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Modelling job creation in the circular economy in Flanders

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Modelling job creation in the circular economy in Flanders

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Summary

Framed within the Flemish policy research centre Circular Economy, this research paper is the second output of the research line that studies employment and actor analysis for the circular economy (RL 6).

This research paper presents the summary of an assignment conducted for the Department of Work and Social Economy of the Flemish Government, with support from the Flemish policy research centre Circular Economy. The goal of this research paper is to investigate the impact of the transition to a more circular economy in Flanders on employment. In order to be able to estimate this impact, we firstly want to understand what "the circular economy" actually means and how we can demarcate it at NACE-code level. Secondly, we want to get an idea of the characteristics of employment in the circular economy sectors we define at company and employee level. Finally, we want to make an estimate of the potential job creation of the transition to a more circular economy.

Looking at the general impact of the circular economy on employment, existing studies generally predict a net increase in jobs, although some existing jobs may be lost. It also appears that, depending on the type of action in the circular economy, the effects vary, both for the different levels of skilled labour (i.e., low, medium, high-skilled) and for geographic location (local, regional, global). Moreover, while some existing occupations may be lost, new professions may be created, or changes may occur at the level of the tasks within a particular job, with some specific tasks being replaced by others.

Our own exploratory analysis for Flanders for the period 2010-2016 showed that:

1. the circular economy employment index rises faster than the average Flemish employment index;
2. employment in the circular economy mainly consists of low- and medium-skilled workers, meaning that the CE is an important growth sector with significant employment opportunities for these groups.
3. the circular economy in Flanders is a predominantly male sector, and
4. no specific spatial patterns were discovered in the location of the circular companies and the circular employment. It was clear, however, that some municipalities stand out in terms of circular jobs as percentage of total number of jobs.

Finally, we estimated the employment potential of the Flemish circular economy using regional input-output tables and based on two approaches. The first approach, based on estimating the increase in value added per sector, taught us that, by 2030, potentially more than 30,000 jobs could be created in the circular economy. The second approach, although it did not provide an absolute number for possible future job creation, indicated in which of the selected circular economy sectors most jobs would be created if final demand in these sectors increases. When comparing both results of the input-output approaches, it appeared that there was overlaps in the biggest employment potential, particularly in the machinery repair sectors (NACE_C - 33.1), rental and leasing (NACE_N - 77.2), and repair (NACE_S - 95.1 and 95.2). It is important to bear in mind that these sectors are relatively small in terms of turnover and number of employees compared to, for example, NACE_E (sewerage, waste management and remediation activities) and NACE_G (motor vehicles, wholesale waste and scrap, and second-hand retailers), which showed lower potential in terms of conversion keys or employment multipliers.

Samenvatting

Dit onderzoeksrapport, gekaderd binnen het Steunpunt Circulaire Economie, is de tweede output van de onderzoekslijn die de werkgelegenheid en de actoren in de circulaire economie bestudeert en analyseert (OL 6).

Deze onderzoekspaper geeft de samenvatting weer van een opdracht voor het Departement Werk en Sociale Economie van de Vlaamse overheid, met steun van het Steunpunt Circulaire Economie. Het doel van deze onderzoekspaper is om de impact van de overgang naar een meer circulaire economie in Vlaanderen op de werkgelegenheid te onderzoeken. Om deze impact te kunnen inschatten, willen we eerst een idee krijgen over wat “de circulaire economie” eigenlijk betekent en hoe we deze op NACE-code niveau kunnen afbakenen. Ten tweede willen we een idee krijgen over hoe de werkgelegenheid in deze circulaire sectoren eruitziet, zowel op bedrijfs- als op werknemersniveau. Ten slotte willen we een inschatting maken van de potentiële jobcreatie van de overgang naar een meer circulaire economie.

Als we kijken naar de algemene impact van de circulaire economie op de werkgelegenheid, voorspellen de bestaande studies over het algemeen een netto toename van jobs, hoewel sommige bestaande jobs verloren kunnen gaan. Het lijkt ook dat, afhankelijk van het type actie in de circulaire economie, de effecten van een "meer circulaire economie" variëren voor de verschillende niveaus van geschoolde arbeidskrachten (laag, midden, en hooggeschoold) en geografische locatie (lokaal, regionaal, wereldwijd). En, terwijl bepaalde bestaande beroepen mogelijk verloren gaan, kunnen nieuwe beroepen gecreëerd worden of kunnen gelijkaardige wijzigingen optreden op het jobtakenniveau, waarbij sommige specifieke taken door anderen kunnen worden vervangen

Uit onze eigen verkennende analyse voor Vlaanderen voor de periode 2010-2016 blijkt dat:

1. de werkgelegenheidsindex van de circulaire economie sneller stijgt dan de gemiddelde Vlaamse werkgelegenheidsindex;
2. de tewerkstelling in de circulaire economie voornamelijk bestaat uit laag- en middengeschoolde werknemers. Dit betekent dat de circulaire economie een belangrijke groeisector is met significante tewerkstellingskansen voor deze groepen.
3. de circulaire economie in Vlaanderen een overwegend mannelijke sector is; en
4. er geen specifieke ruimtelijke patronen ontdekt werden in de ligging van de circulaire bedrijven en de circulaire tewerkstelling. Wel was het duidelijk dat sommige gemeenten eruit springen wat betreft het aandeel circulaire jobs als percentage van het totaal aantal jobs.

Ten slotte schatten we het potentieel in van de circulaire economie in de toekomst met behulp van regionale input-outputtabellen en op basis van twee benaderingen. De eerste benadering, gebaseerd op het inschatten van de toename in toegevoegde waarde per sector, leerde ons dat er tegen 2030 potentieel meer dan 30.000 jobs gecreëerd kunnen worden in de circulaire economie. De tweede benadering, hoewel deze geen inschatting maakte van mogelijke toekomstige jobcreatie, gaf aan in welke van de door ons geselecteerde sectoren de meeste jobs gecreëerd zouden worden bij een toename van de finale vraag in deze sectoren. Bij het naast elkaar leggen van beide resultaten van de input-outputbenaderingen, bleek dat er een overlap was wat betreft grootste potentieel voor jobcreatie, met name in de sectoren van

reparatie van machines (NACE_C - 33.1), verhuur en lease (NACE_N - 77.2), en reparatie (NACE_S - 95.1 en 95.2). Het is belangrijk in het achterhoofd te houden dat deze sectoren relatief klein zijn qua omzet en aantal werknemers in vergelijking met bijvoorbeeld NACE_E (afval) en NACE_G (motorvoertuigen, groothandel afval en schroot en tweedehandsdetailhandel), dewelke een lager potentieel vertoonden in termen van omslagsleutels of werkgelegenheidsmultiplicatoren.

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1. Introduction

The transition to a more circular economy (CE) has, next to ecological and economic impacts, important social effects. The labour market will (have to) adapt to the new reality and it is therefore important to anticipate these changes at an early stage.

This paper presents the results of research conducted for the Department of Work and Social Economy of the Flemish Government, with support from the Flemish Circular Economy Policy Research Centre. The goal of this paper is to investigate the impact of strategic trends in the circular economy in Flanders on the employment in the regular economy in general and vulnerable groups in particular.

In order to be able to estimate this impact, we firstly want to understand what 'the circular economy' actually means and which general trends occur, and, secondly, we want to get an idea of the effects these trends have on employment in the circular economy sectors we define.

To answer these questions, we use three different methods, namely (i) literature research, (ii) a qualitative approach with interviews and workshops, and (iii) a quantitative approach consisting of data analysis. More specifically, we use existing literature and workshops to frame the concept of 'circular economy' and identify trends, we use literature and data analysis to identify the impact of the trends on employment and make predictions about the future.

This report is divided into five sections, the first one of which is this introduction. Section 2 briefly summarizes CE employment impacts and presents the demarcation of the CE, which will be used in the further analyses in this paper. Section 3 looks at the current typology of circular employment in Flanders, while Section 4 analyses the potential for future CE employment in the same region. Finally, Section 5 presents the conclusion of this research paper.

2. Circular economy: general employment trends and demarcation of the concept

In this section, we summarize the findings of the literature review by Willeghems and Bachus (2018) on employment effects of the transition to a circular economy and we define the concept of “circular economy” that we will use in the analyses in Sections 3 and 4.

