SusValueWaste

Mapping Activities in the Norwegian Organic Waste Sector

A survey of Norwegian firms engaged in organic waste activities

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Foreword

This report maps activities of companies in the Norwegian bioeconomy, dealing with organic waste resources. The findings are a result of a survey which is part of the research project "Sustainable path creation for innovative value chains for organic waste products (SusValueWaste)" about better utilisation of organic rest-products. The project is coordinated by the Nordic Institute for Studies in Innovation, Research and Education (NIFU) in collaboration with the University of Oslo (TIK), Østfoldforskning, the Oslo Renewable Energy and Environment Cluster (OREEC), the Norwegian Institute of Bioeconomy Research (NIBIO), the University of Stavanger, the Lund University and the Technical University of Denmark. The project is funded by the Research Council of Norway. The survey has been part of work package 3 of the project and has been conducted by Håkon Endresen Normann who has also written this report.

The aim of the project is to help policymakers better govern and regulate the organic waste industry and the industry actors to identify and exploit new opportunities in the circular bioeconomy. This report highlights that organic waste is currently considered unexploited as a resource by industry actors, and that public policy can play a significant role in stimulating further development related to organic waste.

Antje Klitkou, NIFU

Project coordinator of SusValueWaste

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1 Introduction

This report presents the results from a survey conducted in 2017 of the Norwegian organic waste sector. The aim of the survey has been to map activities and perceptions about organic waste among Norwegian firms. Moreover, the survey has been designed to shed particular light on six sub-sectors of particular interest for the SusValueWaste project. In addition, the population for the survey included a group of respondents outside of these six sub-sectors. The sub-sectors on which the survey has focused are thus:

- aquaculture & seafood processing
- brewing
- dairy
- forestry & wood processing
- meat processing
- waste processing
- other

The survey consisted of 40 questions covering the following areas: mapping of organic waste activities, technology and competence development, drivers and barriers, public policy instruments, costs and financing, collaboration, and innovation activities. The report follows a structure that presents findings from each of these areas.

By "organic waste" (OW) we refer to any form of organic matter (biomass), derived from: food processing industries and other commercial activities (i.e. catering, retail, hospitality), forestry and agricultural activities (i.e. sawdust, vegetable waste, manure, animal waste and by-products, sewage sludge), and households' activities (e.g. kitchen scraps, garden waste).

By "organic waste activities" we mean production activities that concern any form of recycling, energy recovery, reuse, and/or transformation of organic waste (e.g. into higher value and innovative products).

1.1 Description of methods, population and responses

The total population included 304 respondents. Of the total population, 85 respondents (28 %) completed the entire survey. An additional 48 (18 %) responded to the survey but were filtered out of the survey as they responded that they had no organic waste related activities. These were asked to

complete three questions about future potential (results from this presented in section 4.1). Thus, a total of 133 respondents (46 %) completed the survey.

Fig. 1 (below) shows the distribution of the population and complete responses across the sub-sectors. This figure also shows the distribution of those that reported to have no activity in organic waste. The figure shows that there are only three sub-sectors (meat processing, waste processing, and other) with a reasonable number of responses. In some of the subsequent analyses, the other sub-sectors (aquaculture & seafood processing, brewing, dairy, and forestry & wood processing) have been classified as *other*. The sub-sector labelled *other activities* in fig. 1 consists of a number of research institutes.

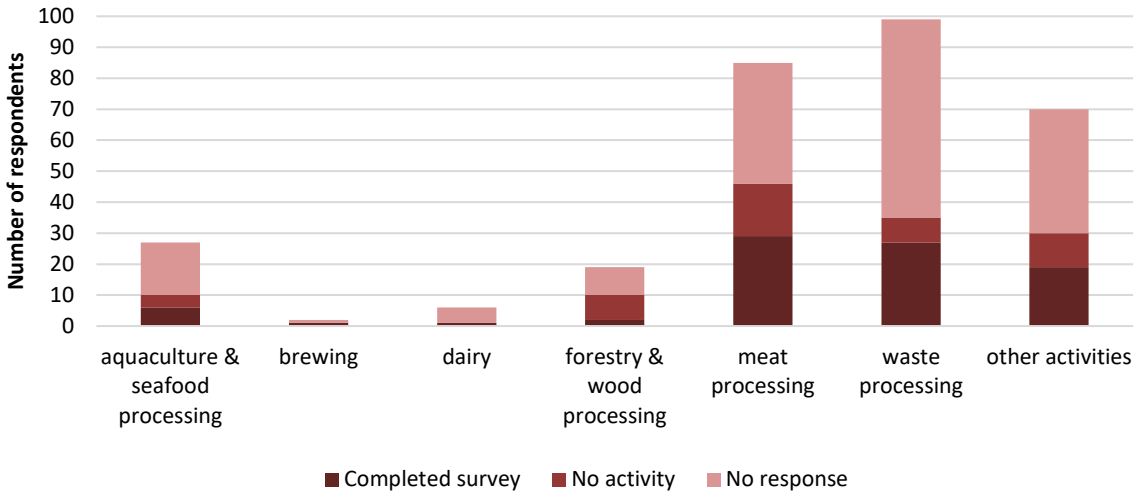

Fig. 1. Distribution of respondents across sub-sectors.

2 Description of activities

This section provides an overview of the types of activities that the respondents are engaged in, the type of feedstock they use, and the relative size of the economic activity in organic waste.

Fig. 2 shows that recycling and energy recovery are the most common activities. Recycling refers to composting of anaerobic digestion of collected OW, with the utilization of compost or digestate for agricultural uses, urban gardening, etc. Energy is typically recovered as heat and power. More than half of the respondents are engaged in *recycling* activities and about one-third in *energy recovery*.

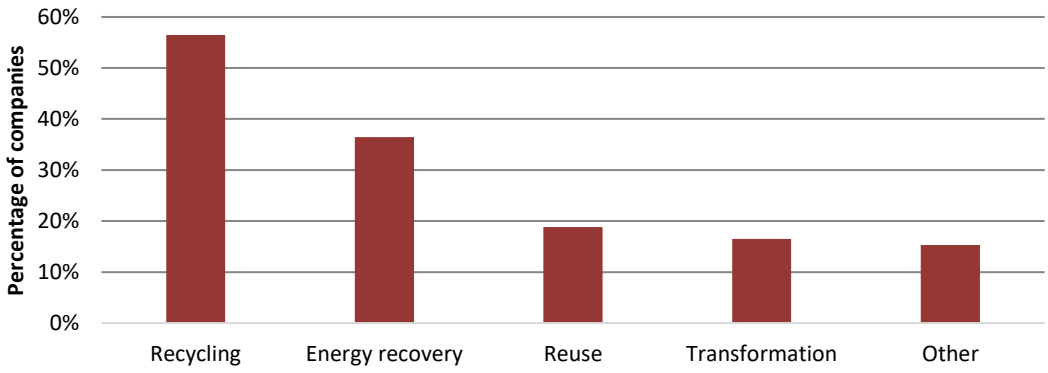

Fig. 2. Distribution of respondents across organic waste activities.

The activity is fairly widely distributed across Norway, as Fig. 3 shows, yet there is somewhat more concentrated activity in the areas around the capital region and inland (though only one in Oslo).

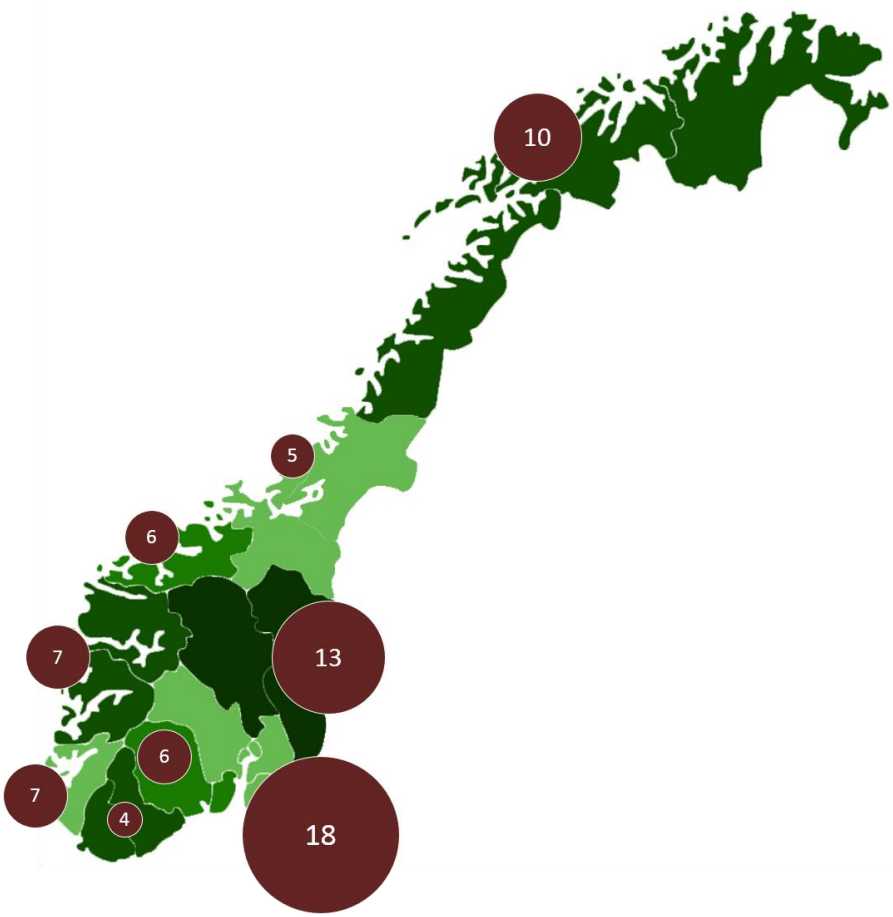

Fig. 3. Geographical distribution of respondents across regions.

