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# Circular Activities of Major Norwegian Cities Communicated through their Websites

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Abstract: The transition to a circular economy entails the creation of new business models, brings new social changes, but also faces a number of challenges and opportunities to meet the goals of sustainable development. The importance of the circular economy has been growing in recent years also at the municipal level, and many large cities are in the phase of transition to a circular city. This paper presents the results of research aimed at identifying the circular activities of selected Norwegian cities, which are communicated through their official websites in order to analyze and evaluate the extent and level of circulation within the implemented activities. The aim is to describe the results of this research, to describe the activities implemented, the level of their communication, the circulation strategies used and to identify examples of good practice for use in other cities. The intention was to obtain at least a general overview of the current state of support for circular activities by municipalities in Norway, i.e. a country with an inspiring approach to the environment. The study shows that all monitored Norwegian cities are dedicated to the concept of circular economy, regardless of their size, the most frequently circularity strategy is Reduce.

Keywords: circular economy; circular city; circular strategy; municipality; Norway

JEL Classification: Q01; Q5; R11

## 1. Introduction

Sustainable development is receiving attention from academics, politicians, various organizations and the public, the set of Sustainable Development Goals – SDGs, have been influencing strategies and policies at international, national, corporate and municipal levels for many years. To achieve them, new approaches are being investigated and new topics are coming to the fore, including the circular economy (Guldmann, 2020). This new concept reaches all levels of the economy, with an increasingly important role also at the level of local government (Dagiliene, 2021).

The definition of the circular economy is not uniform in the literature (Murray et al., 2017; Lakatos et al., 2021; Kirchherr et al., 2017) and its theoretical concept is quite unclear (Geissdoerfer, 2020). It is mainly associated with the principle of "closing the loops" – closing or circulating material flows within product and material systems. Within this economy, new business models are emerging that use and dispose of materials and resources in new ways (Dantas et al., 2021), models that lead to the minimization of resource depletion, waste, and

emissions (Geissdoerfer et al., 2020) and to the responsible and circular use of resources to maintain their value in the economy (Geisendorf & Pietrulla, 2018). As Morseletto (2020) points out, the concept is most often referred to as a restorative and regenerative economy, but restoration is a more appropriate term for its underlying principle and its broad application. According to the results of an analysis of 114 definitions, published by Kirchherr et al. (2017), the term circular economy is primarily defined as a combination of reduction, reuse and recycle activities, but do not always emphasize the requirement for "a systemic shift" and contain only few explicit links between the circular economy and sustainable development. Murray et al. (2017) points out that the circular economy is most often associated with the achievement of economic and environmental goals, but minimal attention is paid to social goals. Therefore, he extends the definition to include these goals, like Ghisellini et al. (2018). Moreover, in pursuit of the Sustainable Development Goals (SDGs), the circular economy can be advantageously combined with new Industry 4.0 technologies, which bring new opportunities for closing the loop; there is growing interest in the practical applications of this combination (Dantas et al., 2021; Preut et al., 2021; Bakes, et al., 2022).

Various approaches have been developed to achieve the goals of the circular economy, most commonly referred to as R-strategies or R-frameworks. Among the most common are the 3Rs – Reduce, Re-use, Recycle, which have been gradually complemented by other strategies. At the highest level of circularity stands Refuse, followed by Rethink, Reduce, Re-use, Repair, Refurbish, Remanufacture, Repurpose, Recycle and Recover (Potting et al., 2017). Higher circularity strategies do not necessarily involve reverse flows of products, components, or recycled materials, but may involve outright rejection or better use of the product or smarter manufacturing; medium strategies focus on extending the life cycle of the product including its parts; and the lowest level circularity strategies represent the beneficial use of materials that are recovered through recycling and incineration (Potting et al., 2017). Higher circularity strategies include, for example, engaging products in the sharing economy in which the product is used more intensively during its lifetime (Jelinkova et al., 2021; Tetrevova et al., 2021). The highest attention is usually paid to the recycling strategy (Potting et al., 2017), but implemented activities could be often categorized within more than one strategy.

