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Current Implementation of the Circular Economy in Enterprises in the Czech Republic

Otakar Ungerman[1], Jaroslava Dědková[2]

Abstract: The subject of this paper is the contemporary use of the circular economy in business practice. The topicality of this theme was the reason for resolving the main objectives, which were to determine how enterprises in the Czech Republic are currently involved in the circular economy. The authors focused on empirical research, the methodological framework of which contains three interrelated parts. The basis was secondary research from scientific databases, which was followed up by the primary research. The objects of the primary research were based on three research questions, which were focused on the use of standardised environmental activities, the identification of tools of the circular economy and determining their importance. The research was evaluated using the methods of content analysis, descriptive and inductive statistics. The research showed that 71 % of enterprises present themselves as taking an active approach to the environment beyond the scope of the statutory obligations. Enterprises then make most use of regulatory tools such as the ISO 14001 standard or Ecodesign. An in-depth interview was used to identify sixteen tools of the circular economy as they are perceived by enterprises. When assessing importance, the highest rated tool was reducing energy consumption in production, waste from production, the consumption of materials, emissions and minimization of waste. Statistically significant differences were also identified with these tools. The research showed that the circular economy is most used in automotive industry enterprise.

Keywords: circular economy, environmental policy, recycling, corporate social responsibility

JEL Classification: L10, L19, M11, M14, Q56, Q57

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[1] Technical University of Liberec, Faculty of Economics, Department of Marketing and Trade Liberec, Czech Rebublic, E-mail: otakar.ungerman@tul.cz
[2] Technical University of Liberec, Faculty of Economics, Department of Marketing and Trade Liberec, Czech Rebublic, E-mail: jaroslava.dedkovat@ul.cz

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Introduction

Corporate social responsibility (CSR) is currently playing an increasingly important role in today's economy. Customers are increasingly interested in whether an enterprise behaves in a socially responsible manner. They are willing to pay a higher price for a product or service if the enterprise presents the CSR philosophy (Tetřevová, 2018). Enterprises are also noticing the growing importance of customers' decision-making process. This is the reason for the implementation of voluntary social and environmental perspectives in a company's daily operations and interactions with company stakeholders. One of the most visible parts of the CSR concept is the circular economy (CE), which differs from the linear approach. The traditional (linear) economy is characterised by a unidirectional linear process of "resources, products and waste" which excessively consumes natural resources and produces an uncontrollable amount of waste with a negative impact on natural resources and on the environment. However, the circular economy is a scientific concept of the permanent sustainable development model of economic management. According to McDonough & Braungart (2010), the application of the circular economy is one of the paths to economic growth and to improving enterprises' competitiveness. Circular economy is an economy constructed from societal production-consumption systems that maximizes the service produced from the linear nature-society-nature material and energy throughput flow. This is done by using cyclical materials flows, renewable energy sources (Korhonen et al.,2018). This way of understanding the economy emphasises the importance of enterprises being economically successful and increasing the quality of the environment as well as of people's lives.

The main aim of the research as presented in this paper is to determine how enterprises in the Czech Republic are currently involved in the circular economy.

This objective was transformed into the following research questions:

1. How are enterprises involved in standardised environmental activities as defined by the Ministry of the Environment?

2. What types of activities enterprises themselves include in the circular economy and to what extent are those activities used?

3. What impact do the characteristic attributes of enterprises (size, sector and country of company culture) have on the degree of their involvement in the circular economy?

Theoretical background

In the literary overview, the authors focused on two areas, which are the global circular economy and the national circular economy.

The current global circular economy

The perception of the circular economy around the world is based on the concept of the constant circulation of resources at the highest quality for the longest amount of time possible. This system not only saves on primary resources, but also creates new jobs, so-called green jobs. The study by McKinsey & Company (2015) estimates that by introducing the principles of the circular economy Europe could create 2 million new jobs

and generate annual savings worth 1.8 billion euros from 2030. In their studies someauthors (O'Brien, 2012; Corvellec & Hultman, 2012; Silva et al., 2016) present a comprehensive analysis of the development of the circular economy, and they agree that the beginnings of the circular economy concept date from 1960, when increased interest was registered in protection of the environment and this issue began being focused on my more environmentalists, economists and mainly consumers. Enterprises reacted to this situation by introducing the concept of corporate social responsibility (Farrington et al., 2017). In the period after 1960, the CE was based on the works of famous thinkers such as Thomas Malthus, John Stuart Mill and Hans Carl von Carlowitz (Lacy & Rutqvist, 2015). Publications such as Silent Spring – Carson, Tragedy of the Commons – Hardin, drew attention to these ideas by problematizing toxicity and scarcity. During this stage, awareness that the impact of environmental pollution extended beyond the superficial and localized (Commoner, 1971) was coupled with the realization that human and environmental well-being are not only linked, but depend on resource use and processing.

After 1986 there is a major surge in ecological awareness all over the world. Ecological awareness becomes part of economic practice and the concept of the circular economy becomes a topic discussed in the public domain (Lewandowski, 2016). Following the massive rise of globalisation and the involvement of China in international trade at the turn of the 21st century, globalisation of thought regarding the circular economy has also been occurring. As stated by Yu & Shi (2007) and Han et al. (2011), in today's global society, with an increased level of integration, protection of the environment is important in relation to enterprises' economic activities worldwide, including China. After 1985 the perception of waste also began to change, from a clearly negative attitude to a positive force, which may serve as a business resource (O'Brien, 2012).