2.1 Size of economic activity

With the survey, we wanted to capture the size of the economic activity that the respondents dedicate to organic waste. The survey, therefore, included questions about turnover and employment related to organic waste activities.

Three-quarter of the companies consider organic waste related activities as a supplement to their core activities. Thus, only one-third of the companies consider these activities to be their core business. We can therefore expect that many companies have only minor activity related to organic waste. The figures below provide more details to this picture.

In fig. 4, the respondents have been split into four groups depending on the share of total turnover that are based on organic waste related activities. The figure shows that close to one quarter attribute less than 5 percent of turnover from organic waste activities. However, this figure also shows that organic waste activities represent more than 80 percent of total turnover for around one quarter of the respondents.

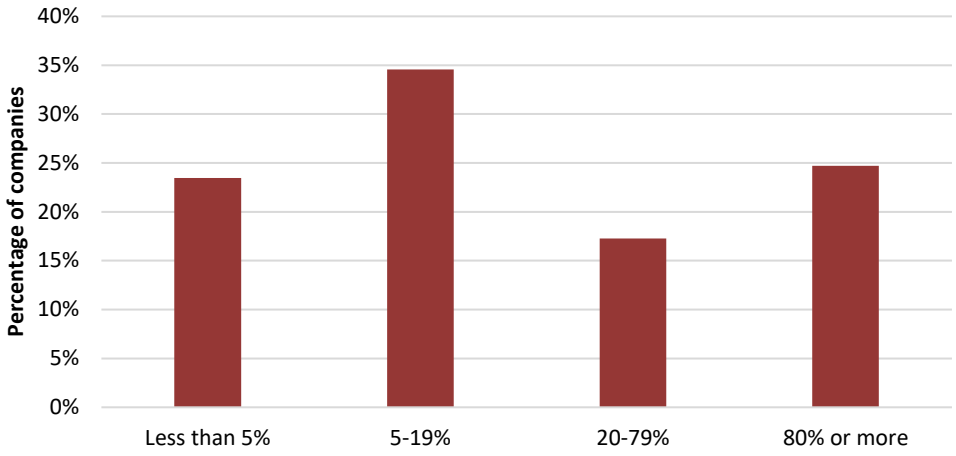

Fig. 4. Share of total turnover from organic waste related activities. Reported average over last three years.

Moving on to total levels of activity, rather than share of total activity, fig. 5 shows the number of full-time equivalents that the respondents dedicate to organic waste related activities. This figure further shows that organic waste represents a small activity within many of the firms. Yet, this figure also reflects that there are many small firms in the total population.

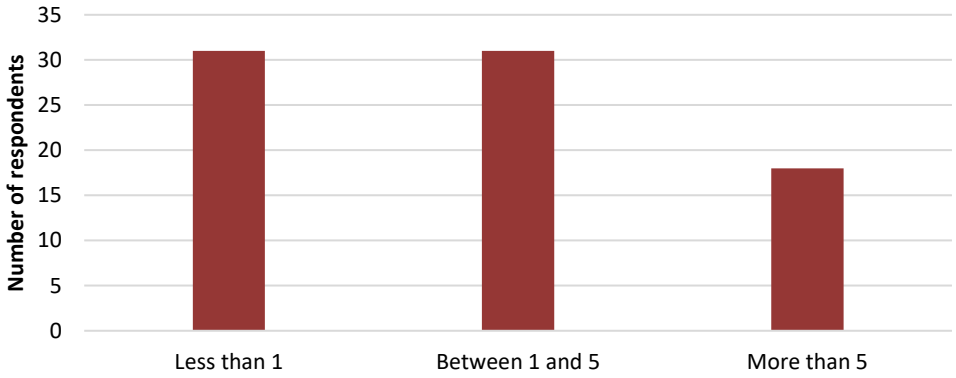

Fig. 5. Full-time equivalents dedicated to organic waste related activities (n=80). Reported average over last three years.

2.2 Activities and feedstock

In the survey, the respondents were asked about the importance of different types of organic waste activities, and the importance of different types of feedstock. Fig. 6 shows that many of the respondents take part in organic waste value chains by resources, products, or technology to other actors. More than half of the respondents provide organic waste related products or services to other companies, many of the firms transform organic waste into new products for end users, whilst 14 companies develop new technologies to be sold to other firms.

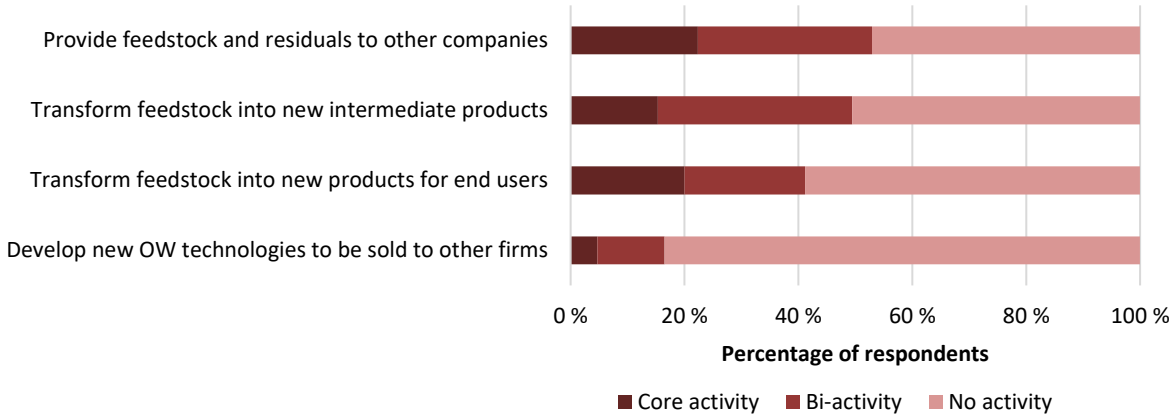

Fig. 6. Significance of the activities related to organic waste for the business.

One observation from the survey results is that the population of companies engaged with organic waste related activities is heterogeneous in terms of size, location, sub-sector, and types of activities. This also applies to the types of feedstock that the respondents use or produce. In fig. 7, we asked the respondents to rate 13 different types of feedstock in terms of how important these are to the company. *Animal manure* is overall the most important, reflecting the large representation of meat processing firms in the population. However, many other types of feedstock are also considered very, or quite, important.

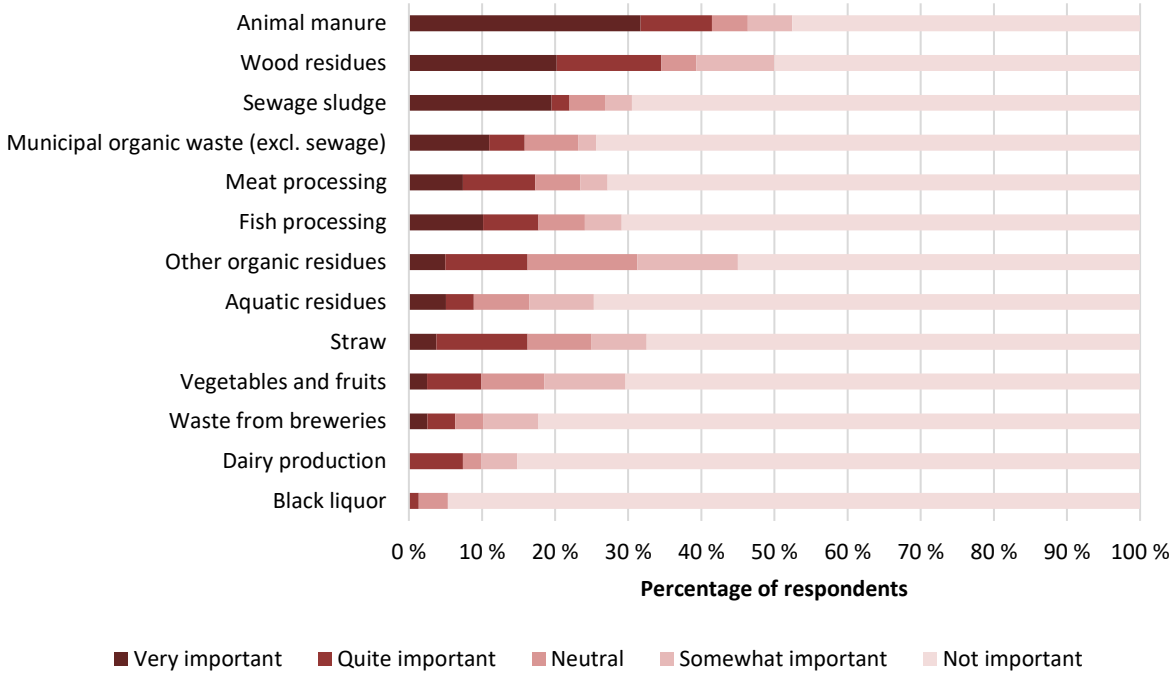

Fig. 7. Importance of different types of feedstock.

More than half of the respondents source the feedstock from the firm's own production activities. However, some of the respondents also acquire feedstock from other companies (see fig. 8).