Willeghems and Bachus (2018), in their literature review, showed that, generally speaking, studies quantifying the job impact of the circular economy forecast a net increase in jobs, although some existing jobs might be lost. Next to quantitative estimates, a number of qualitative estimates have been published on job creation through the transition to a circular economy. More specifically, depending on the type of action contained within the “circular economy”, i.e. reduce, reuse, and recycle, the impacts of a “more circular economy” vary for the different levels of skilled labour (low, medium, high-skilled) and geographical location (local, regional, global). Additionally, while certain existing occupations might be lost, new occupations might be created (job substitution and job creation), or similar changes might occur at the job activity level where some specific tasks might be replaced by others (job transformation). Similar developments occur due to technology changes and robotization. Finally, the impact of circular design and innovation on the labour market depends on the area in which the innovation occurs. Innovation that creates new demand generally generates new employment, while end-of-pipe innovations usually go hand in hand with labour-saving technologies. For more information on CE employment effect, we refer to Willeghems and Bachus (2018).

As the goal of this paper is to analyse current and potential future employment trends in the CE in Flanders, it is important to define the “Flemish circular economy”. In the literature review we defined, based on a number of sources, the circular economy. In a next step, we translate this concept into NACE codes. The NACE rev. 2 classification is the "statistical classification of economic activities in the European Community" (Eurostat, 2008, p. 5). This classification provides a framework for collecting and presenting a large number of statistical data per economic activity and has been used in the European Union since 1970 (Eurostat, 2008). The NACE system consists of a hierarchical structure that is organized as follows:

- a first level consisting of sections identified by an alphabetical code called *sections*,
- a second level consisting of sections with a two-digit number code, called *departments*,
- a third level consisting of sections identified by a three-digit numerical code, called *groups*, and
- a fourth level consisting of headings with a four-digit numerical code, called *classes*, and
- for Belgium only, a fifth level consisting of headings with a five-digit numerical code, called *subclasses*.

The reason for defining the CE based on these NACE-codes is that this classification makes it possible to collect quantitative data concerning the companies that undertake circular economic activities. This data also contain information on employment, including the number of employees, gender of the employees, and level of education. Defining 'the circular economy' thus makes it possible to collect statistical data about this sector.

In previous studies (e.g., Dubois and Christis, 2014), the demarcation of the CE was mainly focused on waste management, recycling and wholesale of waste and scrap. In this analysis, we extend the CE to other sectors, such as repair (NACE section C, G and N), restoration of buildings (section F), and rental and leasing activities (section N). We remark that our demarcation is rather narrow. The reason for this is that the system of NACE codes is not perfect for delimiting 'the circular economy'. Companies or entities (companies, individual entrepreneurs or public institutions) can undertake various economic activities, some of which are circular and some of which are not. When reporting on these activities (using NACE codes), companies must distinguish between main (primary) activities and secondary activities. If the main activity is not circular, this does not automatically imply that the secondary activity is non-circular either, or vice versa. When requesting data based on NACE codes in databases, such as Bel-First, one can make selections based on primary or secondary activities, or both. For our data analysis we have opted for the narrow approach, in other words, we have selected companies solely based on circular primary activities to avoid overestimates. However, this also implies that companies with only circular secondary activities are excluded from NACE-based analyses. Hence, the estimates in this study should be interpreted as a lower limit. On the other hand, this effect is somewhat tempered by the fact that some companies with circular primary sectors may also have ancillary, secondary, activities that we do not consider to be circular, but which we do count because they cannot be excluded from the NACE-based analysis. Overall, we still assume that our employment estimates are conservative.

To come to the demarcation of the “CE in Flanders”, we organised two workshops with CE experts to discuss which NACE-sectors should and which sectors should not be part of the analysis. The sectors were defined up to the five-digit level of NACE-codes, i.e., the Belgian subclasses. An overview of the selected sectors is provided in Table 1.

Table 1. Demarcation of 'the circular economy' on the basis of NACE codes

Section	Subclass	Description
C	33.110-33.190	Repair of fabricated metal products, machinery and equipment
E	37.000	Sewerage
E	38.110-38.120	Waste collection
E	38.211-38.222	Waste treatment and disposal
E	38.310-38.329	Materials recovery
F	43.995	Restoration of buildings
G	45.201-45.209	Maintenance and repair of motor vehicles
G	45.310-45.320	Sale of motor vehicle parts and accessories
G	45.401-45.402	Sale, maintenance and repair of motorcycles and related parts and accessories
G	46.771-46.779	Wholesale of waste and scrap
G	47.791-47.793	Retail sale of second-hand goods in stores
N	77.210-77.299	Rental and leasing of personal and household goods
N	77.310-77.399	Rental and leasing of other machinery, equipment and tangible goods
S	95.110-95.120	Repair of computers and communication equipment
S	95.210-95.290	Repair of personal and household goods

Source: Authors’ selection from FOD Economie (2011)

Although renewable energy and energy efficiency are part of the (wider) demarcation of the CE, they are not included here. Similarly, biomass and the bio-based economy are part of the circular economy. It is, however, difficult to define this sector via NACE codes because the activities are spread over different sectors. For example, some companies identify with 'agriculture, forestry and fishing' (NACE section A), whereas others are registered in 'waste collection' (NACE group 38.1), 'waste treatment and disposal' (NACE group 38.2), or 'materials recovery '(NACE group 38.3).

3. Circular Economy in Flanders: typology of employment

In this section, we analyse the typology of circular employment in Flanders. First, we explain the methodology we applied, and, next, we zoom in on the characteristics of circular companies and their employees. Where possible and useful, we compare these circular characteristics with the average Flemish ones to see if and how the CE is different from the overall Flemish economy.

3.1. Methodology

To get an idea of current employment trends in "the circular economy in Flanders", we analyse the characteristics of circular companies and their employees. For this analysis, we base ourselves on the demarcation of the CE, which was agreed upon two internal SuMMa workshops (see Section 2). Based on this NACE demarcation, we search for data on the number of companies and employees that are present within this demarcation. To this purpose, we use the Bel-First database. This database contains extensive information about companies in Belgium and Luxembourg, consisting of data regarding the companies' identity, such as name and geographical location, as well as financial and economic data. Moreover, Bel-First contains information about those Belgian companies who have the obligation to report their annual accounts to the National Bank of Belgium (NBB) and about other economic entities such as self-employed or non-profit organizations. A disadvantage of the database, however, is that for companies included in Bel-First, not all the details of the annual accounts are automatically registered. This has consequences for data collection and analysis. The data that are obtained through Bel-First can hence be an underestimation of the actual data. That is why it is important to focus less on the absolute figures in the analysis that follows (because these can be an underestimation), but rather to focus on the evolution of these figures over time and on the relative proportions between different categories. In terms of employment, we only have data on the number of employees and not the number of full-time equivalents (FTEs).

For the detailed delineation of the CE, we refer to Table 1. We summarize the different sections below in Table 2. In what follows we always refer to this specific selection of the different NACE sections.

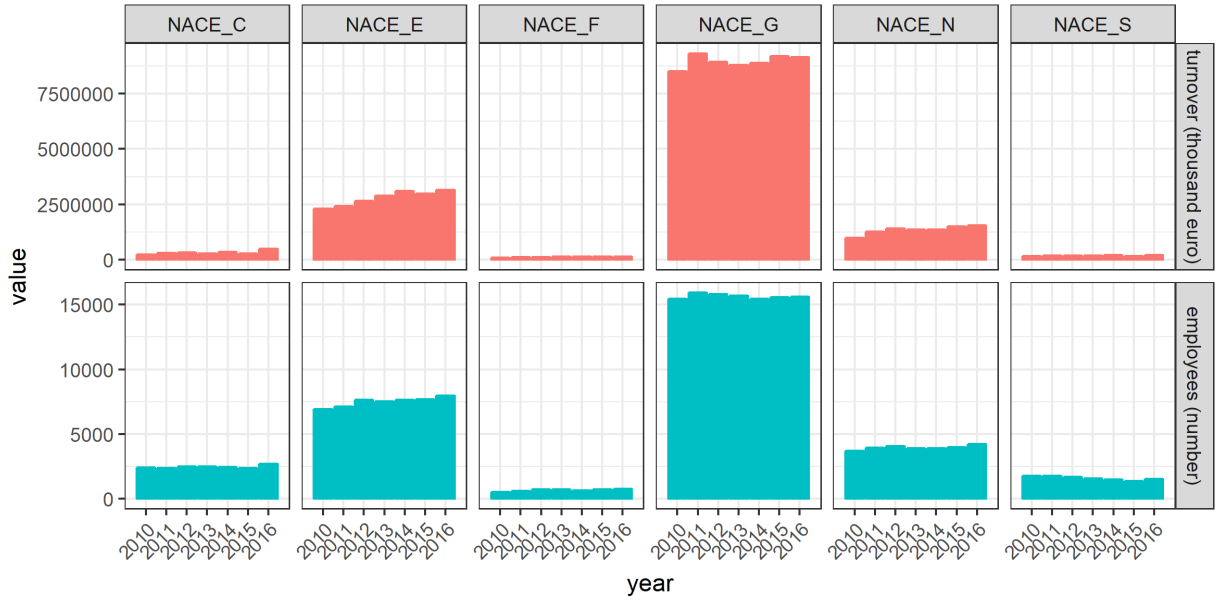
Table 2. Summary of the different NACE-sections that delineate the CE