The current perception of the circular economy is characterised by a closed-loop of the flow of material and energy with natural and human resources as well as science and technology taken into consideration. Velenturf & Purnell (2017) claim that the transition to a circular economy requires scientific and technological progress, including the development of technology with low energy demands for renewal of resources. Another priority is saving and effective use of limited natural resources, improving the effectiveness of production and low generation of waste. It is followed by a reduction in pollution and recycling,. When resources are returned to the production cycle (Zink & Geyer, 2017). As a condition for effective functioning of the circular economy, the author (Sitnikov et al., 2015) states that the necessary steps for implementation of the circular economy system are creation of markets for recycled materials, development of necessary services for customers, support for waste recycling and limitation of the use of non-recyclable materials. Geissdoerfer, Savaget, Bocken and Hultink (2017) introduced the definition of circular economy as a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. It is necessary to emphasise that there are many "ideas" regarding the circular economy, which share common themes, but differ in results and in their optimal implementation (McArthur, 2015). One of these new ideas is the possibility of shortening or lengthening the production cycle using new technologies, such as ecodesign, or additive production. If the product cycle is shortened or extended, it will not have an adverse impact on sustainability. This is conditional upon absolute compliance with CE principles (Li Yi et al., 2020).

The world's largest environmental polluter is China, which mentions CE as part of its 12th five-year plan (2011–2015), where it committed itself to the CE strategy (Su et al., 2013). According to Ghosh et al. (2016), recycling increased in this period from 16% to 34% of industrial solid waste and from 10% to 20% of municipal solid waste. However, relevant recycling data in China is scarce. Recent official information indicates that China will re-introduce 28% of its waste into production (Schroeder et al., 2019). Sakai et al. (2011) state that the second largest polluter, the USA, is taking steps to increase recycling. This corresponds to a shift of 24% in 2001 and 31% in 2008. According to Leal et al. (2019) landfill was reduced from 70% to 45% in 2015. But Chowdhury (2009) claims that reliable data on US recycling rates is not readily available. The most recent data available in the "US Environmental Report" shows that recycling increased slightly to 34%, while 53% of solid municipal waste was still landfilled (EPA, 2016).

On the other hand, there are countries that are very actively involved in CE, such as Japan, which in 2006 launched a CE strategy to recycle 54% of municipal waste by 2018 (Sakai et al., 2019). However, some of Japan's recycling targets for 2020 were much higher: 95% for glass, 72% for paper, 50–70% for various household appliances, and 40–85% for various forms of food waste. The most ambitious goal in Japan was the construction waste target: 95–98% for various materials De Sousa Jabbou et al. (2019). Especially ambitious in CE is South Korea, which has set a target for overall municipal waste recycling at 61% by 2020 and 85% of industrial waste Alpenberg & Karlsson (2019).

However, there are clearly different histories and speeds within the EU. The first drivers were mostly the countries of Central and Northwest Europe among them Denmark, Germany, the Netherlands and the United Kingdom (EUKN 2015). The paper of the European Environment Agency contains reports on the Netherlands, which achieved 50% of municipal waste recycling in 2010, with landfill rates close to 0% (Milios, 2013). For industrial waste, the recycling rate is 88.6%, 7% incineration and 4% landfill. Some EU countries have established "green" politics in their political decision making which encourages the movement towards a circular economy (Howes et al., 2017).This suggests that consumer waste behaviour is a weaker link in the chain than industrial waste (Bocken et al., 2016, Goorhuis et al., 2012). Comparisons of the type of pollution and amounts of pollution between consumers and industrial enterprises have been the subject of studies (Simeoni et al., 2019; RedCorn et al., 2018), which confirm that consumers play a greater role in pollution than industry does.

A recent EEA CE assessment shows that consumers in the wealthier countries of Central and Northwest Europe produce twice as much waste as in Eastern European countries. Yet the overall recycling rate of municipal waste in 2015 in Central and North-western European countries exceeds the 50% target, as in Austria, Germany, Belgium, the Netherlands and Switzerland, where regions even reach 80–90%, while Romania, Turkey and Bulgaria remain almost at 0% recycling. Landfill practices reflect the following: Switzerland and the Netherlands reach almost zero landfill, while Bulgaria, Croatia, Latvia, Lithuania and Turkey still landfill 80–100% of their municipal waste (EEA, 2016). The landfill rate is related to the landfill price and to the approach taken by consumers and subsequently companies to CSR. The higher the standard of living, the greater the pressure on sustainability and the higher the landfill price. Therefore, in terms of economy and the promotion of CSR, it pays to recycle in Western European countries, while it is more profitable to dump waste at landfills in the countries of Southeast Europe. It can be argued

that developed economies in Northwest Europe generated up to 70–90% of the circulation of key materials, including metals and plastics (Reike et al.2018). EU leaders have clearly decided to support the circular economy. This is mainly due to the lack of mineral resources on the European continent. The change in the EU approach culminated in the adoption of the four directives of the circular economy package in 2018. The EU promises a faster transition to a circular economy thanks to a package that fundamentally amends the waste, packaging and landfill directives. The package will bring more recycling, reduced packaging materials, less landfilling or, for example, greater use of secondary raw materials (Saidani et al., 2019).