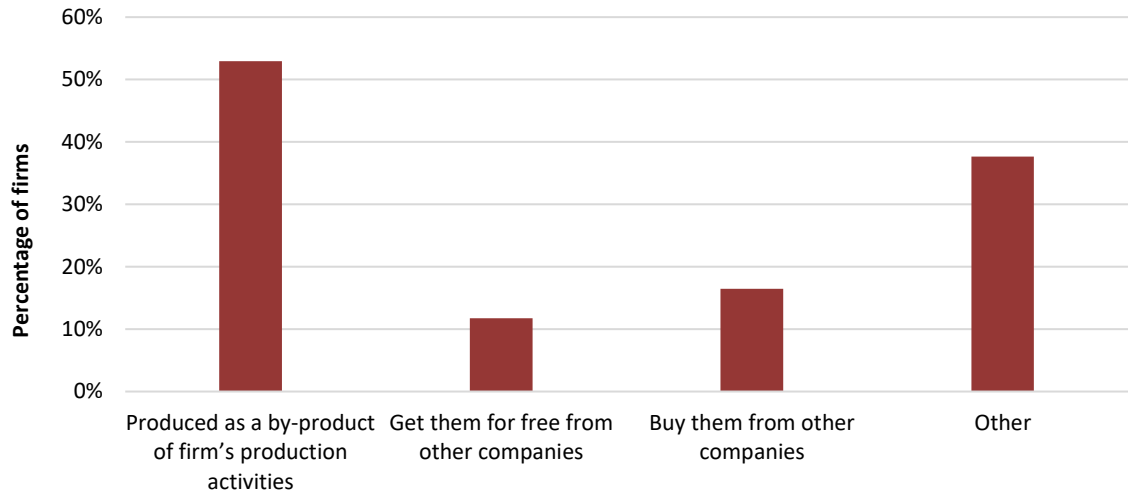

Fig. 8. Sources from which the respondents get hold of bio-based feedstock.

3 Technology and competence

Knowledge and competence development is important for building up new industrial activity. It is therefore useful to understand the relative importance of different sources of competence development. Fig. 9 shows that, in addition to *training of existing staff, internal and external R&D* is the most important source of competence development.

About one-third of the respondents consider *purchase of new machines* as either very or quite important for competence development. An even greater share (42 percent) has in fact purchased new machinery related to organic waste activities in the last three years.

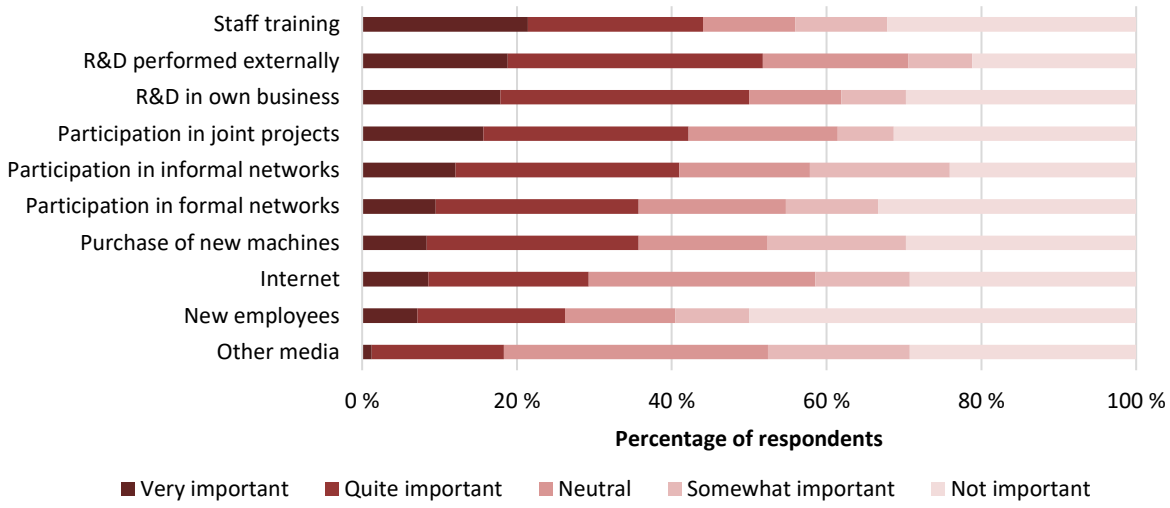

Fig. 9. Importance of different activities for internal competence development.

4 Drivers and barriers

An important motivation for this survey was to get a better understanding of general drivers and barriers for firms engaged in organic waste activities. We therefore asked respondents about factors influencing taking up organic waste related activities and barriers for further development of such activities.

Fig. 10 shows that *public financial support* has been very, or quite, important for just over half of the firms responding to this question. In addition, *regulations and standards* have also been important with more than one quarter considering this to be very important. Thus, public policy has played an important role for starting up organic waste related activities. However, *a desire to exploit by-products* from core activities has also been an important driver.

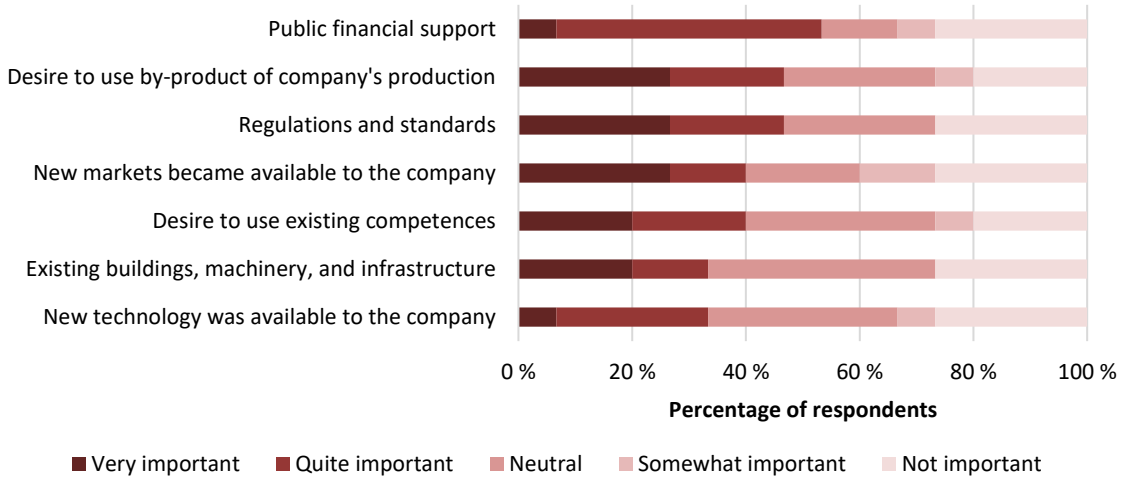

Fig. 10. Importance of different factors for starting up activity.

The respondents also consider public policy to be important for the continued development of products related to organic waste. Fig. 11 shows that *regulations and standards* together with *lack of public financial support* are seen as the two most important barriers for further development of organic waste related activities.

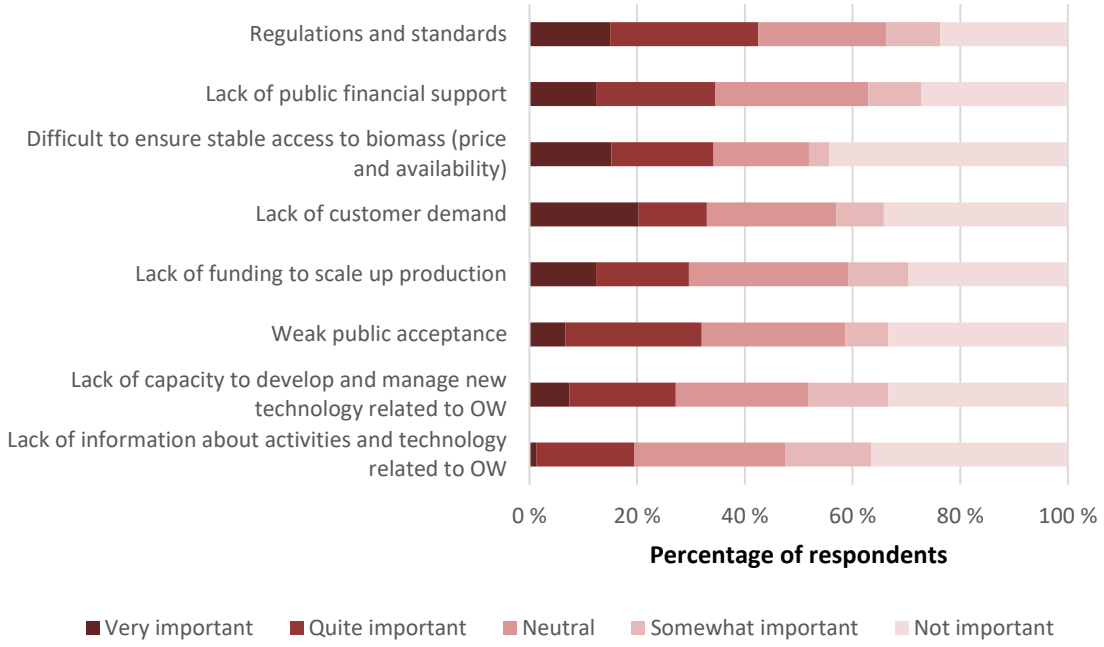

Fig. 11. Importance of different barriers to developing products related to organic waste.

Fig. 12 shows that there are differences between the main sub-sectors with regards to the importance of these barriers. First, lack of customer demand and (insufficient) regulations and standards are notably more important to firms in waste processing than in meat processing. Stable access to biomass is most important to the other sub-sectors (which include research institutes and aquaculture & seafood processing. The lack of public financial support, however, seems to equally important across the sub-sectors.

