



# **Arctic smart specialisation and municipal waste management**

## **Case: North Norway**

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## Contents

<b>1. INTRODUCTION</b> .....	3
<b>2. METHODOLOGY AND STRUCTURE</b> .....	5
<b>3. LITERATURE REVIEW</b> .....	7
<b>3.1 Municipal waste management - an introduction</b> .....	7
<b>3.2. Municipal waste management – part of foundational economy</b> .....	8
<b>3.3. Smart specialisation</b> .....	10
3.3.1. What is smart specialisation? .....	10
3.3.2. S3 evolution from regional specialisations to systemic solutions.....	11
3.3.3. S3 in practise.....	13
<b>4. EMPIRICAL PART: MUNICIPAL WASTE MANAGEMENT IN NORTH NORWAY AND S3</b> ....	15
<b>4.1. Arctic waste management in North Norway</b> .....	15
<b>4.2. Regional innovation activities in Troms County</b> .....	17
<b>4.3. Municipal waste management in North Norway and S3 - Case Remiks</b> .....	18
<b>5. DISCUSSION</b> .....	21
<b>6. CONCLUSIONS</b> .....	23
<b>References</b> .....	25

**Abstract:** This Working Paper introduces and analyses innovation and renewal of municipal waste management in North Norway. We explore how the concept of smart specialisation (S3) could be utilized to enhance R&D and innovation in municipal waste management - a foundational sector which is not typically considered as one of the most innovative sectors of the economy. Our paper reveals that innovation and renewal can be identified within municipal waste management in Arctic peripheral regions, too. Moreover, the paper reports that smart specialisation could be utilized as an additional tool and concept for innovation promotion and R&D collaboration in the Arctic waste management sector under certain conditions.

This Working paper is part of the ReCoWaMa (Research collaboration with the Waste Management sector in Troms and Finnmark for improved value creation) project 2023-2025, funded by the RFF Arktis programme.

## EXECUTIVE SUMMARY

This working paper looks at the waste management sector in Northern Norway from the viewpoint of innovation processes. We study how the waste management sector would benefit from smart specialisation (S3), which is a European innovation policy application. Even though Norway is not part of the EU, smart specialisation has been used in several counties in Norway as a useful tool for regional development and innovation promotion.

We apply smart specialisation perspective to the field of waste management to see how smart specialisation works in an industry, which can be seen as more mundane sector, representing a foundational economy. Furthermore, we are also interested to study what smart specialisation could provide to waste management sector in practise in North Norway. We aim to find out how and to what extent the core elements of smart specialisation can be applied to individual companies or organizations in the waste management sector. Our research question is:

*How and to what extent would it be possible to apply smart specialisation to municipal waste management in North Norway?*

We have gathered data to answer this question from two major sources. The first source includes literature on waste management, foundational economy, and smart specialisation. The second source includes interviews at the Troms County Council, and at the Remiks waste management company in Tromsø.

Based on our analysis, we can state that applying S3 in practice consists of three steps. Step 1 looks at the problem and makes a plan how it should be solved. Step 2 is about cooperation, where potential solutions are looked together with other actors. Step 3 applies the discovered solutions into practice in the local context. During this process it is important to identify both internal needs and external factors.

Our findings reveal that the three identified steps show similarities with those identified by Dominique Foray (2015) in the original Morez case of smart specialisation. Moreover, we were able to identify the steps as representations of the modern smart specialisation strategy framework. Strategy framework is represented in Step 1, when a problem is identified, and actions are decided. This is followed by mutual problem solving, representing s Open Discovery Process (ODP), as well as application of the solution into local context, which can be seen as a policy and action mix. Our results indicate that S3 can happen in practice and in more mundane sector of municipal waste management, under certain conditions.

## 1. INTRODUCTION

This Working paper provides an overview and analysis of smart specialisation applied to municipal waste management in North Norway.

Waste management in the circumpolar north attracts rising attention. Global trends including climate change, the green transition and increased circular economy force the waste business sector to upgrade management plans and industrial operations that are characterized by vulnerable conditions such as harsh climatic circumstances, scattered populations, remoteness, long distances, and smaller waste volumes.

The waste management sector could be considered as a foundational sector (see e.g. Hansen 2021) - a traditional sector, which differs from more innovative sectors such as information and communication technology, biotechnology, and nanotechnology, which are more university or high-tech focused. Even though the innovative capabilities in foundational sectors are different from the more high-tech oriented sectors, there is innovation activity to be identified in the foundational economy. In addition, there is growing research interest looking at innovation in foundational sectors (see for example Henderson et al., 2024, Coenen et al., 2021; Heslop et al., 2019).

In this working paper, we examine whether it would be possible to enhance innovation in the foundational economy sector in Arctic peripheral regions - often lacking knowledge base of most innovative cities. For the waste management sector actors in North Norway, the regional preconditions such as low diversity, large distances between settlements and recycling facilities, and relatively small markets and volume of produced waste, provide specific geographical and operational challenges.

The ReCoWaMa (Research collaboration with the Waste management sector in Troms and Finnmark for improved value creation) project 2023-2025 takes these Arctic and peripheral preconditions into account to recognize opportunities and challenges within the waste management sector in northern Norway. Accordingly, ReCoWaMa aims to contribute to value creation and a positive development in the waste management sector in Troms and Finnmark by enhancing research collaboration between waste management firms and research institutions fostering regional development. The project facilitates dialogue and close partnership between research institutes in North Norway and waste management actors in the region.

The ReCoWaMa project includes an initiative to apply the smart specialisation concept to the waste management sector in North Norway. Through smart specialisation, firms in the waste management sector could engage in and mobilize new collaborators and new markets previously unexplored. Universities and research environments can play an important role in regional smart specialisation and innovation processes and considerably increase the pace of innovation.

## **About NORCE and the authors**

**NORCE** is one of Norway's largest independent research institutes with long-term experience in Arctic research and focus areas such as, e.g., sustainability, climate change, circular economy, and regional development issues. The Sustainable Development in the Arctic group of NORCE in Tromsø works intensively on waste management issues. NORCE acted as the Lead partner for the GROM (Green transition in North Norway) project, under RFF Nord programme, in 2019-2022, with Arctic waste management as one of key themes. The WANO project (Waste Management in the Arctic North, under Research Council of Norway programme) in 2021-2024 focuses on Arctic cross-border innovations and technology transfer, and the ReCoWaMa (Research collaboration with the Waste Management sector in Troms and Finnmark for improved value creation) project 2023-2025, funded by the RFF Arktis programme, focuses on innovation promotion and research collaboration in waste management in North Norway.

**Jukka Teräs** (D.Sc. Tech., MBA), Research Professor at NORCE in Tromsø, acts as the Project Director of the WANO and ReCoWaMa waste management projects. He has over 25 years of experience in regional development. He possesses a comprehensive network of business, research, and technology transfer actors in the field of waste management in the Nordics and at the EU level, as well as broad-based experience and network in the field of smart specialisation.

**Antti Mäenpää** (D. Sc. Admin.), Postdoctoral researcher at University of Vaasa, in Finland, has studied European innovation policies and smart specialisation for over 10 years. He has participated in the latest PRI (Partnerships for Regional Innovation) pilots and studies on how smart specialisation has been evolving and put to practice in the context of sustainability. Antti Mäenpää paid a field study visit to Tromsø in May 2024, organized by NORCE and the ReCoWaMa project.

## 2. METHODOLOGY AND STRUCTURE

In this Working Paper, the concept of smart specialisation is applied to the municipal waste management sector in North Norway. We explore how smart specialisation, often attached to development of industries with advanced technology and innovation, could be applied to more traditional sectors such as municipal waste management. Additionally, we are interested in applying smart specialisation in non-metropolitan, peripheral areas in the Nordic Arctic. The following major research question is presented as follows:

*How and to what extent would it be possible to apply smart specialisation to municipal waste management in North Norway?*

Importantly, we explore smart specialisation dominantly from the viewpoint of waste management practitioners. This will provide important knowledge on innovation activities not only for the regional strategy and regional policy development actors but also for the waste management practitioners. Our theoretical approach includes literature review on key characteristics of the municipal waste management sector from the viewpoint of innovation and renewal, and on the concept of foundational economy. Moreover, we introduce smart specialisation as an innovation concept and study its applicability in the Nordic Arctic area. The empirical analysis includes the municipal waste management sector in North Norway and is largely based on the ReCoWaMa 2023-2025 project work.