According to a UN study (2019), 99 % of directors of firms with a billion-dollar turnover declared that sustainability is an integral part of their future operations and included the circular economy in their strategic plan. Examples include Google and EIT Climate-KIC, which have set up the "Impact Challenge" project, providing financial support for technological projects designed to help with the climate. The sum allocated under this project is 10 million EUR (Google, 2020)

Current circular economy in the Czech Republic

The EU and its policies aimed at support for sustainable development have the main influence on the development of the circular economy in the Czech Republic. Between 2011 and 2015, the EU Generation Awake campaign was conducted, which pointed out problems related to waste. In 2014 the EU issued a notice regarding the circular economy, entitled "Towards a circular economy: A zero waste programme for Europe" under which according to the EU's plans, by 2030 Europeans should recycle 70% of household waste and 80% of packaging waste (Environment, 2014). The most significant research in the Czech Republic was conducted in 2012 by Henkel Czech Republic in cooperation with the research agency GfK Czech, relating to environmental protection, in which representatives of enterprises active in the Czech Republic were surveyed. It was apparent from the research that a total of 71% of companies active in the Czech Republic have a long-term sustainable development strategy. Companies focus the most on reduction of energy consumption (77%), reduction of waste production by (70%) and emphasis of the relationship of sustainability to a company and its products (59%) (Mediaguru, 2012). The discovered data are relatively extensive. The reason is that the Czech economy is mostly based on exports to the EU and mainly to Germany, where such behaviour is a condition for cooperation (Ungerman & Dědková, 2019). The Circular Economy Institute was established in the Czech Republic in 2015 to support the circular economy, and the institute focuses on educational as well as practical activities aimed at applying the circular economy and analysis of waste monitoring (Jonášová, 2017). The Czech Association of the Circular Economy (ČAObH) has operated in the Czech Republic since 2016. Since its establishment, it has supported all aspects of the circular economy and its support is currently directed primarily at recycling and using waste rather than dumping it onto ever-expanding Czech landfill sites Data about enterprises' spending on environmental protection related to the use of the circular economy model is ensured by the Czech Statistical Office. Table 1 shows that spending grew continuously until 2015, when it amounted to more than CZK 40 billion, but was followed by a major decline, and in 2016 it amounted to only CZK 25 billion. (CSU, 2020).

Table 1. Waste production and investment in environmental protection in the Czech Republic in 2011-2018

	2011	2012	2013	2014	2015	2016	2017	2018
Total waste production in th. tons	23576	23436	23724	23789	26947	25758	24926	28353
of which business waste	19919	19939	20127	20236	23247	21802	20884	24189
Investment in environmental protection in mill. CZK	24814	25617	27074	31390	40110	25476	35423	31028
of which waste management	3626	3148	4668	4968	5645	3293	3354	5476

Source:(CSU, 2020)

According to Rais et al. (2016), company waste amounted to 21.8 million tonnes in 2016. Compared to in 2015, it was reduced by 6.2%. The greatest share of company waste consisted of construction and demolition waste (64%). Another group consists of miscellaneous waste (16%), waste generated by waste processing facilities (12%) and waste originating from thermal processes (8%). Environmental legislation in the Czech Republic is putting constant pressure on finding new solutions, which are expected to be both economically advantageous and beneficial for the environment (Žižka & Rydvalová, 2014). This strategy enables the state to carry out greater implementation of the circular economy in practice (Chebeň et al., 2015).

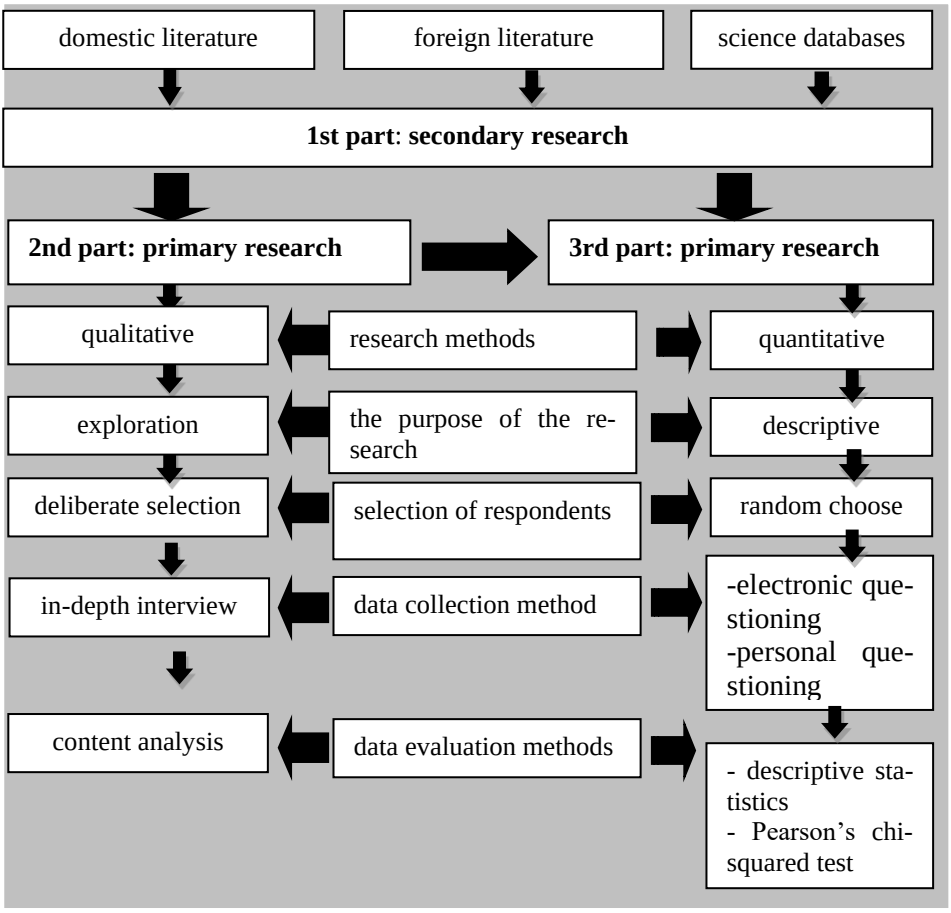
However, most of the barriers to the implementation of the CE in the Czech Republic are merely a question of mindset. According to a survey (Ipsos, 2017), 68 % of people in the Czech Republic are willing to pay extra for a product that is environmentally friendly. In the same study, the figure is as high as 72 % for young people aged up to 24. Also, according to this study, only 5 % of employees do not take into consideration the (ecological) responsibility of their employer. Moreover, consumers are increasingly accustomed to purchasing new products and demanding new services. These tendencies thus create great market potential for environmentally-friendly products and services.