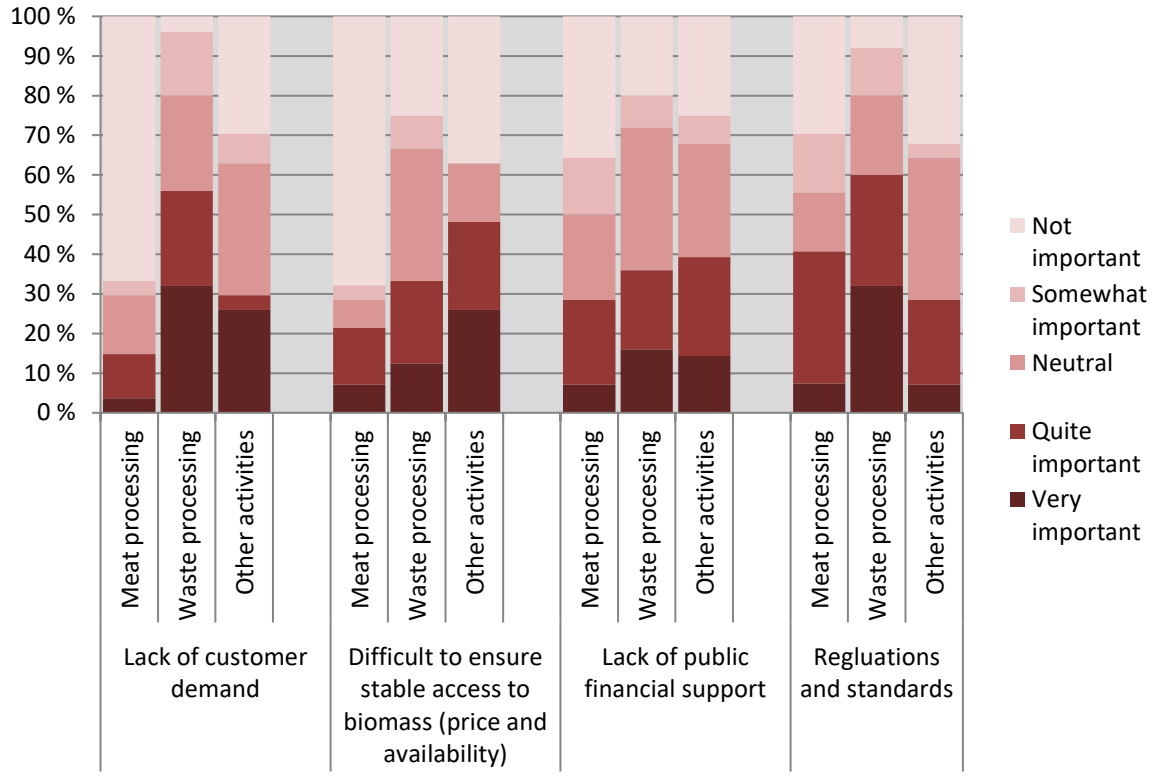

Fig. 12. Importance of different barriers to developing products related to organic waste. Split between sub-sectors: meat processing, waste processing, and other sub-sectors.

4.1 Unexploited opportunities

More than 60 percent of the respondents currently engaged in organic waste related activities believe that there are unexploited opportunities related to organic waste. Moreover, about one third of the respondents that report no current activity recognize that there are opportunities related to organic waste that have not been exploited (see fig. 13).

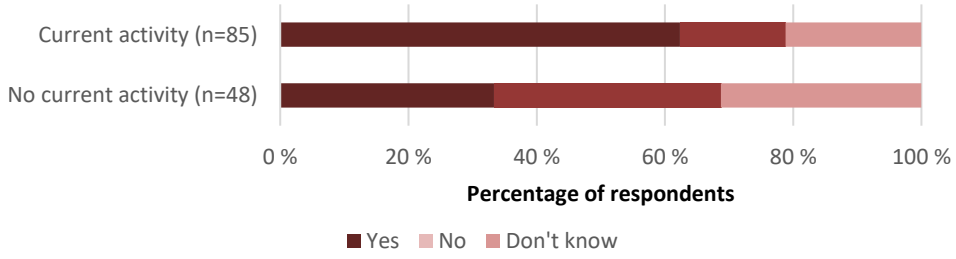

Fig. 13. Are there unexploited opportunities related to organic waste activities?

It is particularly in the meat processing sub-sector where the largest share of respondents see opportunities to increase organic waste related activity (Fig. 14).

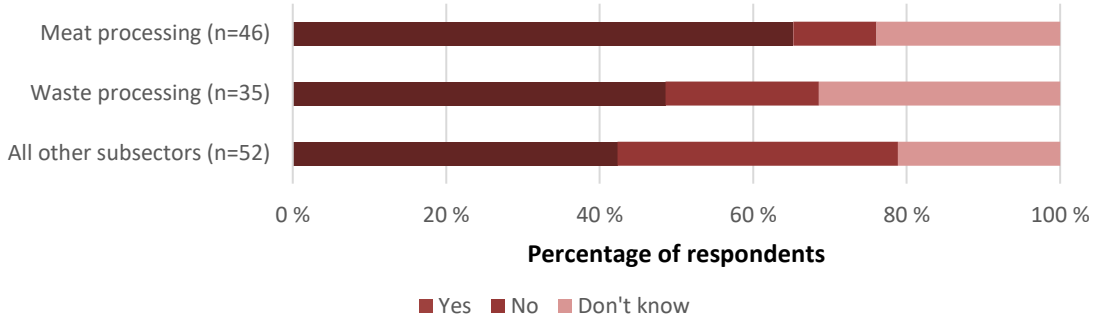

Fig. 14. Are there unexploited opportunities related to organic waste activities?

It is here interesting to note that whereas public policies are seen as the most important factors when it comes to developing current activities, *long-term supply of raw materials* is seen as the most important factor for the exploitation of new opportunities. In fact, more than half of the respondents (whom pointed to unexploited opportunities) consider this factor very important (fig. 15).

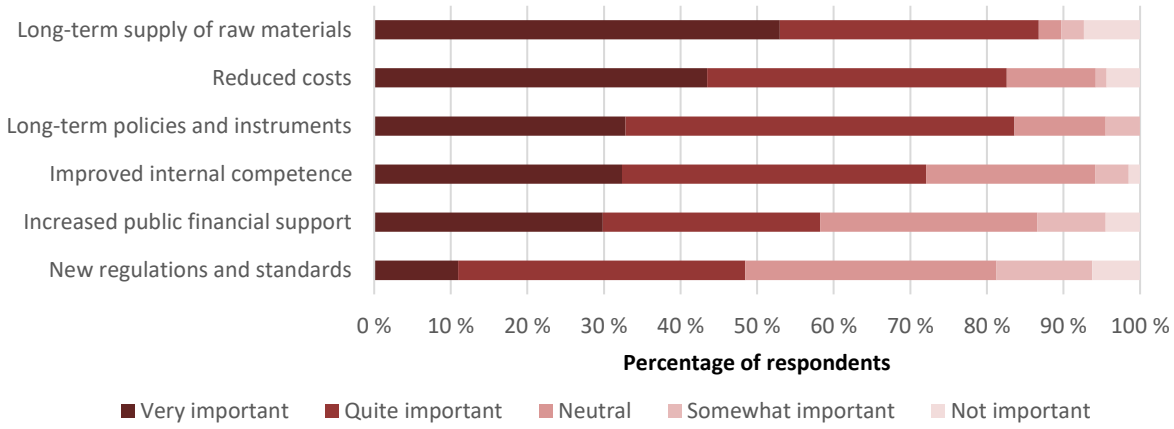

Fig. 15. Importance of different factors for the business to exploit these opportunities associated with organic waste.

Around half of the firms (35 of 69) would source the feedstock either solely from other companies or from a combination of the firm's own by-product and other companies. Facilitating stabile and long-term access to feedstock from other companies might be one potential area that could help firms exploit new opportunities related to organic waste.

5 The role of public policy

The above section on barriers and drivers suggest that public policy can play an important role in stimulating further development related to organic waste. Furthermore, the lack of appropriate policy might hinder such development. Yet, as sections 0 and 0 show, the firms in the Norwegian organic waste sector are heterogeneous in terms of sub-sector, firm size, degree of dedication to organic waste, and in terms of physical location. Thus, we might find that different types of firms rely on or call for different types of public policies.

As a way of opening up the topic of public policy, the respondents were initially asked two open-ended questions. First, the respondents were asked to name the public policy instrument that has been most important for enabling the business to engage in activities related to organic waste. The answers where standardized and grouped into broader categories. Fig. 16 shows that close to one third of the respondents point to *public investment subsidies* as the most important type of instrument. However, it is also noteworthy that 12 out of the 60 firms responding to this question did not see any public policies as important for their engagement in organic waste.

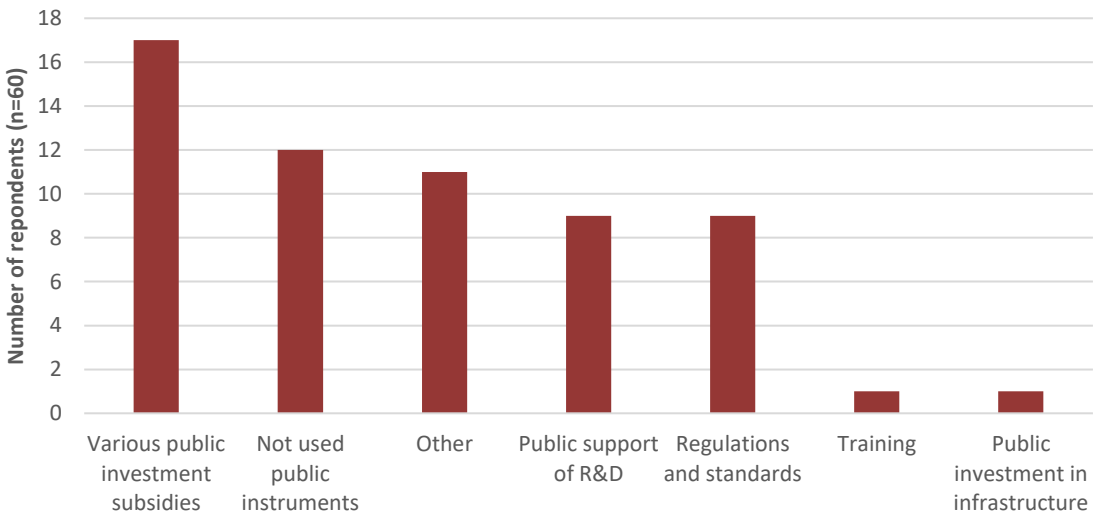

Fig. 16 Most important public instrument that has enabled the business to engage in activities related to organic waste. Respondents were asked an open ended question and to name the most important policy instrument. Responses grouped in categories.

