Deliverable title	**D6.2 Report on value-chain and business model analysis**
Deliverable Lead:	UNIVPM
Related Work Package:	**WP6 Evaluation of consumer needs, preferences, and acceptance towards thistle-curdled and control cheeses**
Related Task:	**Task 6.2.** Prospect value chain analysis and business model canvas analysis
Author(s)	Raffaele Zanoli, Vittoria Romiti
Dissemination level	Public
Due Submission Date:	Month 35 _ 31.03.2023
Actual submission:	26.04.2023
Start date of project	**01.05.2019**
Duration	36 months (after project end extension: 48 months)
Abstract	This report presents a case study of applying the Business Model Canvas (BMC) model to study the case for employing the Cynara-humilis vegetable rennet in feta cheese production. The report is based on research performed in four countries; Italy, Spain, Tunisia, and Greece. The BMC is a visual representation of the key components of a business model, including customer segmentation, value proposition, channels, revenue streams, cost structure, and key partners, resources, and activities. After having presented the various components we conclude by recommending wider dissemination of the use of *Cynara humilis* extract in the processing of Feat cheese, given its technical, economic and market advantages, while seconding the current consumer trends.

Versioning and Contribution History

Version	Date	Modified by	Modification reason
V1.0	21/04/2023	Vittoria Romiti	First draft
V2.0	26/04/2023	Raffaele Zanoli	Final version

Table of Contents

1. INTRODUCTION

In today's fast-paced and competitive business landscape, understanding the fundamentals of a successful business model is vital. The business model canvas (BMC) is a strategic management tool that helps businesses conceptualize and analyse their underlying business model. The canvas was initially developed by Alexander Osterwalder and Yves Pigneur, who argued that the traditional business plan was limiting in identifying and analysing a company's business model, which is crucial when seeking to create and maintain a viable business venture (Osterwalder & Pigneur, 2010).

The BMC provides a visual framework where businesses can describe their value proposition, customer segments, key partners, revenue streams, cost structure, and key activities in a single page (Osterwalder & Pigneur, 2010). The BMC constructs six core elements that collectively define how companies create, deliver, and capture value, which are interconnected, repetitive, and interdependent.

Alexander Osterwalder and Yves Pigneur introduced the business model canvas in 2008, bringing in a fresh perspective on developing and managing businesses. The canvas includes nine components that help business leaders understand the correlations between the business's key features and how they interact with each other.

The nine components of the business model canvas are customer segments, value proposition, channels, customer relationship, revenue streams, key resources, key activities, key partnerships, and cost structure. Each of these components plays a crucial role in shaping the organisation's success.

The first and central element of the BMC is the value proposition or the unique solution that the company provides to customers that differentiates it from competitors. The value proposition highlights the company's distinctive characteristics and benefits while differentiating it from competitors (Osterwalder & Pigneur, 2010).

The second component of the Business Model Canvas defines the customers that are being targeted. In this section, businesses need to consider their customer’s wants and needs to determine how to attract them to the company. The channel component focuses on how a company is going to connect with its customer base. The customer relationship part covers how businesses interact with their customers and maintain credibility over time. The fifth element describes the company's revenue streams, which refer to the ways in which businesses generate revenue. Companies need to identify the most lucrative revenue streams that align with their value proposition and customer needs (Osterwalder & Pigneur, 2010).

The next four components of the canvas, including key resources, key activities, and key partnerships, focus on internal factors required to make the business successful and define the cost structure of the canvas.
The sixth element of the BMC is key resources that might include technology or skilled labour.
Key activities define the necessary tasks, processes, and resources that require attention to execute the business model effectively. These activities can vary for each business, and it is imperative to identify the processes and tasks necessary for success.

The eight element is the key partners, the entities companies partner with to conduct their business. For example, they can include suppliers, distributors, or other strategic partners who help the company gain a competitive advantage and develop a successful business (Osterwalder & Pigneur, 2010).
Finally, the last element is the cost structure, which outlines the fixed and variable costs that the company incurs. Companies must ensure an efficient cost structure that enables them to operate profitably while delivering value to customers (Osterwalder & Pigneur, 2010).

Despite its simplicity, the business model canvas helps business leaders to clearly define their objectives while understanding the key parameters of their businesses. It is a valuable tool for startups, nonprofits, and other organisations that need to establish themselves in the marketplace clearly and concisely. It can also help existing businesses understand their operations better as they seek to expand or reposition themselves. The business model canvas has been used in different industries, including healthcare, finance, technology, food and retail.