The approach of large multinational corporations in the Czech Republic is strongly focused on the development of the CE, proof of which can be seen in the conference Circular Economy, It's CEO's Agenda! (2020), held in Prague, where the directors of the Czech branches of multinational corporations such as Coca-Cola, HBC, IKEA and Nestlé jointly showed that for a long time now, the circular economy and sustainability have not been a mere trend, but a long-term strategy they now implement in running their companies.

Research objective, methodology and data

The basis for the elaboration of the research methodology was the definition of scientific questions. Based on this, the methodology was divided into three parts. The first part took place throughout the year 2018 and dealt with secondary research. The source was the research of domestic and foreign literature, scientific articles and the Internet. An information base was created for the given issue on the basis of this. The second part was the primary data collection, carried out using qualitative research. This research was conducted through in-depth interviews during January and February 2019. The third part consists of further primary research, carried out by quantitative data collection. This third part was conducted through questioning during September-December 2019. The methodology is based on a sequence of parts, where one part has to be evaluated to begin the next part. The results of the first part (secondary research) were used as a basis for the second part, and those then for the third part. For the sake of clarity, the research concept together with the methodology is shown in figure 1.

Figure 1. Conceptual framework and methodology of research



Source: own

1st part – secondary research. A year-long analysis of previously published research served as a basis for orientation in the issue. The most interesting results of secondary research are presented in the introduction and the literature overview. The information found served as an information base for the second part.

2nd part – primary research, qualitative. Qualitative research served to reinvigorate the subject of research which were activities in the environmental field. Due to the fact that the research was carried out under natural conditions, a comprehensive picture of current environmental activities was created in a real environment (Creswell, 2008). This research was conducted through in-depth interviews. In total, fifteen structured interviews were conducted in 15 major enterprises in the Liberec region. In this type of research, it is very important to establish personal contact with the respondent. That is why only the Liberec region, where there is a long-term personal contact between the Faculty of Economics and the major companies of the region, was chosen. Employees of enterprises who were directly responsible for the environmental behaviour of the enterprise were always approached, thereby ensuring the validity of the responses. A deliberate selection of respondents was used *for the selection of respondents.* As the respondents were enterprises in the Region of Liberec, representatives of small enterprises (up to 49 employees), medium-sized enterprises (up to 249 employees) and large enterprises (over 250 employees) were chosen. The size of the enterprise was combined with the industry in which the enterprise moves. The companies were from the sectors: automotive, glass, construction and services. The "in-depth interview" was chosen as the *data collection method,* where the problem is looked into in depth. The research was conducted by a questioner who conducted an interview on the subject of the circular economy and its use in the enterprise. The interviewer had a prepared script that was supplemented as needed during the interview. A second member of the research team was present along with the interviewer, recording the interview with audio equipment and making a written record. The *data were evaluated* using content analysis. Each of the fifteen interviews was judged separately using group assessments. The group was represented by a marketing expert, a specialist in environmental management and business economics. Each of the fifteen in-depth interviews was coded, a consensus was sought, and a resulting list of specific environmental activities of the enterprises was compiled.

3rd part – primary research, quantitative. Quantitative research uses quantification or statistical methods for evaluation. This type of research describes the fact examined by means of variables (characters) that can be expressed by numbers. The questioning usually includes scale-based questions and the scaling of respondents into certain groups. This was also the case for this research. The logic of quantitative research was deductive, as the research required strong standardization to ensure high reliability. The purpose of the research was descriptive because the rate of frequency was investigated (Saunders, 2002). The selection of respondents was randomized, where each core set unit had the same probability of being selected (Mc Givern, 2009). The core set was made up of all business entities in the Czech Republic registered in the commercial database purchased by the Faculty of Economics. Every tenth business entity was randomly selected from the database and subjected to questioning. The combination of electronic and personal questioning was used to collect data. There was a very low level of return for electronic questioning, so personal interviews were conducted. For questioning, a questionnaire was compiled, which contained three questions about the circular economy and three enter-

prise-specific classification questions (see appendix). The first question was a closed enumeration and addressed the strategic activities of enterprises in the environmental field. The second question was a closed enumeration with sixteen variants of responses that dealt with the activities of enterprises that are beyond the legislative framework. The third question was a closed matrix with sixteen variants that emerged from the qualitative research from part 2. The answers were set on a scale of 1 to 6, the reason being to get information on the importance of individual activities. The other three classification questions were to characterize the enterprise and related to the size of the enterprise, the field of business and the geographical corporate culture that is applied in the enterprise. For the presentation of enclosed enumeration questions, the percentage expression was used. For the matrix scale question, descriptive statistics were used: modus, median, mean, standard deviation and variation coefficient. For the classification questions and the discovery of the differences in the files, the method of testing statistical hypotheses was used: Pearson's chi-squared test.