The survey data allows us to look at the responses split across sub-sectors. Fig. 17 (below) shows that there is some variation that is worth pointing out. First, when we look only at the two largest groups (see section 1.1) – meat processing and waste processing – *regulations and standards* is referenced as much as public investment subsidies. Further, *public support of R&D* is mainly referred to by firms in the other sub-sectors. This is not surprising considering that many of these firms are research institutes.

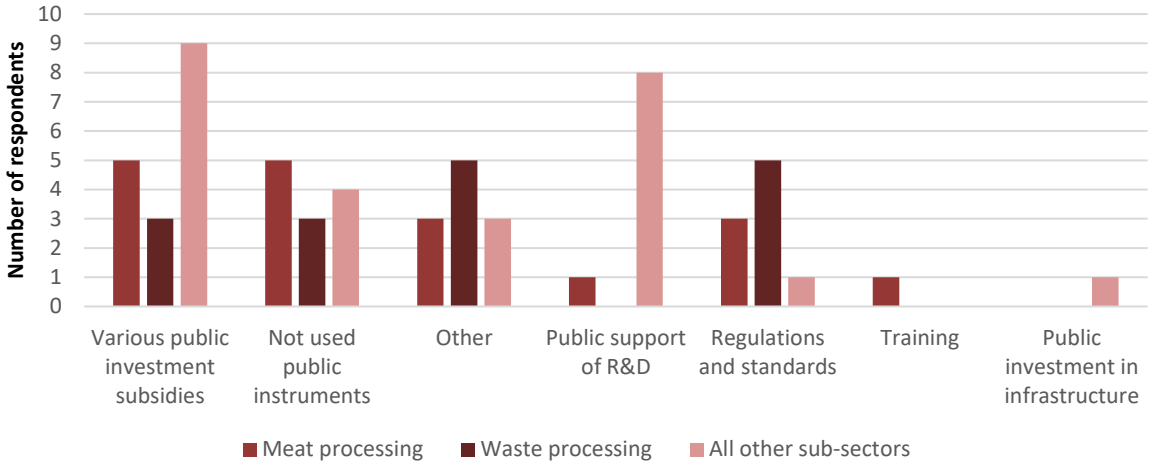

Fig. 17. Most important public instrument that has enabled the business to engage in activities related to organic waste. Distributed across sub-sectors.

The respondents were also asked which instrument policy makers should introduce (or improve) that would better the conditions for developing existing or new organic waste related activities (see fig. 18). Once more, *various forms of public funding* is seen as important for firms' ability to further develop existing organic waste activities. *Stricter regulations* is also mentioned by many of the respondents.

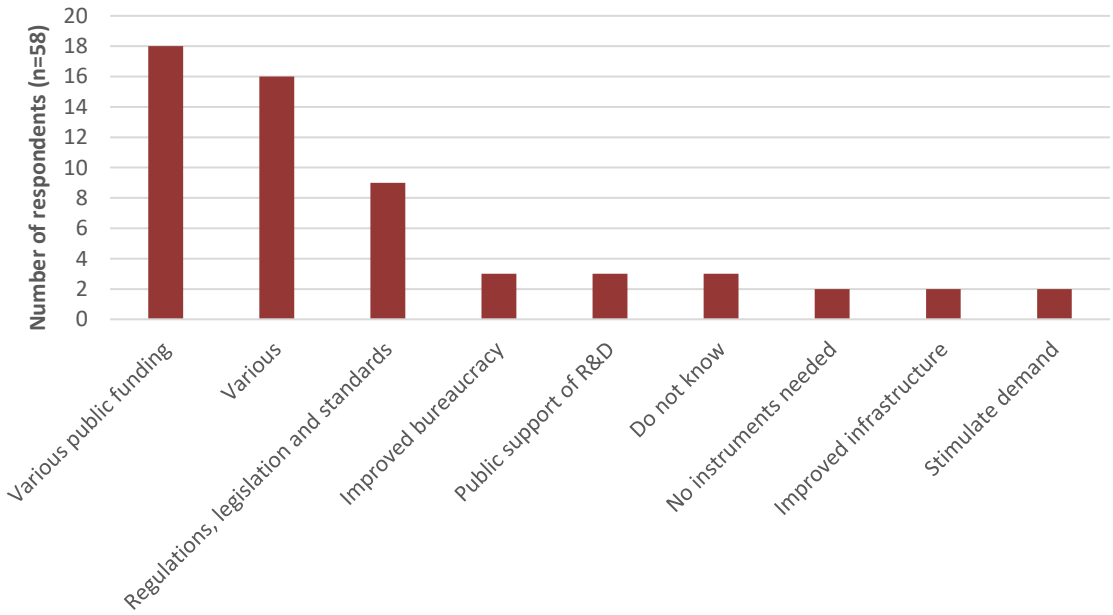

Fig. 18. Respondents were asked the open ended question: "What policy should politicians introduce (or improve) that would improve the conditions for developing existing or new activities related to organic waste in your firm?" Responses grouped in categories.

Once again, when we look at the two largest sub-sectors in the population, we see some clear differences (see fig. 19). Most notably, respondents in the waste processing sector point mostly to

regulations, legislation and standards as well as various other instruments as most important for further development.

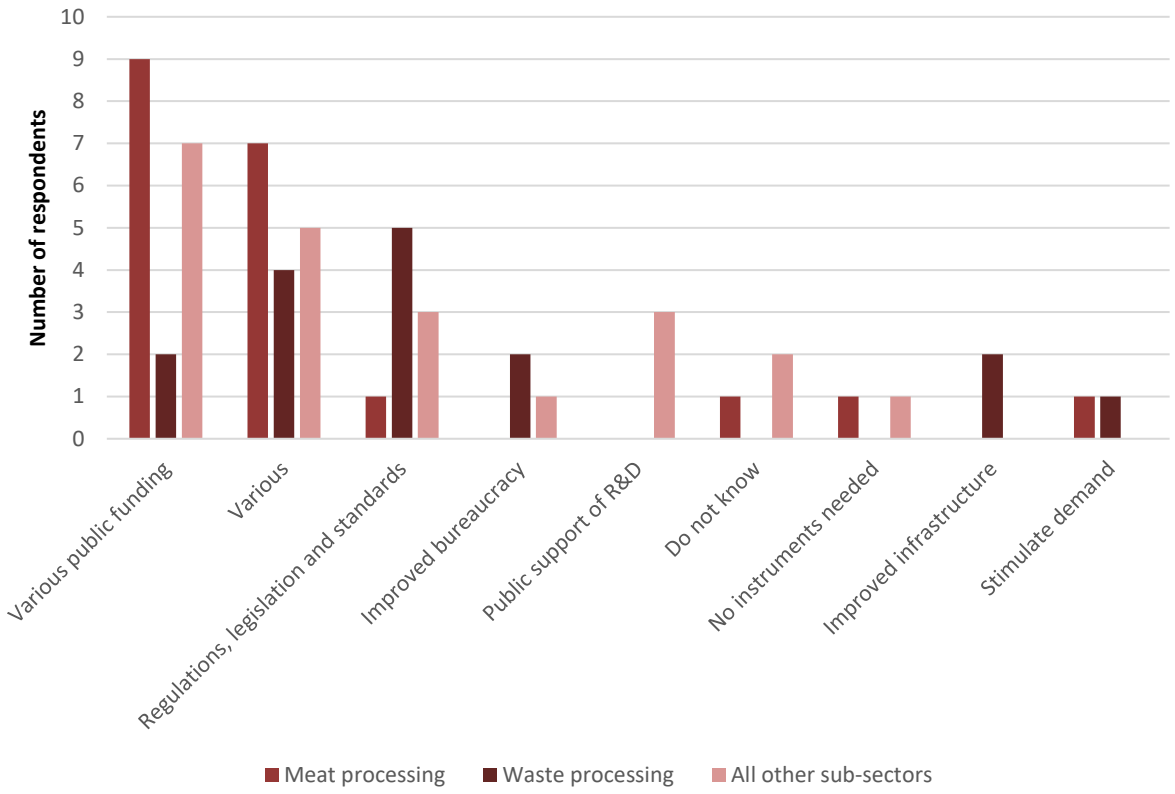

Fig. 19. Respondents were asked the open ended question: ”What policy should politicians introduce (or improve) that would improve the conditions for developing existing or new activities related to organic waste in your firm?” Responses grouped in categories, distributed across sub-sectors.

Finally, the respondents were asked to rate 9 types of policy instruments, according to their importance for further development and profitability for organic waste activities. Fig. 20 (below) shows that when given these alternatives, environmental regulations and standards as well as various forms of R&D support are considered most important.

