieve established climate goals nor a circular economy. Material choices and material design will become an increasingly critical issue for almost all businesses, and RISE will be an innovation partner in this regard.

Process Manufacturing

Research activities that generate expertise and capabilities for the transition to fossil fuel-free production and new resource-efficient production methods, processes and logistics in process-related industrial environments. This is accomplished by means of a sustainable raw material supply and the sustainable extraction of steel, metal, minerals and biomass, applied digitisation/smart production, processing and utilisation – including biorefinery and sustainable chemistry. Production may pertain to, for example, steel, metal, biomass, food, castings/mouldings, cement/concrete.

Risk, Safety and Resilience

Research activities that generate expertise to support trade and industry and the public sector in order to increase safety, reliability and resilience. Examples include urban climate adaptation, robust infrastructure for transport, operation and maintenance, and heightened preparedness in the event of crises and disasters.

Service Research and Process Digitisation

Research activities that generate expertise for the transition to the new service society in both trade and industry and the public sector. This is accomplished by applying service logic to value chains and new verticals, often supported by digital processes and infrastructure, and with, for example, the connected individual as the target audience.

Transport and Mobility

Research activities that generate expertise to support trade and industry and the public sector in the transition towards autonomous vehicles and transport. Research activities that generate expertise for the realisation, verification and validation of new solutions, technologies, systems, processes and services for the sustainable mobility of people and goods. Focus on increased safety, more efficient transport and logistics.

Transport Systems

Research activities that generate expertise and capabilities to support trade and industry and the public sector in the transition to a fossil fuel-free and shared transport system. The area includes powertrains, components, energy storage and energy supply systems for charging and refuelling. Focus on increased safety and efficient infrastructure in the transport system.

2.2 Principles of strategic research

The strategic research portfolio exists in multiple organisational dimensions, i.e. strategic knowledge development in the Divisions and Group-wide in B&I Areas and our other strategic initiatives (see Figure 3).

Our strategic initiatives adhere to the following principles. We strive to maintain a total of 15 defined Group-wide Research Areas (currently 16 in 2020). Strategic investments in the form of SC funds are distributed among divisional strategic initiatives and Group-wide initiatives in a proportion determined by the Board of Directors.

We have several types of initiatives linked to various strategic initiative needs in terms of content, provision of results and timeframes. The purpose of this is to be able to drive knowledge development for the development of new offers in the most efficient way possible, which together provide the opportunity to produce the effect we seek. They can be considered different tools in a RISE toolbox comprising project types with diverse characteristics, and where the overall budgetary framework is linked to the budget process based on identified strategic needs. This allows the different types of initiatives to interact in order to strengthen RISE's assignments.

We categorise our SC funded initiatives into Group Strategic Initiatives and Division Strategic Initiatives (see Figure 3). In terms of budget, they are more or less equal. Categorisation is based on who makes decisions concerning the initiatives. Projects are always carried out by the divisions. For the Group

Strategic Initiatives, decisions are taken by Group management with the Technology Council or B&I Area steering groups serving as the preparatory forums (see Table 1). For divisional strategic initiatives, decisions are taken by the respective divisional management teams.

Figure 3. Principles for the distribution of SC funds among Group Strategic Initiatives and Division Strategic Initiatives.

Group Strategic Initiatives largely consist of the initiatives that produce interdisciplinary knowledge development. The initiatives aim to develop knowledge for the future independently of today's organisation. The initiatives have different timeframes and different degrees of implementation depending on the timeframe, as shown in Figure 4. The initiatives have different requirements and complement each other in order to collectively and optimally prepare us for the questions and issues of tomorrow. All initiatives conclude with preparations for the implementation of the research results in trade and industry and the public sector.

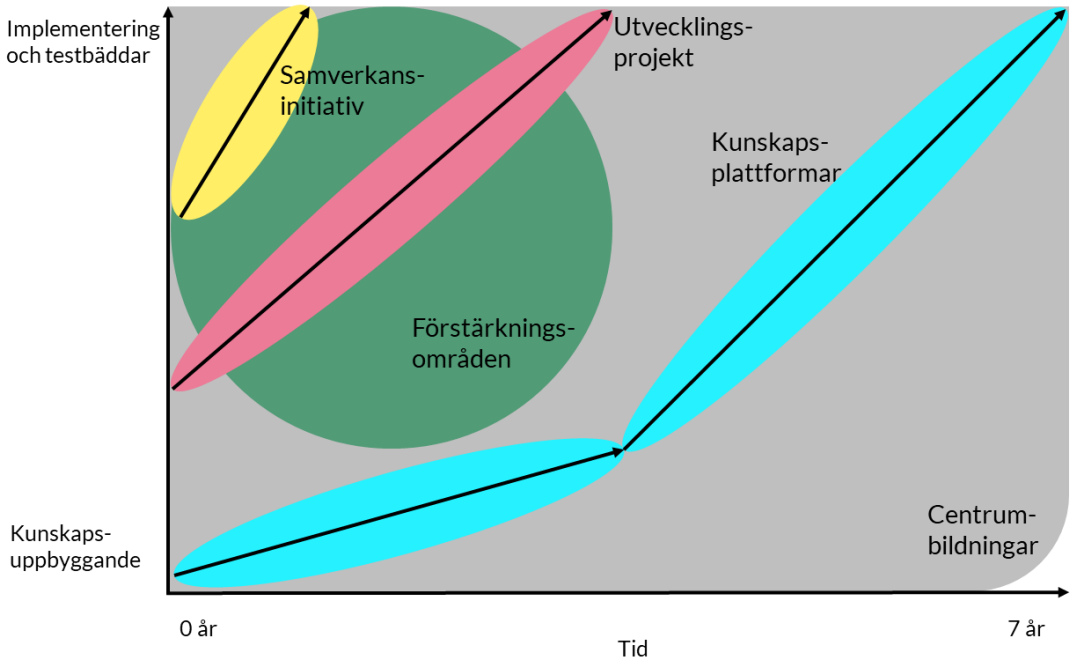

Figure 4. Illustration of the relationship between different types of SC funded initiatives. The x axis represents time and the y axis represents the scale from basic knowledge development to implementation of research.

Descriptions of the overall nature of the Group-wide initiatives are provided in Table 1.

Table 1. Overview of Group-wide SC fund initiatives.

Type of project	**Time**	**Number in 2020**	**Typical annual budget per project**	**Financing**	**Preparatory forum (decided by Group Management)**
Collaborative Initiatives	1-3 years	60	SEK 0.5-1 million per year	SC funds	B&I steering group
Focus Areas	According to need	31	SEK 2.5 million per B&I	SC funds	B&I steering group
Development Projects	3 years	10	SEK 0.5-1 million per year	SC funds	Technology Council
Reinforcement areas	3 years	5	SEK 8-10 million per year	SC funds	Technology Council
RISE Centre	7 years	1-2	SEK 50 million per year, of which SEK 12 million in SC funds and at least SEK 12 million privately funded.	SK funds and external funding	Group management
Knowledge Platforms	3 + 4 years	22	SEK 3 million per year	SC funds	Technology Council

2.3 SC funds as control instrument

In general, RISE strives for a good balance in the project portfolio between different timeframes, both short and long-term, as well as among the different Group-wide research areas. The desirable balance shall reflect identified needs. At the same time, it is important to also maintain an ability to prepare and respond quickly to what may be tacit needs today, but which may emerge unexpectedly as a consequence of the transition that society is undergoing.

To ensure active and constructive strategic dialogue with a view to facilitating forward planning and preparedness, we will continue to actively work with balance in the portfolios. We shall accomplish this by continuously maintaining an overview of the current situation (see Figure 5) and by engaging in strategic dialogue to outline a desired future situation. This enables strategic direction changes to be made if needs arise. In this, the distribution of SC funds serves as a tool in creating mechanisms able to stimulate progress in the desired direction.

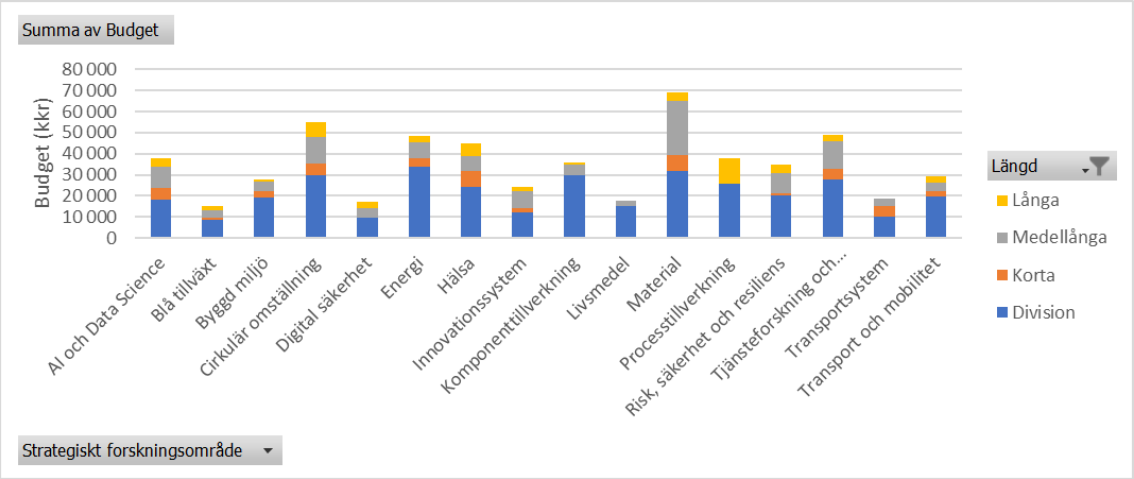

Figure 5. Budget allocation in 2020 among the Group-wide research areas for the divisional and central SC fund initiatives (categorised according to short, medium and long-term projects). Charts pertaining to the 2020 SC fund initiatives can be found in “RISE Research and Innovation Strategy Part 2 Strategy Landscape, Research and Innovation Processes”.

2.4 Interactions at Group and divisional level

It is imperative to have a common ground on which to stand when analysing the project portfolios, regardless of whether a strategic initiative is implemented at Group level or within divisions. Interaction must be possible between a certain basic structure and work process. This means that the 16 Group-wide Research Areas (GRAs) have a common definition and that projects should be able to be allocated per respective GRA and any other agreed on “buckets”. Examples of buckets are short-term, long-term or EU projects in the project portfolio. This will

afford opportunities for analyses in different dimensions as well as good strategic dialogue relating to potential needs for progress in the desired direction and the use of SC funds as a strategic investment, based on a holistic RISE perspective.

The process concerning analysis, follow-up and dialogues on strategic investments and direction changes will follow an annual wheel, where different activities are carried out at different times of the year. We recently (in 2019) started to consider the project portfolios according to GRA and timeframe, and this work method will be further developed in the coming years in consultation with the Technology Council.

2.5 Strategic areas

We work within a wide range of subject areas in the fields of technology and social sciences, which enables the use of technology and innovation.

Following below are the strategic areas into which we already invest, along with areas that we believe require a more focused investment. They are categorised as:

1. Proposed priority areas where a need for reinforcement has been identified owing to changing challenges
2. Initiative areas in our B&I Areas (Focus Areas and projects in the form of Collaborative Initiatives, CI)
3. Divisional strategic areas
4. Long-term knowledge development in the form of Knowledge Platforms

2.5.1 Research priorities – areas requiring further investment

The previous year's analysis of our ongoing strategic initiatives and our intelligence studies identified a need to strengthen the build-up of a larger critical mass and level of knowledge in certain subject-specific areas or areas of application. Five areas were therefore selected as Strategic Reinforcement Areas (priority research areas). The five selected areas were: Applied AI, Cybersecurity, Measurement for Sustainable Transformation, Value-creating System Design, and Robust and Flexible Energy Systems. The Applied AI area has since been ramped up to a RISE Centre, a decision made in 2020. Following below is a brief description of the reinforcement areas and the Applied AI RISE Centre.

Cybersecurity

The rapid pace of digitalisation has come at a cost in the form of increased cybercrime and other negative consequences. To protect society, trade and industry and individuals, cybersecurity needs to be strengthened. The challenges are both technical and social. We want to focus on utilising cyber ranges to test solutions and appropriate levels of protection in a controlled manner. Security policies, processes and agreements also need to be formulated and tested. Measurements carried out remotely need to be quality assured, and the same is true for development of digital authentication. Another important area with potential for improvement relates to data sharing privacy. In a world of disinformation, RISE plays an important role in development – and our independence is paramount.

Measurement for sustainable transformation

At present, Swedish society and trade and industry are progressing towards a service economy, yet the way we perform follow-ups and measurements is akin to a product economy. As a result, we find it difficult to assess the success and impact of measures targeting sectors that encompass innovations relating to services, interoperability and sustainability. We need to develop new quantities such as categorical measurements along with quality assurance outcomes. Furthermore, methodological development is needed for calibration and the development of benchmarks for categorical quantities. For this development and to be able to work with prediction and prevention, data, modelling and simulations are needed. It is necessary to design management processes using cause-and-effect logic to be able to ensure confidence in change processes at different system levels.