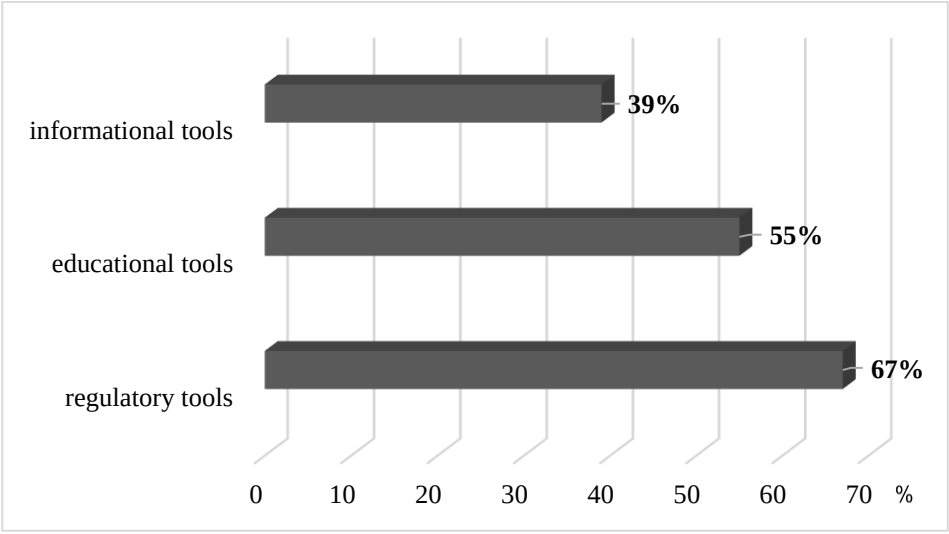
Results

This section presents the results of the research, which provide the answers to the three designated research questions. One subsection is devoted to each research question. The primary research had two parts. The first was participated in by representatives of fifteen enterprises from the Liberec Region, and the second part was participated in by representatives of 205 enterprises throughout the Czech Republic.

Standardised environmental activities

The first research question was determined as follows: **How are enterprises involved in standardised environmental activities as defined by the Ministry of the Environment?** First of all, researchers wanted to find out if enterprises are engaged in environmental activities in a long-term time horizon and, if so, in which areas. The results show that 29% of the enterprises, which represents 60 enterprises in absolute numbers, apply a passive environmental approach. This means that these enterprises resolve only activities that are required under Czech or EU legislation. However, 71% (145 enterprises) are active in the environmental area and take an active approach. This means that additional voluntary environmental activities take place. Only enterprises that take an active approach in environmental policy (145) were involved in further research. The active approach can be divided into three areas. The area of involvement is based on the Czech Ministry of the Environment publication entitled “Voluntary Environmental Activities” (Remtová, 2006). In this decree, active environmental activities are divided into three main tools: regulatory tools, educational tools and information tools. Enterprises were asked about involvement in these three areas. The presented results can be found in Figure 2.

Figure 2. Instruments of active approach in environmental field



Source: own research

Most enterprises (67%, 97 enterprises) stated that they applied **regulatory tools**, which reduce enterprises' overall negative impacts on the environment. This involves their own active application of corporate social responsibility for necessary legislative requirements. The second most common environmental activities according to enterprises are **educational tools**, which a total of 55% of respondents mentioned, which represents 80 enterprises in absolute numbers. This involves educating employees to understand environmental and social responsibility issues. The least used activities according to enterprises are **informational tools**, which were referred to by a total of 39%, which amounts to 50 enterprises in absolute numbers. These involve providing information to customers about environmental impacts.

It was also necessary to determine what specific types of voluntary standardised environmental activities enterprises apply. The definition of this concept includes such activities (methods, approaches, behaviour) which are harmonised at the international level and which enterprises carry out voluntarily, beyond the scope of legislative requirements with the purpose of reducing negative impacts on the environment and also boosting their position on the market, increasing competitiveness, improving their reputation and last, but not least, increasing profit. Each of the three main tools is then broken down in detail into individual specific activities - table 2.

Table 2. Division of voluntary standardised environmental activities.

Regulatory tools	Educational tools	Information tools
"Product-service" innovation Strategies	Eco-Management and Audit Scheme (EMAS)	Environmental reporting
Environmental agreements between the state and the enterprise	Life Cycle Assessment (LCA)	Environmental managerial accounting
Ecodesign	Environmental benchmarking	ČSN ISO 14025 standard
Monitoring and targeting	Total Quality Management (TQM)	ISO 26000 standard
Cleaner Production Assessment	-----	ČSN EN ISO 14024 standard
ISO 14001 standard	-----	ČSN 14021 standard

Source: own research

Sixteen voluntary activities were used for the own research, as reported by the Ministry of the Environment of the Czech Republic, in the publication "Voluntary Environmental Activities" (Remtová, 2006). Respondents chose from listed responses, and each respondent also had the opportunity to add additional responses. Individual activities and their uses are presented in Table 3.

Table 3. Voluntary standardised environmental activities of enterprises

1.	Standard ISO 14001	55.6 %
2.	Environmental agreements between the state and an enterprise	36.1 %
	Eco-friendly design	30.6 %
	Total Quality Management (TQM)	27.8 %
	Environmental reporting	20.4 %
3.	Monitoring and targeting	16.7 %
	Standard ČSN ISO 14025	15.9 %
	Eco-Management and Audit Scheme (EMAS)	13.6 %
	Cleaner Production Assessment	12.1 %
	Standard ČSN 14021	11.2 %
	Environmental management accounting	11.1 %
	Life Cycle Assessment (LCA)	10.3 %
	Product-service" innovation strategy	10 %
4.	Standard ČSN EN ISO 14024	8.3 %
	Environmental benchmarking	8 %
	Standard ISO 26000	5.6 %

Source: own research

The activities can be divided into four groups, described below. Use was clearly dominated by the implementation of **standard ISO 14001** with 56%, which represents 81 enterprises. This is the basic Environmental Management System (EMS) standard, which is focused on the reduction of the impacts of an organisation's activities on the environment, which results in improvement of the environment and improves the company's profile.