Section	Description
C	Repair of metal-based products, machines and equipment
E	Waste sector
F	Restoration of buildings
G	Maintenance and repair of motor vehicles and bicycles, trade in spare parts of motor vehicles and bicycles
	Wholesale of waste and scrap
	Retail sale of second-hand goods
N	Rental and leasing of consumer goods and other machinery and tools and other tangible goods
S	Repair of computers, communication equipment and consumer articles

3.2. Company characteristics

As a first step in our analysis, in Figure 1, we look at the evolution in time of total turnover per NACE section and number of employees. The figure shows that NACE_G is the largest circular sector, both in terms of turnover and number of employees, followed by NACE_E. Moreover, there is a clear increase in turnover in the waste sector (NACE_E). In total, 32,808 people were employed in the CE - as defined by us in this paper - in 2016. Please note that we could only take into account the companies that have submitted their complete annual accounts to the NBB. In Bel-First, generally speaking, no information is available regarding turnover and number and type of employees of those companies that submit the abbreviated version of annual accounts (for small and micro-companies). The figures below are therefore an underestimation.

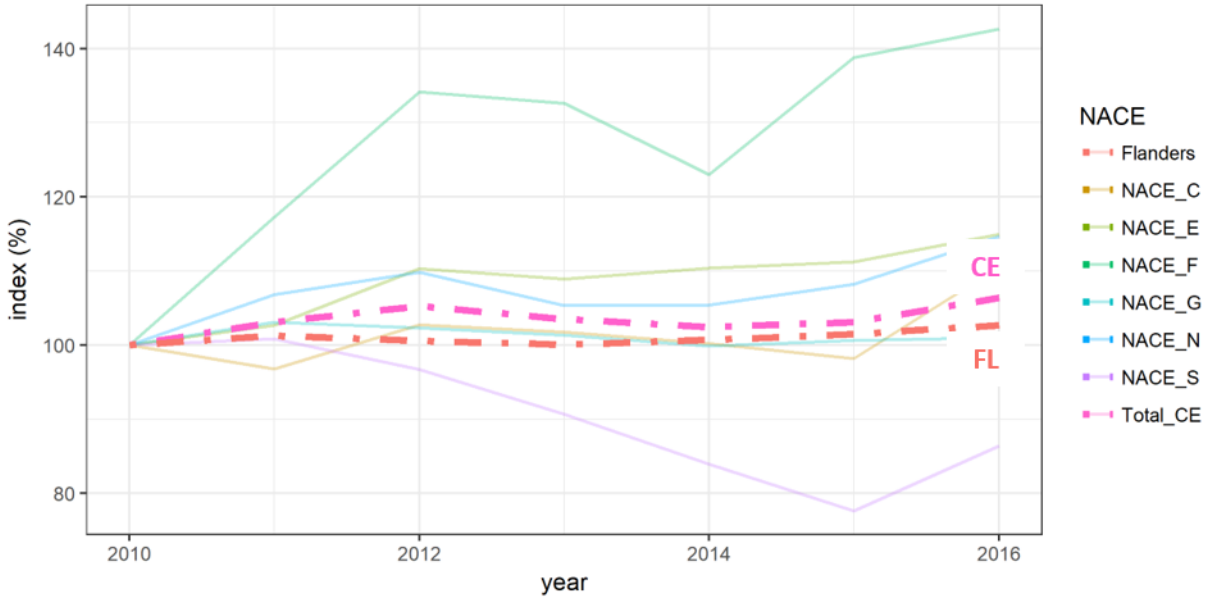
Figure 1. Evolution in time of turnover and number of employees per circular NACE section in Flanders



Source Authors' own data processing based on Bel-First-data

In order to get a better idea about how employment in the CE has evolved over time, in Figure 2, we calculate the employment index of the various individual sectors and of the total CE, and compare this evolution with the overall Flemish one. The employment index shows how the number of jobs has changed in percentage terms compared to the base year 2010.

Figure 2. Evolution of the employment index of the circular sectors in Flanders



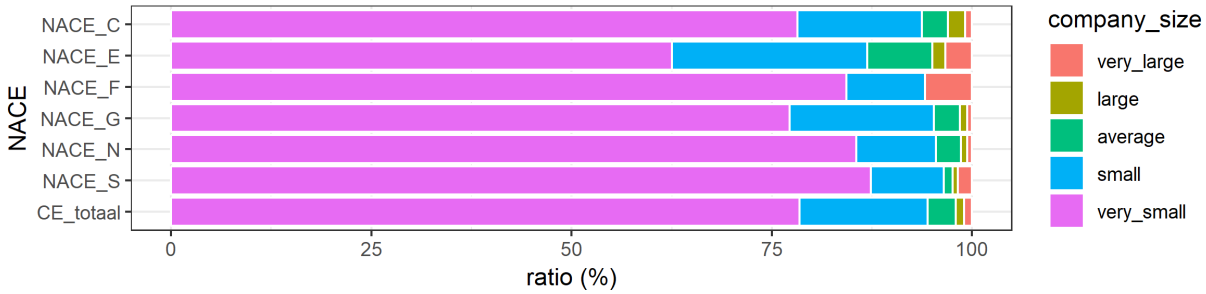
* In 2010, the number of employees amounted to 2,443 in NACE_C; 6,927 in NACE_E; 539 in NACE_F; 15,462 in NACE_G; 3,699 in NACE_N; 1,763 in NACE_S; 30,833 in Total_CE; and 2,083,512 in Flanders. Growth between 2010 and 2016 is 10.6% for NACE_C, 15% for NACE_E, 42.7% for NACE_F, 1% for NACE_G, 14.7% for NACE_N, -13.6% for NACE_S, 6.4 % for Total_CE, and 2.7% for Flanders.

Source Authors' **o**wn data processing based on Bel-First, RSZ, RSZPPO, Steunpunt WSE, DynaM-dataset, Rijksdienst voor Sociale Zekerheid

Figure 2 indicates that, although some sectors, in particular NACE_S, declined in employment, in general terms employment in the CE is growing. Moreover, overall CE employment (CE) is increasing more than the Flemish average (FL), with a growth of 6.4% for the CE versus a general Flemish growth of 2.7% between 2010 and 2016. NACE_G, which has the largest number of employees, experienced only limited growth (1% between 2010 and 2016) and hence reduces the average number for the total CE.

Next, we look at the distribution of the circular companies according to their size (number of employees). We divide the companies into five categories, based on their number of employees. Figure 3 gives an overview of the relationship between these categories, i.e., very small (0-4 employees), small (5-20 employees), medium-sized (21-50 employees), large (51-100 employees) and very large (more than 100 employees).