Value-creating system design

Society and industry are facing many complex challenges. An isolated issue cannot be resolved without taking into account the associated consequences, regardless of whether the solution required is technical, scientific or social in nature. A combination of these is often required along with a cross-link of consequences based on a holistic perspective. To elucidate the system dynamics of the challenges as well as the value networks in trade and industry, expertise in scenario analysis is required. For society and trade and industry to adopt circular thinking with respect to our services and the associated resources, a developed circular approach including co-creation between companies is needed. To usher in this behavioural change, we need to develop and carry out comprehensive regulatory innovation.

Robust and flexible energy systems

The target established through the Swedish Energy Policy calls for a fossil fuel-free electricity system by 2040. Not only does this place high demands on the development of renewable production and integration, but on functioning market models and reliable forecasting as well.

Large volumes of solar and wind power present challenges in terms of flexibility, storage and interoperability between energy carriers. Electrification of industry and the vehicle fleet presents further challenges in terms of electricity supply. With a smart energy system, the integration of electricity and district heating/cooling must be ensured in order to exploit synergies. To achieve a robust and flexible energy system, energy systems and scenario analysis that include policy and market design are crucial to the system's effect.

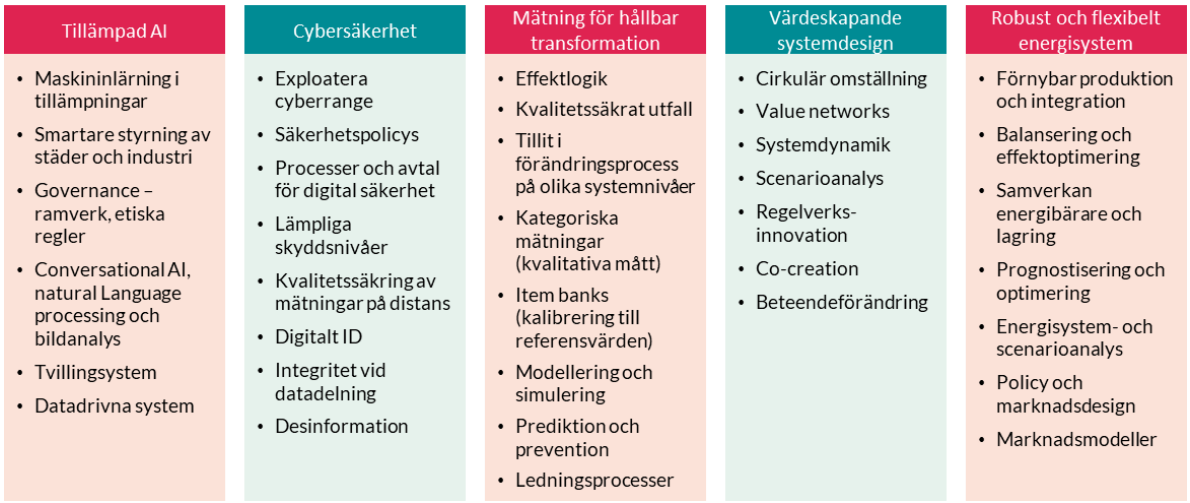

Figure 6. Our selected Strategic Reinforcement Areas. Applied AI has recently been remodelled as a RISE Centre.

RISE Centre for Applied AI

Sweden has good opportunities to make progress in AI since a generally high level of digital competence exists. AI is the nexus of advanced digitalisation and its applications in smart products, smart production, services and automation, and it is fundamentally changing companies and society. An increase in available computational power, very high volumes of data, better algorithms and machine learning will enable smarter governance of cities, industrial processes and applications. Digital twin systems are made possible in a whole new way by means of data-driven systems. Other AI development areas include image recognition and spoken language translation in real-time, as well as the development of autonomous vehicles. In addition to the development of hardware and software, it is of great importance to work with governance by influencing the framework and ethical rules for AI, since the consequences of AI differ from what society has experienced in the past.

2.5.2 Business and Innovation Areas, Focus Areas and Collaborative Initiatives

Our Business and Innovation Areas bring together expertise and infrastructure across all divisions and operations in order to respond to long-term and major challenges. Through our business areas we enable interdisciplinary innovation for increased growth and a sustainable society.

We currently have six Business and Innovation Areas: Digitalisation, Energy and Bio-based Economy, Sustainable Cities and Communities, Health and Life Science, Mobility, and the recently established Material Transition. These areas are further divided into priority areas called Focus Areas. A Focus Area represents a sub-area within which we develop expertise. We work with strategic initiatives in each Focus Area in the form of interdisciplinary Collaborative Initiatives (1-3 year investment timeframes), which are ramped up by means of external research funding including EU funding. The focus is on developing our ability to combine expertise in multiple cutting-edge fields and on building a larger critical mass to meet challenge-driven needs. Following below are descriptions of each Business and Innovation Area including Focus Areas and current Collaborative Initiatives.

Business and Innovation (B&I) Area: Digitalisation

The Digitalisation B&I Area addresses changes resulting from the digitisation of several industries. Although our society is facing some of its greatest challenges ever, we have never had greater awareness and better opportunities to deal with them. Digitalisation is – and will be for a long time – a great opportunity for both the management of societal challenges and for increased competitiveness and growth among companies, and it also creates possibilities for rationalisation in the public sector.

The basic goal is to achieve digital transformation at our customers/partners and in our own business at RISE through development, access to and understanding of digital technology, digital methods and data.

The Digitalisation B&I Area employs a broad approach with Focus Areas that correspond to major sectors, such as the public sector, industry and the individual. This broad approach affords good opportunities to understand market changes due to digitalisation and also how RISE can best benefit our customers and partners in the different sectors. Through cooperation among the Focus Areas within the B&I Area, we can also enable cross-fertilisation between sectors where a solution that works in one sector can be transferred to another.

Table 2. The Digitalisation B&I Area's Focus Areas and their descriptions.

Focus Area (FA)	Description
Digitalisation in Industry (DI)	Drives and coordinates competence development and digital applications in industry with a special focus on industry 4.0, data analysis, visualisation, machine learning and industrial data security together with confidence in data-driven work methods. EIT Manufacturing is managed in this FA.
Digitalisation in the Public Sector (PS)	The area manages knowledge to support the digital transformation of the public sector. RISE will drive the potential of data-driven management and innovation such as Optimisation (of existing resources), Service delivery (greater impact of services through better analysis), Prediction (proactive efforts and decision-making are made possible through better trend analysis). This requires jointly managed digital infrastructure with jointly managed solutions conducive to efficient, secure and precisely regulated information exchange.
The Connected Individual (CI)	The Focus Area works with issues concerning individuals in a connected society, and highlights the opportunities and risks associated with the collection, analysis and use of personal data. Individuals can choose to provide personal data and obtain personalised services, products and medical treatments, but since personal – sometimes sensitive – data is at risk of being disseminated or used, a clear user-centric and secure process is necessary.
Connected Cities (CC)	Supports and drives the development of smart, sustainable cities by means of data-driven innovation and applied ICT solutions. The core of the Focus Area is to help municipalities (and others) to generate technical and organisational capacity in order to collect data and make it available in a controlled manner.
Digital Health/E-Health (DH)	Digital Health/E-Health is interdisciplinary, multidisciplinary and disruptive with the power and opportunities of digitalisation as a common denominator. Areas in which we operate include digital medical technology, sensorics, diagnostics, treatment, service design, system design, big data, artificial intelligence, clinical decision support, digital genetics and proteomics.
RISE Internal Digitisation (ID)	Supports RISE employees to increase their understanding of what digitisation means for their own research and what we deliver to our customers.

Table 3. The Digitalisation B&I Area's Collaborative Initiatives and their descriptions. The Focus Area with which the Collaborative Initiative is affiliated is shown in brackets in the table below: The Connected Individual (CI), Public Sector (PS), Industrial Application (IA), RISE Internal Digitisation (ID), Connected Cities (CC), and Digital Health/E Health (DH).

Collaborative Initiative (Focus Area)	Description
AIBIND (B&I Area general)	The objective of the initiative is to establish a few major project proposals and industrial consortia for specific industries. These will then serve as proposal applications to funders in the field of data- and model-driven AI and Big Data for industrial products, services or processes. The aim of the project is to strengthen the capacity and competitiveness of Swedish industry with regard to data- and model-driven development. This will be achieved through collaboration among different operators within RISE to gain stronger project proposals with a focus on specific industries and their value chains.
Construction 4.0 (CC)	A digitised construction process provides the right conditions for increased automation and new ways of working. Using models from other manufacturing industries, new digital tools are applied to reduce costs, shorten timeframes from planning to completion, reduce environmental impact, and enable more innovative construction. Through the initiative, RISE – with its cutting-edge expertise in digitisation and experience of the built environment – contributes to this development. Special focus is placed on the management phase of the construction process.

RISE2AM – II (DI)	This Collaborative Initiative will facilitate rapid development of the AM research within RISE and would allow for a more complete AM partner both nationally and internationally. The RISE divisions (such as Digital Systems, Safety & Transport, Materials and Production) collaborate to be able to cover all parts in an AM value chain, which will put RISE in a unique position.
Pilot Park FENIX – a digital living lab (ID)	The ambition is to create new project initiatives and industrial consortia through targeted proposal applications and the development of business models towards increased digitisation in the pulp and paper industry. The initiative will work closely with the Vinnova-funded research project SALLPI to develop the FENIX pilot park in an industrial environment towards digital services and products, such as AI, IoT, big data and cybersecurity. The aim of the project is to strengthen the competitiveness of Swedish industry by providing a platform that affords opportunities to reduce the time from idea to implementation with respect to the digital transition.
Industrial production and process modelling package for Digital Twins (DI)	The concept of digital twins is popular and broad. In this Collaborative Initiative, RISE establishes a team and work methods to effectively meet and support industry's needs for different types of digital twins. The team works extensively with the needs of products, materials and processes for analysis, optimisation, traceability and visualisation for decision-making support with regard to digital twin concepts and technology.
Digi-food (DH)	The digitisation of the food chain can offer major improvements in terms of increased production and sustainability. Measuring and visualising primary production and processes in the food industry can offer improved decision-making support and operational rationalisation. Agricultural companies today possess many sophisticated products and systems, but further development, interconnection and systematics are needed to a greater extent.
Digitalisation and Circular Economy (DI)	The CEDIGS Collaborative Initiative will assist society and industry in the ongoing transition related to Circular Economy and Digitalisation through collaboration among individuals and areas within associated frameworks. Another aspect involves strengthening RISE's role in this transition. We accomplish this by creating networks of expertise within RISE, which, in combination, can present a clear offer from RISE to research funders, society and corporate customers.
Computer Vision (CC)	Computer vision is a powerful tool being used in a growing number of areas. This Collaborative Initiative will primarily focus on smart products (smart cameras for alarms, smarter 'appliances', etc.) as well as smart production where computer vision can streamline and improve production.
Open and Shared Data (PS)	A goal of the public sector is to make its data accessible. However, there are certain technical, organisational and financial obstacles. The purpose of this Collaborative Initiative is to identify means for the public sector to work with data in a structured and standardised way, which in turn would lead to more structured data of higher quality. The Collaborative Initiative will stimulate cooperation and generate internal RISE expertise in the field.
Reliable and Valuable Data (B&I general)	Reliable data is a prerequisite for sustainable digitalisation. Several industry networks (Sustainability Circle, Combient and others) assert that, presently, one of the biggest obstacles to digitisation and digital decision-making support is lack of trust in the data. This Collaborative Initiative focuses on the quality assurance of measurement data BEFORE it is used in digital applications. The Collaborative Initiative stimulates cooperation, understanding and needs, knowledge and methods for research and contract projects.
RFID Task Force (DI)	The objective is to bring together RISE's expertise in Radio Frequency Identification (RFID) tags and related technologies, such as Near Field Communication (NFC) and Bluetooth Low Energy (BLE). We seek to collaborate with all divisions in RISE. We will make use of shared knowledge and approaches to identify new projects and generate new business.
Smart Chemistry and Materials (DI)	This is a joint Collaborative Initiative between the Health and Life Science and Digitalisation B&I Areas. The participating divisions are Bioeconomy and Health, Digital Systems, Materials and Production. The aim is to link RISE's cutting-edge expertise within AI and Machine Learning with industrial domain knowledge in chemical processes and, in combination, be able to offer long-term services and products at a new level. The objective is to build project portfolios with industrial applications and establish RISE as an operator in the combined fields of chemical processes and materials and AI. Examples of areas in which this Collaborative Initiative can contribute to new

	innovations include pharmaceuticals, surfaces, materials, pattern recognition, predictive models, safety, etc.
3D Geometry Measurement of Large Objects (DI)	Work is in progress to build a testbed for model-driven 3D geometry measurement of large objects. There is demand for such a testbed from a number of Swedish industry partners, such as Volvo Cars, Saab, Scania, NEVS and Tetrafix, in order to meet a broad industrial need for measurement method development and equipment qualification. The testbed will contain both a physical measurement environment and a digital measurement environment with simulation, analysis and visualisation functions. This testbed will be internationally unique.