The second group consists of four activities, and more than 20% enterprises mentioned their application. This group consists of: 1. Environmental agreements between the state and the enterprise, specifically contractual obligations agreed upon between the state administrative bodies and the enterprise. 2. Eco-design - inclusion of requirements for environmental protection in the proposals and designs for products. 3. Total duality management, daily checking of compliance with environmental conditions. 4. Environmental reporting - a description of all own impacts on the environment, both positive and negative.

The third group is the largest and consists of eight activities, and more than 10 % enterprises mentioned their application. This group consists of: 1. Monitoring and targeting based on an energy audit providing dynamic data about the degree of effectiveness during consumption of energy. 2. Standard ČSN ISO 14025 - own environmental claims, which the manufacturer may declare alone. –. 3. Eco-Management and Audit Scheme - inclusion of all employees in environmental activities. 4. Cleaner Production Assessment - material and energy flows of the selected production system. 5. ČSN ISO14021. 6. Environmental management accounting - expressed in an accounting unit's cash flows. 7. Environmental aspects in all phases of LCA, verified by an independent third party. 8. The product-service system involving a transition from the sale of products to the sale of the function of such products or the sale of services.

The fourth group is made up of three activities, which in evaluation are used by fewer than 10% of enterprises. This group consists of: 1. Environmental benchmarking with a comparison of environmental performance, functions and/or processes of an organisation with the best existing analogies in relation to the competition. 2. Standard ČSN EN ISO 14024 grants licences allowing the use of environmental labels on products. 3. Standard ISO 26000 is focused on ensuring compliance with fair trade principles in the areas of social responsibility, economic responsibility and management of environmental impacts.

To conclude, the defined research question may be answered as follows. 71% of enterprises present themselves as taking an active approach to the environment. This means that those enterprises carry out more activities than required by the legislation. Of those 71% of enterprises, 67% use regulatory tools.

There are large differences in the use of various voluntary activities. When more than 55% of enterprises implement the ISO 14001 standard, which is clearly the most used tool. The reason is customer demand, especially in the B2B market, where it is often a condition for establishing a partnership. This is especially true when a Czech enterprise does business with an enterprise from developed EU countries (e.g. Germany). On the contrary, many voluntary tools are used by Czech companies only marginally.

Environmental activities in the circular economy

The second research question, which was: "What types of activities enterprises themselves include in the circular economy and to what extent are those activities used?" The reason for this research question was the fact that standardised environmental activities do not exactly correspond to circular activities. The aim of this part of the research was to precisely determine what enterprises consider is involved in the concept of the circular economy and how they use those tools.

Table 4. Environmental activities of the circular economy

No	Environmental activities of the circular economy	mean	modus	median	SD	VC
1	Reduction of energy consumption in production	2.32	1	1	1.70	0.73
2	Reduction of waste from production	2.35	1	2	1.55	0.66
3	Reduction of material consumption	2.38	1	2	1.43	0.60
4	Reduction of emissions	2.57	2	2	1.68	0.65
5	Reduction of amounts of hazardous substances during production	2.63	1	2	2.04	0.78
6	Safe disposal of product	2.69	2	2	1.78	0.66
7	Minimisation of packaging	3.00	3	3	1.54	0.51
8	Use of longer-lasting materials for the product	3.13	2.3	3	1.79	0.57
9	Standardisation of types of materials	3.30	3	3	1.46	0.44
10	Construction of products facilitating modernisation	3.42	3	3	1.92	0.56
11	Use of recyclable and recycled materials for production	3.44	2	3	1.64	0.48
12	Reuse of parts and whole assembly units	3.63	5	4	1.59	0.44
13	Production of parts accessible for maintenance and repairs	3.85	6	4	2.09	0.54
14	Ensuring easy disassembly of products	4.22	6	5	1.82	0.43
15	Product simplification (number of parts, etc.)	4.24	6	5	2.12	0.50
16	Multi-function design enabling greater product variability	4.50	6	5	1.52	0.34

Source: own research

The research has two levels, and it first involved qualitative collection of data, when specific activities of enterprises related to the environment were determined, as described in the research methodology. The resulting values are presented in table 4.

The discovered activities are sorted based on average from the most important to the least important. If the average is divided by the borderline value of 3.5, then 11 activities can be referred to as important. Enterprises only labelled five activities as unimportant. In the first five places in the evaluation of importance, respondents stated everything related to reduction. The modus represents the large difference in evaluation of importance, when the values with the greatest frequency are 1 and 6. Evaluation of the median ranges from 1 to 5, while the most common values of the median are 2 and 3, which can be described as having high to medium importance. The standard deviation (Sd), which defines the average dispersion of values of the statistical set around the arithmetic average, is lowest in relation to impacts 3 and 9, and highest for impacts 5, 13 and 15. In view of the certain

differences in the level of values for individual impacts, the relative level of variability is also used, specifically the variant coefficient (Vc), which defines the dispersion of values in view of the average. It ranges from 34 to 78%, and the lowest variability is shown by impacts 9, 11, 12, 14 and 16, and the highest relative variability is in relation to impacts 1 and 5. It is apparent that for impacts with the lowest variability, the agreement among respondents in their answers to questions is high, while for impact with high variability, respondents have agreed to a lesser extent.