Figure 3. Company size in number of employees per circular sector in Flanders



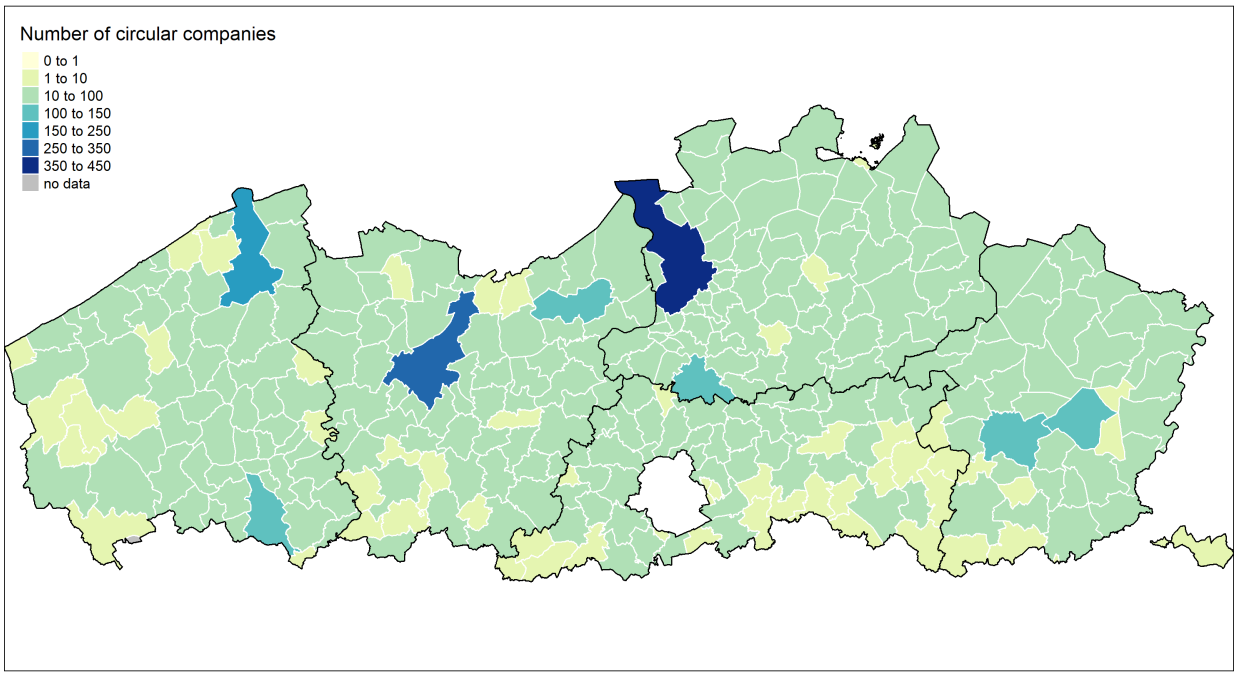
Source Authors' own data processing based on Bel-First

The figure shows that more than 75% of the companies in the CE are very small. The exception here is NACE_E where only about 60% of the companies are very small. On average, 78% of the circular companies has zero to four employees. The percentage of small businesses varies

between 9% (NACE_S) and 24% (NACE_E). The CE average for small business is 16%. On average, 3% of companies is medium-sized, 1% large and 1% very large.

Next, we look at the spatial distribution of the companies. It should be noted, however, that the distribution is based on Bel-First data and that it, hence, represents the location of the companies' headquarters.

Figure 4. Spatial distribution of the number of circular companies per Flemish municipality for the year 2016

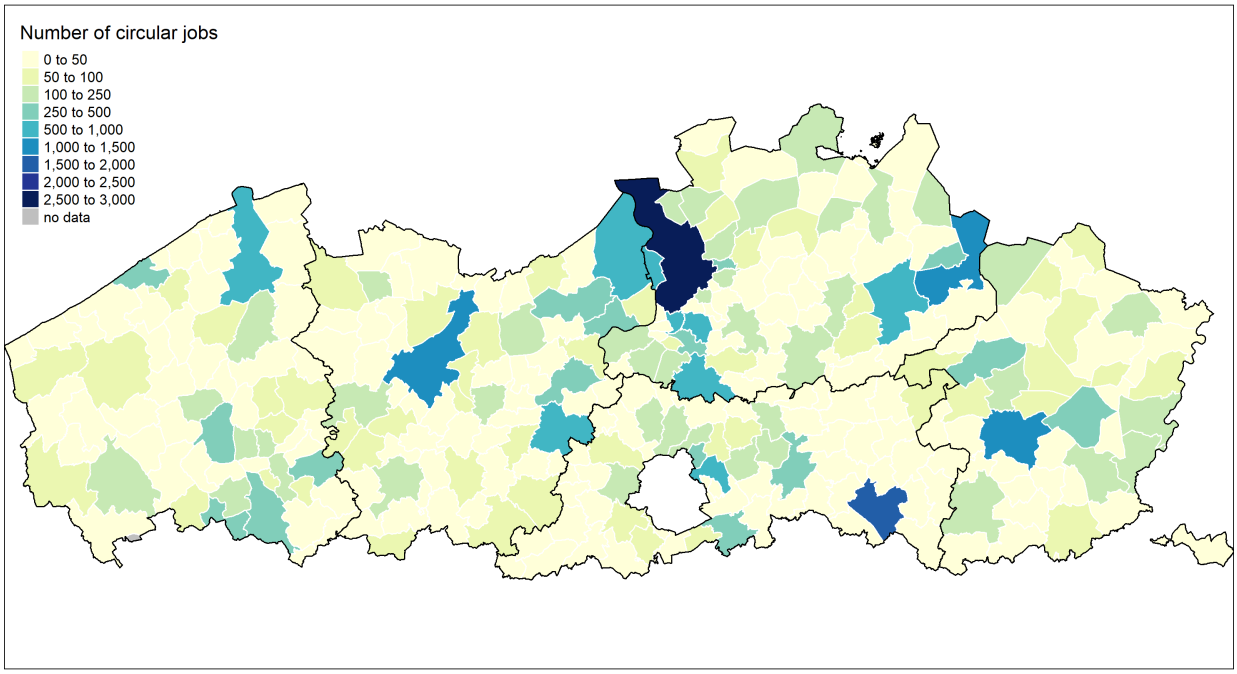


Source Authors' own data processing based on Bel-First

Figure 4 suggests there are no specific spatial patterns in the distribution of CE companies. The largest concentration of companies can be seen in Antwerp (843 companies), Ghent (287 companies), Bruges (150 companies), Genk (135 companies), Hasselt (121 companies), Mechelen (115 companies), Sint-Niklaas (107 companies), and Kortrijk (102 companies). These are also the larger cities within the various provinces. In Flemish Brabant, no municipality has more than 100 circular companies.

After zooming in on the number of companies per municipality, we look at the spatial distribution of the number of employees in the CE in Figure 5 and Figure 6. Figure 5 presents the total number of CE employees per municipality. Obviously, the total number of employees is larger in larger municipalities, and, therefore, the figure can therefore present a distorted view. To correct this picture to some extent, Figure 6 shows the percentage of circular in relation to the total number of jobs in a specific municipality, removing the influence of municipality size.

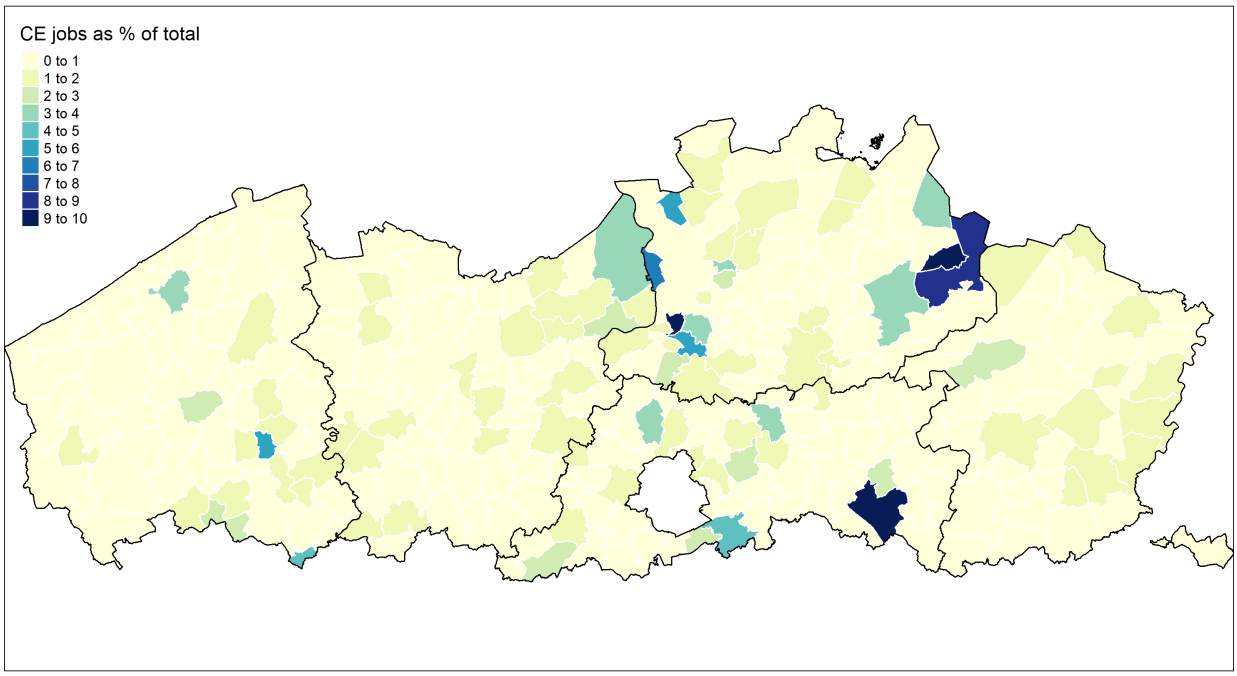
Figure 5. Spatial distribution of the number of circular jobs per Flemish municipality for the year 2016



Source Authors' own data processing based on Bel-First

The figure indicates that there are five municipalities with more than 1000 circular jobs. These are Antwerp (2670 jobs), Tienen (1524 jobs), Mol (1267 jobs), Hasselt (1159 jobs), and Ghent (1062 jobs). Furthermore, no specific geographical patterns can be derived.