Business and Innovation (B&I) Area: Energy and Bio-based Economy

The transition of the energy system and achieving a bio-based economy are crucial to the sustainable transition of society and industry alike. The Energy and Bio-Based Economy B&I Area enables us to address these challenges and opportunities. It involves, for instance, renewable, robust and flexible electricity systems, cold-climate wind power, renewable fuels or green chemicals, resource efficiency, solar power or new market models and policy issues. We bring together expertise related to future energy systems, bioeconomy, industrial energy systems, system analysis, and service design.

Together with our customers, we develop, for example, smart grids, renewable energy sources, biofuels, system solutions for sustainable water use as well as new business models for tomorrow's energy supply and industry.

Tables 4 and 5 describe our strategic initiatives in the form of Focus Areas and Collaborative Initiatives for the B&I Area.

Table 4. The Energy and Bio-Based Economy B&I Area's Focus Areas and their descriptions.

Focus Area (FA)	Description
Fossil Fuel-Free Transport (FFT)	The starting point lies in the challenges and opportunities associated with moving towards a fossil fuel-independent vehicle fleet and fossil fuel-free transport system. Emphasis is on the development and implementation of new technologies and system solutions for renewable fuels and green chemicals from forests, agriculture and waste for applications in road transport, aviation and shipping.
Future Energy Systems (FE)	Focuses on the challenge of transitioning to a 100% renewable system by 2040 and addresses technological and market changes in a weather-dependent and decentralised energy system.
Industrial Transition (IT)	Works towards the transition to a resource-efficient, energy-efficient and carbon neutral processing and manufacturing industry. The focus is on replacing fossil raw materials and energy carriers with renewable and/or recycled materials, as well as the capture and storage and/or utilisation of carbon dioxide (CCS/CCU). We develop and introduce methods for more process-intensive and flexible production.
Sustainable Water Use (SWU) – *under development 2020*	Established during HT20 and currently under development. Tentatively, the Focus Area will cover urban and industrial water and the entire water cycle, from the capture and utilisation of rainwater from runoffs and storm water to water use, resource efficiency, treatment, circular management of nutrients and other resources, along with the environmental impact of water.

Table 5. The Energy and Bio-Based Economy B&I Area's Collaborative Initiatives and their descriptions. The Focus Area with which the Collaborative Initiative is affiliated is shown in brackets in the table below: Fossil Fuel-Free Transport (FFT), Future Energy Systems (FE), Industrial Transition (IT) and Sustainable Water Use (SWU).

Collaborative Initiative (Focus Area)	Description
Wind (FE)	New wind power systems are being rapidly established in Sweden. New production systems that will be put into service and/or adapted to new local conditions require new solutions. We drive the development of testbeds for wind power in cold climates. The focus is on: measurement technology, testing and certification, material technology from a life cycle perspective, fire and fire safety in wind turbines, big data, Machine Learning & AI mainly linked to operation and maintenance issues. Offshore wind power, including network connections and maritime logistics.
Flexibility in the Energy System (FE)	Increased flexibility is considered a key issue for achieving a fossil fuel-free, stable and efficient energy system. An array of different solutions conducive to flexibility exist, and many parts of RISE possess expertise related to this. This Collaborative Initiative works to create new projects through collaborations that combine expertise in storage technology, system integration, governance, digitisation and business models.
SunRISE (FE)	The development of solar power has accelerated in Sweden as a result of subsidies for solar panels. The work of this Collaborative Initiative involves the technical modification of solar power components for a Nordic climate and the establishment of a testbed for building-integrated photovoltaics.
AI and Big Data in Industry (IT)	This is a joint Collaborative Initiative with the Digitalisation B&I, and the aim is to merge the cutting-edge expertise that RISE possesses in AI, machine learning, etc. with industrial domain knowledge in the energy industry, chemical industry, pulp and paper industry and others. The objective is to build project portfolios with industrial applications and establish RISE as an operator in the field of industrial AI.
Industrial Symbiosis (IT)	In order to maximise the utilisation of energy, materials, products and by-products, it is necessary for trade and industry to identify new solutions. Integrated and shared solutions are imperative for resource efficiency, increased competitiveness and reduced climate and environmental impact. We combine our own expertise with that of our partners and customers to jointly develop innovative and integrated solutions for industrial symbiosis.
Negative Emissions + P2X (IT, FFT)	This Collaborative Initiative aims to strengthen RISE's role in the related areas of *negative emissions* and *P2fuel/chem/food* – areas that are highlighted by multiple industrial and social sectors as high priority R&D areas in order to achieve the goal of a carbon-neutral society by 2045 along with negative emissions. In this case, the area of *negative emissions* includes various measures to increase carbon capture, such as bioenergy with carbon capture and storage (BECCS), the production and use of biochar and/or other incentive measures in forestry and agriculture for enhanced carbon sinks overall.
Bio-oil from Lignocellulose (FFT)	The Swedish Climate Act stipulates a rapid reduction in CO2 emissions from the transport sector. Today, approximately 20% of the energy supply to road transport is bio-based and, if the volumes required by 2030 are to be reached, processes based on lignocellulose are needed to a far greater extent. The Collaborative Initiative aims to bring together environments working with different technologies at different scales to create broader and better projects for customers and funders.
Biochemical Processes and Molecular Biology (FFT)	The aim of the Collaborative Initiative is to strengthen the field of biochemical processes and molecular biology within RISE. The long-term goal is to create the right conditions for Swedish industry to be a world leader in the transition to a fossil fuel-free society. The focus of the project is to inventory existing resources (expertise and equipment) and identify

Collaborative Initiative (Focus Area)	Description
	common interests, elements that can be strengthened, future key areas based on the needs of the industry, and which partners and customers should be prioritised.
Collaboration for Fossil Fuel-Free Transport – use and systemic perspective (FFT)	Considerable pressure is being placed on fuel suppliers to lead the transition owing to current policy in the form of "Bränslebytet" (*Eng: Fuel Replacement Initiative*) and obligations to gradually reduce the climate impact of their fuel mixtures by 2030 as part of the 70% reduction target compared to 2010. This transition requires scientific knowledge – not least of all among the operators who are expected to contribute to the transition. The aim is to strengthen RISE's role as a leading innovation partner in the area pertaining to the use of and systemic perspective for non-fossil fuels, and to develop and bolster relationships with key customers and partners.
Role of the financial sector in the transition of industry and construction (FFT)	The technological shift and behavioural changes associated with the transition require substantial investments. The use and allocation of funds from the financial sector play a major role in achieving climate goals and resource-efficiency targets. The purpose of this Collaborative Initiative is to create joint proposal applications and offers to spur financial sector involvement in projects while, at the same time, playing an investigative and advisory role in the ongoing work related to funding for national roadmaps for fossil fuel-free competitiveness and for investments for increased resource efficiency in industry and construction.
Industrial Water Use (SWU)	The aim is to establish RISE as Sweden's strongest centre of expertise for industrial water treatment and water management (Industrial Water Management).

Business and Innovation (B&I) Area: Sustainable Cities and Communities

In the Sustainable Cities and Communities B&I Area, RISE carries out interdisciplinary and cross-boundary work in collaboration with academia, trade and industry, the public sector and civil society. We bring together RISE expertise in areas such as construction, energy, resources, infrastructure, service design, policy, collaboration processes and organisational capacity for innovation and transition. Through contact with customers and partners and long-term skills and competence building, we strengthen RISE's ability to meet the needs of cities and society for development, innovation and collaboration for a sustainable future. Tables 6 and 7 describe our strategic initiatives in the form of Focus Areas and Collaborative Initiatives for the B&I Area.

Table 6. The Sustainable Cities and Communities B&I Area's Focus Areas and their descriptions.

Focus Area (FA)	Description
Viable & Sustainable Districts (VSD)	This Focus Area combines technology, health and behaviours – fields of expertise which overlap complement one another. All in order to achieve viable and sustainable districts.
Resilient Cities and Communities (RCC)	Society is becoming increasingly complex and the ways we have worked with safety and security thus far are not always applicable. At the same time, we are facing a global pandemic, ongoing climate change, as well as a deteriorating politico-security landscape. Therefore, we must increase capabilities and improve conditions at multiple levels of society in order to adapt accordingly to unforeseen events or disruptions. The Focus Area supports cities and communities in their ability to avoid, manage and adapt to the changes and crises taking place in society.
Cities and Societies in Change (CSC)	Globalisation, migration, and urbanisation in conjunction with digitalisation are intertwining the local with the global, resulting in the most monumental societal change in modern history. Climate change, deepening social exclusion and pandemics are complex societal challenges that underscore the need for innovation and adaptability within organisations. Complexity is increasing – we are moving from hierarchical organisation towards greater network organisation, self-organising teams, flexibility and continuous development. How does this affect society and us as human beings? How do we lead, organise and govern in this new world? The Focus Area supports this complex transition with an emphasis on support through system innovation, new value calculation methods and co-creating processes.
Integrated Infrastructure (II)	Contributes to the development of smart, integrated solutions in the built environment. The maintenance of physical infrastructure must be optimised for maximum benefit. At the same time, resources should be utilised across the life cycle and contribute to ecologically, socially and economically sustainable development. RISE has expertise in subjects such as infrastructure maintenance – from material knowledge, design and performance assessments – to decision-making and business models.
Connected Cities (CC)	In the future, data will be collected and made available in a structured manner. Cities in Sweden must agree on a common technical framework (digital infrastructure). This requires collaboration within a city and among cities, and will also lead to organisational changes and new relationships with inhabitants (through interactive plan visualisation, processes, flows, data democracy and transparency aspects, for example), and new relationships with city entrepreneurs (servicification). RISE can support trade and industry and society in this.
Urban Mobility (UM)	The Focus Area addresses the ongoing paradigm shift related to transport and mobility in tomorrow's cities.

Table 7. The Sustainable Cities and Communities B&I Area's Collaborative Initiatives and their descriptions. The Focus Area with which the Collaborative Initiative is affiliated is shown in brackets in the table below: Viable & Sustainable Districts (VSD), Resilient Cities and Communities (RCC), Cities and Societies in Change (CSC), Integrated Infrastructure (II), Connected Cities (CC) and Urban Mobility (UM).

Collaborative Initiative (Focus Area)	Description
Positive Energy Districts (VSD)	In the EU, efforts are being made to create 100 positive energy blocks (PEBs) by 2025 and 100 carbon-neutral cities by 2030. RISE supports and encourages property owners, municipalities, energy suppliers, city developers, etc. to join forces and create the cities of the future.
Sustainable Lifestyles (VSD)	To reduce our ecological footprint, we need to change our lifestyles and behaviour. The "right" lifestyle changes benefit the environment but should also lead to improved quality of life. We offer expertise in sustainable lifestyles, which includes sustainable community building, consumption, travel, accommodation, activities, etc.
Comfort and Safety in the Indoor Environment (VSD)	Wellbeing is based on the comfort and safety perceived by the user. The initiative brings together RISE expertise in indoor environments, sound, light, thermal comfort, cooling, ventilation, humidity, air quality, etc. as well as measurement of experience both in buildings and vehicles.
Holistic Climate Adaptation (RCC)	The work involved with climate adaptation – to address both subtle and extreme consequences – is becoming increasingly important in planning and building the sustainable cities and communities of the future. The development of innovations and new solutions necessitates a holistic approach. RISE's work with all sectors of society and technology areas adopts an interdisciplinary and innovative approach to systems and technology development. Together with our partners and customers, we tackle challenges from a holistic perspective.
National Defence (RCC)	Cities and communities need to generate new knowledge and strengthen their capabilities to deal with undesirable incidents resulting from today's deteriorating security situation and the consequences that may follow. By initiating strategic partnerships, the Collaborative Initiative works with research organisations, companies and the public sector to develop new solutions able to reduce the pressure on societal functions and increase society's security of supply. This is accomplished by combining our own expertise related to the built environment, safety & transport, agriculture and food with ICT.
Urban Transition and System Innovation (CSC)	Cities and communities are facing complex societal challenges that require a greater ability and increased capacity to address systemic, structural and policy-related barriers and roadblocks to bring about changes in the system. Through this initiative, we are developing RISE's offer concerning capacity for innovation and transition for both private and public operators in cities and local communities. We combine expertise in system transformation, system innovation, design thinking, norm-critical innovation, data-driven innovation, governance innovation and policy innovation. With this assemblage of capabilities, we investigate issues affecting cities in the fields of, for example, mobility, health and professional education, and we initiate strategic R&I collaborations.