This paper applies qualitative research methodology, and case study approach. The collection of the empirical data for this Working Paper largely focused on the field study of Antti Mäenpää and related interviews and data collection. To set the background and lay a basis for the analysis of waste management sector, a literature review was implemented.

The key interviews of this Working Paper included:

- a group interview on 15.5.2024, including 5 people from the regional development organisation (Troms Fylkeskommune) with focus on how smart specialisation has been implemented in Troms County and which plans the region has for applying it in the future. This discussion helped the researchers to understand better the regional context and familiarity of the local officials with the smart specialisation concept <sup>1</sup>
- an individual interview focusing on the characteristics of the waste management sector in general, as well as skills & competences requirements of the waste management sector, cooperation (multi-level cooperation, helix cooperation) and innovation processes (internal vs external processes, vertical vs horizontal innovations). The interview was conducted at the Remiks company with an experienced expert on municipal waste management.<sup>2</sup>

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<sup>1</sup> Smart specialisation is not an ex-ante condition in Norway, since it does not belong to EU, meaning that any S3 activities in Norway are based on the value-added for the practical innovation work, not on EU funding incentives.

<sup>2</sup> The authors wish to express their gratitude to all the respondents, who helped us to look at how S3 can be put to practise. The conducted interviews were an invaluable source for preparing this study. The authors are solely responsible for discussion and conclusions.

The Working Paper is structured as follows. The literature review sets the scene for the study and opens up what we know of the waste management sector, foundational economy and smart specialisation in a more general manner. The literature review is followed by an empirical section, which consists of closer inspection of waste management in Northern Norway, as well as presentation of the Remiks case from the S3 viewpoint. This is followed by analysis of the Remiks innovation practices and how Remiks aligns with the latest knowledge of smart specialisation. We follow up this inspection in the discussion, where we generalize the findings and connect them with the wider S3 literature. Finally, we present our answers to the research question in the conclusions.

We have chosen a working paper as our format of publication, because it offers an opportunity to provide insights both from the research literature and from the field of practitioners in a more open format. This aspect seems very relevant for a paper inspecting the practical use of S3. The results presented here will be useful both for the purposes of further academic writing, and for the purposes of the ReCoWaMa project activities.

### **3. LITERATURE REVIEW**

In this chapter, we provide a literature review on the key themes and concepts relevant to this Working Paper. First, we introduce the municipal waste management sector from the viewpoint of innovation and renewal, as well as the concept of foundational economy. Second, we introduce smart specialisation as an innovation concept.

#### **3.1 Municipal waste management - an introduction**

More than 2 billion tonnes of municipal solid waste are generated globally each year, and the trend is growing (World Bank, 2022). In 2008, the European Union (EU), as part of the efforts to develop a more sustainable and resource-efficient economy, adopted the "Waste Framework Directive» (2008/98/EC). The directive establishes several principles for how EU member states must treat waste in a responsible and environmentally sound manner that does not harm people or the environment. In 2015, the waste directive was incorporated into the "Circular Economy Package", which required each country to draw up a plan for waste management, an analysis of the current system, as well as measures to increase the proportion of waste that collected, sorted and delivered for reuse and recycling. These regulations were renewed and strengthened in 2018 (European Commission 2018). Municipalities face challenges not only in meeting the EU goals related to waste management but also related to the social acceptance of these changes; waste management is an activity that usually requires financial support by system users (that is, citizens).

Waste management is not only about collection of waste and technical processes of waste treatment, but also includes firm renewal and innovative processes to create value out of waste products. However, the waste management sector does not search for solutions within a contextual vacuum. The waste management companies need to consider a changing regulatory framework as well as challenges related to relevant competencies and knowledge development (Moalem & Kerndrup 2023).

According to the European Parliament and European Council Directive 2008/98/EC municipal waste means: (a) mixed waste and separately collected waste from households, including paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture; (b) mixed waste and separately collected waste from other sources, where such waste is similar in nature and composition to waste from households. MSW does not include waste from production, agriculture, forestry, fishing, septic tanks and sewage networks and treatment, including wastewater sludge, end-of-life vehicles or construction and demolition waste.

Municipal waste management deals with all the waste under municipal responsibility: waste collection, waste sorting stations, local collection points for sparsely populated areas, enough reception points for hazardous waste, as well as takes care of waste treatment and landfilling. Municipal waste management also provides information and advice on separate waste collection and is responsible for environmental awareness raising. An example of the typical structure /value chain of municipal waste management is presented in Figure 1.

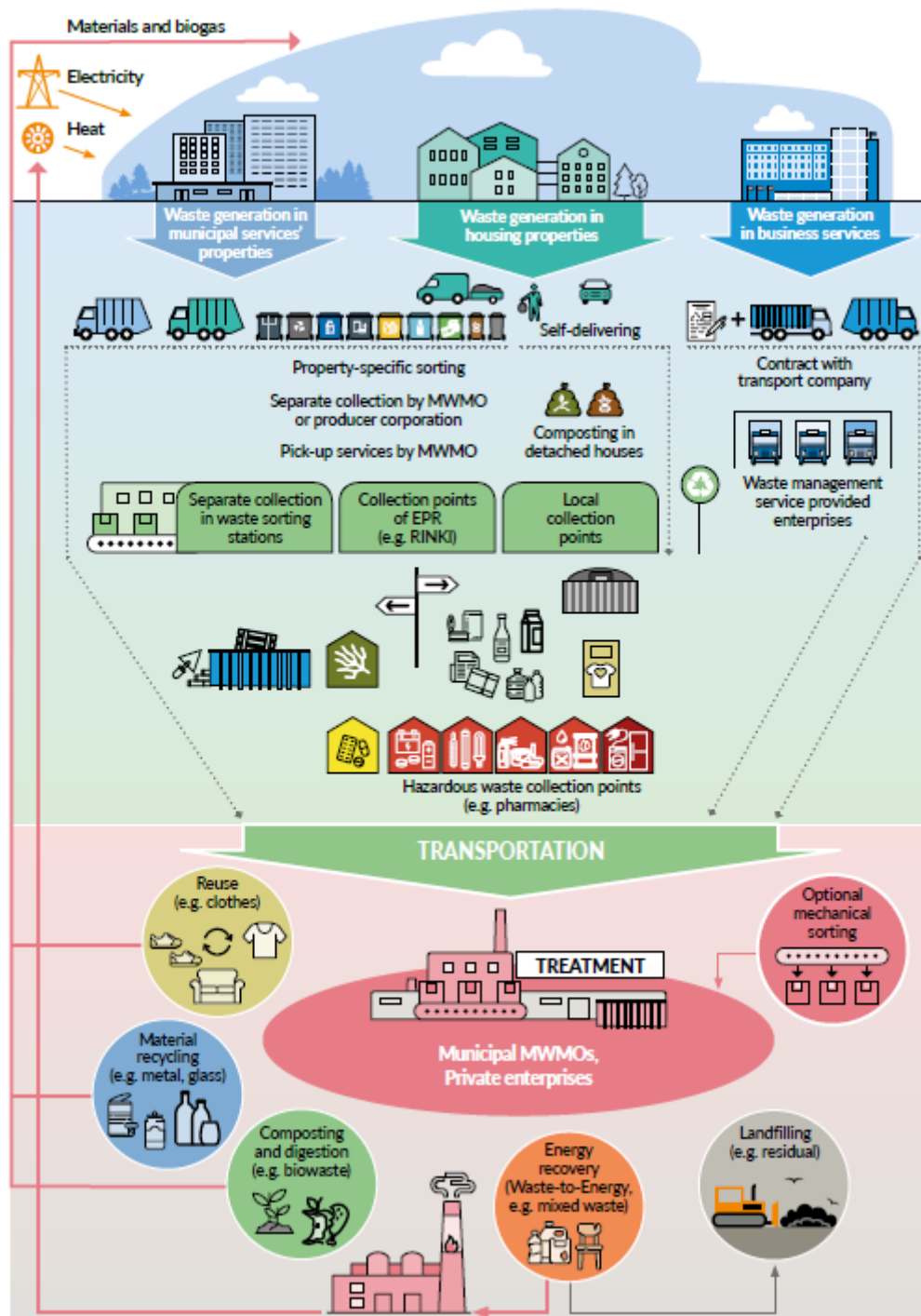


Figure 1. Value chain of municipal waste management, example of a typical structure (Finnish Ministry of Environment 2022, p. 39).