Figure 6. Spatial distribution of the number of circular jobs as percentage of the total number of jobs per Flemish municipality for the year 2016



Source Authors' own data processing based on Bel-First

If we look at the ratio of circular jobs to the total number of jobs in Figure 6, we notice the colouring of the map looks different from Figure 5. The highest ratio of circular jobs can be found in Tienen (9.6%), where *Robert Bosch Production* is located. Then, there is the municipality of Dessel (9.5%), where a majority of CE jobs can be attributed to *Belgoprocess*, and Aartselaar (9.1%) where the high ratio of CE jobs is most likely due to the presence of *Aquafin*. Mol, Zwijndrecht, Rumst, Ingelmunster and Stabroek complete the list of municipalities with over 5% of CE jobs with a ratio of respectively 8.5, 6.6, 5.8, 5.7 and 5.6% CE jobs.

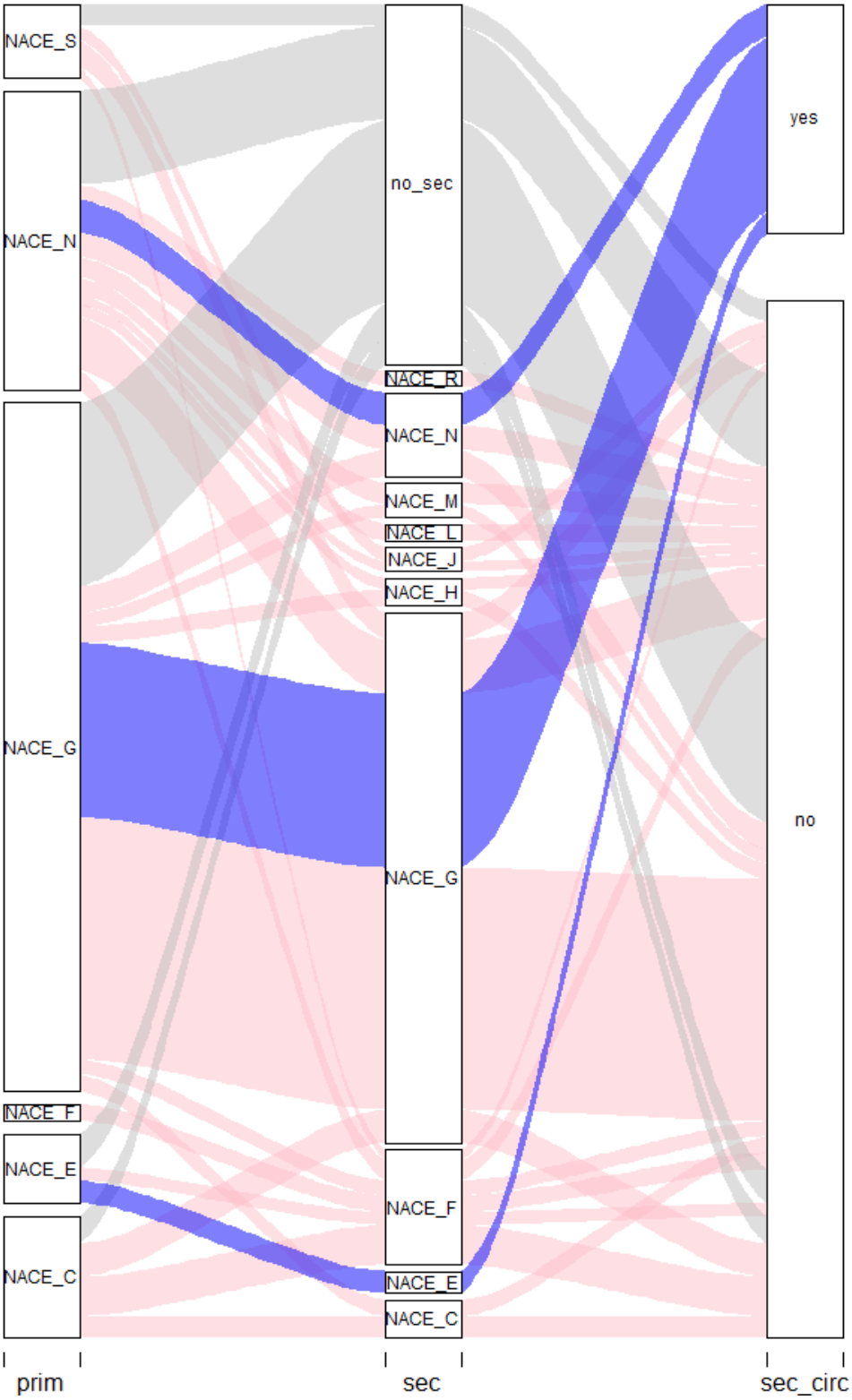
So far, we have focused our analysis on the primary NACE code of the companies. This primary code refers to the activity that contributes most to the total added value of the company. However, companies can still enter a (number of) secondary NACE codes that refer to "any other activity of a unit that results in the production of goods or services and that gives rise to the production of suitable goods or services intended for third parties" (FOD Economie, 2011, p.26). In order to get an idea about the type of ancillary activities these circular companies perform, we draw up a Sankey diagram depicting the combination of primary and secondary NACE codes (see Figure 7). A Sankey diagram is a specific type of flow chart, in which the width of the arrows proportionally reflects the size of the flow. The diagram places visual emphasis on the main flows within a system and is useful in locating the dominant contributions for an overall flow. In our case, the flows are determined by the different combinations of primary (first column in the figure, "prim") and secondary (second column in the figure, "sec") NACE codes. In other words, the flows indicate how often a certain combination occurs[1]. The primary codes always refer to a circular activity that falls within our CE demarcation. This is, however,

[1] A company only has one primary NACE code but can have multiple secondary codes. Every combination of a primary code with a secondary code was included. Consequently, there are more combinations than number of companies.

not necessarily the case for the secondary codes. The third column in the figure ('sec_circ') indicates if the secondary codes are circular or not. In summary, the purple flows represent the combinations of a circular primary with a circular secondary code. The pink flows represent the combinations of a circular primary with a non-circular secondary code. The grey flows, finally, represent the companies that have only a (circular) primary code and no secondary ones.

From the third column of the figure ("sec_circ"), we can derive that for about one third of the combinations the companies do not have a secondary code. Then, 37% of the combinations of primary and secondary codes are both circular. As mentioned earlier, the figure concerns the combinations of codes and not the companies themselves, since one company has multiple combinations if it has entered several secondary NACE codes. Hence, we can conclude that companies more often combine circular activities with non-circular activities (63%). We also notice large differences between the various circular sectors in terms of combinations of activities within the same NACE sector (both circular and non-circular activities). For sectors such as NACE_C and NACE_S the number combinations is relatively low, at 6 and 7% respectively, while for other sectors such as NACE_E and NACE_N the number is higher, at 29 and 23% respectively, and for others such as NACE_F and NACE_ G is very high, at 73 and 75% respectively.

Figure 7. Sankey diagram of the combination primary and secondary NACE codes of companies for the year 2016



* Purple flows represent combinations of circular primary and circular secondary NACE codes. Pink flows represent combinations of circular primary and non-circular secondary NACE codes. Gray flows represent companies that have only 1 (circular) activity (i.e., they only have a (circular) primary NACE code and no secondary code. NACE combinations that occur less than 100 times are not shown in order to keep the figure interpretable.