The business model canvas is also flexible and can be customised according to each organisation's unique needs. For instance, some businesses may require more emphasis on customer relationship management, while others need to focus on internal processes such as technology, talent acquisition, or significant partnerships. Organisations can make modifications to the canvas to suit their requirements as long as they do not alter its fundamental components.

Another advantage of using the canvas is the ability to visualise how each component interacts with the others, leading to a more robust business model. It also makes it easier to assess the feasibility of a particular business idea, identify strengths and weaknesses, and develop strategies to maximise the chances of long-term success.

The BMC offers several advantages to businesses. First, it provides a framework for business planning and strategy. The BMC can help managers understand the company's strengths and weaknesses, identify gaps in the business model, and develop a successful strategy to achieve its goals (Osterwalder & Pigneur, 2010). Second, the BMC improves communication and collaboration within the organisation as it outlines the key components of the business model, and everyone understands the company's direction and purpose.

Moreover, the BMC is a flexible tool that businesses can adapt to changing environments. The canvas is dynamic, allowing businesses to adjust their business model quickly to industry changes, market trends, and shifts in customer needs (Osterwalder & Pigneur, 2010) Lastly, business models enhance creativity and innovation within the organisation. It encourages managers to think of new and creative ways to achieve their business goals while satisfying customer needs (Zott et al., 2011).

Business model canvas has been widely adopted worldwide, with many universities and business programs offering courses in business model innovation that incorporate it. Some businesses require new staff, particularly heads of innovation or business development, to show they can effectively use the business model canvas. The canvas is flexible and adaptable, encourages innovation and creativity and has also been incorporated into entrepreneurship development programs and hubs that aim to develop new and aspiring entrepreneurs.

In the following, we will apply the BMC to study the case related to the production of feta cheese with *Cynara humilis* vegetable rennet. To our knowledge, insofar only one study has used the BMC in the cheese-making or dairy industry (Pozo & Durán, 2018).

2. VALUE CHAIN ANALYSIS & BUSINESS MODELS

A value chain is a series of activities that a company performs to deliver a product or service to its customers. The value chain includes all the activities from the initial production of raw materials to the final delivery of the product or service to the customer. Value chain analysis is the process of examining each of these activities to identify opportunities for cost savings, process improvements, and value creation.

On the other hand, a business model is a framework that describes how a company creates, delivers, and captures value. It includes the company's value proposition, target customers, revenue streams, cost structure, and key partnerships. A business model is essential for any company as it helps to identify the key drivers of profitability and sustainability.
Value chain analysis and business models are closely related as a company's business model is often based on its value chain. A company can identify opportunities to improve its business model by analysing the value chain. For example, a company may identify opportunities to reduce costs by outsourcing certain activities in the value chain or improving its production processes' efficiency. Alternatively, a company may identify opportunities to create value by developing new products or services that better meet the needs of its customers.
By analyzing its value chain, a company can identify opportunities to improve its business model and create value for its customers. A strong business model, based on a well-designed value chain, is essential for any company that wants to succeed in today's competitive business environment.