### 3.2. Municipal waste management – part of foundational economy

It is important to note that municipal waste management – the sector of our empirical study – is being characterized as a foundational economy, including the production of goods and services that are critical to human welfare (e.g., Hansen 2021). The municipal waste

management sector does not attract the same attention as high-innovative and high R&D intensive sectors such as information and communication technology.

Compared to the innovation studies related to traded sectors, few studies have been conducted with a focus on the foundational economy when it comes to collaboration and innovation. However, more recently, the field has been attracting more attention from researchers (Coenen et al. 2021; Heslop et al, 2019; Henderson et al., 2024). The foundational economy is coined as everyday practices where actions brought together are the sum of what every well-functioning society consists of. We can divide FE into two parts: *material goods and services* such as the pipes, cables and networks that deliver essential services such as gas, electricity, and water (op cit), and *providential services* such as health and social care, and education (Foundational Economy Collective 2022). It is a concept of a traditional sector outside the sectors categorized as most innovative, such as information and communication technology, biotechnology, and nanotechnology. Paradoxically, though, some innovations such as street lighting have revolutionized some foundational industries and significantly improved the delivery of foundational services (Hansen 2021). Coenen & Morgan (2020) highlight the importance of networks, and the influence of regional contexts on foundational innovation processes.

FE represents a regional development approach focusing on mundane, but important, goods and services that are consumed by all inhabitants both in cities and peripheries, irrespective of health, wealth, and location (Foundational Economy Collective, 2022). While much of the literature on innovation in the private sector emphasizes factors such as competitiveness, FE is more directed towards a place-based agenda for regional development (Russell et al., 2022).

Recent study by Henderson, Morgan and Delbridge (2024) looked at mundane innovations in the peripheral areas, exploring the foundational economy and its role in innovation. One important aspect of it, as identified by Russell (et al. 2022), is that the foundational economy highlights centrality to goods and services in the local economy. Usually, these services are delivered by public actors, or they are outsourced to private or third parties, but still serve as a public function (De Boeck et al., 2019). Based on this description, waste management can be seen as a providential service and an example of foundational economy.

Henderson, Morgan and Delbridge (2024) also highlight the importance of foundational economy for wellbeing and the role of mundane goods and service providers in sustaining people and communities alike. Foundational economy also opposes the traditional goals of economic growth which have dominated the characterisation of value in debates about the role of economies (Henderson, Morgan & Delbridge 2024: 3). This can be seen in waste management sector, which operates only on a costs-base and is not driven by markets for municipal waste management. It should be noted that commercial waste is another story and is operated based on market logic.

### 3.3. Smart specialisation

#### 3.3.1. What is smart specialisation?

The European Commission has established the innovation concept of smart specialisation, also known as S3 (smart specialisation strategies). The aim of the smart specialisation concept is to enable smart, sustainable, and inclusive growth throughout Europe. This process is happening via regional stakeholder mobilisation, which will help in developing the most promising areas for innovation, entrepreneurship, and growth, by taking into account regional levels of expertise and resources relative to the rest of the world as well as the current trends (S3 Västerbotten Roadmap 2022). Smart specialisation is not only focusing on existing strong industries, but it also promotes new value chains to foster innovations and innovation diffusion. Regional smart specialisation is looking at potential competitive strengths and realistic growth potentials supported by a critical mass of entrepreneurial resources and regional innovation ecosystems (S3 Västerbotten Roadmap 2022).

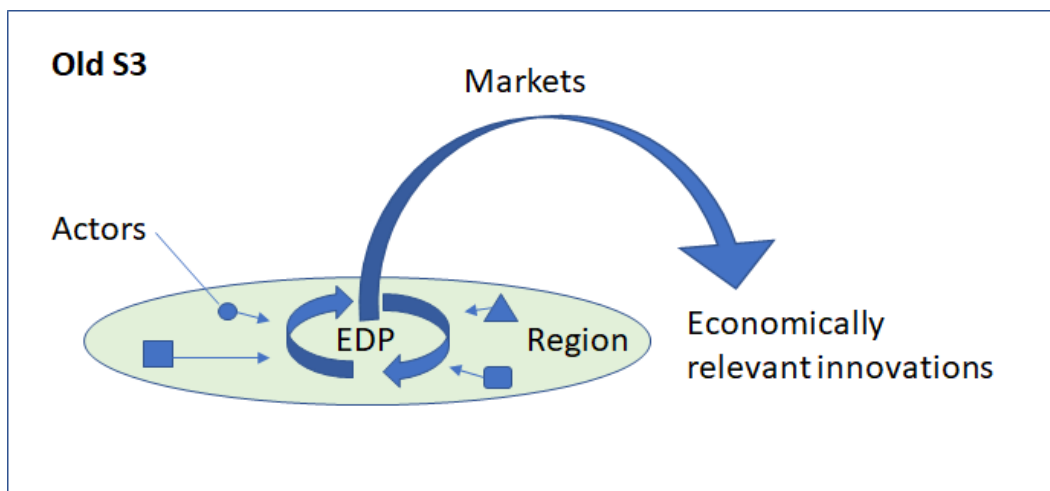
Originally, smart specialisation strategies were a European innovation initiative, which focused on economic development (Foray et al. 2012). It was adopted across EU and developed into a global concept. S3 implementation is based on a regional entrepreneurial discovery process (EDP), where local stakeholders meet and discuss what activities are important for the local innovation processes. These regional discussions and local development dialogue lead to enhanced innovation activities (Mäenpää, 2020; Teräs & Mäenpää 2018). This has been pushed into practise by the ex-ante conditionality of the strategies: to gain ERDF funds, EU regions have needed to utilise the strategies and connect local actions with the planned strategy work (Foray et al. 2012).

The idea behind smart specialisation was that companies could utilize their market knowledge for looking at new niches, where the regions could specialize, in order to open up new development trajectories for the regions. This was a core idea of EDP (Mäenpää 2020; Foray 2015). However, we do already know that smart specialization implementation also had some issues with engaging companies (Kroll, 2015) and that some regions have tried to utilize it in a way, which continues the existing activities as they were (Pugh, 2014), meaning that S3 has not been a success story in all cases. Despite this, S3 has been applied broadly in different types of regions from large metropolitan cities (Kristensen et al. 2023) to non-metropolitan areas (Kristensen et al. 2018).

In practise, S3 has been focusing on applying research and innovation activities, with heavy engagement from public organisations and universities. This became evident via the inclusion of key enabling technologies, such as nano and biotechnology, which were considered important for the original S3 processes (Foray et al. 2012), meaning that S3 connected higher technology solutions and their application into different regional contexts. It could be said that S3 was helping the introduction of new key enabling technologies in the existing activities and more traditional fields (Nowakowska et al. 2024). However, the focus of S3 has been changing, and this evolution of S3 is described more thoroughly in the next section.

### 3.3.2. S3 evolution from regional specialisations to systemic solutions

Smart specialisation can be understood both as a theoretical concept and as a policy. The theoretical concept originally relied on the entrepreneurial discovery process (EDP) and related theories, such as Regional Innovation Systems (RIS) and triple helix (3H), where regional specialisation was identified by mutual cooperation, knowledge exchange and inspection of the institutional capabilities of a region. Indeed, EDP has been described as “regional entrepreneurship”, as regional stakeholders act like entrepreneurs (Teräs & Mäenpää 2016; Lundström & Mäenpää 2017; Mäenpää & Teräs 2018). This process meant that regional stakeholders met, analysed, and discussed as well as decided, what their region should focus on, whilst keeping in mind the global markets (Mäenpää & Teräs 2018). This process can be seen in Figure 2 below.