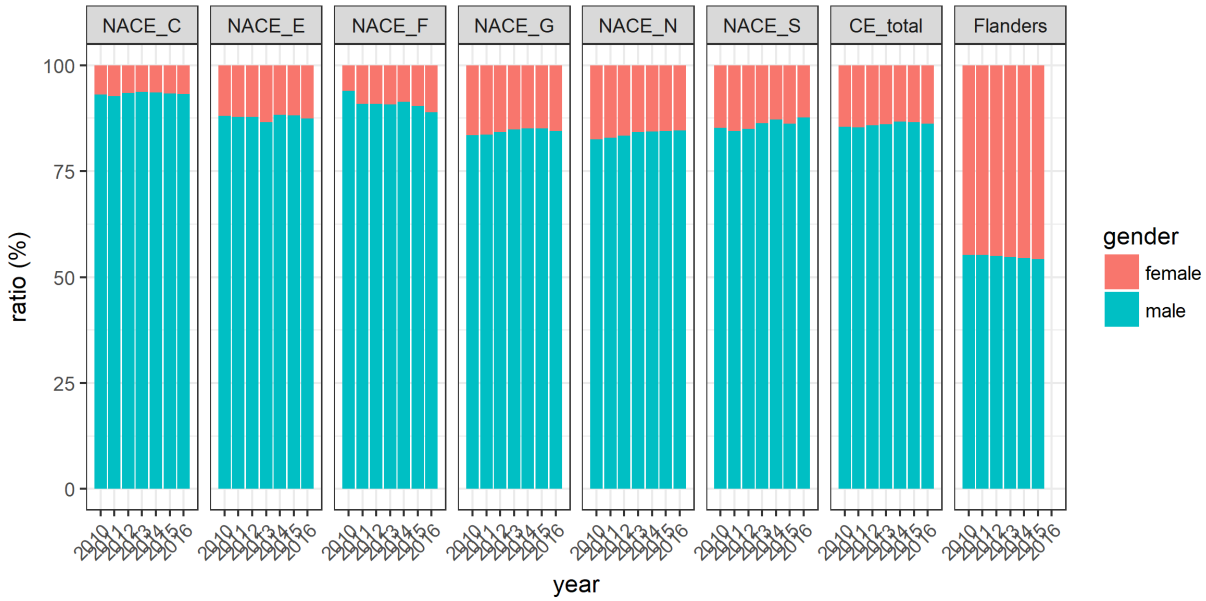
Source Authors' own data processing based on Bel-First

3.3. Employee characteristics

After focussing on the characteristics of circular companies, we now look more closely at the characteristics of employees working in the CE. Based on a number of graphs, we can draw a couple of clear conclusions.

Figure 8 shows the evolution over time (from 2010 to 2016) of the male-female ratio in the selected circular sectors as well as the same evolution for Flanders.

Figure 8. Evolution in the time of the male-female ratio of the employees of the Flemish circular sectors and Flanders



Source Authors' own data processing based on Bel-First

From the figure is clear that the CE, as we demarcated it, is a very masculine sector. About 85% of the workers are men. For some sectors, this percentage is even higher, such as in NACE_C, where more than 90% are men. These numbers contrast the Flemish average, where the male-female ratio is approximately 55-45%. A possible explanation for this can be found in the fact that, on average, more than 60% of employees have the status of blue-collar worker ("arbeider" in Dutch), as compared to around 40% for Flanders. Data from the National Social Security Office (Rijksdienst voor Sociale Zekerheid, RSZ)[2] show that, generally speaking, twice as many men as women have the status of blue-collar worker. Specifically for the circular NACE groups (up to three-digit numerical code[3]), it appears that in NACE_C 3% of the blue-collar workers are women, in NACE_E 7%, in NACE_F 1%, in NACE_G 17%, in NACE_N 11%, and in NACE_S 23%[4]. A large number of male blue-collar workers can thus be a possible explanation for the large share of men in these sectors.

In a next step, we look at the level of education in the circular sectors. We work with two different sets of definitions because the education data in the Bel-First database are not the same as those which VDAB uses, and which are available for the whole of Flanders. The definition used by Bel-First, namely primary education, secondary education, higher non-

[2] RSZ statistics - evolution of number of jobs.
[3] The CE NACE codes we selected can go up to five digits. The numbers provided here therefore relate to a slightly larger selection of companies, but we assume that they are nevertheless relevant.
[4] Data processed based on online statistics of the Datawarehouse Labour Market and Social Protection.

university education and university education requires no further clarification. The VDAB definition is clarified in Table 3.

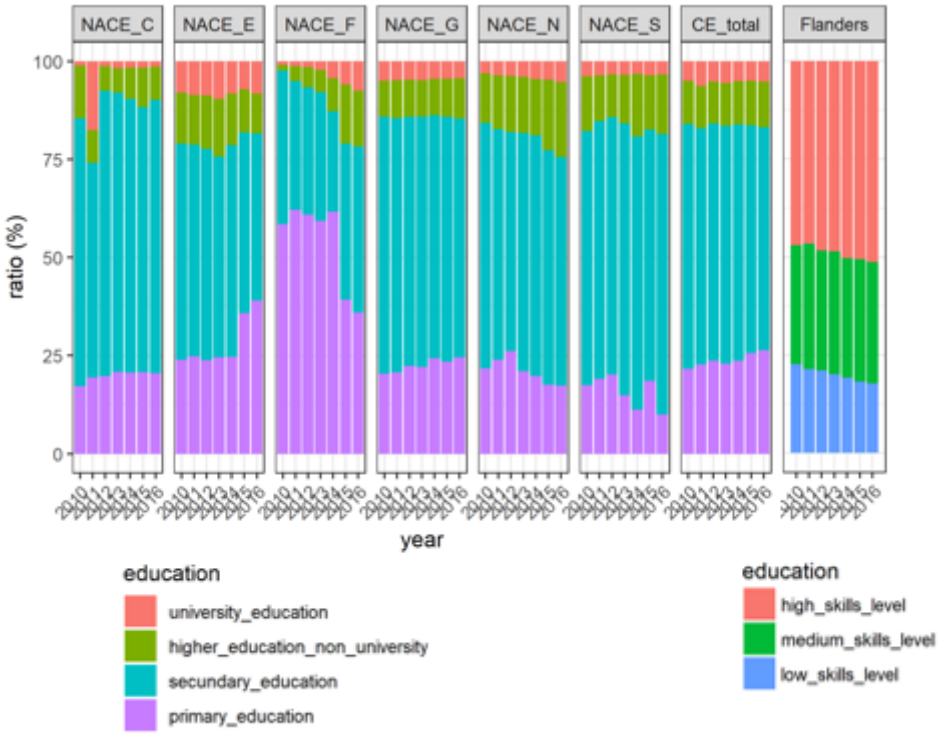
Because it is difficult for both definitions to be merged completely - for example, secondary education occurs both in the definition of low-skill and medium skill level, we compare the level of education between CE and Flanders in general at the “high skills” level. More concretely, this means that, in Figure 9, we compare the red and green bars of the first six columns (NACE_E to NACE_S) with the red bars of the last column (Flanders). We can then compare the purple and turquoise bars of the first six columns with the blue and green bars of the last column for the ratio of low- and medium-skilled workers.

Table 3. Overview of skill levels in Flanders

Low skill level	Medium skill level	High skill levels
Primary education	Third degree secondary education	Professional bachelor
First degree secondary education	Study certificate third grade vocational secondary education	Academic bachelor
Second degree secondary education	Higher professional education (‘hoger beroepsonderwijs HBO’)	Master
Apprenticeship (‘leertijd’, Syntra)	Secondary after secondary education (‘Secundair-na-Secundair Se-N-Se’)	
Part-time vocational secondary education (‘bijzonder secundair onderwijs BSO’)	Study certificate fourth grade vocational secondary education	

Source Studiedienst VDAB (2013)

Figure 9. Evolution in time of the level of education within the Flemish circular sectors and in Flanders in general



Source Authors' own data processing based on Bel-First, Algemene Directie Statistiek – Statistics Belgium EAK

The figure shows that it is mostly low and medium-skilled workers who are employed in the CE. Generally speaking, about 65-70% of employees in the CE in Flanders is low or medium-skilled. On the other hand, about half of the employees in the overall Flemish economy are low and medium-skilled, while the other half are high-skilled. Hence, we can deduce that the CE, far more than the overall Flemish economy, employs low- and medium-skilled workers.