Value-creating models for sustainable governance and monitoring of societal development (CSC)	In order to develop and implement sustainable, long-term future solutions and achieve established global sustainability goals at a time when cities are under pressure economically, new holistic ways of promoting and evaluating preventive measures and investments are required. We offer a hub of expertise for developing and offer new services for promoting and evaluating values, such as quality of life and social and environmental values. We initiate R&I projects and learning processes to develop governance and interaction processes, financial solutions and new value propositions (business models) in cities and municipalities. We offer participation in a new intersectoral knowledge cluster for new value calculation methods aimed at community building and tailoring training and educational initiatives.
Infrastructure for future mobility (II)	Infrastructure as a system undergoes gradual change and is greatly affected by rapid development – and this is particularly true of infrastructure for mobility. RISE utilises system integration to ensure that transport infrastructure benefits from knowledge of energy, fibre, and water and sewerage. Transport infrastructure in Sweden is owned by the Swedish Transport Administration, municipalities and private operators, such as private individuals and private road associations. Interaction with all these stakeholders is of great importance and must be combined to bring success. We also combine expertise in the fields of civil engineering, energy technology, ICT, safety and transport.
Urban and Rural (II)	Enhance conditions for living and working sustainably in rural areas and for enabling cities and rural areas to enrich each other. This encompasses R&I and tests pertaining to infrastructural investments, community planning, business models and services in the following areas: Passenger and freight transport, entrepreneurship, increased citizen participation, food production and local processing, and living environments.
Framework for Open Digital Platforms (CC)	All elements in the civil engineering process seeking to initiate data-driven work require basic technical and organisational prerequisites to be able to collect and make data available in a controlled manner. This includes the need for digital platforms, organisational capabilities concerning data governance, and functioning value chains. We want to bring together municipalities, municipal companies, property companies and government authorities from different segments in order to understand and define these prerequisites.
Digital Twins for Cities (CC)	Cities are complex systems of buildings, infrastructure, people, vehicles, energy, materials, plumbing, etc., and the amount of information that needs to be collected and managed in order to make informed sustainable decisions related to these is essentially endless. Municipalities need to develop their expertise when it comes to inventorying, managing and communicating this information internally and externally. One approach is to create a “digital twin” for the city where data from many different data sources is assembled into an advanced visualisation.
Urban Logistics (UM)	Self-driving and electrified vehicles influence the planning of new districts, the relationship between urban and rural, and the way we transport ourselves. We are in the midst of a paradigm shift. RISE brings together expertise in community development, urban planning, mobility and ICT. Together, we develop new business models as well as new techniques. We initiate and run projects within, for example, SIP Viable Cities, SIP Drive Sweden, EIT and H2020.

Business and Innovation (B&I) Area: Health and Life Science

The field of life sciences is experiencing a high pace of innovation. Data-driven innovative solutions combined with scientific advances will have a profound impact on development related to prevention, diagnostics, treatment, follow-up, convalescence and rehabilitation. Sweden's capacity to seize these new opportunities has consequences with respect to societal costs, health outcomes and competitiveness.

The Health and Life Science B&I Area aims to contribute to improving health and wellbeing for all – without driving up the cost of healthcare in terms of GDP. We possess unique expertise in areas such as pharmaceutical production and development, formulation, sensors, data analysis and storage, security, visualisation, interaction design, service development and innovation management. We also have extensive experience in implementing new technologies and services in both the public sector and industry.

Table 8. The Health and Life Science B&I Area's Focus Areas and their descriptions.

Focus Area (FA)	Description
Preventive healthcare	Preventive healthcare brings together researchers, social partners and industry in research and innovation projects with the aim of preventing disease and mental ill-health. Our work has focused on creating the right conditions for new business models and funding solutions through our investment in the RISE Social and Health Impact Centre (SHIC). We have also focused on generating expertise related to how we measure health outcomes and how to design preventive health services.
Digital Health/E-Health	The government has a goal for Sweden to be the best in the world by 2025 at utilising the opportunities afforded by digitalisation and eHealth. Digital Health/E-Health is interdisciplinary, multidisciplinary and disruptive with the power and opportunities of digitalisation as a common denominator. Activities, projects and funding are initiated through interaction with the line, and other conditions are created for the development of the area. Areas in which we operate include digital medical technology, sensorics, diagnostics, treatment, service design, system design, big data, artificial intelligence, clinical decision support, digital genetics and proteomics.
New therapies	The Focus Area contributes to the development of effective, safe and personalised medicines. An ageing population, chronic diseases and diseases for which there are currently no treatments or cures require new solutions. Precision medicine involves new ways of formulating and delivering medicines, new types of medicines such as cell and gene therapies (ATMP) and biological medicines, digitised processes and analyses, and new business and payment models. Our vision for the future constitutes 1) a nationally coherent infrastructure for pharmaceutical development in which RISE plays a significant role and 2) RISE serving as an innovation partner for the development of tomorrow's medicines with an agile offer that encompasses our entire range of expertise, including those beyond the core business of toxicology, formulation, process development and production.
Infection Control	The starting point of the Infection Control Focus Area revolves around the global challenges associated with infection and the increasing prevalence of antibiotic resistance. The emphasis is on innovations geared towards preventing the emergence of infections, countering the spread of infection, treating infections, improving diagnostics and monitoring, and the responsible use of antibiotics. The focus is on people but the work is driven from a One Health perspective (people, animals and the environment are closely interconnected). The overall purpose of the Infection Control Focus Area is to strengthen RISE's role in the urgent work to accelerate and facilitate innovations in the field.

Table 9. The Health and Life Science B&I Area's Collaborative Initiatives and their descriptions. The Focus Area with which the Collaborative Initiative is affiliated is shown in brackets in the table below: Preventive Health (PH), Digital Health/E-Health (DH), New Therapies (NT). This year we do not have a Collaborative Initiative linked to the Infection Control Focus Area.

Collaborative Initiative (Focus Area)	Description
Health and Nutrition (NT)	Industrial and social operators need better guidance, validation and development in the field of Health & Nutrition. The objective of the initiative is to build project portfolios with applications and continue to bolster RISE's position as an operator in this field. Examples of areas in which the Collaborative Initiative can contribute include how the constituents, formulation and/or structuring of a product affect the breakdown, release and absorption of both macro and micro substances in the body and how this is expected to affect the health of the consumer. Other potential areas include product communication with respect to current legislation, as well as tools that facilitate the selection and procurement of healthy and flavourful food.
Pharma Office (NT)	The purpose of the Pharma Office Collaborative Initiative is to offer an entry point into – and make available – the full range of expertise related to pharmaceutical development at RISE, from target to patient. Initially, the initiative will identify and connect internal resources and expertise in the field of pharmaceuticals. It involves identifying people with unique expertise who can participate on the Pharma Office advisory board and Innovation's Due Diligence, as well as internal infrastructure that already provides a offer in pharmaceutical development or which can be converted as per request. The Pharma Office Collaborative Initiative will also link with (and act as an umbrella for) the pharmaceutical sections in adjacent Collaborative Initiatives such as "Testbed TOX", Regulatory, and Smart Chemistry, as well as with research initiatives and other projects in the field of pharmaceuticals to address future needs in pharmaceutical development. An ambition of Pharma Office is to collaborate with national infrastructures in order to contribute to a nationally interconnected infrastructure for pharmaceutical development. We see several opportunities to formulate proposal applications together with other entities, which will both help to tailor the offer according to the needs of the outside world and hopefully lead to funding for skills development and assignments.
Smart Chemistry and Materials (NT)	This is a joint Collaborative Initiative between the Health and Life Science and Digitalisation B&I Areas. The participating divisions are Bioeconomy and Health, Digital Systems, Materials and Production. The aim is to link RISE's cutting-edge expertise within AI and Machine Learning with industrial domain knowledge in chemical processes. Together, we intend to offer services and products at a higher level owing to the fact that data analysis and prediction, for example, are now becoming increasingly important components in the development of chemical processes, and will continue to be in the future. The objective is to build project portfolios with industrial applications and establish RISE as an operator in the combined fields of AI and chemical processes and materials. Examples of areas in which this Collaborative Initiative can contribute to new innovations include pharmaceuticals, surfaces, materials, pattern recognition, predictive models, and safety.

RISE Regulatory (DH)	The purpose of the Collaborative Initiative is to increase awareness within RISE about regulations pertaining to medical technology devices and to create networks between people and units working in the field, with the aim of making RISE a better innovation partner in the field of medtech. PL from the Digital System division, but is on loan to the Built Environment division in the Certification department for much of the time. The other divisions involved are Safety and Transport and Materials and Production. Individuals from Bioeconomy and Health have also contributed to the project, through attendance at meetings. The SME office is involved.
Large-scale implementation in healthcare and social care (DH)	By mapping our knowledge of large-scale implementation in industries and the public sector in order to learn from proven processes and methods, we modify these according to the challenges faced by healthcare and social care associated with the large-scale introduction of new digital services and technologies (in this case, we employ the term "welfare technology"). We will actively pursue grants and work within projects that focus on large-scale implementation. Our goal is to create a knowledge base and certified methodology that can be used nationally, disseminate our knowledge internationally, and package offers related to large-scale implementation where RISE becomes the 'go-to' partner thanks to our experience and expertise in assisting the public and private sectors to identify ways to move forward.
Testbed TOX (NT)	The Testbed Tox Collaborative Initiative will merge existing expertise and offers from three units into a joint offer to provide advice, testing and safety assessment of chemicals, cosmetics, food, pharmaceuticals and medical devices. Based on a parallel needs analysis, new expertise and offers will be generated. Offers will be presented externally at customer meetings and internally within RISE to ensure maximum utilisation of the entire company's network. Ramping up will primarily take place through a number of business deals based on these offers. Synergies between the units and joint strategic initiatives – as well as a collaboration with Pharma Office – will contribute to the ramp up. Proposal applications for co-funding of strategic initiatives are being considered.
Social and Health Impact Centre 2019 (PH)	To establish a new Knowledge Platform at RISE, Social and Health Impact Centre, able to support the transition towards more preventive and proactive work methods in the welfare sector. This is accomplished by establishing an interdisciplinary team working both strategically and operationally with specific expertise in analysis, intervention design, economic modelling and innovative outcome-based contract forms. Ties in with other core expertise within RISE such as measurement technology and ICT. The plan is to initiate collaboration with several municipalities and key authorities in a project called "First 1,000+ Days".
Prevention Impact Lab Skåne (PH)	The results that the Collaborative Initiative is expected to achieve is that RISE – in partnership with Region Skåne/Innovation Skåne – will develop expertise and services to support innovation in the public sector together with the private sector. Specific ongoing and planned collaborations for 2020 include: • SWElife Childhood Obesity Project with trade and industry and public operators. • Procurement process for SMEs funded by Medtech4Health • UDI2 1) better lifestyle habits and 2) public health 2.0

Business and Innovation (B&I) Area: Materials Transition

Materials Transition is our newest B&I Area, and was inaugurated on 1 January 2020 (though preliminary work was carried out in autumn 2019). The objective is to support trade and industry and society in the system transition needed to achieve climate goals and a circular economy, where the impact of materials accounts for about 50% of the solution. However, circular material flows are not something that individual companies can accomplish on their own. Ensuring an effect by 2030 and 2045 will require many organisations striving for the same thing, at the same time and in multiple countries. We are starting with three Focus Areas (see Table 10), one of which, Circular Transition, was already active in B&I Energy and Bio-based Economy.

The start-ups are MaterialEcosystem and Future Production for Materials Transition. To maintain momentum, each Focus Area is running 2-3 Collaborative Initiatives in 2020, which are briefly described in Table 11 below.

Table 10. The Energy and Bio-Based Economy B&I Area's Focus Areas and their descriptions.

Focus Area (FA)	Description
Circular Transition (CT)	The starting point for the Focus Area is that the circular transition required constitutes a powerful engine for innovation. In the Focus Area, we amass knowledge and tools for Swedish trade and industry and society to be able to transform visions into actions. The focus is on measurements, tools and profitable new business models for a circular economy.
MaterialEcosystem (ME)	The MaterialEcosystem Focus Area works towards increased recycling and upcycling where the value of material resources can be increased. This is a prerequisite for increased circularity. The focus is on infrastructure for the procurement of materials, better processes, design for circularity and increased demand for secondary materials.
Future Production for Materials Transition (FPM)	Works to support industry in the transition to more circular materials and a resource-efficient, carbon-neutral industry. The initial focus is on composites and cellulose, the utilisation of greener raw materials, and the manufacture of more recyclable components for industries such as automotive, solar and wind power, packaging and construction.