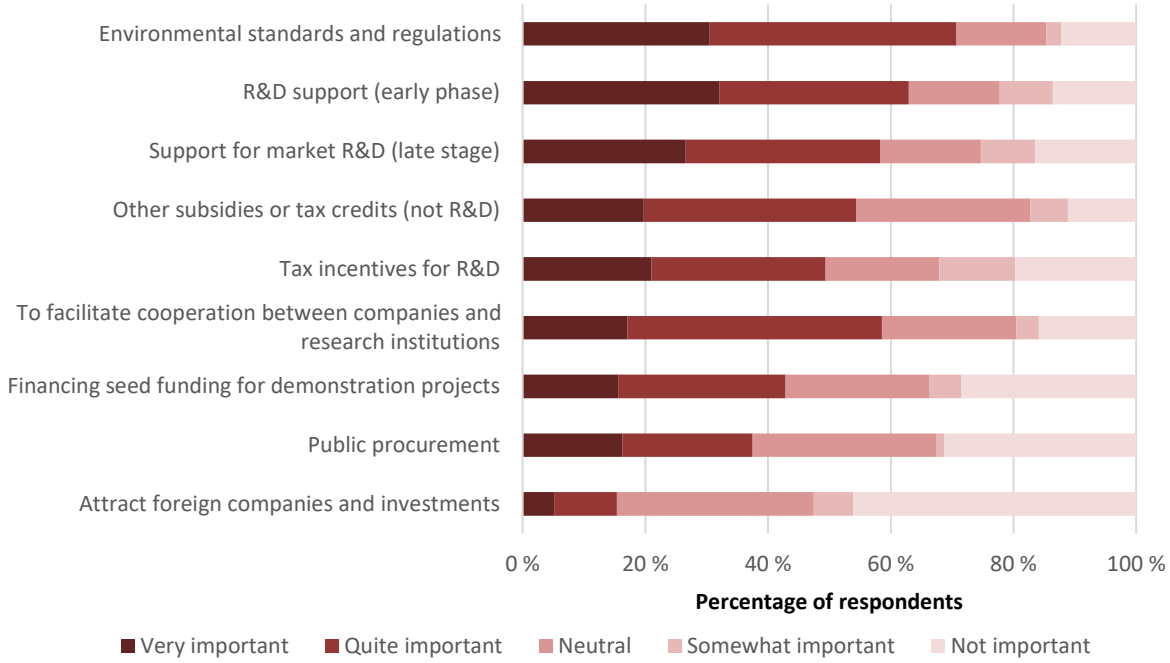

Fig. 20. Importance of different policy measures to support further development and profitability for activities related to organic waste.

Also here we can observe differences when we compare the sub-sectors of meat processing, waste processing and all other sub-sectors (see fig. 21). If we only focus on *standards and regulations*, and *R&D support (early phase)* we can see that R&D support is by far the most important instrument to the other sub-sectors. Regulations and standards remain more important to the meat and waste processing sub-sectors.

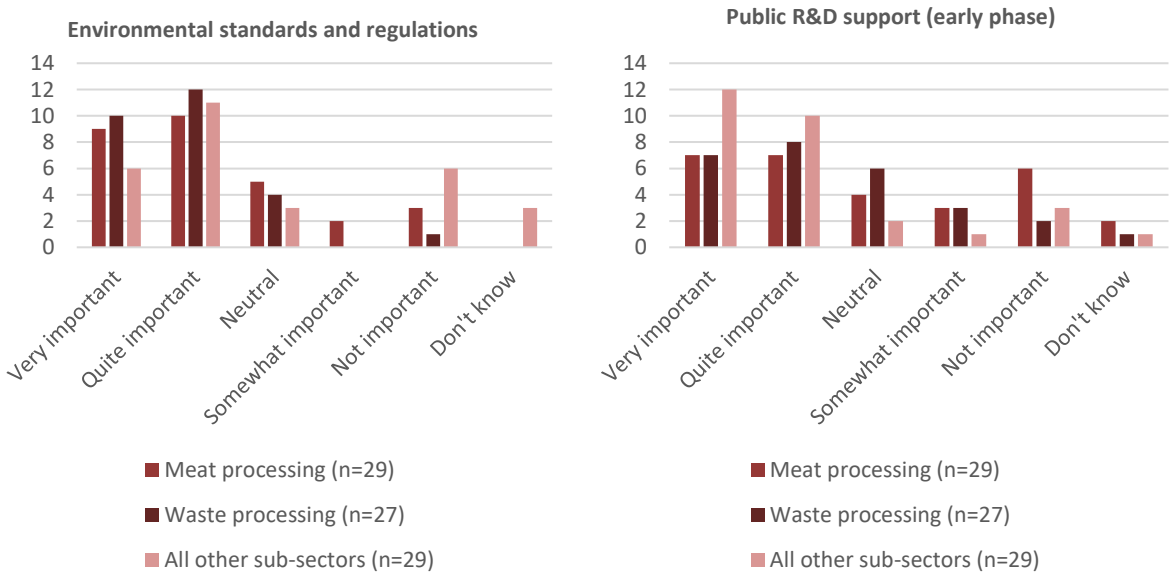

Fig. 21. Importance of selected policy instruments to the meat processing, waste processing, and all other sub-sectors.

6 Financing

New activities, such as those related to the exploitation of organic waste, requires funding. Section 5 shows that various forms of public financial subsidies such R&D funding, investment support and tax credits are considered important policy instruments by most of the firms in the survey. Fig. 22 (below) shows that these activities are financed over the firm's balance. *Subsidies and tax deductions* are also important, whilst close to 40 percent of the respondents see bank loans as either very or quite important. It is worth noting that only 16 percent of the respondents consider *venture capital* an important source of funding. We cannot tell from the survey whether this is due to lack of access to venture capital in Norway or because the nature of the organic waste activities are less compatible with this type of funding. This could be explored through more in-depth case studies.

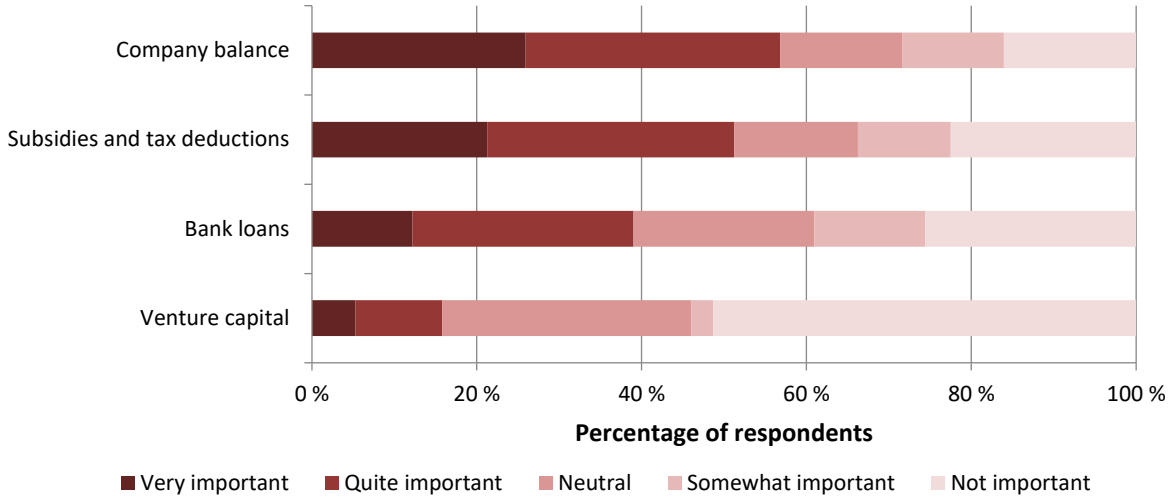

Fig. 22. Importance of different sources of funding for the firms' business related to organic waste.

7 Collaboration

New technology and new industrial activity is driven by innovation. Innovation often occurs through collaboration between firms and between firms and other types of actors. We therefore asked the respondents about the type of collaboration that they have been engaged in, related to organic waste activities. 54 percent (46 respondents) responded that they have participated in collaboration in relation to organic waste activities in the last three years. The figures on collaboration refer to these 46 respondents.

First, very few respondents collaborate much with international partners. Three-quarters of the group that have participated in collaboration have done so with only or mostly Norwegian actors (see Ffig. 23).

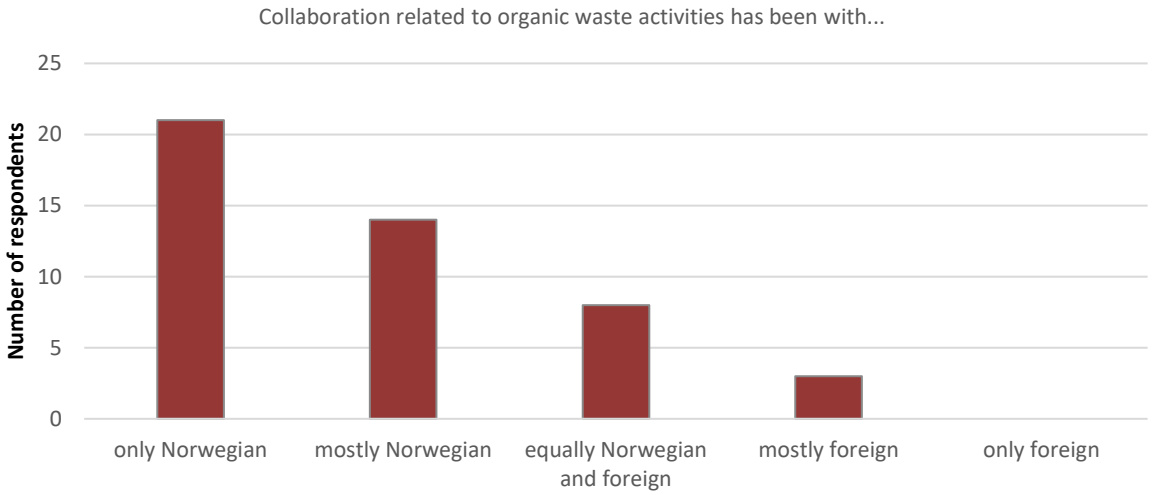

Fig. 23. Responses to whether collaboration related to organic waste activities has been with Norwegian or foreign actors.