This is an interesting conclusion, as Cedefop's predictions in their skills forecast show that, between 2018 and 2030, Belgian employment for high and medium-skilled labour is expected to increase by 1.3 and 0.2% respectively, while growth for low-skilled labour is expected to decrease by 2.9%. The overall European forecasts amount to 1.8% for the high-skilled, -0.5% for the medium-skilled, and -2.5% for the low-skilled labour. Cedefop's forecasts take into account global economic developments up to May 2017. The EU economy as a whole is expected to grow in 2018 and 2019, albeit at a slower pace as compared to 2017, supported by rising household spending and falling unemployment, although wage growth remains moderate. It is also expected that investments will increase in view of the favourable financing conditions and improved economic outlook. The main assumptions for the forecast include the Eurostat population forecast and the short-term macroeconomic outlook prepared by the European Commission's Directorate-General for Economic and Financial Affairs in May 2017. Hence, in the forecast, the transition to a more circular economy in the mid-long term is not taken into account.

An analysis carried out by the VDAB Study Office in 2013 also shows that low-skilled workers have the highest risk of becoming unemployed and have the lowest chance of remaining employed after finding a job. As a result, about one in two Flemish job-seekers is low-skilled and the unemployment rate of this group is three times as high as that of the high-skilled,

namely 7.1% for the low-skilled, 3.1% for the medium-skilled, and 2.1% for high-skilled people (Studiedienst VDAB, 2013).

4. Circular Economy in Flanders: potential for future employment

In the previous section, we analysed data from circular companies to improve our understanding of the characteristics of these companies and their employees, as well as the geographical location of the companies and the circular jobs. In this section, we quantitatively predict how many jobs could be created through the transition to a more CE. We do this by basing ourselves on the methodology of previous studies and carrying out the calculations on more recent data.

4.1. Methodology

In this section, we quantitatively estimate how the transition to a more CE can influence employment. To make an estimate of the net number of jobs that can be created, we use the input-output methodology (IOT) and the interregional input-output table (RIOT) for Belgium, drawn up every five years by the Federal Planning Bureau. This table includes the three Belgian regions, i.e., Brussels-Capital Region, the Flemish Region and the Walloon Region, as well as the 133 industries present in the Belgian economy (based on and very similar to NACE codes). The RIOT provides information about the destination and cost structure of the production of each region (Avonds et al., 2016). Products (goods and services) produced in a certain region can be used within the same region (intraregional), in other regions in Belgium (interregional), or outside Belgium. They can either be used in the production process of other industries (intermediate consumption), or finally, in the form of consumption, investments or exports. A number of cost factors can be distinguished: intermediary supplies from the own region, other regions or abroad, non-deductible taxes and subsidies and various components of the added value that serve to compensate the labour and capital production factors, including 'remuneration of the employees'. For more information about the RIOT we refer to Avonds et al. (2016.

The literature review showed that the transition to a more CE will be accompanied by a number of trends, such as an increase in reuse, repair, overhaul, recycling, etc. This means that the demand for products (goods and services) associated with these trends will also increase. The RIOT allows, through analyses based on the Leontief model, to quantify the impact of such change on production, employment and added value. This impact is traditionally summarized in multipliers (Avonds et al., 2016) (see also Section 4.3). However, there are also other ways to estimate the impact of an increased demand, on, amongst others, employment, using (R) IOT.

Specifically for the CE in the Netherlands, an analysis was carried out by TNO (Bastein et al., 2013). This methodology was applied to Flanders by Dubois and Christis (2014) and, at that time, performed on the most recent regional (Flemish) input-output table, namely for the year 2007. Since then, an updated version of the table is available, based on data from 2010, which also looks at the interregional flows between the different Belgian regions, i.e., the RIOT[5]. We will use the latter table to update the analysis by Dubois and Christis (2014) with more recent data, based on the TNO methodology (Bastein et al., 2013).

[5] In the regional IOT, exports to the other Belgian regions are regarded as exports.

4.2. Application to CE in Flanders

TNO's analysis (Bastein et al., 2013) looks at the CE from two perspectives: (i) the utilization of residual flows from biomass and (ii) a CE that can arise from products from the metal industry. By extrapolation to other sectors, a complete picture of the Dutch potential was then estimated.

The transition to a more CE implies a more intensive use of products and is associated with an increase in maintenance, repair, refurbishment, remanufacturing and recycling of products. TNO's choice for the metal-electro sector is based on a number of reasons. Firstly, the products in this sector are already, to a significant extent, reused, repaired, leased and recycled. Furthermore, it appears that there is a certain interweaving of this sector with different service sectors. Finally, TNO argues that the willingness of this sector to transition is large.

Following Dubois and Christis (2014), we only calculate the potential for the metal-electro sector. The methodology to calculate the potential of biomass flows is not reproduced because the flows and assumptions from the TNO report do not seem relevant to the Flemish case (Dubois and Christis, 2014).

With regard to the metal-electro sector, the TNO method consisted of making an inventory of the flows in the current system and then estimating future possibilities based on technological and societal trends. The sector itself was subdivided into 17 concrete product categories. An inventory was made of the current state of reuse, repair, recycling, etc. Then, based on literature and interviews, an estimate was made of the extent to which the transition to a CE could take place. This increase was expressed in number of pieces per product category and (market) value. Then, (R)IOT were used to calculate the share of labour in the various sectors. As the increase in market value was determined by the transition to a more CE, the increase in employment could also be calculated.

Dubois and Christis (2014) identified a number of limitations with regard to the TNO method. First of all, TNO assumes that an increase in the value of a sector corresponds to a proportional increase in added value, which is not necessarily the case because “often additional efforts are required that lead to a more than proportional cost increase” (Dubois and Christis, 2014, p. 17). TNO also extrapolated the microanalysis of metal-electro sector to other sectors. The estimates for those other sectors are therefore less well established.

After applying the TNO methodology to the Flemish IOT, Dubois and Christis calculated, in 2014, based on the Flemish 2007 IOT, that the CE could create 26,573 jobs. Since that analysis was conducted, a new IOT, the RIOT, has been made available, based on data for the year 2010 (see Section 4.1). Using the same assumptions, we repeat the calculation of Dubois and Christis (2014) on these more recent data to see if the result has changed significantly.

The IOT of 2007 is based on the SUT[6] branch and NACE-BEL[7] classification of 2003. In 2008, however, the system of NACE codes was revised and codes were adjusted. The NACE-BEL 2003 consisted of 17 sections and 62 departments, while the current NACE-BEL 2008 consists of 21 sections and 88 departments (FOD Economie, 2011). By means of conversion tables (Instituut voor nationale rekeningen - Nationale Bank van Belgie, 2013; Instituut voor Nationale Rekeningen - Nationale Bank van Belgie, 2014; StatBel FOD Economie K.M.O. Middenstand en Energie, n.d.), we were able to find the corresponding SUT branch and NACE-BEL classification of 2008, which are also used in the 2010 RIOT and adapt the "conversion keys". Conversion keys indicate the percentage by which the added value in a particular sector will increase as a result of the transition to a more circular economy. Consequently, the sectors, which, in terms of percentage, offer the greatest potential for an increase in employment, can also be identified. Because of the change in NACE-code system, the keys could not always be easily converted. Therefore, in some cases, we took the arithmetic mean, which is an approach that could certainly be improved in future estimations.

Based on the RIOT 2010 and the TNO methodology applied to Flanders (Dubois and Christis, 2014), we calculate that, in Flanders, 30,578 jobs could be created by 2030. Job creation takes place in all sectors of the economy and not only in the circular sectors that we defined previously. For example, our calculation indicates that more than 4,300 jobs will be created in the furniture manufacturing sector and more than 2,300 in the manufacture and assembly of motor vehicles sector. The job creation figure we calculated is higher than the figure calculated in 2014 based on data from 2007. In order to get a more accurate picture of the potential of the CE, this exercise could be refined using the TNO methodology as a guideline, but with assumptions specifically applied to the Flemish situation.