Table 11. The Materials Transition B&I Area's Collaborative Initiatives and their descriptions. The Focus Area with which the Collaborative Initiative is affiliated is shown in brackets in the table below: Circular Transition (CT), MaterialEcosystem (ME), Future Production for Materials Transition (FPM).

Collaborative Initiative (Focus Area)	Description
Digitisation and Circular Economy = True (CT)	The ability to generate data and measure and follow-up our progress towards circularity in certain industries is crucial for Circular Transition. Initial work related to windows, packaging, and textiles.
Traceable Materials for CE (CT)	Create traceability by incorporating means of identification into materials. This is necessary to streamline collection, sorting, and recycling, and to create a material ecosystem with greater control than at present.
Textile 2020 (CT)	ICT meets fashion and textiles. Textiles and Fashion are ready to create new business models, but need help to develop systems with greater transparency for monitoring producer responsibility, recycling and reuse.
Packaging Value Cycle (ME)	All types of materials are used in packaging, and there is a considerable need to create higher value for recycling and to build material ecosystems, in Sweden and globally. Sweden has had a prominent role in packaging since the 1950s, and we will build further on that for future success globally.

Material Refinery (ME)	New techniques are required for understanding systems, handling materials and producing "new materials" from recycled materials. The right secondary material must be able to be matched with right secondary application in order to generate demand and create value. Initially linked to Packaging Value Cycle above, as well as textiles and plastics in general (e.g. for composites)
High Volume and Cost-Effective Composites (FPM)	High-performance composites, or adequate composites, need to become more circular in terms of material selection and manufacturing processes and – not least of all – to achieve higher levels of recycling or reuse. If we manage to succeed in all parts of this, Sweden will be poised for export prosperity.
Reject Upcycling Demo (FPM)	The world needs more upcycling to increase the pace of transition. A clear example is how we upgrade materials instead of downgrading or burning them. Reject fibre is transformed into foam to be used as "sustainable" insulation for heating/cooling and sound. A product with higher value and a longer service life than the original product (e.g. newspaper or cardboard).

Business and Innovation (B&I) Area: Mobility

We bring together RISE expertise in the fields of transport and mobility under the Mobility B&I Area. Within Mobility, we research and test everything from materials technology, production technology and software to complete vehicles and simulations of logistics flows. We also work with long-term strategies for skills and competence building that aim to continuously strengthen our ability to meet future needs for expertise and testing for trade and industry and society.

Tables 12 and 13 describe our strategic initiatives in the form of Focus Areas and Collaborative Initiatives for the B&I Area.

Table 12. The Mobility B&I Area's Focus Areas and their descriptions.

Focus Area	Description
Servicification (S)	How can passenger and freight transport be made truly smart? This is the main question in the Focus Area, which works with everything from bicycle-sharing systems to connected shipping.
Energy and Environment for Mobility (EEM)	Focus on energy-efficient, eco-friendly transport. Electromobility – from battery-powered and hybrid systems, energy management and control, and charging infrastructure to new business models and user behaviours.
Automation (A)	The area focuses on the development, simulation and testing of technologies and methods for active and passive road safety and autonomous driving.
Manufacturing (M)	We develop and test new production methods and materials for resource-efficient and cost-effective manufacturing, processing, maintenance and material use.
ICT for Mobility (ICT)	Electronics, software and communications facilitate innovation – as well as disruptive innovation – in the field of mobility. RISE works with virtually everything from EMC testing to machine learning and issues related to the system-of-systems.

Table 13. The Mobility B&I Area's Collaborative Initiatives and their descriptions. The Focus Area with which the Collaborative Initiative is affiliated is shown in brackets.

Collaborative Initiative (Focus Area)	Description
Electromobility (EEM)	Electrification is a major part of the solution if Sweden is to reduce its emissions of both particles and carbon dioxide. In order to accelerate Swedish innovations in the area and be a significant player in the transition, RISE needs to bring together its expertise and develop good offers in the field of electromobility.
Connected Transport Automation (A)	Achieving an automated transport system requires connected road users. "Connected, Cooperative and Automated Mobility (CCAM)" is being discussed within both research and industry. The AstaZero and AWITAR test and demo facilities must be continuously developed to keep up with the rapid development in the industry. RISE shall be experts in the forms of CCAM needed to achieve, for example, safety, climate and environmental goals.
Electric Flight Systems (EM)	Electric aircraft can already be considered a realistic concept for efficient, sustainable and economically viable regional transport. However, it is not just a question of developing an electrified aircraft – it requires a major infrastructural transition, as well as a new way of thinking about the coordination of air transport systems. Through Electric Flight Systems, we bring together RISE expertise in order to contribute to this transition. The initiative also serves as a link to the other innovation projects and networks related to electric aviation both nationally and in the Nordics.
Hydrogen Fuel (EM)	The project creates new socio-critical projects in the fields of hydrogen fuel and fuel cell technology, and the project increases RISE's reception capacity for fuel cell projects from industry. Coordination, ramp-ups, mapping and the occasional reinforcement of expertise are required to cope with assignments and the considerable interest now being directed towards RISE with regard to this field. RISE will assume a position as the first-choice partner for consortium building related to the accelerated implementation of hydrogen fuel technology in the transport system and – down the line – in the entire energy system.
Rail (ICT)	Rail transport is an important part of the transport system for long-distance freight and passenger transport, and is also an important part of communication solutions in several cities. Transferring transport to rail offers obvious advantages, e.g. low CO2 footprint. RISE works with many issues from timetable optimisation, technology, and maintenance matters to safety and energy supply.
Safe Battery Systems (ICT)	Holistic concept for circular planning of battery systems: requirements, design, production, status analysis, LCA and recycling. The combined results of quality-assured, efficient measurement methods and cost-effective integration in battery systems provide Swedish industry with a competitive advantage throughout the value chain – from battery manufacturer via system integrator (vehicles, buildings, etc.) to users and recyclers.
First Mile/Last Mile Personal Mobility (S)	Several studies show that first mile/last mile transport is an important challenge when it comes to achieving sustainable mobility for both freight and passenger transport.

	This project aims to act as a catalyst and generate knowledge through several other externally funded projects in the field. New mobility solutions such as dynamic ride-sharing, electric scooters, etc. Together with 5G and connectivity, new conditions can be created, but user acceptance, willingness to change behaviours, and business models are examples of significant challenges.
Policy and Regulatory Innovation in Mobility (S)	The project aims to expand RISE's capacity to contribute to policy and regulatory development, thereby closing the gap between technology and law in order to support Swedish innovation. As society becomes more complex and technological development accelerates, we must eliminate 'tunnel vision' and adopt other ways of working where engineers, economists, behavioural scientists, environmental scientists and lawyers, for example, are able to work together in policy labs to better address the whole. This will enable sustainable technical solutions, among others things, to reach the market faster.
Flexible Automation for Industrial Transformation (M)	The project focuses on the challenges posed by the manufacturing industry's transition related to mobility, through the transformation underway with: New products for electrification or other fossil fuel-free propulsion, connectivity and autonomous driving. New technological possibilities with automation and robotisation for manufacturing. New business models for both vehicle users and production resources. Increased demands for individualisation, circular material flows, and attractive and safe workplaces.

2.5.3 Divisional strategic areas

RISE's operations are divided into five divisions: Bioeconomy and Health, Materials and Production, Digital Systems, Urban Development and Safety and Transport. Each division undertakes initiatives geared towards various strategic areas both for long-term knowledge development and the development of new offers.

Division: Bioeconomy and Health

The Bioeconomy and Health division endeavours to accelerate the sustainable transition of trade and industry and society with regard to circular bioeconomy and life science. The strategic areas of Bioeconomy and Health are described in Table 14.

Table 14. The Bioeconomy and Health division's strategic areas.

Area	Description of strategic area
Medicine	In the field of Life Science, RISE contributes to the development of tomorrow's medicines by taking advantage of the possibilities offered by digitalisation. We also offer toxicological evaluation of chemicals and pharmaceuticals (in silico, in vitro, in vivo, bioanalysis). The ongoing coronavirus pandemic has made the need for virus analysis at RISE a matter of urgency. Examples of mobilisation efforts: • Nanotoxicology Centre • Establishment of virus-related operations • Biomarkers – development of the offer from the bioanalysis group within the toxicology unit • IVD – development of an offer in this field • Develop our offer in large-molecule pharmaceuticals based on our knowledge of conjugate chemistry/ADC/AAC • New therapies (new modalities/biologics) • Aseptic processing
Agriculture	Agriculture is a key element of sustainable development, in all dimensions. The issue of supply has become highly pertinent in light of the pandemic, but was already a major issue owing to geopolitical developments. Our initiative includes additional elements, but the focus for the near future is on digitisation and knowledge intensification. This includes increased precision concerning biological processes through technical and organisational development and implementation. Innovation development in the value chain is an area run in close cooperation with the Food strategic area.
Food	The food industry (including agriculture) is facing – and has already begun – a major transformation. There is growing demand for new products with better climate and health performance, particularly with regard to the "green protein shift" but also seafood and other livestock. Local and transparency are keywords. Our initiatives focus on production, products and innovation in the value chain, where added value in terms of health and sustainability is generated and maintained to create value for all operators. Ample knowledge must be amassed concerning how changing diets actually affect health and sustainability, and how this can be developed and communicated. Key challenges for the area also involve creating new business models for sustainable transformation.

Pulp and Paper	We support the pulp and paper industry to ensure its competitiveness with existing and future processes. Improved product quality and process streamlining. Examples of mobilisation efforts: • Boosting fibre performance • Water efficiency (e.g. around pulp and paper mills) • Material transition (e.g. recycled fibre, plastic to fibre. Overlaps with Packaging) • Digitisation (process control/simulation, etc. Overlaps with the Packaging) • Optimal test and demo utilisation (we use our pilot park to both answer today's process/product questions and to scale up materials of interest for future applications)
Packaging	We increase understanding of different materials in the packaging industry and offer solutions for future packaging, thereby increasing the performance of present-day packaging for material manufacturers and for those for whom material transition is necessary, such as brand owners. Examples of mobilisation efforts: • Digitisation, see Pulp and Paper above. • Material transition, see Pulp and Paper above. • Product safety, especially for materials intended for contact with food • Packaging development (simulation, corrugated fibreboard, packaging design)
Bio-based Materials	The area covers everything from special cellulose for cosmetics to wood treatment, and aims to progress from lab to pilot scale in diverse biomass-based value chains, not least of all lignin. Examples of mobilisation efforts: • Digitisation perspective, generate expertise and internal collaborations to meet customer needs for today's digital transformation with regard to materials and surface design. • Circular design. Business-critical Focus Areas: Smart Materials: Develop technical concepts for next-gen electronics and material processes to speed up the time to market. • Material traceability, digital cellulose, smart materials, etc. • Sustainable hygiene products: Develop cosmetic and medical device concepts for superior functionality, safety and environmental profile. • Wood materials: Develop processes and products with extended lifespans, performance and material value for wood-based products. • Perception and design: Develop methodology for the evaluation and effect of sensory, visual and tactile experiences • Green chemistry: Develop processes and products for pigments, aromas and additives for superior consumer experience and price, safety and environmental profile.
Energy, Chemicals and Fuels	We increase understanding of the potential possessed by different bio-based raw materials to be processed to achieve higher values. Our operations are based on fundamental expertise and understanding as well as more practical skills with experience from today's commercial industrial businesses. Our pilot equipment enables promising unit operations and concepts to be scaled up. We offer services related to the development of process solutions for bio-based energy, fuels and chemicals. Examples of mobilisation efforts: • New and improved processes along with upscaling to facilitate bio-based energy, fuels & chemicals • Industry opportunities with CCS/CCU
Industrial Water Management	Industry accounts for 40% of Europe's water use. RISE has a unique opportunity to contribute to more efficient water management in industry and to develop business and generate expertise linked to resource efficiency, water treatment and substitution of non-biodegradable substances in watercourses and waterborne waste streams. Change is achieved by means of, among other things, political pressure and market incentives to reduce "water footprints" and industrial emissions, and to institute microplastic bans.

Material Recycling	Develop business and generate expertise linked to recycling, upcycling and processes for closed material streams. Short-term mobilisation with regard to fibre-based material streams.

Division: Digital Systems

Digital Systems carries out research and innovation based on both scientific and industrial experience. Knowledge in the division encompasses sensor systems, sustainable mobility, automation, the processing and analysis of very large data sets, machine learning, cybersecurity, visualisation, interaction design and circular business models. The strategic areas of Digital Systems are described in Table 15.

Table 15. The Digital Systems division's strategic areas.