3. IMPACT OF VEGETABLE-RENNET ON THE FETA-CHEESE VALUE CHAIN

According to the European Commission (2023), Feta PDO is a traditional Greek cheese made from ewe's milk or combinations of ewe's milk and goat's milk with a maximum of 30% goat's milk. Feta cheese has a clear white colouring and a slightly peppery flavour that is linked to the cheese milk, which comes solely from native breeds of ewes and goats. It can be made from pasteurised or unpasteurized milk - nowadays, feta cheese is produced exclusively from pasteurized milk (Papadopoulou et al., 2018)- which must have at least 6% fat content and be obtained seasonally. There are no colourants, preservatives, lacto-proteins, casein salts, or condensed or powdered milk added (The European Commission, 2023). The European Commission Regulation requires Feta to meet the following characteristics in order to comply with the PDO label: cheese is characterized by the absence of rind, with a soft texture, a pure white colour, and a faint acidic taste. Feta cheese can be prepared from sheep's milk or a combination of sheep's and goat's milk, with a maximum of 30% of the total milk used to make the cheese. Milk can only be produced in Macedonia, Thraki, Ipiros, Thessalia, Sterea Ellada, Peloponnissos, and Lesvos Island. Condensed milk or milk powder are prohibited, nor are concentrated milk proteins or caseinates, colourings, or preservatives. The maximum moisture must be 56 g 100 g-1 and the minimum fat-in-dry matter (FDM) 43 g 100 g-1 and maturation must take at least 60 days. The majority of feta cheese does include the use of rennet. Indeed, as reported by (Rampanti et al., (2023), the coagulation of milk for cheese production is achieved by adding rennet to the milk in about 75 % of cases. It is worth noting that rennet plays an important role in cheeses in which it is used, especially in specialty cheeses that have specific organoleptic and aesthetic characteristics that define their uniqueness; rennet in this sense contributes to the attainment of these characteristics, as it may affect the quality and texture of the final product. (Rampanti et al., 2023). The most commonly used rennet is animal rennet obtained from calf abomasum, which contains the proteolytic enzymes responsible for curdling casein. For several years, there has been a shortage of animal rennet and a corresponding increase in its price, which has prompted research into replacement options for this milk coagulant. Hence, the dairy industry's growing interest in using vegetal coagulants for cheese production is due to the global increase in cheese demand and, at the same time, the decreasing supply of calf rennet (Bathmanath et al., 2019; Jacob et al., 2011), increasing numbers of lactovegetarian consumers, religious considerations (kosher and halal diets), and negative consumer perceptions of the use of genetically modified microorganisms (Roseiro et al., 2003).

Today, several types of rennet alternatives to animal rennet are available, in particular microbial rennet, rennet produced by chymosin fermentation and vegetable rennet (Rampanti et al., 2023). Proteolytic enzymes of plant origin capable of coagulating milk are extracted from various plants. Among plants, cardosin proteases from *Cynara spp*. are the most used for cheese manufacturing (Roseiro et al., 2003). (Foligni et al. (2022). Some recent investigations, such as those conducted by on *O. tauricum* proteases as vegetable rennet, have revealed that plant proteases have good coagulation performance, corroborating the hypothesis of plant rennet as a valid substitute for animal rennet.

In principle, using a vegetable rennet not only does not hamper the production process of Feta cheese, but may also provide some business opportunities, as shown in the next section.

4. CASE STUDY: BUSINESS MODEL FOR FETA CHEESE BASED ON VEGETABLE RENNET

In 2022, global cheese production amounted to about 22.17 million metric tons. The European Union was by far the top cheese producer worldwide, with a production volume of around 10.55 million metric tons of cheese that year. The global cheese market is projected to grow from $123.87 billion in 2021 to $161.23 billion by 2028, at a CAGR of 3.84% in the forecast period 2021-2028 (Fortune Business Insights, 2022). Feta cheese is one of the most popular varieties. Feta cheese is traditionally made using animal rennet – an enzyme extracted from the stomach of a young lamb or kid. However, vegetarian and religious (Muslim) consumers are driving the demand for vegetable rennet feta cheese. This report will analyse the business model canvas of a vegetable rennet feta cheese in Italy, Spain, Tunisia, and Greece.

This report will use the BMC to analyse the opportunities and challenges of introducing a vegetable rennet feta cheese in the selected countries. The information for this report was gathered through online research, interviews with industry experts, project partners and empirical consumer research reported in D6.1.
The following discussion is summarized in the BMC reported in Figure 1.