**Figure 2.** Old smart specialisation process

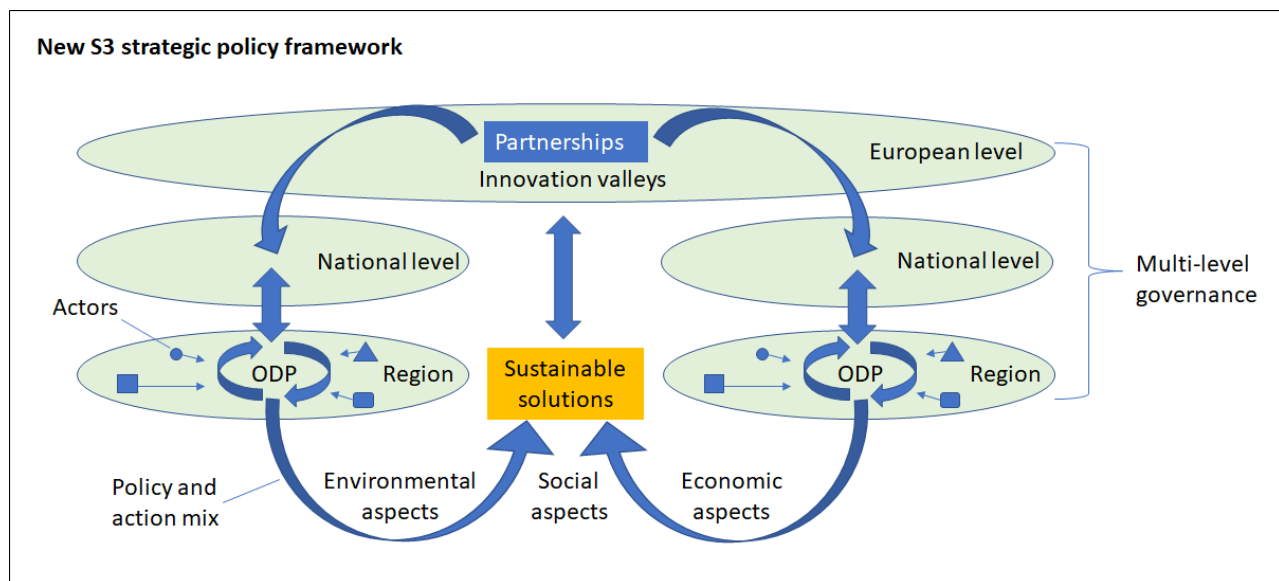
This theoretical concept was applied to policy when public intervention was required, i.e., when market failures happened, and regions could not specialize on their own (Foray 2015: 30–31). Policy also included funding instruments, as it was an ex-ante condition for receiving ERDF funding. European regions are currently implementing their smart specialisation strategies all around Europe. The scientific concept, which was originally developed by the “Knowledge for growth” expert group (Foray 2015; Foray et al. 2012), has been developed to answer new concerns about green innovation activities, which has linked the concept with sustainability aspects. According to place-based development strategies, S3 should be tailored to the local context based on the best data available, the most detailed knowledge and an explicit consideration of the realistic potential of the region (McCann & Ortega-Argilés 2013).

This tailoring for local needs has been highlighted by the new S3 (sometimes named S4 or S4+), which was developed after the launching of Partnerships for Regional Innovation (PRI) -pilot in 2023. It could be said that smart specialisation needed to re-orientate itself to enable deeper transition towards sustainable innovations (Poikela, Mäenpää & Laakkonen 2023). This also meant a fundamental shift in the goals of S3.

The purpose is no longer the change in regions themselves necessarily but ensuring a more sustainable development path with a global perspective, contributing to the UN Sustainable Development Goals (McCann & Soete 2020: 10). This discussion has recently evolved the concept of S3, referring to more sustainable and inclusive smart specialisation

strategies (McCann & Soete 2020). New S3 and PRI also introduced the concept of strategic policy framework, which sets the conditions for a S3 process. Framework itself consists of two main components; open discovery process (ODP), and policy and action mixes (Pontikakis et al. 2022). ODP emphasises inclusive actions in implementation processes to gain broader perspective for the potential solutions (Pontikakis et al. 2022). This should lead to more practically oriented policy and action mixes (Pontikakis et al. 2022), which enhance the region's activities in sustainability and helps European efforts for solving sustainability issues.

However, it is questionable whether regional ODP is sufficient in order to aim for a more systemic change. This is why multi-level governance is seen as an important factor for enhancing innovation processes (Pontikakis et al. 2022). Regions and nations alike should learn from each other's and spread the best practises as well as information on the challenges which they face. This transnational learning perspective (cf. Mariussen & Virkkala 2013) is seen as important aspect in ODP - so important that EU has established Innovation valley concept to guide EU funds towards this regional cooperation across the borders (European Commission 2023). Innovation valleys are based upon collaboration networks, where more advanced and following regions have ongoing dialogue in order to enhance co-development between different types of regions and mutual learning concerning the challenges which different regions are facing. This process can be seen in Figure 3.



**Figure 3.** New S3 strategic policy framework

Finally, the new S3 strategic policy framework also means shift from more vertical innovations towards horizontal innovations. Horizontal elements can be seen as targets or industries, which interact with a broad knowledge base and are not limited to singular areas of expertise (Poikela, Mäenpää & Laakkonen 2023). One example of these are mission-oriented targets, which may focus on carbon neutrality, microplastics or other environmental challenges (Mazzucato 2016). Circular economy is also a good example of horizontal innovation activities, since it may mean, for example, more advanced recycling and material distribution in some industries, like food production, or adding of service and

maintenance services in other industries, like electric car production. This idea of enhancing the life cycle of existing activities may add new services to existing activities or may even create entirely new ones, like car battery recycling. Ideally, regions should try to combine existing vertical aspects with horizontal perspectives (Poikela, Mäenpää & Laakkonen 2023). It could be argued that environmental and social aspects are adding a new, horizontal layer of cooperation into the previous vertical specialisation focus of S3, as has been described by McCann and Soete (2020).

### 3.3.3. S3 in practise

It should be stated that although smart specialisation has focused on key enabling technologies and high-end innovations and their adaptation in regions across Europe (Lo Conte et al. 2023), the original concept includes elements of more “mundane” origins, too. Foray (2015: 20–21) has demonstrated that smart specialisation can indeed happen without any strategies or policies. One example is an old Swiss French border case in the town of Morez in 1796, where nail production transformed into eyeglass production when one entrepreneur noticed the similarities in their manufacturing. After his efforts, many local companies (such as glass producers) followed the entrepreneur, and this led to the creation of an eyeglass production cluster. The case demonstrated the core idea of smart specialisation well according to Foray (2015: 21) as it shows three distinct phases which occur in a successful smart specialisation process: mutual discovery and spillovers (the discovery of similarities in nail and glass production), entry and agglomeration (other companies followed and formed a cluster), as well as structural changes (nail production changed into eyeglass production within the town).

This discovery of Foray is one example of S3 in practice. There were no public actors involved and the transition of the regional economy happened on its own. This case demonstrates that S3 can happen even without official strategies and indeed also in more remote areas when favourable conditions are met. This same aspect has also been noticed by Teräs et al. (2023), as they describe Arctic “de facto Smart specialisation projects”, i.e., which act as flagship initiatives, where stakeholders or regional councils collaborate in mutual regional strengths without a formal smart specialisation framework. This shows that S3 can be seen from both theoretical and practical point of view.

It could be argued that recent developments of S3 have become more relevant for peripheral regions and more mundane fields. This is due to the PRI (Partnerships for Regional Innovation)-pilot and the ideas developed within. PRI can be seen to develop the theory of new S3 with the inclusion of new central aspects of it, like the strategic policy framework and its main components; ODP and policy and action mix (Pontikakis et al. 2022). Ultimately these three aspects follow the three main steps of Foray’s (2015) original description of S3 process in practice as they consist of problem identification (setting the strategy), stakeholder engagement (ODP), and applying the results into practice (policy and action mix). However, the methods and tools have now been expanded (based on good examples from the PRI network) which has led to the publication of a practice-based Playbook for place-based innovations (Bianchi et al. 2024).

The PRI Playbook contains new ideas and practices on how smart specialisation could help in sustainability transition, together with suggestions for a broader basis of local stakeholders. These activities include engaging, envisioning, orchestrating, designing, implementing and learning aspects (Bianchi et al. 2024: A9). Out of these six sections,

orchestrating refers to the governance of S3, whereas the other sections describe ways on how to engage stakeholders, form visions with them, design a local sustainability action, then act upon it and share knowledge with local stakeholders and the wider, European community. Based on the descriptions of the six themes, citizen engagement is very important for new S3 activities. Focus on choosing the targets for transition is given to local people through envisioning. This seems promising, since recent discovery by Kristensen et al. (2023) suggests that success rests more on the adequate empowerment of actors entrusted with RIS3 than on general regional preconditions.