Area	Description of area
Data Science – AI and Cybersecurity	**AI and Data Science** are two of the strongest drivers of the digital transformation currently taking place in society, industry and the public sector. RISE's task is to utilise its combined world-class capabilities in the fields of applied research and innovation to help safeguard Sweden's position as a leading nation in sustainable digitalisation for increased growth and reform. **Digital Security** – as a consequence of digitalisation, security issues are high on the agenda. Our main objective is to improve opportunities to prevent, detect and manage cyberattacks and incidents and to increase and promote knowledge of digital security nationally and internationally. The main focus is on applied and practical security, complemented by practicable security expertise that also incorporates the human and organisational aspects of digital security.
Innovation and Design	In our task to promote and generate innovation in society, industry and the public sector, we combine technology with application knowledge based on an understanding of human interaction: • Development and implementation of design processes and methods • Design of innovation management systems, development of concepts and participatory innovation processes. • Regulatory innovation and policy formulation
Hardware – Sensors and Networks	A cornerstone of a connected society is data collection and distribution by means of sensors, sensor systems and networks – the Internet of Things (IoT). RISE advances world-class research, innovation and development related to new digital materials, sensors, networks, and system-of-systems, and strengthens knowledge in the new field of Energy Harvesting.
Connected Society & Industry	A fundamental area for growth and increased global competitiveness is the automation and digitisation of industry, which places Sweden and Europe in a leading position. Combining technology and domain knowledge within RISE (creating a holistic perspective of knowledge, tools, platforms, protocols, etc.) provides us with a unique position to make a difference and drive the industry of the future – "Connected Industry 5.0"; Digitalisation for sustainability: economic, environment and social. Mobility, eHealth, urban planning and electricity supply are important areas of application for digitalisation. RISE provides guidance to all operators in society and enables positive socio-economic impact through

	knowledge of platforms and systems for connected cities, where holistic processes are digitised and improved for better urbanised and sustainable housing for all.
Data-driven Societal Transformation	**Inclusion and democracy.** The combination of knowledge in digitisation, AI, digital security, design and ethics provides RISE with a unique platform to actively promote issues that ensure that digital transformation remains within generally accepted ethical norms and strengthens democratic society. The objective is to ensure positive humanistic and democratic societal impact, and to work proactively to increase digital integration, reduce inequality and strengthen institutions and initiatives that promote democracy and active civic engagement; Sustainable Digitalisation. **People 4.0** How will our roles and tasks change in the current social transformation? How will our behaviours, skills and learning methods change in order for us to live in harmony with AI and autonomous systems in a fully digitised world? Focus Areas are Lifelong Learning, eHealth, Wellbeing, Healthy Food, Circular Economy and Life Science.
Future Mobility	Mobility is a prerequisite for an urban society, but it brings with it challenges in terms of environmental impact, congestion, time and cost. Research is focusing on new fossil fuel-free vehicles, autonomous technology, and new forms of ridesharing instead of vehicle ownership. These will lead to tremendous changes in society and trade and industry over the coming decades. RISE helps customers to make knowledge-based decisions in the face of this major transition. We actively generate knowledge through applied research, tests with users in their normal environments, technology testing in our special test facilities, and the transfer of knowledge to trade and industry and society. Laws and regulations correspond to today's transport system and, in many ways, can hinder new solutions. RISE works with regulation innovation together with authorities in order to understand which changes are needed.

Division: Materials and Production

The division's strategic operations are developed from a social and industrial perspective where a major focus is placed on the division's most important customer segments: the automotive, furniture and textile, process & chemicals, energy, construction and life science industries with a focus on the medical technology industry including the healthcare sector. The main issues identified revolve around the need for circular and sustainable transition, where the key drivers arise from trends such as: sustainable and smart production, material innovation, electrification of the vehicle fleet, and the digitisation of industry. Other important factors affecting the division include blue growth, needs for resource efficient and sustainable healthcare, business innovation and new value chains, safety and resilience, and the Covid-19 pandemic. The Covid19 pandemic, in particular, is expected to engender extensive and lasting change in both society and industry, which inevitably affects the division and its future operations as well as strategic initiatives. For instance, we see an increased need for services and research linked to transition issues, including new value chains (local and national), electrification of the vehicle fleet, business innovation, and medical technology, but reduced demand for issues linked to the fossil fuel industries.

Table 16. The Materials and Production division's strategic areas.

Area	Description of strategic area
Digitisation of Industry – Smart Production and Products	The focus of the area is on enhancing the Swedish manufacturing industry and products, and aligns well with the necessary measures to be implemented by the industry subsequent to the Covid-19 pandemic. The division therefore invests considerable resources in order to be relevant, to facilitate the digitisation of industrial production systems, and to introduce circular business models for these. The division also drives the development and realisation of AM technology through hosting a national AM centre. Other important initiatives in the field include research and development in the joining and forming of composite materials and products, as well as high-volume composite manufacturing. The driving force for digitisation also has a sustainability perspective, where the aim is multifaceted: increased productivity through robust and reliable manufacturing, thereby achieving environmental sustainability.
Sustainable Products and Production – Material Transition	A key driver in society, further reinforced by the Covid-19 pandemic, is the reduction of resource extraction and a shift to circular material flows, where non-toxic, quality-assured, recycled and/or fossil fuel-free materials are in demand. A prerequisite for the transition is advanced material characterisation in combination with design and production knowledge. The division meets the future needs of industry through proactive research and development related to multifunctional materials and products, biomaterials and bioactive polymers, as well as new bio-based materials originating from, for example, the ocean. The transition also calls for the development of new recycling processes and methods for tracing and validating these. Another important prerequisite for a sustainable future constitutes methods for service-life prediction and alternative uses for end-of-life products.
Electrification of the Vehicle Fleet	The transition to fossil fuel-free and sustainable transport requires a strong focus on developing electric machines, vehicle structures that protect batteries in the event of a crash and from fire, and the production of new, lightweight components and structures for increased energy efficiency. The R&I area and work method have been bolstered and given a clear focus owing to the Covid-19 pandemic. RISE is working with automotive companies and their subcontractors to devise completely new design solutions for these components, where major challenges in areas such as durability and new production methods are leading to greater receptiveness to innovative solutions and closer cooperation between the parties involved. Another important issue linked to electrification is the increased production volumes and the expected standardisation of electric powertrains.
Resource-efficient and Sustainable Care	Resource-efficient and Sustainable Care is the divisional strategic initiative area experiencing the most apparent positive effect due to the Covid19 pandemic. Here we seeing that significant scientific discoveries, which are now beginning to achieve clinical use, have changed the basis for how we view medicines and possibilities for curing diseases, as well as possibilities to utilise biological testing to, at an early stage, diagnose and detect diseases, determine disease susceptibility, monitor pathogenesis, and oversee treatment. In order for RISE to continue to be a relevant partner in Life Science, the division is investing in more biologically oriented methods as opposed to traditional methods where chemistry/materials have served as the driving force and biology has been a necessity in the development.
Blue Growth	The ocean is the new economic frontier with massive potential for growth, employment and innovation. Realising economic growth based on the exploitation of marine resources is being seen as increasingly necessary to address many of the global challenges we will face in the coming decades. One of the most important challenges in "Blue Growth" concerns the actual use of various materials, components and products in the marine environment. The division's operations therefore focus on the extreme conditions in the ocean which place high demands on materials and products used there as well as methods to extend their service life. The division meets the future needs of the industry through

	proactive research and development, which includes, among other things, building test and demo infrastructure at the Kristineberg Marine Research Station.
Business Model Innovation and Industrial Transition	Companies today are facing major changes where adaptability is of paramount importance, and this has been further accentuated due to the Covid-19 pandemic. Interdisciplinary approaches and cross-industry cooperation are required here. There exists considerable breadth within RISE and the Materials and Production division, in terms of the worked carried out for different industries and in different areas of knowledge. In this, we see major opportunities to combine industry knowledge, technical knowledge and change knowledge to create a whole with a common thread able to produce powerful system impact. There is also a great need to develop and refine policy formulation, which can, in turn, accelerate capacity for transition. We also work to develop methods for lifelong learning and competence validation to ensure relevant skills in the industry.
Safety and Resilience	Developments in recent years have resulted in increased uncertainty among countries, in society and at the individual level. The need for resilience and redundancy in society has been further emphasised owing to the ongoing Covid-19 pandemic. Issues pertaining to safety and resilience are therefore priorities, and this need creates a driving force for the development of diversified and comprehensive R&I operations. The division works with matters related to, for example, personal protective equipment, chemical safety and decontamination. Other ongoing initiatives in this area address the work environment and the development of methods for biological and chemical safety. Complete examples include the development of tests for face masks and respiratory protection against Covid-19 as well as PFAS decontamination in our test and demo facility: Testbed PFAS. We also contribute to society's transition to a non-toxic environment through substitution of hazardous chemicals.

Division: Built Environment

There is solid experience in Sweden and globally with regard to promoting technology development and innovation, but it remains untested in terms of coordinating the transition that society must achieve so as to fulfil the Paris agreement. For many, the concept of transition is synonymous with innovation, despite the fact that climate goals can be met with current technology. In order to take advantage of available technology as well as innovations within our grasp, prevailing norms, operator clusters, policies, behaviours, and business models must be given greater prominence. Increased awareness of socio-technical barriers and increased ability to address systemic weaknesses are imperative.

The Built Environment division combines holistic thinking and expertise in areas such as the built environment, resource efficiency, function and construction, infrastructure solutions and urban development. We generate new knowledge and climate-friendly, energy-efficient and cost-effective services and solutions for a sustainable, attractive and people-centric society. The strategic areas of Built Environment are described in Table 17.

Table 17. The Built Environment division's strategic areas.

Area	Description of strategic area
Societal Infrastructure	The division intends to become more prominent in the field of **infrastructure**. This refers to infrastructure from a broad perspective in areas including energy, water, sewage, waste, fibre, roads, rail, bridges, dams. etc. The focus is on climate adaptation, circularity, integrated infrastructure, improved decision-making and permit-issuing processes, multi-modal construction, and other assignments for policy makers
Transition Acceleration	The Built Environment division aims to establish a **transition accelerator** that is intended to serve as a platform for broader expertise (and lifelong learning) related to transition. Key elements include: training, communication initiatives, policy labs, foresight/scenario/roadmap work, management systems, analysis and provision of tools for transition. The banking and finance sector is a particularly important operator with which relationships can be further cultivated. Participation in, and the establishment of, arenas for transition are other central aspects in this area. The Development Project Mobilisation Governance Innovation Centre is a hub for this work
Implementation of Fossil Fuel-Free Roadmaps	The division also intends to strengthen its ability to contribute to transition by working with roadmaps, leading operators, arenas and the operationalisation of knowledge, tools and testbeds. A clear example of this is to achieve structured work geared towards **the implementation of fossil fuel-free roadmaps**, mainly in the cement and concrete, building and construction, and heating and electricity industries. A further goal is to establish long-term cooperation with the Fossil Free Sweden initiative and local initiatives in Stockholm, Gothenburg and Malmö

Division: Safety and Transport

Safety and Transport builds trust through research, development, evaluation, calibration and testing. To ensure sustainable development, our employees and testbeds collaborate in application-related operations internally and with customers and partners. The overall strategy for 2020 constitutes an interdisciplinary initiative focused on growth areas. For the coming four-year period, the division has defined six strategic initiative areas, which will be central to, among other things, the transition from a manual to automated transport system. Common to all areas is a focus on digitisation. The strategic areas of Safety and Transport are described in Table 18.

Table 18. The Safety and Transport division's strategic areas.