It should be noted that there is a discrepancy between the sectors that we have defined as circular in Section 2 and the sectors of which the TNO study indicated that they showed the most potential, because both approaches have a different starting point. TNO's approach looks at how all other, and, therefore, also non-circular, sectors will be influenced by the transition to a more circular economy. The NACE sectors that we viewed as circular were given the following conversion keys (in brackets) to indicate how the added value in a certain sector will increase if the economy becomes more circular: 33.1 (9.8%), 37 (0.1%), 38.1 - 38.2 (0.21%), 38.3 (21.8%), 43.9 (1.9%), 45.2 - 45.4 (0.1%), 46.7 (0.1%), 47.9 (0.5%), 77.2 (23.3%), 77.3 (21.7%), and 95.1 - 95.2 (15%). The number of additional jobs per sector therefore depends on the size of the conversion key for that specific sector and on the size of the added value of the sector (where it is possible that fewer jobs will be created in smaller sectors with larger potential as compared to larger sectors with lower potential). The conversion keys show that job potential is mainly expected in the sectors of repair of machines (NACE_C - 33.1), materials recovery (NACE_E - 38.3), rental and leasing (NACE_N - 77.2 and 77.3) and repair (NACE_S - 95.1 and 95.2).

[6] SUT refers to 'Supply and Use Table' and are used in input-output analysis. In order to link the relevant NACE codes for CE to the SUT branches, conversion tables are required (Instituut voor nationale rekeningen - Nationale Bank van Belgie, 2013; 2014).

[7] NACE-BEL is the classification of the NACE codes with, for Belgium only, a fifth level consisting of headings with a five-digit numerical code, called subclasses (see Section 2).

4.3. Employment multipliers

Another method to estimate job creation using (R)IOT is to use employment multipliers. First, the increase in final use per region and NACE sector is estimated. Then, using employment multipliers, it is possible to calculate how many jobs[8] can be created, not only in the sector and region concerned, bus also in the other sectors that act as subcontractors and suppliers for the sector in question. These sectors can be located in the same or another region. The Belgian Federal Planning Bureau has calculated these employment multipliers at the regional level[9].

Table 4 shows the multipliers for the CE sectors for the Flemish Region.

Table 4. Overview of the employment multipliers of the CE sectors for the Flemish Region

NACE Rev.2		Absolute	FL	BXL	WAL	Initial	Direct and indirect
C	33*	10.8	9.9	0.4	0.5	7.3	3.5
	37.0	5.9	5.3	0.3	0.4	2.6	3.3
E	38.1 and 38.2*	9.8	8.5	0.5	0.9	4.2	5.6
	38.3	4.3	3.5	0.3	0.5	1.2	3.1
F	43.9*	10.8	10.0	0.4	0.5	5.3	5.5
	45*	9.1	8.1	0.5	0.4	6.5	2.6
G	46 excl. 46.71	7.7	6.9	0.4	0.4	4.5	3.3
	47 excl. 47.3*	15.3	14.3	0.6	0.5	11.4	4.0
N	77.2*	12.2	11.2	0.5	0.4	5.4	6.7
	77.3 and 77.4	6.7	5.7	0.6	0.3	2.1	4.5
S	95*	16.7	15.7	0.6	0.4	12.1	4.6
General for Flanders		9.0	8.3	0.3	0.3	5.8	3.1

* sectors whose single multipliers are above the Flemish average

Source Federaal Planbureau (2016)

We distinguish three types of multipliers. The first type is the *single (or absolute) employment multiplier* (pink column in the table), expressed in the cumulative number of jobs per million euro of final demand for domestic production (Avonds et al., 2016). If we can estimate how much the final demand will rise in one or more of the circular sectors (expressed in euro), we can calculate how many jobs this increase will create (in the own sector and other sectors that depend on this sector). The second type of multiplier is the *regional multiplier* (green columns in the table). We make the distinction here between the intraregional and the interregional employment multipliers. If we look at the change in the final use aimed at the production of an industry in Flanders (FL), the *intraregional multiplier* tells us what the impact of that change will

[8] Employment is measured in number of people and not in number of full-time equivalents.
[9] The multiplier can be found here.

be on the employment of all branches of industry in that region, in this case Flanders. The *interregional multiplier*, then, indicates the impact on employment of all industries in the other regions, i.e., Brussels (BXL) and Wallonia (WAL). The third type of multiplier includes the *initial, direct and indirect employment* (blue columns in the table). The *initial employment* refers to additional jobs in the own sector and region due to an increase in final use aimed at the production of a (Flemish) industry. *Direct employment* refers to the additional jobs with direct suppliers of their own sector at Belgian level. Finally*, indirect employment* refers to all effects that occur upstream, at the level of the domestic suppliers of the direct suppliers. We remark that, for each sector, the sum, per NACE code, of the green columns, and the sum, per NACE code, of the blue columns, is always the same as the pink column. Also, the multipliers in the table relate to NACE sectors that may be larger than just the circular sectors that we have selected (see also Section 2).

From Table 4 we can deduce that, for some of the sectors that we previously defined as circular, the absolute employment multiplier is higher than the general number for Flanders. This is the case for repair (NACE_C and NACE_S), sewerage, waste management and remediation activities (NACE_E), restoration of buildings (NACE_F), retail sale of second-hand goods (NACE_G), and rental and leasing of consumer goods (NACE_N). An increase in the final demand for domestic production by one million euro in each of these sectors in Flanders will therefore create more than nine jobs, even 16.7 for NACE_S. Logically, most jobs will be created in Flanders itself. Also, only in half of the cases the initial employment is larger than direct and indirect employment. This implies that in the other half of the cases more jobs will be created at the level of sector-suppliers than in the sectors themselves. For certain CE sectors there is an overlap between, on the one hand, the employment multipliers that show a lot of employment potential, and, on the other hand, the TNO-based conversion keys that show a lot of potential. These sectors are NACE_C (33.1 - repair of products of metal, machinery and equipment), NACE_N (77.2 - rental and leasing of consumer goods), and NACE_S (95.1 and 95.2 - repair of computers, communication equipment and consumer articles).

In a further research stage, the increase in final use in the selected circular sectors could be estimated, and, consequently, the impact on employment could be defined using employment multipliers.

5. Conclusion

The transition to a more circular economy has, next to ecological and economic impacts, important social effects. The labour market will (have to) adapt to the new reality and it is therefore important to anticipate these changes at an early stage.

This research paper present the summary of an assignment conducted for the Department of Work and Social Economy of the Flemish Government, with support from the Flemish policy research centre Circular Economy, to investigate the impact of strategic trends in the circular economy in Flanders on the employment in the regular economy in general and vulnerable groups in particular.

Based on a previously conducted literature review, we summarize general circular employment trends. Next, we demarcated the Flemish circular economy and examined the characteristics of the companies present in this demarcation and their employees using Bel-First data. Finally, based on existing methodology, we made an estimate of the potential number of circular jobs that could be created in the future Flemish CE.

Looking at the general impact of the CE on employment, existing studies generally predict a net increase in jobs, although some existing jobs may be lost. It also appears that, depending on the type of action in the CE, the effects vary, both for the different levels of skilled labour (i.e., low, medium, high-skilled) and for geographic location (local, regional, global). Moreover, while some existing occupations may be lost, new professions may be created, or changes may occur at the level of the tasks within a particular job, with some specific tasks being replaced by others.

Our own exploratory analysis for Flanders for the period 2010-2016 showed that:

1. the CE employment index rises faster than the average Flemish employment index;

2. employment in the CE mainly consists of low- and medium-skilled workers, meaning that the CE is an important growth sector with significant employment opportunities for these groups.

3. the CE in Flanders is a predominantly male sector, and

4. no specific spatial patterns were discovered in the location of the circular companies and the circular employment. It was clear, however, that some municipalities stand out in terms of circular jobs as percentage of total number of jobs.

Finally, we estimated the employment potential of the Flemish CE using regional input-output tables and based on two approaches. The first approach, based on estimating the increase in value added per sector, taught us that, by 2030, potentially more than 30,000 jobs could be created in the CE. The second approach, although it did not provide an absolute number for possible future job creation, indicated in which of the selected CE sectors most jobs would be created if final demand in these sectors increases. When comparing both results of the input-output approaches, it appeared that there was overlaps in the biggest employment potential, particularly in the machinery repair sectors (NACE_C - 33.1), rental and leasing (NACE_N - 77.2), and repair (NACE_S - 95.1 and 95.2). It is important to bear in mind that these sectors are relatively small in terms of turnover and number of employees compared to, for example, NACE_E (sewerage, waste management and remediation activities) and NACE_G (motor vehicles, wholesale waste and scrap, and second-hand retailers), which showed lower potential in terms of conversion keys or employment multipliers.

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