The mutual co-creation element, which has been the focus of criticism previously, might change to some extent in the next EU programming period. Conversely, research and innovation strategies for smart specialisation emphasise specialisation at the regional level but also encourage the creation of links to inter-connected policies and governance spaces at the European level to create more outward-looking policies (Uyarra et al. 2018.) This aspect did also exist in the old S3 via the peer-review workshops, which were organized by the S3 Platform (2024). However, they were individual events and thus did not necessarily encourage enough active European dialogue, which is currently seen as important.

## 4. EMPIRICAL PART: MUNICIPAL WASTE MANAGEMENT IN NORTH NORWAY AND S3



Figure 4: The map of North Norway

### 4.1. Arctic waste management in North Norway

According to the main principle of the Norwegian waste policy, the municipalities are responsible for the collection and treatment of household waste, while the handling of industrial waste takes place in a free market within the framework of the legislation. The Pollution Control Act obliges municipalities to ensure collection of waste from households - the municipalities decide solutions for source separation, ensure collection and treatment of waste. Moreover, the municipalities are free to choose how they wish to organise the municipal waste management: it may be through a separate department, agency, municipal enterprise or through participation in inter-municipal cooperation. The municipalities are also relatively free to choose which waste collection solutions they offer their residents (Miljødirektoratet 2019). The waste management sector in Norway has undergone a transition from a completely publicly owned sector to a public-private sector where privately owned companies carry out increasingly larger parts. Secondly, its orientation and scale-of-operations is shifting from strictly regional or national to a truly international setting.

The Arctic waste management sector in North Norway consists of three northernmost counties (Troms, Nordland, Finnmark) of Norway with 484 000 inhabitants. North Norway borders Finland, Sweden, and Russia, and consists of different cultures with a mixture of northern cities (such as Tromsø and Narvik), rural and peripheral communities, and indigenous Sámi people in the inner parts of the region. Northern Norway has important peripheral characteristics with low population, long distances, and a mix of high and low skills levels. The major industries include fisheries, aquaculture, construction sector and

service functions. Tourism is also a rising industry. Moreover, the public sector is an important employer.

The North Norway waste management sector was highly regulated until the beginning of 2000's. The local waste management was a *de facto* local monopoly, to be compared with fire brigade type of activities. Since the deregulation of waste management in Norway started in 2002, the waste management sector has been regarded as a sector with possibilities to make things more efficiently, i.e., to create value out of waste.

The waste management sector in North Norway is an example of a sector of economy with strong public-private interlinkages, embedded in a circular economy context. Remiks Miljøpark A/S in Tromsø and Hålogaland Ressursselskap IKS (HRS) in Narvik are the leading waste management companies in North Norway. Remiks is 100 % owned by the municipalities of Tromsø and Karlsøy and has approximately 130 employees. Remiks handles approximately 69.000 tons of waste per year, including waste from Svalbard in the north to Nordland in the south, and serves 77 000 inhabitants. Hålogaland Ressursselskap IKS (HRS), with main administration Narvik, is a waste management and recycling company owned by 8 municipalities in the northern part of Nordland and Sør-Troms and has a total of 125 employees. The company provides daily services to our 60 000 inhabitants. HRS handled more than 100 000 tonnes of waste in 2021.



Figure 5: The Remiks optical waste sorting facility in Tromsø

## 4.2. Regional innovation activities in Troms County

To put the Northern Norway waste management sector in a regional development context, a group interview with 5 respondents was conducted at the Troms County on May 15, 2024. The following description of the regional innovation system in North Norway is largely based on the data from the group interview.

Troms county is known for its fishery and aquaculture industries, and for a growing tourism industry. The region has been suffering from an aging population, like many other regions in Norway and across Europe, and the region is making efforts to attract talent to diminish this challenge. The Troms County has recently re-structured its innovation and regional development activities after the demerging from the Finnmark county from the beginning of 2024. A new four-year regional plan is currently being developed. As part of it, there are plans to include a new form of inter-municipal cooperation between the Troms County and four groupings of municipalities in Troms. This form of sub-regional governance is seen as a way to look more into specific issues across the county. One way for developing this sub-regional cooperation is smart specialisation. The smart specialisation concept is seen as a potential tool to benefit the regional development.

The concept of smart specialisation is relatively well known in Troms County, as the region has published a smart specialisation report in 2018, which analysed the methods and practises concerning smart specialisation in other Norwegian regions. The region also participates in the Northern Sparsely Populated Areas (NSPA) (2024) network in Brussels, which keeps North Norway and other NSPA members on track with the European innovation developments. Troms county also actively collaborates on EU projects and is in this way connected to the wider European development networks.

Troms county has a university (UiT) and several research and development agencies such as NORCE and Sintef. In addition, Troms County collaborates with the Innovation Norway and National research funds as well as Norwegian business development institute (SIVA). The cooperation between the knowledge providing institutions and Troms County takes place mostly via individual projects on a temporal basis. This is a challenge for regional development since Troms County is aiming to increase its systematic efforts in providing knowledge-based data and statistics about regional development in Troms.

Waste management is considered as a positive cooperation sector for Troms County. Cooperation between the industry, various regional actors and the UiT has intensified through cooperation in the Rå Biopark initiative. The Rå biopark (2024) is a planned biogas production facility in Troms. The development process of the Rå biopark has increased cooperation between waste management actors and knowledge providers such as university and development agencies.

Waste management has been mentioned as a possible link between the county and future actions in the Norwegian missions 2030 -programme, which is currently under development, based on the work done in the Vestland county (2021). There have been discussions on enhancing regional industrial symbiosis, development of green industrial zones, as well as enhancing knowledge infrastructure for green transformation. Waste management is seen important as it offers a way to connect with several of these initiatives. In this sense, waste management sector also serves broader innovation policy objectives of the Troms County.

### 4.3. Municipal waste management in North Norway and S3 - Case Remiks

The following analysis is based on an interview conducted at the Remiks company premises in 16.5.2024 with a representative of Remiks management & innovation activities. The interview questions focused on the characteristics of the waste management sector in North Norway, as well as cooperation, competences, and innovation processes.

The waste management firms in North Norway mainly rely on internal sources of knowledge, capital and competence. The waste management process consists of collecting waste, separating it based on the type of waste, and then either burning it (general waste) to provide heating services, or transporting waste to other locations for further processing or landfill. Traditionally, municipal waste management is seen as part of a foundational economy sector in Northern Norway.

In recent years, the North Norway waste management and especially the Remiks company, have taken steps towards increased innovation and co-operation. Remiks could be categorized as an actor in the horizontal innovation field since it's dealing with systemic material flows. Since waste management is an inherently and already systemic (a form of circular economy), a further development would require that more vertical elements are added into the specialisation. Indeed, it can be seen from the processes, how Remiks has looked at further automation of waste sorting, including e.g., development of advanced cameras that would inspect the type of waste that individuals throw into the bins. This shows that even in typically mundane field of waste collection, new types of innovations are required, and being developed. If the required knowledge cannot be provided locally, it will be brought in by external actors.