Area	Description of strategic area
Automated Systems	Society is facing a disruption in connection with the transition from a manual transport system to an automated one. The objective is for RISE to occupy the international top tier, lead and advance the field, and be the natural partner for industry and academia.
Alternative Energy Carriers	In order to meet climate challenges and contribute to a fossil fuel-free society, the number of energy carriers on the market is growing, where batteries and hydrogen fuel are two technologies being given strong focus at EU level. At the same time, there is a lack of societal experience and established standards, systems and infrastructure for the widespread use of these technologies in different modes of transport as well as stationary energy storage. These new technologies pose significant risks in terms of safety, robustness and reliability. The Safety and Transport division has an important role to play in the research, development and provision of testing, methods, policies and practical application know-how at component and system level. Safety and Transport's activities aim to increase public and business trust in these technologies, and to contribute to the safe, competitive and wide implementation of new energy carrier technologies in society.
National Defence	RISE shall play a clear role, serve as vital resource, and provide recognised expertise for the further development of Sweden's National Defence. By focusing principally on industrial robustness and analysis, support, innovation and development of resilient social systems, we help establish and contribute to well-functioning security of supply in Sweden.
Risk and Safety	In a complex, constantly evolving and increasingly technologically advanced society facing global competition and the simultaneous transition towards sustainability, there is considerable need for measures able to foster confidence in new technologies and systems. RISE can make a substantial contribution to this. By building on and developing our expertise in risk analysis, MTO, technical system understanding and relevant T&D resources in combination with standardisation development, we ensure that the necessary changes in society and industry can be implemented safely and securely while facilitating the introduction of new technologies and innovations.
The Maritime Institute	RISE shall contribute to sustainable blue development and growth in Sweden by being a recognised and important part of the Swedish maritime cluster, as well as a prominent research and innovation partner for trade and industry and society. RISE's leading position in several technology areas, together with well-developed infrastructure in the form of test and demonstration facilities, provides very good conditions for Sweden to position itself internationally. An investment should focus primarily on the smart ships of the future, smart and sustainable ports, autonomous underwater technologies and renewable marine energy.
Test and Demo	RISE possesses a large portion of Sweden's testbeds, and Safety and Transport is home to several of our larger ones, such as AWITAR, AstaZero, SEEL, Fire Lab, and National Metrology Institute. A significant proportion of Safety and Transport's total revenue comes from the testbeds. The emphasis is on industrial assignments and certain applied research. The world is undergoing rapid change and our testbeds need to keep up with development in order to remain relevant with respect to the needs of industry and research partners. This strategic initiative involves increased digitisation, along with research and development related to services and expertise linked to our testbeds. Another important aspect is to develop a single offer for testing, for example,cybersecurity, by means of collaboration between testbeds. Our testbeds also play an important role in TIC operations and should be developed in close cooperation with the TIC project.

2.5.4 Knowledge Platforms

With a view to developing new areas and creating opportunities to invest in areas with the potential to address to tomorrow's challenges, we have established long-term initiatives with timeframes of 7 years in the form of Knowledge Platforms. The platforms mainly conduct in-depth research but also interdisciplinary research in some cases. At the time of writing, we are running 22 Knowledge Platforms. They have been in progress for different lengths of time, and we constantly overhaul the platforms. Table 19 describes ongoing platforms.

Table 19. Knowledge Platforms 2020 and their objectives.

Knowledge Platform	Objectives
Biomass	The Knowledge Platform aims to improve and expand the use of biomass in order to meet "fossil fuel freedom" targets by developing technologies and methods for the long-term sustainable production of fuels, materials and chemicals from biomass as raw material. The focus is on products from aquatic biomass, methane from organic waste, liquefaction of lignocellulosic raw materials, products from agricultural crop residues, and products from the forestry industry's residual streams.
Biomaterial Scale-Up Centre	Sustainable materials will play a central role in the future of a healthy planet, and there is a high demand but a lack of supply. Biomaterial Scale-Up Centre is a Knowledge Platform that accelerates the process of converting new bio-based materials into functional and sustainable products – at a large scale.
Centre for Categorically Based Measurements	Quality assurance of categorically based measurements, such as measurements of behaviours and experiences, is a large and important but oft-overlooked area. Through this Knowledge Platform, generic methods and approaches can be developed and then applied in different specific contexts. The aim is to give Sweden access to comparable and quality-assured measurements of categorical variables.
Circular Economy	Circular Economy is one of RISE's areas of strength. The Knowledge Platform focuses on the development and demonstration of innovative technologies and processes to make linear material flows more circular. RISE runs a large number of projects to extract, characterise and use secondary resources such as plastics, food waste, construction and demolition waste, biomass and metals.
Climate Opportunity Accelerator	Achieving global climate goals requires the development of radical mechanisms in the innovation system, such as business models, decision-making support and policy instruments, able to contribute to innovation at system level. These new solutions must also be implemented at a much higher rate than up to this point. The Knowledge Platform has a transdisciplinary approach and aims to support and lead industry and society in the development, application and funding of solutions that shift the perspective from climate threats to climate opportunities, where truly climate-friendly – or even climate-positive – solutions are rewarded.
Computational Modelling and Validation	Computer-based simulation is an established tool in industrial research and product development. Through the intelligent use of simulations and experimentally validated calculation models, costs and lead times can be reduced in the development of new products. For example, material consumption can be reduced and performance optimised. The Knowledge Platform's Focus Areas include modelling of systems and processes for the bio and/or chemical industry, thermal processes and characterisation of material properties.

Cybersecurity	Cybersecurity is one of RISE's areas of strength. In order to protect Swedish citizens and safeguard the competitiveness of Swedish industry, solutions are needed for both the technical and social challenges resulting from a connected society. In collaboration with companies and the public sector, the Knowledge Platform runs research and innovation projects with a focus on, among other things, secure networks and infrastructure, cloud solutions, personal data privacy and confidentiality, applications for autonomous vehicles and traffic systems, and more.
Data Science Centre	Data Science is a national initiative for the advanced digitisation of Swedish industry and society using data-driven methods. The Knowledge Platform leads and mobilises the whole of RISE with regard to research, development, education and information in this transformative field. The initiative develops the next generation of data science technologies and applications in collaboration with companies, universities and government agencies, and spans all industries: process, production, telecom, urban development, automotive, healthcare, life science, and more.
The Digitised Production System	This Knowledge Platform addresses challenges related to industrial digitisation and green transformation by developing new industry-relevant solutions for tomorrow's resource-efficient, digitised production through the generation of new theoretics and knowledge for connected, robust, smart and competitive production processes. This strengthens RISE's capacity to improve Swedish industry by practically demonstrating how digitisation can boost the Swedish manufacturing industry and the products therein.
Digital Cellulose	Cellulose is recyclable and biodegradable and thus a very attractive choice of material for a circular economy and a sustainable society. Digital cellulose is an emerging field of research originating from two separate research areas: organic electronics and cellulose. The objective of the Knowledge Platform is to generate expertise, produce research results and establish technological platforms with high scientific excellence while also being highly industrially relevant to enable the realisation of cellulose-based products for a sustainable, digital society.
EcoBuild	The EcoBuild Knowledge Platform is an international arena for cooperation among industry, institutes and universities. Together we create products for a sustainable society with innovative materials from forest raw materials and other renewable biomass. The vision is to develop fully bio-based materials and products for application in the civil engineering sector – outdoors, indoors and in the marine environment.
Industrial Water Management	The Knowledge Platform focuses on achieving more in-depth and keener RISE expertise in a number of key areas in order to offer solutions for many of the problems that currently hinder efficient industrial water management. For example, in industries such as pulp and paper, food processing and mining. The aim is to ensure that expertise generated in the area leads to better resource efficiency in industrial water systems.
Infrastructure and Built Environment 2.0	The Knowledge Platform focuses on service innovation in order to increase capabilities for the sustainable use and further development of the built environment. This includes procurement, administration, maintenance and conversion of infrastructure and buildings and properties. The aim is to improve conditions, systems and work methods in order for society to achieve a sustainable transition in the infrastructure and construction industries that meets the ambitious goals set by Fossil Free Sweden.
ICT Learning	To ensure that everyone is offered good education and lifelong learning in a high-quality education system, digital services, products and innovations are essential. The Knowledge Platform offers opportunities for organisations in the education and lifelong learning sector to participate in applied research projects, acquire new knowledge, test products and systems, and gain access to both research and intelligence studies concerning digitalisation.
Innovation for Reduced	Antibiotic resistance is a serious and growing global threat to human and animal health and to the productivity of society. The Knowledge Platform has a broad approach and aims to help both society and companies deal with the threat of resistant bacteria. The focus is on reducing/optimising antibiotic use by participating in the

Antibiotic Resistance	development of new solutions for infection control and to prevent infection transmission in healthcare and social care, food production and agriculture.
Market Driven Energy Systems and Technologies	The energy system is facing a major transformation in terms of renewable production, electric vehicles, energy storage, and distributed system resources, all of which significantly increase the complexity of the system. The Knowledge Platform focuses on the relationship between energy markets and business models and technological development and innovation in collaboration with operators in national and international energy systems.
Nanocellulose in Future Advanced Hybrid Materials	RISE is at the forefront of international research into the production, modification and applications of nanocellulose. Nanocellulose is a new, advanced and bio-based material component with a wide range of known – as well as yet to be discovered – applications. For example, applications for paper and packaging, food, cosmetics, biomedicine, composites, oil fields, membranes and flexible screens. There is abundant interest from industry, and the industrial use of nanocellulose technology has the potential to make a significant contribution to Sweden's bioeconomic targets.
Offshore	Offshore operations have distinct challenges owing to the often extreme environments beset by winds, waves, salt water, and cold temperatures far from land. The Knowledge Platform supports and participates in research and innovation development for the whole ocean-based energy sector, as well as in future industries such as aquaculture, marine biomass cultivation and ocean-derived food. Intersectoral knowledge transfer, where technology meets biology to create new and sustainable solutions, is a driving factor and strategic initiative for Offshore.
Perform	The Knowledge Platform focuses on needs-driven research and innovation for formulated products in the areas of controlled release, biological material formulation, emulsions and dispersions and powder technology. Formulation is a key competence for sustainable development. For example, by achieving more while using fewer raw materials and less energy, through the reformulation of products to reduce chemical loads, and by developing formulation strategies for biological materials.
ROBY	The objective of the Knowledge Platform is to generate, develop and provide strong national expertise in defence-related areas for the needs of Swedish national defence. The core areas of expertise are explosion loads and weapons impact, electrical hazards, robust energy supply, fire protection, physical access security, and CBRNE defence. The focus is on supporting the construction of protection for buildings, facilities and critical infrastructure in partnership with the Swedish Fortifications Agency.
Validation of Autonomous Driving	All road transport operators work with automated transport systems, or automated vehicles and craft. Autonomous driving will impose requirements on the further development of existing validation and verification methods so as to ensure the roadworthiness and functionality of future vehicles. Today's established methodology for technical evaluation is inadequate for addressing issues related to artificial intelligence, cybersecurity and communication. The Knowledge Platform focuses on research and innovation in order to provide assurance in relation to these new issues.
3D Bioprinting	3D bioprinting uses a combination of living cells and support materials to build structures that mimic living tissue. These types of structures are of interest as systems for testing, for example, the biological effects of pharmaceuticals under development or chemicals in general. RISE generates expertise relating to the manufacturing process itself and studies the properties and functions of 3D bioprinted systems. We are researching new materials and applications for 3D bioprinting in areas such as cancer research. We run the projects in collaboration with medical and clinical research groups and industry.

2.5.5 Development Projects

Development Projects are projects that address research issues and challenges requiring development, testing and analysis. The projects focus on increasing capacity to apply research in trade and industry and/or society. For example, projects that link knowledge development with infrastructure, or think-and-do tanks. The projects' clients should preferably be involved. Development Projects typically run for a period of 3 years. Ten Development Projects are currently being funded. Their descriptions and objectives are described in Table 20.

Table 20. Development Projects in 2020 and their objectives.

Development Project	**Objectives**
Digital Learning	Our society is currently being revolutionised by the concept of digitalisation, which presents opportunities as well as challenges in the field of education. With a growing need for knowledge and innovations to create a sustainable society, our education system faces major challenges. To ensure that everyone is offered good education and lifelong learning in a high-quality education system, digital services, products and innovations are essential.
Automated Transport	RISE possesses internationally leading expertise in and testbeds for automated transport, such as AstaZero, but we are also building new areas and testbeds for automated maritime transport (test site Skagerak) and unmanned aerial vehicles (Drone Centre Sweden). RISE is also highly proficient in the field of cybersecurity and, among other things, we are in the process of setting up a test lab in Kista for data security, referred to as a cyber range. By merging our skills and competence in cybersecurity with automated transport, we can gain an entirely new, internationally leading area of expertise, where testbeds for mobile systems are linked to a testbed for cybersecurity.
Mobilisation for a Governance Innovation Centre GIC	Through this project, RISE mobilises the establishment of a national Governance Innovation Centre. It primarily involves developing capabilities, work methods and processes to accelerate transition and to better manage the major and complex societal challenges Sweden is facing, thereby increasing the country's competitiveness. Among other things, the project will focus on: Strengthening expertise to generate higher levels of innovation and system demonstration (deep demonstrations) and increase capacity for progress/action in complex issues, such as the ability of cities to reach decisions regarding issues for which no single operator is responsible or a accountable.
BECCS/CCU for a Sustainable Society and Industry	This Development Project aims to lay the foundations for a new Knowledge Platform at RISE within BECCS/CCU, i.e. bioenergy with carbon capture and storage (BECCS) and/or bioenergy with carbon capture and utilisation (BECCU). The BECCS/CCU research and development area is today deemed a high priority by industry as well as social sectors in order to achieve both national and international climate goals. The project will increase capacity to apply BECCS/CCU in trade and industry and society, with RISE becoming a leading innovation partner in the field within 3 years.
Rotary Rigs	The electrification of the transport system is crucial to reducing CO2 emissions. RISE has expertise and runs research projects in many areas related to this. Examples include components such as batteries and power electronics as well as systems such as electric roads and transport systems. RISE also has extensive expertise in materials that should be relevant for, among other things, the development of completely new concepts for electric motors/electric machines. However, there is a skills shortage with regard to electric motors and powertrains. A large fraction of the investment into the SEEL testbed will be spent on rotary test rigs for electric motors, transmissions, powertrains, and complete vehicles.

