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# Transition to the circular economy and new circular business models – an in-depth study of the whey recycling

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**Abstract.** Depleting natural resources and large amounts of waste increase the environmental pressure affecting the economy and humans. Emerging sustainability challenges require new behavioural patterns from both the business and consumers. Responding to these constraints, the circular economy is promoted as a new way towards a sustainable future. While the circular economy provides new principles for improving resource efficiency and reducing waste, most of companies run traditional business models with the perception that competitive advantages can be achieved by increasing production. Instead circular business models seek for increase of profitability and efficiency through adapting various business model innovations. However, their adoption process and results are unclear for many industries highlighting the topicality of this article. This research shows that milk processing companies lack an experience and understanding of benefits and challenges of circular business models. In milk processing, the whey is considered as problematic waste or the production leftover, which requires new treatment. The research provides analyses of the whey recycling circular business models that ensured new revenue streams, higher profitability, return on assets and competitive advantages for milk processing companies. The COVID19 pandemia increases the importance of this issue as the dairy industry due to livestock requirements shall ensure business continuity despite a crises or other risks that slowdown the business.

## 1 Introduction

The circular business models are often related to larger investment projects, which in many sectors, including the milk processing sector, which develop and introduce new technologies and technological solutions. In Latvia, in the milk processing industry and in the economy as a whole, there is a relatively small understanding of the circular economy and implementation of its principles in companies. Companies lack information and understanding of the advantages, benefits and challenges of circular economy business models.

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The number of circular economy projects implemented in Latvia so far is low. Thus, the process of implementing new circular economy projects and their results are unclear for many sectors, including the milk processing. As the milk processing sector in Latvia mostly run traditional business models, they lack an experience and practices in developing new circular business models and circular economy projects. This uncertainty comparing to traditional business strategies bear larger risks and therefore constitute greater expectations towards the financial viability and expected returns from the investments.

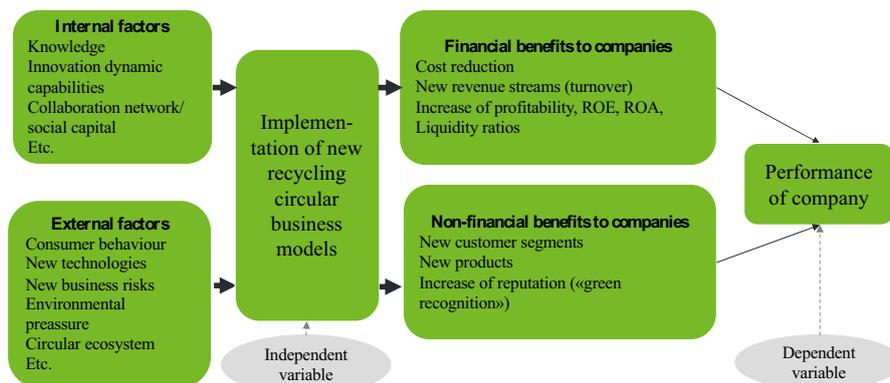
Although it is relatively common to add value to end-of-life products or materials through recycling, this is general approach to design the use and appropriate disposal of the product. This is not usually reflected in product design and pricing mechanisms [1]. It has been recognized by EU institutions that the market for secondary raw materials is an area that needs to be significantly improved and the promotion of recycling has an important role [2].

The European Commission has approved ambitious agenda for further promotion of the circular, sustainability and green objectives, envisaging comparatively large support and financial instruments. The sustainable agriculture, safe and natural food is one of the specific concerns for the circular transition of European Union [2]. Changing the food system is one of the key issues in tackling climate change, building a healthy society and promoting biodiversity. The circular economy can contribute to the improvement of the food system. This raises the importance of this movement not just on the political level, but also on the business level. The circular economy acknowledges the food waste and seeks for solutions to reduce this waste by the time it is generated.

The hypothesis of this research: the implementation of circular business models improves the competitiveness of milk processing companies and it is measured by the return on assets (ROA). The aim of this research: to investigate the cost efficiency and financial viability of the circular business models in the milk processing industry in Latvia. The main tasks of this research are as follow: 1) to study the nature and main principles of the circular economy and circular business models; 3) multifactor and financial analyses of the milk processing company “Smiltenes piens” with regard to circular business models; 3) to evaluate the profitability and the return on assets (ROA) of implementation of circular business models within Latvian milk processing industry.

## 2 Methods

The figure below demonstrates the conceptual research model (Fig.1).



**Fig. 1** Conceptual research model, created by authors

Following research and data mining methods were used for this research: the analysis of theoretical and scientific literature, the comparative statistical analyses and the financial

analyses. In-depth interviews were conducted with representatives of “Smiltenes Piens” ltd., experts of the milk processing and cheese industry, the circular economy and other experts.