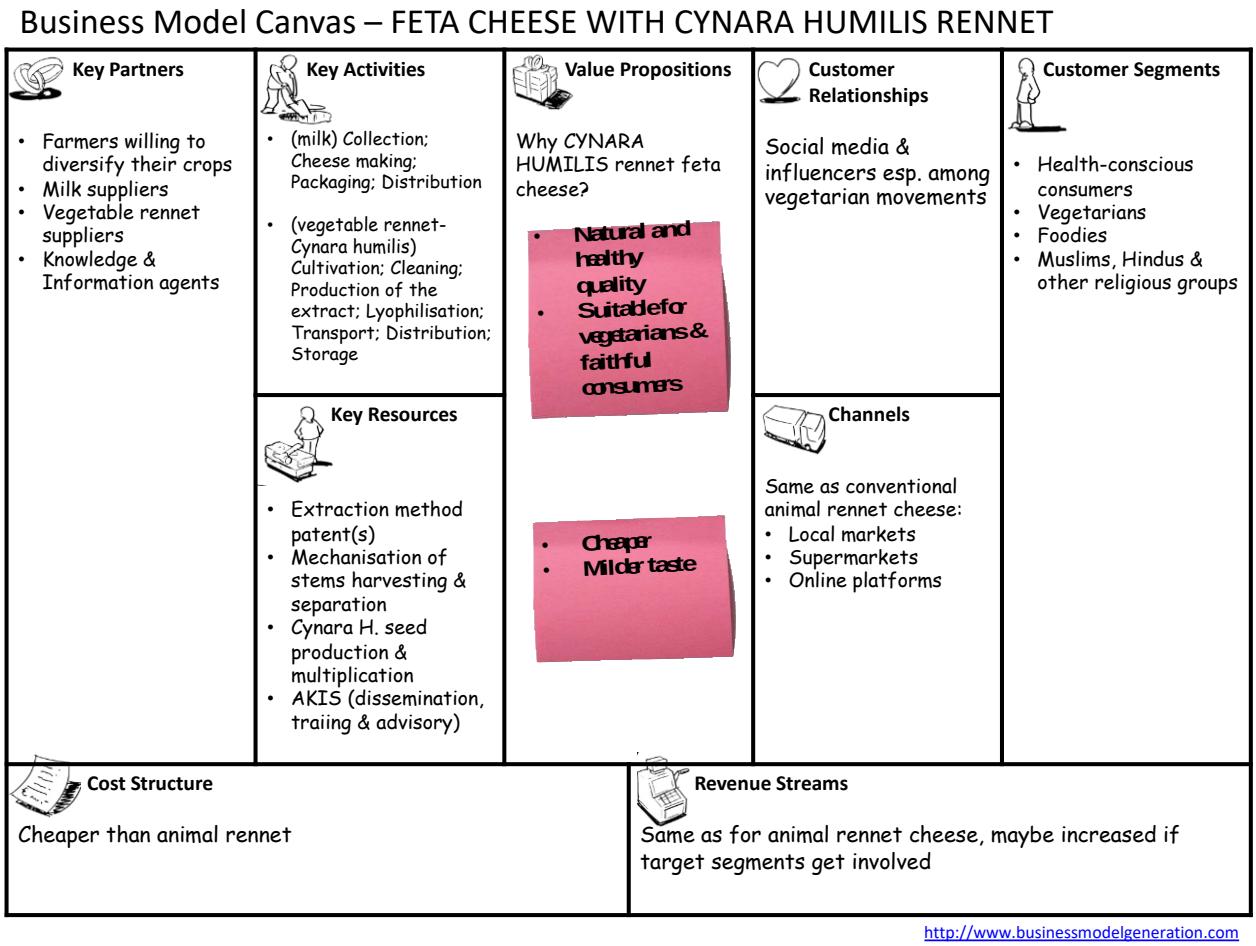

Figure 1. Business Model Canvas for vegetable-rennet Feta cheese made with Cynara humilis

1.1. Key Partners

In the production of vegetable rennet feta cheese, key partners include farmers, milk suppliers, and vegetable rennet suppliers. Farmers provide milk, which is a key ingredient in the cheese-making process. Milk suppliers must be carefully chosen to ensure quality and consistency. Vegetable rennet suppliers provide the enzyme required to thicken and coagulate the milk. Vegetable rennet from Cynara humilis has been shown to perform very well. Differently from Cynara cardunculus, Cynara humilis is cultivated and compared to the wild one, it produces more flowers, which are key organs as they contain the proteolytic enzyme.

1.2. Key Activities

The key activities involved in producing vegetable rennet feta cheese include milk collection, cheese making, packaging, and distribution. Milk is collected from farmers and transported to the cheese-making facility. The cheese-making process involves adding vegetable rennet to the milk, allowing it to thicken and coagulate, and then cutting and draining the curds. The cheese is then shaped, salted, and packaged. Finally, the cheese is distributed to local and international markets. To obtain vegetable rennet from Cynara humilis, the first activities include cultivating the cardoon and cleaning the flowers - which is currently handmade and not mechanised. Then the maceration in water occurs and produces a macerated aqueous extract that will be rehydrated at the time of use - lyophilisation is carried out to facilitate transport, distribution and storage. Saline solution (calcium chloride or sodium chloride) must be added and generally it is added after lyophilization. In general these activities may be optimized further giving an efficient and lower-cost production process than the one using animal rennet.