The resulting list of sixteen activities that enterprises rank in a circular economy is almost identical to the results presented in the literary overview that emerged from the research. It can be said that Czech enterprises are familiar with the term circular economy and can correctly assign activities to this concept that are recognized worldwide. In determining the importance, the enterprises classified most of the activities as important, eleven in total. It can be stated overall that respondents agree more about activities of less importance. For activities with greater importance, there is less agreement. It can be stated overall that the variability of responses is relatively high and that opinions regarding importance differ. Therefore, it was decided to carry out further evaluation in relation to determining differences between individual types of companies.

Influence of sorting questions

The third research question was as follows: "What impact do the characteristic attributes of enterprises (size, sector and country of company culture) have on the degree of their involvement in the circular economy?" Sorting questions that have been included in the questionnaire make it possible to divide up enterprises based on various criteria. These involve the following areas: *company size, *line of business and *geographic corporate culture, which is applied in the enterprise. The method of inductive statistics was used for evaluation. All three sorting questions are presented in Table 5.

The responses to these questions will be subjected to Pearson's chi-squared test. Critical values are not presented in the contribution, but only p-value and the tests have been conducted with a degree of importance of α=0.05. The defined hypothesis was as follows:

$H0_{1, 2, 3}$: There are no statistically significant differences in responses to the question of recycling. $H1_{1, 2, 3}$: non $HO_{1, 2, 3}$

Research has proved statistically significant differences in relation to two questions, which are "industrial sector" and "parent company's seat". In relation to these questions, there are statistically significant differences in responses, and therefore for these questions, the H0 hypothesis can be rejected, and the H1 hypothesis can be accepted. Responses were then compared for sorting questions, where statistically significant differences have been identified. Following a thorough breakdown and comparison, the following differences were discovered.

Table 5. Respondent characteristics by size, sector and parent company seat

1. Enterprise size			2. Industrial sector			3. Parent company's seat		
	Number	relative frequency		Number	relative frequency		Number	relative frequency
0 to 10 employees	21	15 %	Automotive	49	34 %	CZ	67	46 %
11 to 50 employees	2	15 %	Construction, Transport, Storage	29	20 %	Germany	28	20 %
51 to 250 employees	39	27 %	food industry, commerce, retail	22	15 %	EU	27	18 %
251 or more employees	64	44 %	Farming, forestry, fisheries	19	13 %	World	23	16 %
			Services	26	18 %			
Total	145.00	100	total	145	100	Total	145	100.00
p-value	α=0.05	0.06564	p-value	α=0.05	**0.01156**	p-value	α=0.05	**0.03216**

Source: own research

In relation to the question about the industrial sector, statistically significant differences were apparent. The main differences are between enterprises that belong to the automotive sector, where there is a strong effort to include in the production process equipment that has already been excluded, and therefore they assign great importance to most activities. They assign nearly the same great importance to enterprises from the farming, forestry and fisheries sectors. The use of environmental activities is logical since the conditions involve work with natural materials and in natural conditions. Contrastingly, enterprises providing services assign the least importance to environmental activities. This can be attributed to the fact that a service is intangible, and therefore does not produce excluded products that can be recycled. However, the production equipment used in services can be reintroduced into operation following repairs or modification. In relation to questions pertaining to the seat of a parent company, a difference has been statistically proved. It is most apparent in enterprises that are directly German or whose parent company is from Germany. These enterprises generally have assigned much greater importance to environmental activities than enterprises from other countries. However, significantly less importance was assigned to the examined activities by enterprises with a parent company outside of the EU. Since in relation to this response, there has been aggregation, it is not possible to exactly identify parent countries. It can be stated overall that enterprises' opinions regarding environmental activities greatly vary. This has been proved both by the variation coefficient and by statistical induction focused on sorting questions. Overall, the views of enterprises on environmental activities are very different. This was proved

by both the variance coefficient and the statistical induction focused on classification questions.

Discussion

Back in 2009, global demand for commodities was one and a half times higher than the amount the planet is able to provide and renew at a sustainable rate. Current consumption models combined with the anticipated increase in the number of inhabitants to 10 billion people by 2050 means that global demand will be triple the sustainable production of our planet (Rockstrom et al., 2009). The question that must be answered is: How can we satisfy the needs of the growing population when even now we are facing the adverse consequences of our consumer lifestyle? Authors Baxter et al. (2016); Linder & Williander (2017); O'Brien (2012) see the solution as lying in the concept of the circular economy.

One common argument given by enterprises as to why they do not behave in a sustainable manner is the capital intensity of the circular economy. However, according to some authors Sepulveda (2015); Antikainen & Valkokari, (2016), paradoxically CE is economically beneficial. The prices of primary raw materials are dependent on the commodity markets and are often associated with expensive transport. On the other hand, there is waste that the country does not know what to do with, so why not use it as a resource? Some landfill sites, for instance, contain a greater concentration of gold than gold mines do. The important criterion, as stated by Kuo, et al. (2018), is that waste processing must be non-energy-intensive.

Some authors Hart & Milstein (2003), Hermansen, (2006) claim that the following belong in the circular economy: enclosing material flows within functional and endless cycles, drawing energy from renewable and sustainable resources, and designing products and services that have no negative impact on natural ecosystems and human resources. A precise specification of CE tools is often lacking. In this paper, the authors have managed to eliminate that shortcoming, presenting both standardised activities, as well as particularly activities that enterprises associate with the CE.

If we compare the other findings with the research conducted by the GfK agency in 2012, the figures are very similar. The agency found that 71% of companies operating in the Czech Republic have a long-term strategy in the field of sustainable development, of which 77% of companies are focused on reducing energy consumption, 70% of companies are reducing waste production, and 59% of companies present the relationship of sustainability and their products. In the presented research, 71% of the companies stated that they had been applying a strategy in the environmental field for a long time. Of these, 67% use regulatory tools, 55% of enterprises use training tools, and 39% of enterprises use information tools. It can be said that there have been no significant changes in the environmental behavior of companies over the last five years.