Collaboration with customers is seen as the most important type of collaboration. However, we can also see that more than half of the firms that have collaborated see *collaboration with research* institutes and universities as either very or quite important. It is interesting to note that close to 50 percent consider *collaboration with the state or municipality* important for organic waste related activities (see fig. 24).

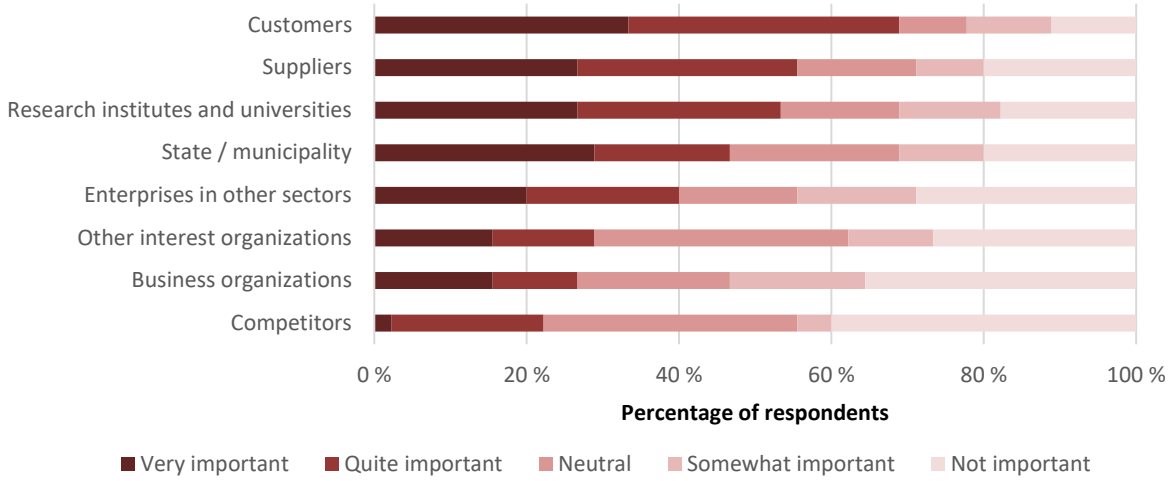

Fig. 24. Importance of organic waste related collaboration with different types of actors (n=46).

Finally, we asked the respondents about their motivations for collaboration in relation to organic waste activities. Here, we also find variation across the sub-sectors. Figures 25-27 show that for meat processing firms, *access to capital* is the most important motivation for collaboration, whereas this is the least important motivation for actors in the waste processing sub-sector. For the other sub-sectors (many whom are involved in research), *access to markets and technology development* are primary drivers for collaboration. These differences are perhaps not surprising, but nonetheless important to consider if we are to look at organic waste as one sector.

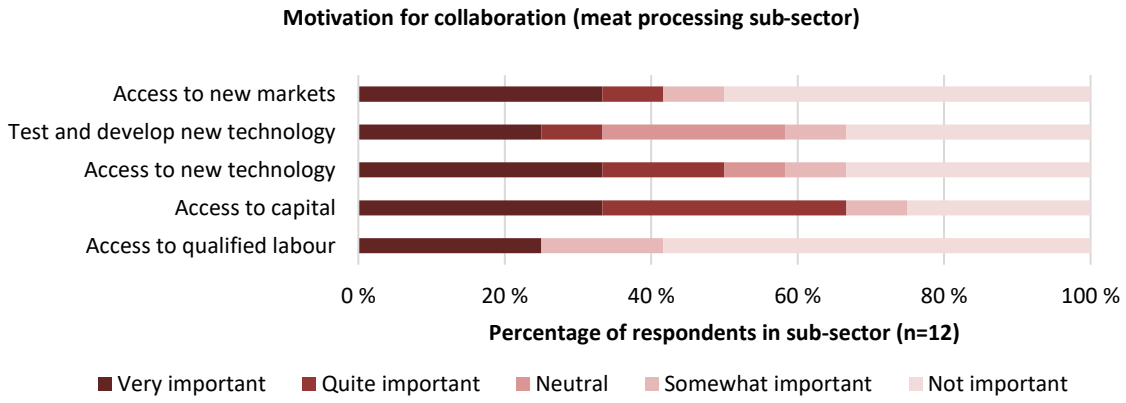

Fig. 25. Motivation for participating in collaboration (meat processing sub-sector).

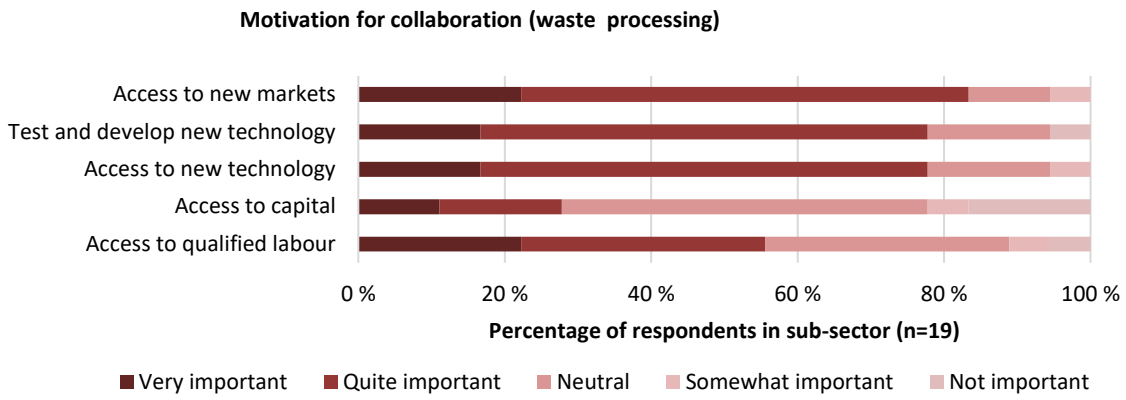

Fig. 26. Motivation for participating in collaboration (waste processing sub-sector).

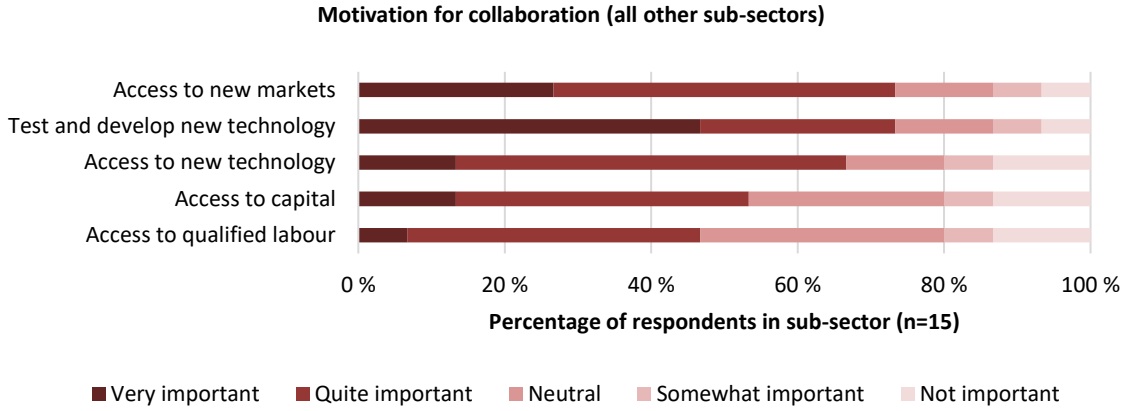

Fig. 27. Motivation for participating in collaboration (all other sub-sectors).

8 Innovation activities

Investments in knowledge creation through research and development is important for stimulating innovation. Of the 85 firms in the survey, 31 (37 percent) responded that they have made investments in R&D in the last 3 years. From fig. 28, we can see that only one in five firms in the meat processing sub-sector have invested in R&D, whilst nearly every other firm in waste processing and in the other sub-sectors have made R&D investments.

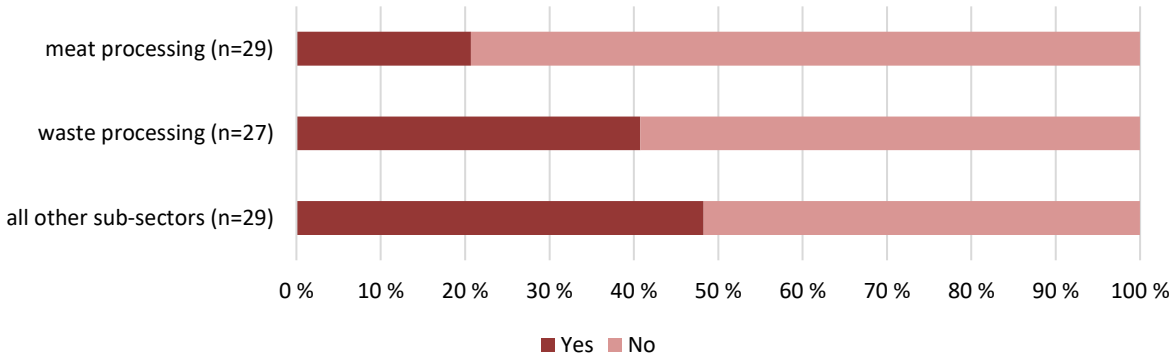

Fig. 28. Percentage of respondents that have invested in organic waste related R&D in the last 3 years (yes), split between sub-sectors.