1.3. Key Resources

The key resources required to produce vegetable rennet feta cheese include a cheese-making facility, equipment, personnel, and raw materials. The cheese-making facility must comply with food safety regulations and have the necessary equipment to process and package the cheese, not differently from feta produced with animal rennet. Personnel must be trained in the cheese-making process and food safety procedures. The biggest problem with vegetable rennet made from Cynara humilis is the lack of a technology to automate or at least simplify the cleaning process. In this regard, one choice would be to begin with the dried flower, as it is easier to remove, rather than working on the fresh flowers which is more challenging due to their high resistance. Since Cynara humilis is cultivated, there must be suitable substrates for its growth (which do not include saline soils). To market a product that is almost finished, it may be desirable to patent the extraction and production method of a vegetable rennet that already contains the saline solution before it is lyophilized.

1.4. Value Proposition

The value proposition of the vegetable rennet feta cheese is its **natural and healthy** qualities and, if properly prepared, potentially a **milder taste** (Vioque et al., 2000), given the reduced lactic acid content and higher pH values of cheese prepared with *Cynara humilis* rennet[1]. The cheese is free from animal products, making it **suitable for vegetarians and people with religious beliefs** that impose rules on how animals from which the rennet originates are butchered. Hence, the market for feta cheese made with vegetable rennet is larger and more accessible (i.e., new market segments).

1.5. Customer Segments

The customer segments for vegetable rennet feta cheese include health-conscious consumers, vegetarians, Muslims, Hindus and other religious groups and foodies. Health-conscious consumers are looking for healthier alternatives to traditional cheese. Vegetarians and Muslims - who can be confident that they will not consume a product whose production is not entirely halal - are looking for a cheese choice that meets their dietary requirements. Finally, foodies are interested in unique and unconventional food options.

[1] However, our results (Deliverabale D 6.1) and other sensory studies did not find a significant taste perception of cheese made with *Cynara humilis* and the ordinary animal-rennet cheese, in blind conditions.

1.6. Channels

The channels for the vegetable rennet feta cheese are similar to conventional aminal-rennet cheese, and include local markets, specialty food stores, supermarkets, and online platforms. Local markets and specialty food stores are suitable for reaching foodies and gourmet food enthusiasts. Supermarkets are suitable for reaching a wider audience, including health-conscious consumers. Online platforms such as e-commerce websites and social media are suitable for reaching customers in remote areas and those who prefer to shop online.

1.7. Revenue Streams

The revenue streams for the vegetable rennet feta cheese include direct sales to customers, wholesale sales to retailers, and export sales to international markets. Direct sales to customers can be made through local markets and online platforms. Wholesale sales can be made to specialty food stores and supermarkets. Export sales can be made to international markets, such as Europe, North America, and Asia. In general, a quick survey of feta retail prices, provide evidence that vegetable-rennet feta cheese can get similar or higher prices than animal-rennet feta, depending on the channel and the customer target (e.g., vegetarians and ethical/health-conscious consumers).

1.8. Cost Structure

The cost structure of the vegetable rennet feta cheese includes raw materials, labor, packaging, marketing, and distribution costs. Raw materials, such as milk and vegetable rennet, are the most significant cost for the production of cheese. Labor costs include salaries and wages for personnel involved in the cheese making process. Packaging costs include the cost of materials and design. Marketing costs include advertising and promotion. Finally, distribution costs include transportation and logistics. There is evidence that vegetable rennet, which costs around 33€/liter as opposed to animal rennet, which costs between 50 and 100 €/litre, is more affordable. The same amount of milk requires far less vegetable rennet than animal rennet, hence vegetable rennet performs better overall.

5. CONCLUSIONS

Our case study on Cynara humilis vegetable-rennet Feta cheese shows that abandoning animal rennet is both feasible and efficient. The high demand for animal-rennet and its limited availability has increased the costs for cheese makers. Consumers do not perceive the taste of vegetable-rennet Feta as different. Besides, its potential milder taste due to lower lactic acid content could actually be further exploited by optimising cheese-making recipes, and attracting consumers – especially from extra-European countries - that may prefer milder cheese and consider Feta too sour.

Some recommendations for the industry and the policymakers can also be made.