The research compares a carefully selected range of international and local case studies. Particular focus is kept on the exploring the case study of the milk processing company “Smiltenes piens” operating in Latvia. This company has succeeded with adoption of new business model of whey recycling and introduced within the market innovative products derived from whey recycling. International case studies allow the exploration of twofold perspective - the development of product and business model innovations through further processing of whey. The comparative analysis is used in order to compile theoretical and practical findings.

### 3 Results and Discussion

#### 3.1 Circular economy and circular business models

The depletion of the natural resources is putting increasing pressure on the environment, which in turn result in economic consequences. In order to improve the efficiency of the use of natural resources and reduce their extraction, as well as to prevent pollution of nature, air, water and soil, a transition to a circular economy is needed. The circular economy seeks solutions to environmental problems and challenges posed by climate change, while thinking about the growth of the economy based on the sustainability principles [3, 4]. The circular economy advocates the values and benefits of the environment, the economy and human well-being of current and future generations [5, 6, 7, 8]. We define this as the 3E circular economy value model, which include environmental values, economic values and emotional values of people.

The concept of the circular economy began to emerge in the scientific debate in the 90s, but the number of studies and scientific publications has begun to grow significantly over the past 5 years (Fig.2).

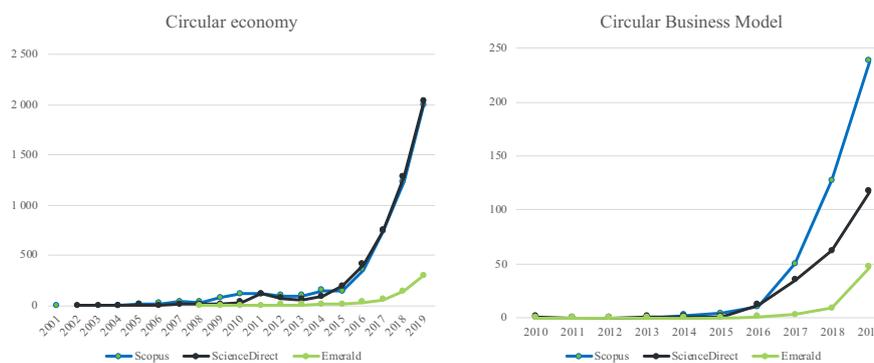


Fig. 2 Number of articles, created by authors, based on the literature analyses

Circular business models ensure the transition to the circular economy on the micro-level dealing with companies, consumers, products and services [9, 10]. Circular business models as the scientific concept is new and got more attention from researchers in last 4years (Fig.2). Circular business models ensure circular value creation, proposition, delivery and capturing within companies [11, 12]. Circular business models apply various circular activities or strategies - reduce, reuse, repair, refurbish, recycle, redeploy, remanufacture, redesign and other [5, 13]. These circular strategies aim at closing or narrowing the resource loop, reducing

the waste, extending the product lifecycle, promoting product-service systems, the sharing economy and industrial symbioses [14, 15].

The recycling is one of circular strategies that requires certain technological advancement for further processing of the production leftovers or waste and using recycled resources for manufacturing new products. Companies may reach competitive advantages when adopt upcycling technological solutions in their business models. This means that as a result of recycling a company manufactures products with higher value, quality and better functionality comparing the recyclable materials used [16].

In order to make better use of resources in the economy and close the resource loop, it is necessary to create information platforms on raw materials, waste and recycled materials, on production processes and technologies. This is also a matter of so-called industrial symbiosis. Industrial symbiosis is a model of cooperation between companies, in which one company uses the other's waste or production leftovers as raw materials in its production process [17, 18, 19].

### **3.2 Whey recycling and a case of Latvia**

Whey is a product obtained during the processing of milk into cheese, cottage cheese or yoghurt. Studies and practice show that whey has so far been mainly used for animal feed or as a biogas substrate [20, 21]. This is considered as downcycling as it is realised further as the resource with a smaller value. From one hand it is considered as positive as the whey is not eliminated into the wastewater as the whey, if not recycled, has negative environmental effects. Therefore, it should be specially treated when eliminated in the wastewater. Researchers previously acknowledged that in order to ensure sustainable development, the industrial wastewater shall be reused or recycled, and therefore considered as the valuable resource for the manufacturing of other products [22]. Many yoghurt and cheese producers have to pay to milk suppliers to take the whey back for fodder to avoid disposing of it into the sewers [20, 21].

There are also good practices applied, when the whey is recycled and from the resources obtained various products are manufactured, both for end-consumption and industrial production. Research and technological innovation in recent decades have developed allowing to produce higher value-added products as a result of whey upcycling [23, 24]. Currently, in the market the demand exists for both animal feed products and for higher value-added products for end-consumers. Also, there is a grow in the demand of the whey-based protein as it is used as nutritional ingredient for food with expected annual growth approximately 14% [23]. Researches identify that soft drinks and alcoholic drinks have been produced from whey derived ingredients, for instance, Rivella based in Swiss and Alchowhey, start-up established in Denmark. However, researchers acknowledge that the use of whey in the production of beverages is uncommon and relatively small success [23, 24].