Fig. 29 shows that a large share of the respondents dedicate 20 percent or less of their total R&D budget towards organic waste related activities. This is not surprising considering that only one quarter of the respondents consider organic waste their core activity (see section 2.1). Fig. 29 also shows that the firms with organic waste as a core activity dedicate a substantial share of their total R&D budgets towards such activities.

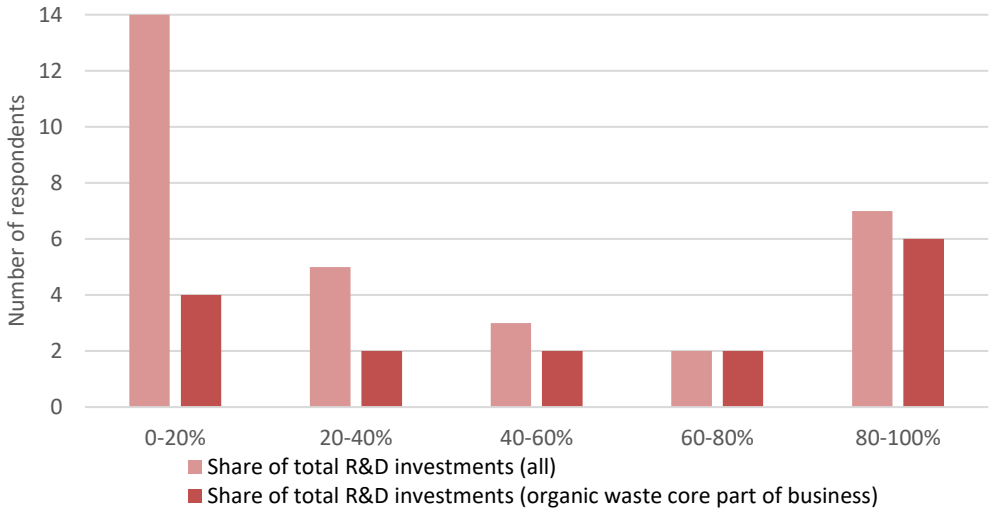

Fig. 29. Share of total R&D investments dedicated to organic waste related activities. All respondents that responded to this question (n=31) compared with respondents with organic waste as core part of business (n=16).

Finally, innovation is more than research and development. Many other types of activities and investments can contribute to a firm's innovative capacity. The firms in our sample have made many of these other types of investments. From fig. 30, we see that nearly half of the respondents have invested in *improvements in the effectiveness of existing activities.* This is an example of incremental innovation, which can be very important for making activities profitable to the firm. A large share of the respondents (39 percent) have also invested in *new buildings or infrastructure.*

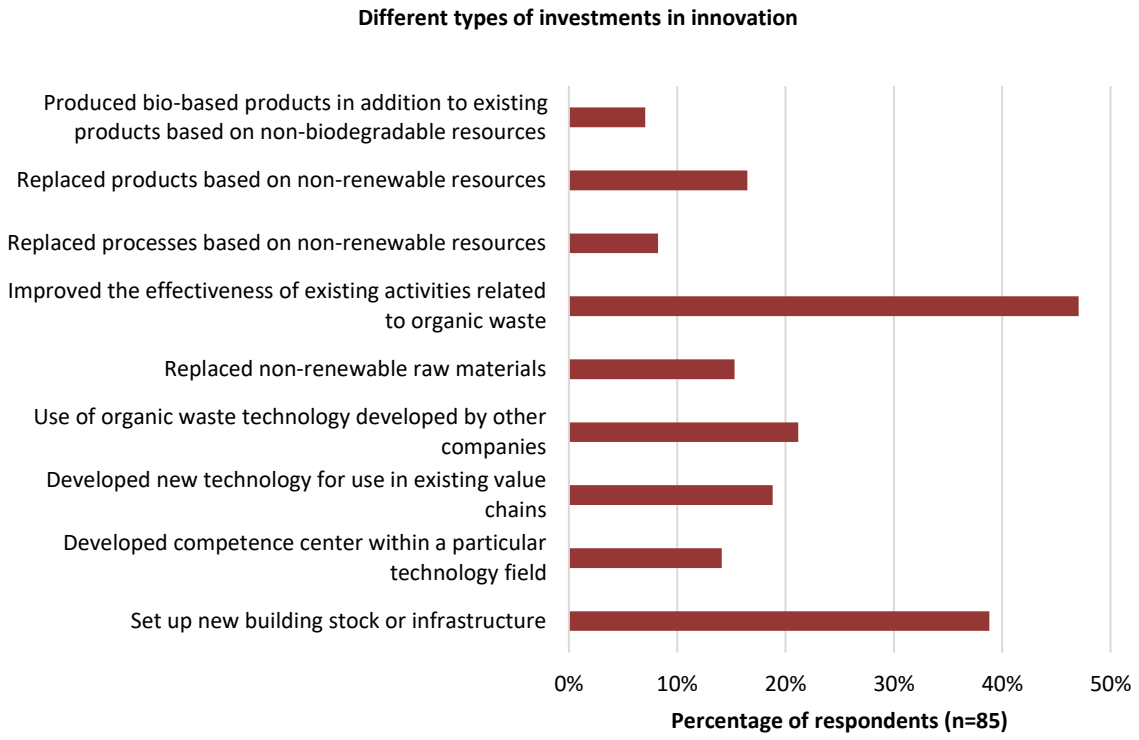

Fig. 30. Percentage of firms that made different types of investments in innovation activities in the last 3 years.

The section above shows that many of the firms can be referred to as innovative firms. Only 16 respondents (19 percent) report to not have made any form of investment in the innovation activities presented in section 0. Many of these firms belong in the meat processing sub-sector and many of them employ less than 5 full-time equivalents.

8.1 Product and process innovation

To further explore the potential output from investments in innovation activities, we asked whether the respondents had introduced and commercialized new products or services related organic waste in the last three years. 21 percent of the respondents had introduced and commercialized a new product, whereas 29 percent had commercialized a new process.

We also asked which type of organic waste activities these new products and services were related to. Fig. 31 shows that most of the product innovation has occurred related to recycling and transformation activities. Most of the process innovation has occurred related to pre-treatment and fermentation.

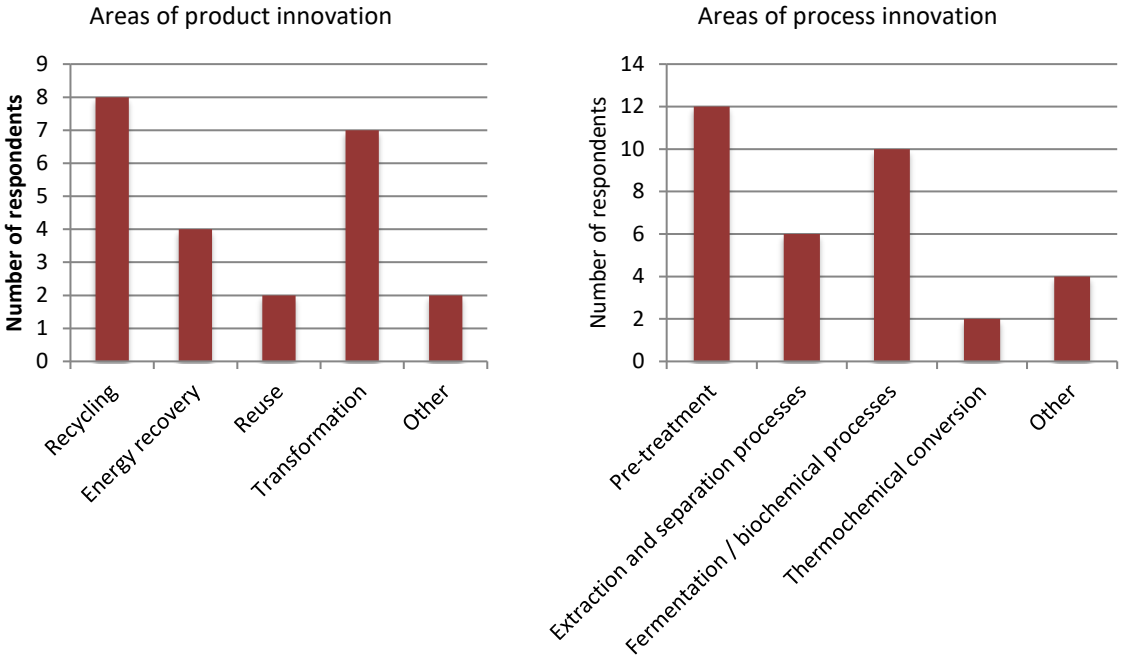

Fig. 31. Responses to which areas product and process innovation has occurred.

9 Summing up

The survey results presented here maps activities among companies in the Norwegian organic waste sector. The respondents of the survey represent six sub-sectors, including: aquaculture & seafood processing, brewing, dairy, forestry & wood processing, meat processing, and waste processing. The survey respondents (133 in total) answered questions on organic waste activities, technology and competence development, drivers and barriers, public policy instruments, costs and financing, collaborations, and innovation activities. Some of the highlights of the study follows. One-third of the firms considered organic waste related activities to be their core business, while three-quarter saw them as a supplement to their core activities. When rating which feedstock that was of the highest importance to the company, animal manure, followed by wood residue and sewage sludge, came out on top. The most important factors in regards to starting up organic waste related activities were 1) public financial support, 2) the desire to use by-product from the firm's production, and 3) regulations and standards. In terms of innovation activities, nearly half of the respondents reported to have invested in improvements in the effectiveness of existing activities, and more than a third invested in new buildings or infrastructure. 19 percent, many of these from the meat processing sub-sector, reported to not have made any form of investment in the innovation activities presented in this study. Both the respondents who engaged in organic waste related activities and those who didn't believe that there are unexploited opportunities related to organic waste. Public policy is expected to play a significant role in stimulating further development related to organic waste.