1. Disseminating the productive advantages of *Cynara humilis* rennet may improve cheese-makers' profitability given its lower costs, higher yields and potentially even higher revenues from well-targeted vegetable-rennet products.
2. Cultivating *Cynara humilis* could improve the livelihood of small farmers in marginal areas since it may provide better income than more common crops highly affected by price fluctuations. Since it is currently a labour-intensive cultivation, especially at harvesting, this is specifically a good recommendation for farmers of the South of the Mediterranean.
3. Training and extension and investing further in research and innovation may also render *Cynara humilis* better suited to mechanisation of harvesting: Further innovation and optimization of extraction methods will result in offering cheese-makers an easily-available, low-cost, high-yield and high-quality substitute to animal rennet.

6. REFERENCES

Bathmanath, R., Yahya, Y. A. C., Yusoff, M. M., & Vejayan, J. (2019). Utilizing Coagulant Plants in the Development of Functional Dairy Foods and Beverages: A Mini Review. *Journal of Biological Sciences*, *19*(3), 259–271. https://doi.org/10.3923/jbs.2019.259.271

Foligni, R., Mannozzi, C., Gasparrini, M., Raffaelli, N., Zamporlini, F., Tejada, L., Bande-De León, C., Orsini, R., Manzi, P., Di Costanzo, M. G., Ritota, M., Aquilanti, L., & Mozzon, M. (2022). Potentialities of aqueous extract from cultivated Onopordum tauricum (Willd.) as milk clotting agent for cheesemaking. *Food Research International*, *158*(April), 1–8. https://doi.org/10.1016/j.foodres.2022.111592

Fortune Business Insights. (2022). *Cheese Market Size, Share & COVID-19 Impact Analysis, By Source (Animal-based and Plant-based), Product Type (Cheddar, Mozzarella, Parmesan, Feta, and Others), Type (Processed, Natural, Block, Spreadable, and Hard & Soft Cheese), Distribution Channel (Sup*. https://www.fortunebusinessinsights.com/cheese-market-104293

Jacob, M., Jaros, D., & Rohm, H. (2011). Recent advances in milk clotting enzymes. *International Journal of Dairy Technology*, *64*(1), 14–33. https://doi.org/10.1111/j.1471-0307.2010.00633.x

Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation: A Handbook For Visionaries, Game Changers, And Challengers*. John Wiley & Sons Inc.

Papadopoulou, O. S., Argyri, A. A., Varzakis, E. E., Tassou, C. C., & Chorianopoulos, N. G. (2018). Greek functional Feta cheese: Enhancing quality and safety using a Lactobacillus plantarum strain with probiotic potential. *Food Microbiology*, *74*, 21–33. https://doi.org/10.1016/j.fm.2018.02.005

Pozo, M., & Durán, R. (2018). Model CANVAS: Its Application for the Promotion of Regional Economies Under the Case Study of Buffalo Milk Cheese. *Journal of Modern Accounting and Auditing*, *14*. https://doi.org/10.17265/1548-6583/2018.04.003

Rampanti, G., Belleggia, L., Cardinali, F., Milanović, V., Osimani, A., Garofalo, C., Ferrocino, I., & Aquilanti, L. (2023). Microbial Dynamics of a Specialty Italian Raw Ewe's Milk Cheese Curdled with Extracts from Spontaneous and Cultivated Onopordum tauricum Willd. *Microorganisms*, *11*(1). https://doi.org/10.3390/microorganisms11010219

Roseiro, L. B., Barbosa, M., Ames, J. M., & Wilbey, R. A. (2003). Cheesemaking with vegetable coagulants - The use of Cynara L. for the production of ovine milk cheeses. *International Journal of Dairy Technology*, *56*(2), 76–85. https://doi.org/10.1046/j.1471-0307.2003.00080.x

The European Commission. (2023). *Feta PDO*. The European Commission. https://agriculture.ec.europa.eu/farming/geographical-indications-and-quality-schemes/geographical-indications-food-and-drink/feta-pdo_en#:~:text=Production process,content of at least 6%25

Vioque, M., Gómez, R., Sánchez, E., Mata, C., Tejada, L., & Fernández-Salguero, J. (2000). Chemical and microbiological characteristics of Ewes' milk cheese manufactured with extracts from flowers of Cynara cardunculus and Cynara humilis as coagulants. *Journal of Agricultural and Food Chemistry*, *48*(2), 451–456. https://doi.org/10.1021/jf990326v

Zott, C., Amit, R., & Massa, L. (2011). The Business Model: Recent Developments and Future Research. *Journal of Management*, *37*(4), 1019–1042. https://doi.org/10.1177/0149206311406265