Transition to a circular economy requires innovation, new business models or socio-institutional changes (Williams, 2021). Potting et al. (2017) distinguish three types of transitions to the circular economy: 1. transitions through radically new technology, where social-institutional change gives the new technology a place in society; 2. transitions through social-institutional change, with a secondary role for technological innovation; 3. transitions through social-institutional change, with technology facilitating these transitions. The circular activities could be implemented in the form of projects using project management methods and tools (Kostalova & Tetrevova, 2014; 2018). According to de Jesus and Mendonça (2018), circular economy practices are mainly influenced by social, regulatory or institutional factors; the "hard" barriers are related to the availability of technical solutions and financial factors, the transition to the circular economy requires both technological innovation and institutional changes in markets, public policies and social practices.

The circular economy is an economic system that includes business models of production, distribution and consumption processes, and could be implemented both at the micro level (products, consumers, companies), the meso level (clusters, eco-industrial parks) and the macro level (cities, regions, countries) (Kirchherr at al., 2017). At the city level, its importance is given by the fact that more than half of the world's human population lives in cities, they account for two-thirds of global energy consumption, more than 70% of greenhouse gas emissions etc. (The World Bank, 2023). At the same time, municipalities are expected to be responsible for coordinating and communicating national strategies to local communities and businesses (Dagiliene et al., 2021; Tetrevova & Jelinkova, 2019). The importance of ensuring practices that are in line with sustainable development at the municipal level is also reflected in the fact that their duties often correspond to social responsibility activities (Tetrevova & Jelinkova, 2019). That is also why cities worldwide implement strategies within their transition towards a circular economy (Henrysson et al., 2022). Prendeville et al. (2018, p. 187) sees the concept of circular city in a broad context, as an element of development to ensure its future-proofness and define it as "*a city that practices circular economy principles to close resource loops, in partnership with the city's stakeholders (citizens, community, business and knowledge stakeholders), to realize its vision of a future-proof city*". The benefits from implementations of circular activities can be perceived in all three pillars of sustainable development: environment (reducing resource consumption; restoring urban ecosystem services; reducing greenhouse gas emissions; adaptability to climate change; increasing environmental awareness), economic (reduced supply and production costs to producers; creation of economic value; economy diversification, job creation) and society (health and community benefits) (Williams, 2021).

However, research on the implementation of circular economy activities by local governments has so far been carried out in a rather "fragmented manner" (Dagiliene et al., 2021). Urban policy makers do not often have a clear idea of the purpose and form of a circular city, which form strategic ambitions up to a dedicated smart city concept (Lakatos et al., 2021). Challenges, for example, in municipal waste management, distribution of human resources, networking has been identified, municipalities also commonly face ambivalent goals (Dagiliene et al., 2021). So, it is obvious that a comprehensive analysis is needed on how to implement circular economy in cities and how to become fully sustainable (Lakatos et al., 2021).

This article presents research results in the field of implementing circular activities in cities. The subject of interest was not the largest world or European cities, whose circular practices have already been given attention in some research (Williams, 2021), but the circular activities of cities in Norway, a country that has long been ranked among countries with a positive attitude towards sustainability and environment, were analyzed. The goal was to analyze the circular activities, the implementation of which these cities inform the general public, to describe what activities the cities implement, to find out the level of their communication, to find out what circularity strategies are used, at what level of circularity and to identify examples of good practice interesting for use in other cities.

## 2. Methodology

The literature review became the basis of subsequent primary research that was carried out as part of the project "Towards Regenerative and Sustainable Development and Society"

supported by the Fund for Bilateral Relations within the framework of the EEA and Norway Grants 2014-2021. A partial goal of this project was to analyze circular activities in the largest Norwegian cities and also to find inspiration for cities in other countries and to fill some gaps that literature on circular economy is struggling with. Norway can be considered an important source of inventions, as it is traditionally very proactive in the field of environment and sets ambitious goals. Already in 2020, it announced a strengthened climate target until 2030 as part of the Paris Agreement, and subsequently the Norwegian government strengthened the national climate targets for 2050 as well - a reduction of emissions by 90 to 95 % from the level of emissions in 1990 (Redjeringen.no, 2022). Of course, these intentions are also reflected in the support of the circular economy, which was part of the Granavolden government platform in previous years with the aim of making Norway a pioneer of a green, circular economy that makes better use of resources (Sutcliffe & Alvarado, 2021). Currently, these trends are reflected in the national strategy for circular economy in Norway (Circular regions, 2022).