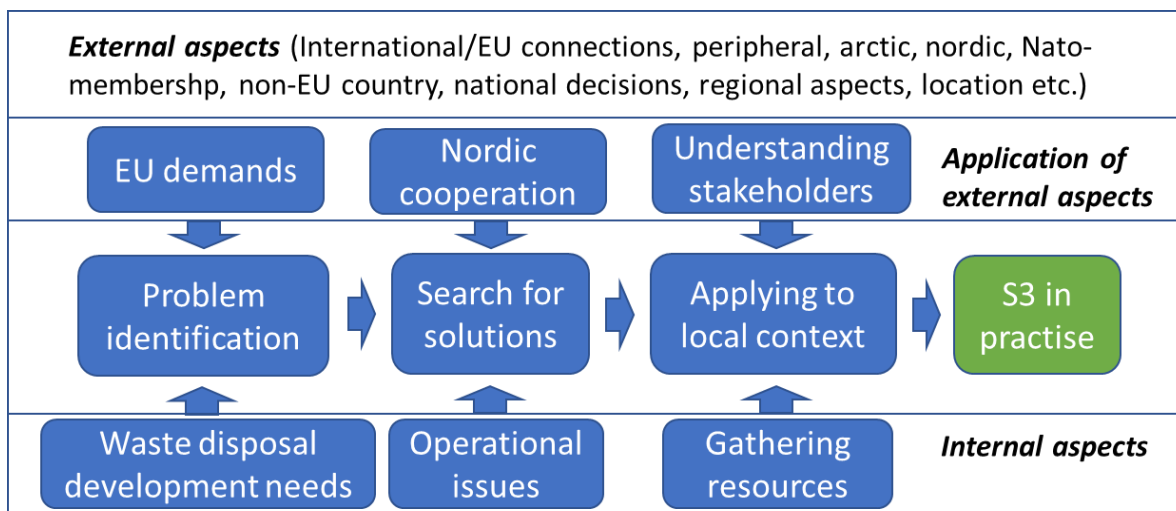


Figure 6: Waste transportation activity by Remiks

The Remiks case is an example of different stages of applying innovations into practice (see Figure 7). Interestingly, the process has similarities with the Morez case presented by Foray (2015). First, there is some sort of problem identification, which can be based on internal issues and need to act (e.g., need to replace the outdated waste sorting system), or on external factors (e.g., EU sustainability legislation that keeps pushing the waste management sector into a more innovative direction). After the problem identification, one starts to search for solutions. For Remiks, solutions have been searched not only from local R&D sources but also from external knowledge sources in Norway, and internationally. As an example, Sundsvall in Sweden was acting as inspiration and

example for the planning of Rå biopark (2024), which is being developed to produce biogas, CO2, ash/landfill and fertilizers.

After finding a possible solution, the implementation needs to be applied in the local context. The overall performance depends both on the available resources and how other stakeholders perceive the activity, and on external aspects, which set the scene and conditions for potential development. Systemic solutions should contain a high amount of acceptance. For example, clustering of local waste management companies has been intensified in Northern Norway to meet challenges which are too large to solve by individual actors. The EU legislation was mentioned by Remiks to be an important reason for looking for solutions together. The clustering trend has led to practical cooperation in the Rå biopark development. Rå biopark development can be seen as one example of S3 in practice.



**Figure 7.** Elements of S3 in practise, from the point of view of individual waste management company

Remiks is not only looking at new ways to introduce more vertical innovations (cameras, sorting systems) into the horizontal waste management industry, but it also looks for deepening the horizontal innovation aspect. This has happened via the establishment of a Rebell second-hand store (Remiks 2024), which literally turns waste into money and allows the continuation of product life cycles. Remiks has also been working on circular economy activities in the built environment (Remiks 2024) and sees that lowering some building standards could help a lot in making use of old building-waste. For example, lowering the standards for having similar doors or certain coloured mats could help a lot in building more sustainable housing.

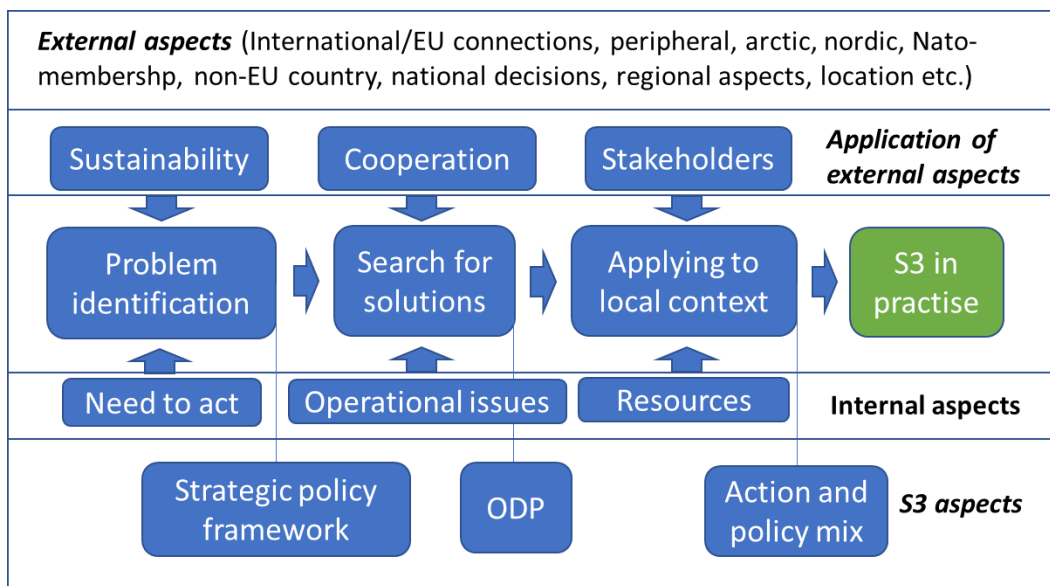
Remiks is also contributing to regional development. The Rå biopark (2024) is helping the regions' future energy production and offers new work opportunities. Furthermore, Remiks is collaborating with the local UiT university (Remiks 2024) by mentoring business students, and by providing opportunities for thesis work in the waste management sector. Remiks helps in upgrading regional competences and improves their own understanding of what is being developed in the universities. Importantly, as environmental and climate issues are currently so high on the agenda, it seems evident that highly educated talent will be more and more interested to work in the field of waste management, also in the

future. However, job positions for more mundane tasks, such as driving waste collecting trucks, may become challenging to fill in the future.

Interestingly, the waste management sector would offer job opportunities for people with various backgrounds. Waste management includes for example technical, logistical, economic, environmental, societal, and political dimensions, so personnel may come from various educational background and fields of expertise. This broadens the scope of potential future workers, but also means that it may be hard to find experts which study specifically waste management in higher education institutions.

## 5. DISCUSSION

As demonstrated by the Remiks case, the core idea of smart specialisation seems to work in foundational sectors, too. Foray (2015: 21) describes three distinct phases which occur in a successful smart specialisation process: mutual discovery and spillovers (the discovery of challenges which require solutions, as well as plan on how to proceed), entry and agglomeration (cooperation with internal and external actors), and structural changes (implementation of new activities). It is possible to analyse innovative waste management using the new, post-PRI S3 framework, which consists of strategic policy framework, ODP and action and policy mix, and the Remiks activities links with them, as Figure 8 illustrates.



**Figure 8.** S3 in practice, following a strategic policy framework.

In comparing figure 8 with the Remiks R&D and innovation process, a certain pattern emerges. The process resembles Foray's (2015) original description, but also translates resonates with the newest S3 framework. If we think about the three elements established by PRI pilot (Strategic policy framework, which consists of ODP and Action and policy mix), we can see aspects of them emerge in the process. The process starts by Problem identification and plan to act (decision to do something) and leads to next step of seeking for solutions. This translates into ODP (Open Discovery Process, more inclusive participation of stakeholders, like citizens). After this, the process turns into Implementation, which can be described via the action (and policy) mix. The Remiks R&D and innovation process seems to fit into S3 process and shows the steps how S3 can happen in practice.

This innovation process in waste management company Remiks also emphasizes how sustainability-focus in the new S3 means that it is more applicable across Europe, and it is not tied into any formal structures. Remiks management was not familiar with the S3 concept, but they have applied it's key aspects in practise based on their development needs. This means that the processes and practices which have been identified in the new PRI Playbook (Pontikakis et al. 2022) may prove to be very useful for different types of local practitioners. Following the idea of the new S3, the main point is to start doing things

also in practice. This is a challenge for many regions, but as our case analysis shows, existing S3 activities may be closer to the real life of companies than one might think.

In the future, the linkages between the practical and different S3 aspects should be further explored. For example, in the Remiks case, strategic policy framework basically means identification of a problem and plan for action based on this identification. Following this logic, ODP did not happen at Remiks via mutual workshops, or focus groups meetings, but was based on learning from concrete activities, in which local knowledge producers contributed. Citizens were involved as end users but not as active participants, even though the new solutions will influence their daily lives. Concerning action and policy mix, we can say that it is more internal, and based on a working plan more so than official regional policies or strategies. All this means that S3 indeed still has an entrepreneurial core as the process seems to correlate with practical aspects in individual company's decision making. Future studies should explore new ways to implement these different S3 aspects into practice and in this more cases could shed some light into the potential differences in S3 implementation. The Remiks case demonstrates that there is much more to discover concerning the interplay between the S3 theory and its practical use.