Evidence and Implementation Support for Digital Methodology in Healthcare and Social Care	The Development Project focuses on research into the multidisciplinary application of digital technology and methodology in healthcare and social care, supported by reliable benefit and impact assessments in order to increase the pace of innovation and implementation within the domain. The goal is to implement mechanisms in healthcare and social care for increased quality, security and efficiency with the help of the transformative power of digitalisation. The project aims to strengthen the structured evidence base so that possibilities increase for ensuring the right digital methodology in the right context, thereby accelerating the pace of implementation.
AI Tox	There is an increasing need to support Swedish bioscience innovation in a variety of sectors by means of the early prediction of potential health risks. The significance of AI as a fundamental cornerstone of bioscience R&D is growing rapidly. The objective of the project is to establish a new, strong and interdisciplinary collaboration area with a shared AI platform where biosciences are the common focus and with toxicology as a compelling example. The aim is to give RISE a technical advantage in an area of considerable interest to partners and clients.
Green Deal for Sweden	In the Development Project, a platform is being established in which RISE helps Swedish companies to understand and participate in funding and work within the framework of the EU's new growth strategy "Green Deal". By establishing this platform, RISE will be a resource for Sweden with a key role in sustainable development at EU level, with the aim that EU funds will benefit Sweden and Swedish industry to a much greater extent.
Battery Safety	The objective of the project is to develop rules, recommendations and risk analysis methodology for battery systems and their use in different types of applications, and to generate RISE expertise and offers in this field. This is accomplished by analysing needs, establishing collaborations within RISE, participating in standardisation work, identifying possible or developable RISE services (including TIC and best practice), and initiating research projects, with the goal of securing a long-term international position and leading expertise in the field.
Validation of Circular Material	We are at the precipice of a major material, process and production transition where we need to use more circular/recycled materials instead of virgin materials. In addition, we need to increase the degree of remanufacturing and reuse in order to contribute to tomorrow's more resource efficient and circular society. However, there is a lack of existing standards for and verification studies of materials from recycled streams. The project will accelerate the transition of companies and society towards increased circular material flows by clarifying material specification needs, making methods for validation available, and assuring the quality of materials and processes when transitioning to circular material flows and the remanufacture/reuse of components.

3 Future direction of strategic initiatives

At the time of writing this R&I strategy, we are in the midst of the coronavirus pandemic and much is difficult to predict, except that there will be changes following the pandemic compared to before the pandemic. This makes it difficult to formulate a complete and detailed strategic overview of required strategic initiatives going forward. Therefore, we have recently conducted an analysis of RISE's contribution to the Swedish Research Bill in light of the coronavirus pandemic. The results show that our contribution is still largely accurate in its description of major initiative areas that will be important for RISE in the future. For this reason, we believe that it is appropriate to describe our strategic direction at this time. However, there are currently difficulties in terms of expressing how much is required for different initiatives. In all likelihood, we will see that investment into certain areas will increase, that transition needs will lead to brand-new initiatives, and that earlier initiatives will become irrelevant due to said transition needs.

Intelligence studies have served as part of the basis for the strategic direction, and have provided valuable input. Moreover, a number of workshops have been conducted on themes related to RISE's future role as Research and Innovation Leader for Sweden. The workshops also analysed the impact and value we seek to create in trade and industry and the public sector, along with needs for strategic focus, initiative areas, and interrelated skills and capability development. The data used to support the R&I strategic direction was largely produced by the RISE Technology Council (collaboration between Strategic Research, Research and Business Development managers and B&I managers) in close cooperation with RISE Group Management.

The prevailing situation necessitates an agile approach. Described below are strategic initiatives that identify needs for progress and where SC fund investments can be used as a control instrument to bring about the desired change. However, we should be prepared for the fact that additional measures may be required at a later stage.

3.1 Significant future initiative areas

3.1.1 Value-creating impact

In its role as Research and Innovation Leader, RISE is expected to create an impact from research and innovation activities so that value is generated for trade and industry and the public sector. Our actions must confirm that RISE makes a difference. In 2030, when we look back, it must be apparent that RISE has played an important role in the transition of trade and industry and the public sector as regards societal challenges. It will therefore be important going forward to advance activities and strategic initiatives from a systemic perspective so that impact is created.

3.1.2 Increased adaptability and utility

RISE's mission is to ensure that research can be practicably applied in trade and industry and the public sector in a way that strengthens competitiveness and innovation. Another important aspect is the need for good adaptability, both for those of us at RISE to be able to respond swiftly to new, unanticipated needs and for trade and industry and the public sector. RISE, in its capacity as Research and Innovation Leader, plays a role here in both strengthening the utility of research and actively contributing to the increased adaptability of trade and industry and the public sector.

One trend is that the timeframe shifts to being sooner rather than later, which also means we will be expected to respond to needs "directly". In terms of our R&I strategy, we need to take this into account when it comes to work methods, skills and capabilities in order to gain impact from research.

We already possess good knowledge and insight into what is happening and taking place in our surroundings and business, but there is an identified external need to strengthen the utility of research and development in trade and industry and society. It is a matter of turning words into action and ensuring that research becomes a "workshop". We need to increase our legitimacy and expand our role in order to produce an impact in trade and industry and society. This can be accomplished by strengthening skills and abilities to implement research in applications used by trade and industry and society. We should work more cross-functionally and interconnect skills and competences, clarify expertise, and transfer knowledge to identified recipient groups, thereby contributing to effective implementation. Ways of working that promote interaction should be strengthened. We must advance activities conducive to increasing the impact of research. An important aspect will involve using intelligence studies and external needs to promote activities that are more market-oriented, along with larger projects that enable mobilisation. Therefore, we need to focus even more on the application and implementation of research.

The fact that research will lead to application and implementation in trade and industry and the public sector will entail progress and a paradigm shift, but at different degrees among the various parts of RISE. To establish a foundation for this progress and more effective implementation of research results, implementation activities will be integrated within the framework of our project portfolio. For example, Collaborative Initiatives and Development Projects can be used for this and – within the framework of long-term knowledge development (e.g. in a Knowledge Platform) – to request implementation planning during the final phase.

Another important skill and ability is to develop solutions from a systemic perspective. The transition that trade and industry and the public sector are facing means that several skills and competences need to interact and the degree of this interaction must increase between social science and technical areas of expertise. High competence in individual subject areas is not enough to resolve tomorrow's societal challenges. It necessitates employing a holistic view, interconnecting skills and competences, and having proficiency with regard to systems analysis.

It also requires an ability to lead large and diverse collaboration programmes under complex conditions, such as a leading work towards transition in a business sector. Solid work methods, expertise and capabilities in this will differentiate RISE from other operators and thus contribute to an important so-called USP (unique selling point) in the description of RISE's role compared to, for example, the role of universities.

3.1.3 Project portfolio analysis of Group-wide research areas

When analysing the project portfolios (divided into the 16 Group-wide research areas), certain conclusions can be drawn for each area. Further initiatives are deemed necessary – primarily for the areas of Risk, Safety and Resilience, Blue Growth, and Health and Mobility. The Risk, Safety and Resilience area in particular stands out as an area for which significantly increased focus and strategic initiatives may be needed in the future to achieve greater social resilience. We have a number of initiatives related to resilience in various areas, but we lack a coherent overview of what is being done and no coordinated mobilisation at present. The innovation system area is also adjudged to have a strong link to adaptability and will therefore require increased strategic focus in our future initiatives.

3.1.4 Seven initiative areas outlined in RISE's contribution to the Swedish Research Bill

In RISE's contribution to the Swedish Research Bill, seven major initiatives were outlined aimed at further developing expertise and establishing structures able to strengthen our capacity to contribute to Agenda 2030, the implementation of the January Agreement, and the priorities expressed by the Swedish Ministry of Enterprise and Innovation through the collaboration programmes.

- Testbed for digital health
- Infrastructure for the development of tomorrow's medicines and medical technology
- Centre for Applied AI
- Governance Innovation Centre
- Testbed for blue innovation power
- Centre for Resource-efficient Economy
- Centre for Applied Research in Battery and Energy Storage Technology

Measures have already been implemented to strengthen one of the above initiative areas by ramping up one of the Strategic Reinforcement Areas to establish a RISE centre: Applied AI, in effect as of May 2020. Preparations are underway to do the same for another centre: RISE Maritime Centre, with an estimated launch by the end of the year.

For the other five areas, various activities are being carried out to further strengthen them by means of strategic initiatives.

3.1.5 Looking ahead

As we described earlier (in Section 2.3), the distribution of SC funds serves as a tool in creating mechanisms able to stimulate progress in the desired direction. Based on identified needs for future strategic initiatives, there are two major new initiatives that must be realised and which will be addressed within the framework of the SC funds budget. Budgetary reallocation may be effected in order to strengthen these two areas.

One involves investigating the possibility of a suitable mechanism for mobilising the Social Resilience area. An analysis of the project portfolio shows that we have a number of initiatives related to resilience in various areas. What is needed in the future is a more coherent overview of what is being done and coordinated mobilisation. To determine the form this initiative should take, a survey of what is being done internally is needed. The external needs must also be investigated and we must understand what type of knowledge RISE needs to be able to provide. Put simply, we must clarify RISE's role and the ways we can make difference in relation to, for example, the seven priority areas indicated by MSB. The need for social resilience in trade and industry will be investigated in dialogue with RISE Research Council.

Another element that needs to be strengthened involves improving opportunities for external implementation of the research. This concerns stimulating and strengthening capacity and capabilities to apply and externally implement research to a greater extent. Experience shows that sound, fundamental subject knowledge is important for the system in which the research results are to be implemented. In addition, there is also a need for capacity and capabilities to transfer the research to an external party and to actively collaborate with the external party in order to increase their competence and ability to understand and receive the knowledge generated through the research, as well as how it should be implemented in the external party's operations so that optimal effect is achieved in a new product, service or manufacturing process. Both performance and cost-effectiveness need to be taken into account. We will investigate suitable ways of working to achieve this, such as setting up teams with complementary skills and abilities. Furthermore, an implementation plan will be requested for different types of projects and where the SC fund projects will be followed up by the Technology Council.

APPENDIX 1 SC Funds

The annual contribution to operations that RISE receives from the State is referred to as Strategic Competence funds (SC funds). The purpose of this contribution is to facilitate forward planning to ensure RISE's international success and participation in the innovation of Swedish trade and industry. Every four years, a political research bill stipulates how much SC funding is intended to be allocated to RISE over the following four years. Precise allocation is decided annually in conjunction with the State budget process.

The contribution corresponds to approximately 20% of RISE's annual turnover. SC funds are governed by state aid regulations and may not be used for commercial activities, which means that SC funds may not be used as financial support in contract research or commercial certification activities.

In general, SC funds are used for investments into skills development and strategic collaborations in the early stages of the research and innovation process in order to generate proprietary expertise, establish networks, and fund endeavours prior to participatory interest from trade and industry. SC funds are also employed as leverage in later phases in order to ramp up ongoing initiatives with trade and industry in combination with the support of other external resources, such as EU projects or national projects such as Vinnova's SIPs.

In RISE, the allocated SC funds are distributed among strategic Group initiatives and divisional strategic initiatives in a proportion determined by the Board of Directors. At present (2020), the proportional ratio is 50/50. Group management and the Board of Directors are ultimately the decision-making body for how SC funds are invested in RISE's operations.

The strategic Group initiatives can be considered investments into Group-wide knowledge development and the development of new, value-creating offers of strategic benefit to RISE as a whole. In essence, there are four parts:

1. Proposed priority areas where a need for reinforcement has been identified owing to changing challenges, so-called research priorities.
2. Initiative areas in our B&I Areas (Focus Areas and projects in the form of Collaborative Initiatives, CI)
3. Long-term knowledge development in the form of Knowledge Platforms
4. EU strategic funds

The Group-wide initiatives are implemented in practice within the divisions' operations, since the divisions possess resources, expertise and infrastructure, such as test/demo facilities. Governance and follow-up are carried out in the Technology Council, which is a shared forum for the Group function Strategic Research and the divisions' research function.

The divisional strategic initiatives can be considered investments into division-specific Knowledge Platforms and for the specific development of new offers. There may be some

difference in structure between the different divisions depending on different needs, market conditions and subject area characteristics.

The Strategic Initiative function within Strategic Research is responsible for the management of SC funds in RISE, so as to ensure that the funds are used in accordance with established strategic guidelines.

The use of the SC funds is reported to the Swedish Ministry of Enterprise and Innovation on an annual basis.

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