The analyses of the milk processing industry in Latvia shows that companies apply comparatively traditional business models regarding the whey recycling, meaning that they tend to sell it or give back it to agricultural enterprises to be used as the subtract for biogas stations or livestock feed. There are just view companies that publicly provide the information about the offer of such product as a whey although there is a much larger number of companies producing cheese, cottage cheese and yoghurt. These companies put more efforts and resources on creation and promotion of existing and new cheese and other milk products, acquiring new customer segments and geographical export markets.

The production of whey derived by-products and end-products require R&D and dynamic capabilities to innovate, which require internal and external research capacity to invent and test new production technologies and technological solutions. Allocation of such resources

of R&D without additional support could be one of hindering factor for milk processing companies as most of them are classified as small and some - medium size companies.

According to the statistical data, it is possible to recognise some relationship between the changes in the value added of the milk processing industry and the overall gross profit margin of the industry, which indicates that dairy companies mostly use the sales price increase and cost reduction method to increase profitability rather than increase sales of existing products or successfully introduce new products.

Statistics show that sales of whey in Latvia have increased significantly over the last 5 years from 51,2 thousand EUR in 2012 to 2 241 thousand EUR in 2016 reaching the peak and with small fall, but still high 1 856 thousand EUR in 2018. It can be observed that these changes in the market raised simultaneously with the introduction of a new whey recycling business model in the company Smiltenes piens ltd. This company intensively cooperating with researchers and research institutions and also attracting the support for these activities have elaborated new technological solutions for whey upcycling. This company produces two types of product for various customer segments. The protein beverage products with various tastes and flavours are realised for the end-user consumption. In addition, using a form of industrial symbiosis, this company produces lactose, which is sold to industrial producers, for instance for the ice cream production. This has been significant innovations not just on the product or business model levels within the company but has forced changes in the whole milk processing industry. End-customer have been introduced with completely new type of protein products with the original and advanced value proposition focussing on the mass market customers instead of small and specific niches. This increased some wave effects encouraging other companies towards some product and value proposition innovations, like, protein yogurts.

The ROA is the financial ratio which compared to the industry median shows the corporate advancement level of the competitiveness and success in reaching competitive advantages [25]. ROA is calculated using the formula below (1), where “E - net profit for the period of review, A – total assets at the end of the period of review” [26].

$$ROA = E/A \tag{1}$$

The financial analyses of the performance of Smiltenes piens show that the landing of new whey recycling business model took approximately 5 years starting from 2010. After successful adoption of new business model and introduction of new products in the market the profitability ratios started the significant increase since 2015. The ROA of Smiltenes piens ltd. has increased more than 5 times. This ensured advancement of the competitiveness within the industry.

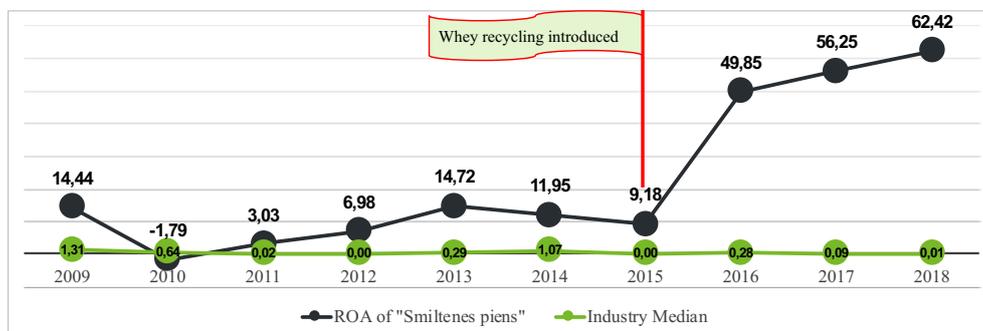


Fig. 3 ROA of “Smiltenes piens” ltd. and average ROA of the industry, created by authors

## 4 Conclusions

The implementation of circular business models (CBM) improves the competitiveness of milk processing companies. In milk processing, the whey is considered as problematic waste or the production leftover, which require adoption of new recycling CBMs. The transition to a circular economy is a logical step for milk processing companies in ensuring the sustainable business development, although majority of companies apply traditional (linear) business models. The COVID19 pandemia highlighted the importance of sustainability and business continuity of companies of the dairy industry due to the everyday care requirements of the livestock.

Implementation of CBMs in milk processing companies provides an opportunity to increase the efficiency and ensure further processing of environmentally harmful waste or wastewater into products with higher added value. Milk processing companies shall develop new recycling CBMs and thus transform production leftovers into new products with added value in order to expand revenue streams.

The introduction of new recycling CBMs in milk processing companies is investment intensive (in new technologies) and additionally require costs for R&D and marketing. Positive financial return after the implementation of CBM is observed in a period of 3-5 years.

ROA of company "Smiltenes Piens" significantly increased since the adoption of new whey recycling CBM, exceeding 3 times the industry.

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