In order to be able to assess the involvement of cities in the framework of the development of circular economy strategies, primary research was conducted to analyze the circular activities published by selected Norwegian cities on their official websites. The cities' websites were chosen as a suitable source of data given that they still play the most important role among the digital tools used by public institutions to provide information (Urs & Spoaller, 2022). This is because they are considered part of the "public face" of the institution (Karani et al., 2021), serve as the main tool for "branding" the city (Manoharan & Wu, 2022) and, last but not least, they also represent the main channel through which cities communicate with citizens and offer their digital public services (Urs & Spoaller, 2022). Based on these facts, the use of a website seemed optimal to meet the research objective of identifying examples of good practice of Norwegian municipalities in the area of their circular activities. The research was carried out in 2021 and included the 25 largest Norwegian cities based on their population according to Statistics Norway on 1 January 2021. An overview of these cities is presented in Table 1.

Table 1. Characteristics of the research sample of Norwegian cities (processed according to Statistisk sentralbyrå, 2023)

| City | Population as of 1.1.2021 | City | Population as of 1.1.2021 |
|---|---|---|---|
| Bergen | 285,601 | Nordre Follo | 60,034 |
| Trondheim | 207,595 | Sarpsborg | 57,372 |
| Stavanger | 144,147 | Tønsberg | 57,026 |
| Bærum | 128,233 | Skien | 55,144 |
| Kristiansand | 112,588 | Bodø | 52,560 |
| Drammen | 101,859 | Moss | 49,668 |
| Asker | 94,915 | Larvik | 47,499 |
| Lillestrøm | 86,953 | Indre Østfold | 45,201 |
| Fredrikstad | 83,193 | Arendal | 45,065 |
| Sandnes | 80,450 | Lørenskog | 42,740 |
| Tromsø | 77,095 | Karmøy | 42,345 |
| Ålesund | 66,670 | Ullensaker | 40,459 |
| Sandefjord | 64,345 | | |
| *Total* | | | *1,777,015* |

The sample of Norwegian cities was selected to include more than 25% of Norwegian settlements with city status, which are home to 33% of the total Norwegian population. These largest Norwegian cities could be expected to implement and communicate a large number of the circular activities that are the subject of our investigation. The capital city of Norway, Oslo, which, unlike all other studied municipalities, is both a county and a municipality, was excluded from the analysis due to this specificity.

To fulfill the goal of our research, the following research questions were formulated:

1. Do larger Norwegian cities communicate more circulation activities on their websites than smaller cities? Does the level of communication of these activities depend on the size of the municipality?
2. Do all larger Norwegian cities inform about their circular activities at least to a minimal extent? Does each of the monitored larger Norwegian cities mention at least one interesting circular economy activity on their website?
3. Does the structure of communicated recycling activities of municipalities correspond to the structure of circular strategies identified in other researches (Potting et al., 2017) i.e., most activities can be identified in the area of Recycle strategy?
4. Is it possible to identify some interesting practices of circular activities published by the monitored cities, which are specific to the cities and are an example of good practice for other cities in the phase of transition to a circular city?

Finding answers to the research questions specified above required an in-depth content qualitative analysis of the official websites of selected Norwegian cities. As part of this analysis, an online search was applied using web browsers installed directly on the analyzed websites. Keywords such as "social responsibility", "environmental project", "circular activity" etc. were used for the search. From the information found, only those activities or projects presented on the website that fall under circular economy procedures were subsequently subjected to a thorough analysis. In order to determine the structure and assess the level of circularity, these activities were further classified into one of the strategies R0 to R9, listed by Potting et al. (2017). The results were sorted, organized and statistically and analytically evaluated.