Conclusion

The main objective of the research as presented in this paper was to empirically "Determine how enterprises in the Czech Republic are currently involved in the circular economy.

This main objective was fulfilling using three research questions. The scientific contribution of the article is primarily in a comprehensive view of the perception and use of the circular economy by enterprises in the Czech Republic. The Czech Republic, as a member of the EU, has undertaken to recycle 70% of municipal waste and 80% of packaging waste by 2030. The process of obtaining that is presented in the paper could serve as a guideline for obtaining information on the state of the circular economy.

The paper was compiled using a methodology that combined qualitative research with an exploratory purpose and quantitative research with a descriptive purpose. This combination is widely used for its effectiveness. The authors strive to apply this combination to standardise this method and use it for further research in another country or to use it periodically in one country at intervals. Both the research objective and all scientific questions were fulfilled and answered by the results of the research and a lot of information has been discovered, in a logical sequence. It was discovered that the Czech enterprises are active in the implementation of the circular economy and do not lag behind advanced economies. This is also due to pressure from consumers, who prioritise enterprises with CSR activities, and due to pressure from international partners who require an environmental approach. This pressure, as has been shown by research, is also apparent with German enterprises, with Germany having shown itself to be the main partner of the Czech exporters and the largest investor in the Czech Republic. Great pressure on Czech enterprises also comes from the European Commission, which adopts ambitious cyclical economic packages that contain revised legislative proposals relating to proposed measures pertaining to the circular economy. This will strengthen global competitiveness and support sustainable economic growth, which will create new jobs. It is a transition from the linear model, which functions based on the principle of raw material extraction, production and discarding of waste, to the circular model of the economy, in which waste is reintroduced into the production process. It is important that all parties involved consider the circular model of the economy to be beneficial.

It can be stated overall that Czech enterprises no longer realise to a great extent the opportunities presented by the circular economy. The use of this opportunity can lead to the rediscovery of the Czech economy and can make it more competitive.

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Appendix – a questionnaire

Dear Madam/Sir,

we are employees of the Faculty of Economics at TUL and we are engaged in research into the application of the circular economy in Czech companies. We would like to ask you to fill in a questionnaire concerning the circular economy and its application in your company. The results of the research will be processed and presented so that no one knows the company involved in the research. If you participate in the research, you will be given priority to the research results. Thank you for your time and information that will help us in further research.

Jaroslava Dědková and Otakar Ungerman, Department of Marketing and Trade, EF TU in Liberec

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1. What are the strategic activities of your companies in the field of the environment?

- ☐ The environmental activities in which our company is involved are based only on the activities required by law.
- ☐ The environmental activities in which our company is involved are based on the activities required by law; at the same time, our company implements environmental activities beyond the legislative framework.

2. If your company is involved in voluntary environmental activities, in which area would you classify these activities? (You can choose multiple answers)

- ☐ We actively apply regulatory tools
- ☐ We actively apply educational tools
- ☐ We actively apply informational tools

3. What specific types of voluntary standardized environmental activities does your company apply? (You can choose multiple answers)

- ☐ Environmental agreements between the state and an enterprise
- ☐ Eco-friendly design
- ☐ Environmental management accounting
- ☐ Life Cycle Assessment (LCA)
- ☐ Environmental benchmarking
- ☐ Total Quality Management (TQM)

- ☐ Environmental reporting
- ☐ Monitoring a targeting
- ☐ Eco-Management and Audit Scheme, (EMAS)
- ☐ Cleaner Production Assessment
- ☐ Standard ISO 26000
- ☐ Standard ISO 14001
- ☐ Standard ČSN 14021
- ☐ Standard ČSN EN ISO 14024
- ☐ Standard ČSN ISO 14025

4. Based on in-depth research, a list of environmental activities was compiled, which by their impact, classifies companies into the Circular Economy. What importance does your company attach to these activities of the circular economy?

Use a scale from 1 to 6, where 1 = max importance, 6 = minimum importance

No.	Environmental activities of the circular economy	1	2	3	4	5	6
1	Safe disposal of product						
2	Construction of products facilitating modernisation						
3	Minimisation of packaging						
4	Reuse of parts and whole assembly units						
5	Reduction of material consumption						
6	Reduction of emissions						
7	Reduction of amounts of hazardous substances during production						
8	Reduction of waste from production						
9	Reduction of energy consumption in production						
10	Standardisation of types of materials						
11	Multi-function design enabling greater product variability						
12	Production of parts accessible for maintenance and repairs						
13	Use of longer-lasting materials for the product						
14	Use of recyclable and recycled materials for production						
15	Ensuring easy disassembly of products						
16	Product simplification (number of parts, etc.)						

5. Enterprise size?

- ☐ 0 – 10 employees
- ☐ 11 – 50 employees
- ☐ 51 – 250 employees
- ☐ 251 or more employees

6. In what industry does your company operate?

- ☐ Automotive
- ☐ Transport
- ☐ Forestry
- ☐ Commerce
- ☐ Food industry
- ☐ Retail
- ☐ Fisheries
- ☐ Storage
- ☐ Services
- ☐ Construction
- ☐ Farming

7. What is the registered office of your company, or if your company is part of a corporation, then what is the registered office of the parent company?

- ☐ Czech
- ☐ Germany
- ☐ EU; what specific country?……...
- ☐ Outside EU; what specific country?…….