## 6. CONCLUSIONS

Based on the literature study and the case study in Troms, some conclusions can be made. Our working paper was looking for an answer to the research question:

*How and to what extent would it be possible to apply smart specialisation to the foundational sector of municipal waste management in North Norway?*

Based on our study, municipal waste management in Northern Norway, although being part of so-called foundational economy, has a lot to offer for higher-end innovations as well. Even though the municipal waste management falls under several characteristics of foundational economy (not to maximize profits, mundane, municipal activity), the R&D and innovation as well as networking activities are rapidly developing in North Norway, with Remiks as the locomotive company for the development. In fact, the municipal waste management sector has several features that make it easy to apply the basis of the S3, like its focus on horizontal innovations, and existing R&D activities and networks. Indeed, we were able to identify both vertical (cameras, advanced separation systems) and even additional horizontal (Rebell store, built environment projects) innovations being developed in the field.

Based on the analysis of the innovation process of the Remiks case, it can be stated that S3 is applicable to municipal waste management with certain conditions. We have demonstrated these conditions in discussions, showing that both internal and external elements have a role in the local problem-solving exercise. However, this discovery is only a beginning in looking how S3 is applied in practice.

The Remiks case also demonstrates that the new focus for sustainable S3 does not exclude attempts towards more economical activities. Remiks has been able to generate additional revenues from waste e.g., via the Rebell store, and is currently active in the planning phase of Rå Biopark as a part of the Rå Biopark consortium. This shows how smart specialisation, or “de facto” smart specialisation, in the waste management business creates new economic activities and collaboration opportunities for the region.

The active collaboration of Remiks has contributed positively for attracting competent labour force. Importantly, young people increasingly look for job opportunities in sustainability issues, including waste management. This has been further enhanced by the cooperation between Remiks and the University of Tromsø UiT, which makes it easier to connect Remiks with future experts. In this sense, Remiks acts as a pioneer in developing public-private partnerships in Troms and acts as an Arctic sustainability hotspot for future development. There is, however, still a lot to be done in the Troms region concerning its innovation cooperation and innovation processes. In peripheral regions such as North Norway, challenges need to be solved with less people. Collaboration is key for solving the complex issues such as acceleration of climate change and geopolitical challenges.

The limitations of our study include having only one case study company (Remiks) to test the applicability of smart specialisation. This was, however, done on purpose as our main idea for the Working Paper was to gather ideas and insights on how S3 could be connected to waste management sector, and Remiks was the natural point of departure, being a leading municipal waste management company in North Norway regarding R&D, innovation, as well as national and international collaboration. By using the Remiks case,

we were able to identify the process how S3 could happen in a practical context. The number of case study companies can be increased in the forthcoming analyses.

Secondly, the current focus of S3 is largely on sustainability issues, which connects it well with the waste management sector. If we would have inspected industries, which are not so clearly connected with circular economy and mundane activities as waste management, it might have been more difficult for us to connect the activities with new S3 literature. And even our discoveries on how S3 in practise connects with the S3 literature (strategic policy framework, ODP and action and policy mix), we only discovered some thoughts about these connections, which need further study. However, we feel that these discoveries are valuable for thinking about what S3 could be in practise.

Finally, what about the potential of S3 - can it solve every issue? This question about the extent of how much S3 can be applied was raised by one respondent - an interesting question for S3 practitioners and researchers alike. According to our interpretation, S3 is not the only solution to R&D and innovation issues, but it seems to resonate well in developing local activities, which require a broader cooperation. This mutual development seems to open up new opportunities and solutions, as well as regional cooperation, which helps in connecting people to look at the sometimes abstract global issues through a local lens. This may prove to be a relevant discovery concerning future sustainability activities.

## References

- Bianchi, G., Matti, C., Pontikakis, D., Reimeris, R., Haegeman, K.H., Miedzinski, M., Sillero Illanes, C., Mifsud, S., Sasso, S., Bol, E., Marques Santos, A., Andreoni, A., Janssen, M., Saublens, C., Stefanov, R. and Toliás, Y., Innovation for place-based transformations, Bianchi, G. editor(s), Publications Office of the European Union, Luxembourg, 2024, doi:10.2760/463723, JRC135826.
- Coenen, L., Hansen, T., Glasmeier, A., & Hassink, R. (2021). Regional foundations of energy transitions. *Cambridge Journal of Regions, Economy and Society*, 14(2), 219–233. <https://doi.org/10.1093/cjres/rsab010>
- Coenen, L., & Morgan, K. (2020). Evolving geographies of innovation: Existing paradigms, critiques and possible alternatives. *Norsk Geografisk Tidsskrift - Norwegian Journal of Geography*, 74(1), 13–24. <https://doi.org/10.1080/00291951.2019.1692065>
- De Boeck, S., Bassens, D., & Ryckewaert, M. (2019). Making space for a more foundational economy: The case of the construction sector in Brussels. *Geoforum*, 105, 67–77. <https://doi.org/10.1016/j.geoforum.2019.07.011>
- European Commission (2018). Circular economy package. Retrieved from: [www.commission.europa.eu/publications/documents-circular-economy-package\\_en#details](http://www.commission.europa.eu/publications/documents-circular-economy-package_en#details)
- European Commission (2023). Regions interested in becoming a Regional Innovation Valley. Available at: <https://projects.research-and-innovation.ec.europa.eu/en/strategy/support-policy-making/shaping-eu-research-and-innovation-policy/new-european-innovation-agenda/new-european-innovation-agenda-roadmap/regional-innovation-valleys-matchmaking-map>
- Finnish Ministry of Environment (2022). Overview of municipal solid waste management in Finland: With practical examples of implementation on regional level. Available at: [https://gnf.fi/wp-content/uploads/2022/12/Overview-of-municipal-solid-waste-management-in-Finland\\_FINAL.pdf](https://gnf.fi/wp-content/uploads/2022/12/Overview-of-municipal-solid-waste-management-in-Finland_FINAL.pdf)
- Foundational Economy Collective. (2022). *Foundational economy: The infrastructure of everyday life*, new edition. Manchester University Press.
- Foray, D. (2015). *Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy*. Abingdon: Routledge.
- Foray, D., Goddard, J., Beldarrain, X., Landabaso, M., McCann, P., Morgan, K., ... & Ortega-Argilés, R. (2012). *Guide to research and innovation strategies for smart specialisation (RIS3)*. Brussels: European Commission
- Hansen, T. (2021). The foundational economy and regional development. *Regional Studies*, 56(6), 1033–1042. <https://doi.org/10.1080/00343404.2021.1939860>

- Henderson, D., Morgan, K., & Delbridge, R. (2024). Mundane innovation in the periphery: the foundational economy in a less developed region. *Regional Studies*, 1–12. <https://doi.org/10.1080/00343404.2024.2320769>
- Heslop, J., Morgan, K., & Tomaney, J. (2019). Debating the foundational economy. *Renewal: A Journal of Social Democracy*, 27, 5–12.
- Kristensen, I., Dubois, A. & Teräs, J. (Eds) (2018). *Strategic Approaches to Regional Development: Smart Experimentation in Less-Favoured Regions*. Abingdon: Routledge
- Kristensen, I. F., Pugh, R., & Grillitsch, M. (2023). Leadership and governance challenges in delivering place-based transformation through Smart Specialisation. *Regional Studies*, 57(1), 196–208. <https://doi.org/10.1080/00343404.2022.2090536>
- Kroll, H. (2015). Efforts to implement smart specialization in practice—Leading unlike horses to the water. *European Planning Studies*, 23(10), 2079–2098. <https://doi.org/10.1080/09654313.2014.1003036>
- Lo Conte, G. & Mina, A. & Rocchetta, S. (2023). Turning technological relatedness into industrial strategy: The productivity effects of Smart Specialisation in Europe. *Papers in Evolutionary Economic Geography (PEEG) 2323*, Utrecht University: Department of Human Geography and Spatial Planning. Available at: <http://econ.geo.uu.nl/peeg/peeg2323.pdf>
- Lundström, N. & Mäenpää, A. (2017). Wicked game of smart specialization: A player's handbook. *European Planning Studies* 25:8, 1357–1374.
- Mariussen, Å. & Virkkala, S. (Eds). (2013). *Learning Transnational Learning*. London: Routledge.
- Mazzucato, M. (2016). From market fixing to market-creating: a new framework for innovation policy. *Industry and Innovation*, 23(2), 140-156. DOI <https://doi.org/10.1080/13662716.2016.1146124>.
- McCann, P. & Ortéga-Argiles, R. (2013). Modern Regional Innovation Policy. *Cambridge Journal of Regions, Economy and Society* 6:2, 187–216.
- McCann, P., & Soete, L. (2020). *Place-based innovation for sustainability*. Publications Office of the European Union. ISBN: 978-92-76-20392-6. <https://doi.org/10.2760/250023>
- Miljødirektoratet (2019) Avfallsplan 2020-2025 (Waste Plan) . Miljødirektoratet, Norway Report M-1582, 2019.
- Moalem & Kerndrup (2023) The entrepreneurial role of waste companies in transforming waste streams to value streams: Lessons from a Danish Municipal waste company. *Waste Management & Research* 2023, Vol. 41(3) 620–634
- Mäenpää, A. (2020). The Challenges of Public Organisations in Coordinating Smart Specialisation and a Connectivity Model as One Solution. *Acta Wasaensia*, 438. ISBN:978-952-476-898-6