## 3. Results

The investigation showed that all Norwegian cities surveyed have their own official websites. It is noteworthy that only 8 of the 25 Norwegian municipalities surveyed, i.e. only 32 %, have a website in English and 68 % of them have a website in Norwegian only, and exceptionally some of the websites link to the Google translation option.

The qualitative analysis of the websites has enabled an overview of the circular activities presented by the major Norwegian cities. The following Table 2 shows the total number of identified circular activities presented on the websites of each analyzed Norwegian city.

Table 2. Numbers of circular activities on the websites of the monitored cities

| City | No. of identified activities | City | No. of identified activities |
|---|---|---|---|
| Bergen | 5 | Nordre Follo | 5 |
| Trondheim | 4 | Sarpsborg | 2 |
| Stavanger | 12 | Tønsberg | 1 |
| Bærum | 15 | Skien | 1 |
| Kristiansand | 3 | Bodø | 6 |
| Drammen | 2 | Moss | 2 |
| Asker | 20 | Larvik | 2 |
| Lillestrøm | 6 | Indre Østfold | 2 |
| Fredrikstad | 5 | Arendal | 4 |
| Sandnes | 4 | Lørenskog | 1 |
| Tromsø | 2 | Karmøy | 2 |
| Ålesund | 3 | Ullensaker | 5 |
| Sandefjord | 6 | | |

Table 3. Activities of Norwegian cities in the field of smarter product use and manufacture

| Circular strategy | Description of city activity | Engaged cities |
|---|---|---|
| R0 – Refuse | Grant support for the purchase of cloth diapers to avoid the consumption of non-organic disposable diapers | Asker, Sandnes, Stavanger |
| | Efforts to shift all personal transport around the city to public transport, walking and cycling | Ålesund, Kristiansand, Larvik, Lørenskog, Moss, Nordre Follo |
| R1 – Rethink | Creating and supporting coworking centers to foster innovation in sustainable solutions | Asker, Kristiansand, Larvik, Lillestrøm |
| | Creating smart multifunctional transport hubs and terminals to reduce the number of cars in the city | Asker, Bærum, Bergen, Drammen, Stavanger, Tromso |
| | Promoting urban transport through shared electric vehicles | Bodø, Moss |
| | Use of car sharing by City Hall employees | Ålesund, Bodø, Bergen, Trondheim |
| | Multifunctional infor. system for intelligent outdoor lighting | Bærum |
| | Multifunctional smart water meters for better water manag. | Bodø |
| | Operating a dishware rental service to reduce the use of disposable products | Stavanger |
| R2 - Reduce | Participation in research projects of mutually cooperating municipalities (often international) aiming at the transition to a low-carbon society, contributing to circular practices and efficient use of energy (7 specific projects identified) | Arendal, Asker, Bærum, Bergen, Bodø, Drammen, Kristiansand, Lillestrøm, Stavanger, Trondheim |
| | Achieving energy savings by providing free and non-binding energy advice to the citizens of the city | Asker, Bærum, Fredrikstad, Lillestrøm Sandefjord, Skien |
| | Energy savings thanks to intelligent outdoor lighting system | Tønsberg, Sandefjord |
| | Demand for circular solutions in public procurement | Arendal, Sandefjord, Sandnes |
| | Reducing fossil fuel consumption by promoting the electrification of transport | Alesund, Arendal, Bærum, Karmøv, Lillestrøm, Sandefjord, Sandnes, Stavanger, Tromsø |
| | Promoting the use of renewable energy sources - e.g. solar panels, biofuels and hydrogen. | Bærum, Lillestrøm, Sandefjord |
| | Promotion of low-energy projects and construction of passive houses | Bærum |
| | Interest in reducing emissions, fossil fuel consumption and packaging waste on construction sites | Bærum, Indre Østfold, Lillestrøm, Sandefjord, Sandnes |
| | Efforts to increase citizen engagement in reducing food waste | Asker, Bærum, Bergen, Fredrikstad, Sarpsborg, Stavanger, Trondhaim |
| | Encouraging home and school production of fruit and vegetables to reduce transport and waste | Asker, Indre Østfold |

In Tables 3, 4 and 5 the activities are broken down according to the different categories of circular strategies based on the list of strategies published by Potting et al. (2017). Although some activities naturally cross several R-strategy categories, the activity has always been included in the category that is primary to the activity. Table 3 captures the activities aimed at a smarter product use and manufacture. Table 4 is oriented towards presenting activities aimed at extending the lifespan of a product or its parts, and Table 5 describes activities in the field of useful application of materials.

Table 4. Activities of Norwegian cities in the field of extending the lifespan of product or its parts

| Circular strategy | Description of city activity | Engaged cities |
|---|---|---|
| R3 - Reuse | Information on product reuse on the City Hall website | Stavanger, Ullensaker |
| | A project seeking to create a market system that facilitates the local recovery of the value of unused building materials | Asker, Bærum |
| | Setting up shopping centers for the re-use of things | Asker, Bærum |
| | Organization of the Sunday "garage sale" | Stavanger |
| | Establishment of collection points and recycling stations allowing the handing over and often the purchase of used items | Asker, Ullensaker, Nordre Follo |
| | Shared fridge operation | Asker |
| R4 - Repair | City Hall's website offers tips and links to various initiatives that teach residents how to repair damaged products | Stavanger, Ullensaker |
| | Repairs can be carried out in established buyback centers | Asker, Bærum |
| | Organization of creative reuse courses, it is possible to learn how to repair things in a sustainable and environmentally friendly way | Asker, Bærum |
| | Support for Repair Cafés or repair evenings and groups | Asker, Stavanger, Ullensaker |
| | Repair of brought items at recycling stations | Asker, Nordre Follo |
| R5 – Refurbish | Within the creative reuse courses, participants learn how to upgrade old items in a sustainable and environ. friendly way, etc. | Asker |
| R6 – Remanufacture | Organizing cooking courses from leftovers | Asker, Bærum, Bergen, Fredrikstad, Sarpsborg, Stavanger, Trondhaim |
| | City Hall's website offers citizens tips and links on how to use leftover products to reduce waste | Stavanger, Ullensaker |
| R7 - Repurpose | Responsible approach to unused building materials, their further use in other constructions and purposes - initiative of the town hall | Asker, Bærum |
| | Use of energy and by-products from wastewater treatment plants | Bodø, Sarpsborg |

Table 5. Activities of Norwegian cities in the field of useful application of materials

| Circular strategy | Description of city activity | Engaged cities |
|---|---|---|
| R8 - Recycle | The creation of a sustainable industrial park, where one company's waste could become a commodity in another one's production | Arendal |
| | Building modern recycling stations and treatment plants | Karmøy |
| | A responsible and sustainable approach to waste recycling | Asker, Fredrikstad, Norde Follo |
| R9 - Recover | Use of energy from wastewater treatment plants – heat generation | Bodø |
| | The residual waste that remains after sorting is sent for incineration with energy recovery | Asker, Fredrikstad, Norde Follo |

The numbers of individual activities and the numbers of cities involved in these activities identified within the categories of circular R-strategies are demonstrated in Table 6.

Table 6. The number of identified activities and the number of cities involved in a specific circular strategy

| Circular strategy | Total number of identified activities | Number of cities involved |
|---|---|---|
| R0 - Refuse | 2 | 9 |
| R1 - Rethink | 7 | 13 |
| R2 - Reduce | 10 | 20 |
| R3 - Re-use | 6 | 5 |
| R4 - Repair | 5 | 5 |
| R5 - Refurbish | 1 | 1 |
| R6 - Remanufacture | 2 | 8 |
| R7 - Repurpose | 2 | 4 |
| R8 - Recycle | 3 | 5 |
| R9 - Recover | 2 | 4 |

Table 6 clearly shows that the monitored Norwegian cities communicate to the greatest extent circular activities from the area of the R2 - Reduce strategy, the aim of which is to reduce the consumption of natural resources, materials and energy through their more efficient and sustainable use. From the point of view of the analyzed municipalities, the R1 - Rethink strategy based on more intensive use of resources is also popular, followed by activities using the R3 - Re-use and R4 - Repair strategies.