- Mäenpää, A. & Teräs, J. (2018). In Search of Domains in Smart Specialisation: Case Study of Three Nordic Regions, *European Journal of Spatial Development*, 68.  
<http://doi.org/10.30689/EJSD2018:68.1650-9544>
- Northern Sparsely Populated Areas (NSPA) (2024). Welcome to the northern sparsely populated areas. Available at: <https://www.nspa-network.eu/>
- Nowakowska, A., Jóźwik-Pruska, J., Madej-Kiełbik, L. & Gzyra-Jagiela, K. (2024). From Traditional Industry to Smart Regional Specialisation: Textile Industry Transformation in the Łódź Region. *Fibres & Textiles in Eastern Europe*, 32(1) 25-39.  
<https://doi.org/10.2478/ftce-2024-0004>
- Poikela, R., Mäenpää, A., & Laakkonen, M.-P. (2023). Why caring counts: Public value creation in smart specialisation through partnerships for regional innovation (PRI). *European Journal of Spatial Development (EJSD)*, 20(2), 22–42.  
<https://doi.org/10.5281/zenodo.8026334>
- Pontikakis, D., Gonzalez Vazquez, I., Bianchi, G., Ranga, L., Marques Santos, A., Reimeris, R., Mifsud, S., Morgan, K., Madrid Gonzalez, C. and Stierna, K. (2022). *Partnerships for Regional Innovation Playbook*, EUR 31064 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-52325-3.
- Pugh, R. (2014). 'Old wine in new bottles'? Smart Specialisation in Wales. *Regional Studies*, *Regional Science* 1:1, 152–157.  
<https://doi.org/10.1080/21681376.2014.944209>
- Remiks (2024a). REBELL Gjenbruksbutikk [REBELL Recycling shop]. Available at: <https://remiks.no/remiks-om-oss/bruktbutikken/>
- Remiks (2024b). Samarbeid med studenter om innovasjon [Innovation cooperation with students]. Available at: <https://remiks.no/samarbeid-med-studenter-om-innovasjon/>
- Remiks (2024c). Samarbeider om bygg i verdensklasse [Building world-class cooperation]. Available at: <https://remiks.no/samarbeider-om-bygg-i-verdensklasse/>
- Russell, B., Beel, D., Rees Jones, I., & Jones, M. (2022). Placing the foundational economy: An emerging discourse for post-neoliberal economic development. *Environment and Planning A: Economy and Space*, 54(6), 1069–1085.  
<https://doi.org/10.1177/0308518X221098745>
- Rå Biopark (2024). The biggest environmental cooperation in northern Norway. Available at: <https://www.raa.bio/>
- S3 Platform (2024). Smart specialisation platform: Strategies for research and innovation-driven growth. Available at: <https://s3platform.jrc.ec.europa.eu/>
- S3 Västerbotten roadmap (2022). S3 Västerbotten Roadmap for Smart Economic Transformation. Available at: <https://www.regionvasterbotten.se/VLL/Filer/S3%20V%C3%A4sterbotten%20Roadmap%20for%20Smart%20Economic%20Transformation.pdf>

Teräs, J., Eikeland, S., Koivurova, T. and Salenius, V., Sustainable development and Sustainable Development Goals in Smart Specialisation strategies in the European Arctic regions, Teras J., Salenius V. and Miedzinski, M. editors, Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/671740, JRC132932.

Teräs, J. & Mäenpää, A. (2016). Smart specialisation implementation processes in the north: Lessons learned from two Finnish regions. *European Structural and Investment Funds Journal* 4:2, 75–86

Uyarra, E., Marzocchi, C. & Sorvik, J. (2018): How outward looking is smart specialisation? Rationales, drivers and barriers, *European Planning Studies*.  
<https://doi.org/10.1080/09654313.2018.1529146>

Vestland County (2021). Grøn region [Green region]. Available at:  
<https://www.vestlandfylke.no/globalassets/innovasjon-og-naringsutvikling/gron-region-vestland/green-region-vestland---summary-unofficial-translation.pdf>

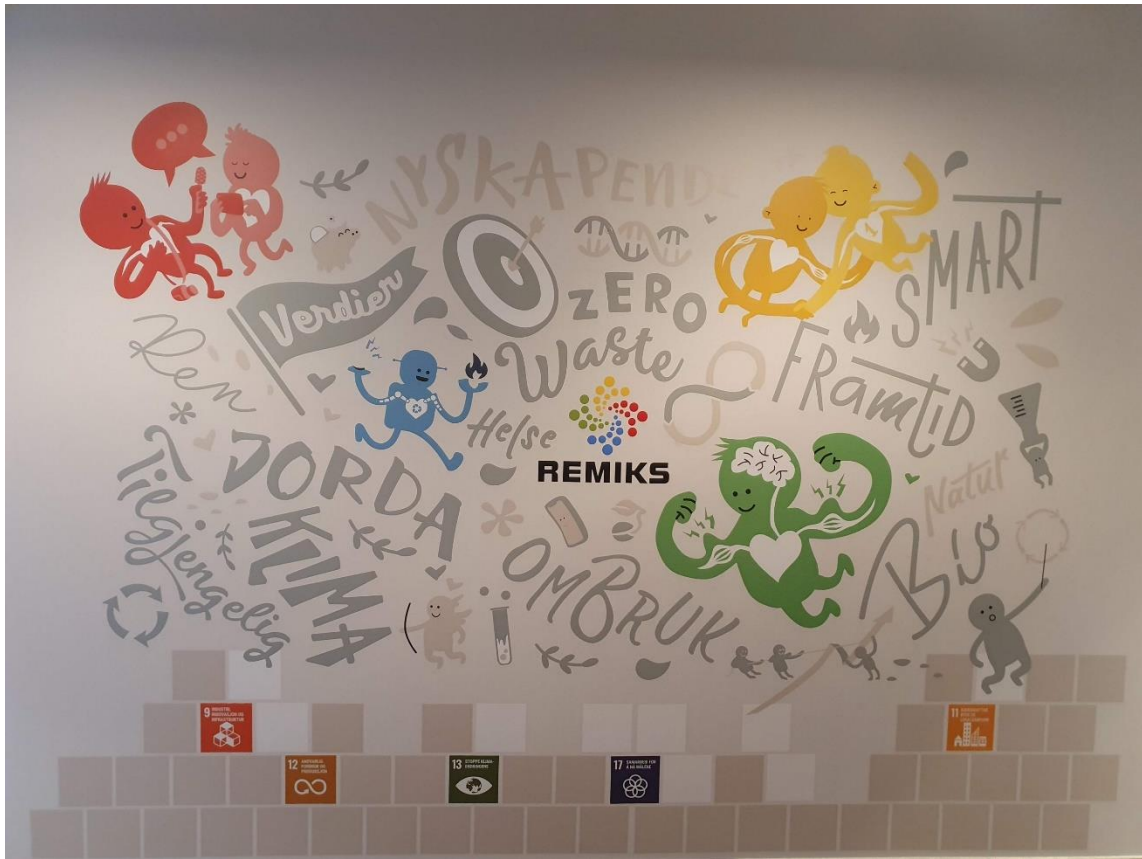
[World Bank \(2022\) Solid waste management. Retrieved from :  
https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management](https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management)

## About ReCoWaMa

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Back cover of the Working Paper: Wall figure at the Remiks office in Tromsø