## Discussion and Conclusions

A detailed analysis of the official websites of selected large Norwegian cities allowed us to answer the set research questions:

Question 1 The research results indicate that the frequency of communicated circular activities on websites does not depend on the size of the municipality according to the number of its inhabitants, but apparently on other factors. The fact that the size of the city does not affect the level of communication may be surprising because, for example, in Europe, large cities such as Amsterdam, Paris, London, Stockholm were the pioneers in the introduction of circular systems (Williams, 2021), and the same is true in other regions. Unfortunately, the scope of our research did not allow us to analyze more deeply the reasons why the Norwegian cities of Asker, Bærum and Stavanger show a higher level of communication of circular activities than other larger Norwegian cities. However, this question could be a suitable topic for future research.

Question 2. It is clear that the monitored Norwegian cities are interested in circular activities, in the research sample, no city was identified that did not mention any circular activity. Only 3 municipalities communicated only one circular activity on their website, which is only 12% of the monitored cities. On the contrary, 10 analyzed municipalities communicate 5 or more circular activities on their website, which is 40% of the monitored cities.

Question 3. An interesting finding within the research was the fact that the structure of communicated circular activities of municipalities does not correspond to the structure of

these activities identified in the literature. While in the literature most activities can usually be identified in the area of strategies R8 - Recycle (Potting et al., 2017), in the cities analyzed, activities falling under the category of strategy R2 - Reduce were the most often mentioned. It is apparently caused by different approaches to solving circular problems from the city's point of view. Businesses more often solve operational and technical problems associated with the production of waste and its recycling or reuse, which corresponds to a number of activities within the Recycle strategy. Rather, cities strive to educate, engage and motivate citizens and businesses to save and use resources more efficiently, which is reflected in the R2 - Reduce strategies.

Question 4. All the circular activities identified on the websites of selected Norwegian cities presented in Tables 3, 4 and 5 can be an interesting example for other cities that are in the phase of preparation or transition to a circular city. The research results revealed the following interesting circular city transition activities:

- Participation in international research projects focused on the development of the circular economy and the transfer of experience with the implementation of various circular activities.
- Orientation to circular principles in the framework of transport in cities – e.g. sharing and electrification of means of transport, creation of multifunctional transport hubs and terminals, etc.
- Involvement of the principles of Industry 4.0 within circular activities in the city – e.g. multifunctional information system within intelligent outdoor lighting, intelligent water meters, etc.
- Circular activity in construction – support of low-energy projects, construction of passive houses, circular approach to building materials, materials and packaging.
- Establishing repurchase centers and recycling stations.
- Web information support of various circular activities directly on the official website of the town hall, where cities offer citizens tips and links to various ways of reusing products, possibilities of their repair, consumption of leftovers, etc.

The identification of the most important circular activities of the monitored cities is partly complicated by the fact that the research was conducted only in Norway. An interesting topic for further research would therefore be to identify the circular activities presented by similar municipalities in other countries as well, e.g. in the Czech Republic, and compare them with each other. Possibilities for follow-up research also result from other limitations of our investigation. The presented research was focused only on the activities that cities communicate, which does not always correspond exactly to the number of activities that might be implemented at the same time. Activities that were intended to be implemented could be published but it is not always clear to what extent they were implemented. On the other hand, cities can implement more activities than they list on their websites. Finding out this fact would certainly require a deeper qualitative analysis based on personal interviewing of the responsible employees of the analyzed cities. The authors also did not address the

identification of factors that influenced the implementation of circular activities in the analyzed cities, which would certainly be interesting for determining the driving forces and limits of the implementation of circular activities within municipalities.

Despite the obvious limitations of our research, we believe that the investigation provided interesting results and topics that can be used in the implementation of circular activities in other cities.

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