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Why Soy Failed

Austria in Its Transnational Setting, 1870–1950

Abstract: This paper examines why soy was not successfully integrated into the Austrian agro-food system until the 1950s despite numerous attempts. The failure is framed as a 'bottleneck' issue in that the transfer of knowledge from the soy niche to the broader agro-food regime was impeded. Emerging from late nineteenth-century agronomic research, the soy niche became a space for experimentation fuelled by diverse actor networks of experts, publicists, and the general public. The bottleneck occurred in the early 20th century when soy was reintroduced as a potential substitute for scarce oils and foods during the First World War. However, conflicting views and insufficient coordination between institutions, policies, and actors stifled its widespread adoption. Efforts to promote soy cultivation and its use in food products failed largely because of ideological divisions and the contrast between agrarian autarky policies and market-oriented ventures. Although the Nazi regime temporarily expanded the bottleneck by incorporating soy into the war economy, postwar socioeconomic shifts led to its regression. As the economy recovered, soy was increasingly stigmatized as an inferior substitute, and meat reclaimed its dominant role as the preferred source of protein. This paper highlights how agro-food transitions are shaped by local conditions and complex, non-linear dynamics, underscoring the idiosyncrasies of national and regional development paths.

Zusammenfassung: Dieser Beitrag untersucht, warum Soja trotz zahlreicher Versuche bis in die 1950er Jahre nicht erfolgreich in das österreichische Agrar- und Ernährungssystem integriert werden konnte. Dieses Scheitern wird aufgrund des strukturell beeinträchtigten Wissenstransfers von der ‚Soja-Nische' in das breitere Agrarregime als *bottleneck*-Problem konzeptualisiert. Aus der agrarwissenschaftlichen Forschung des späten 19. Jahrhunderts hervorgegangen, entwickelte sich die Soja-Nische zu einem Experimentierraum, der von Akteursnetzwerken bestehend aus Experten, Publizisten und der allgemeinen Öffentlichkeit getragen wurde. Der *bottleneck* entstand zu Beginn des 20. Jahrhunderts, als Soja im Ersten Weltkrieg als potenzieller Ersatz für knappe Öle und Lebensmittel wieder ins Blickfeld rückte. Widerstreitende Positionen und mangelnde Koordination zwischen Institutionen, politischen Akteuren und Maßnahmen verhinderten jedoch eine breite Durchsetzung. Bemühungen, den Sojaanbau und die Verwendung von Soja in der Lebensmittelproduktion zu fördern, scheiterten vor allem an ideologischen Gräben sowie am Gegensatz zwischen agrarautarkistischen Politiken und marktorientierten Initiativen. Obwohl das NS-Regime diesen ‚Flaschenhals' vorübergehend ausweitete, indem es Soja in die Kriegswirtschaft eingliederte, führten die sozioökonomischen Verschiebungen der Nachkriegszeit

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zu einem Rückgang. Mit der wirtschaftlichen Erholung wurde Soja zunehmend als minderwertiger Ersatzstoff stigmatisiert, während Fleisch seine dominante Rolle als bevorzugte Proteinquelle zurückgewann.

Keywords: soy, crisis, agricultural change, agro-food transitions

Introduction

In this paper, I attempt to answer the question why soy failed in Austria – or more precisely, why soy and its products did not become part of the agro-food regime despite numerous attempts to establish the East Asian cultigen.

Failure is a temporary assessment in this case, since soy has become an integral part of the Austrian agro-food system in recent decades – one could say that soy seems to be a success story in Austria after all. But from a historical perspective, it took more than a hundred years from the first large-scale field trials to a fully integrated field crop. However, I argue that until the end of the Second World War, there were many attempts to introduce soy and soy products as an innovative solution to regime-related problems. This raises the question of the factors behind the initial failure – a question often neglected by historical research, which tends to favour success stories of commodities, especially those with global implications like sugar, cotton, meat, or corn.[1] The issue that remains is how to frame failure. I propose a network-oriented approach taking into account the contingencies, relationships, actor agency, trends, and crises that affect the adoption of crops and thus the restructuring of the agro-food regime. This study therefore employs an integrative theoretical framework that brings together food regime analysis, transition theory, and commodity studies to investigate agro-food change. Food regime analysis situates agricultural development within shifting configurations of capital accumulation, regulation, and socio-natural relations. Transition theory explains how systemic crises open windows for innovation and regime transformation through the interaction of niches, incumbent regimes, and landscape-level pressures. Commodity studies operationalize these dynamics by tracing how specific goods such as soy embody and mediate broader structural changes over time. To investigate these processes empirically, the study draws on a wide range of archival sources, including over 1,500 contemporary newspaper articles, trade statistics, and administrative records from national and regional archives. A combination of qualitative and quantitative discourse analysis – including techniques such as principal component analysis – is used to examine the interplay between actors, institutions, and materialities across multiple scales. Together, these approaches offer a multi-dimensional perspective on both continuity and rupture in agro-food regimes, shedding light on how global and national dynamics, actor coalitions, and material constraints interact to shape the trajectories of crop adoption and agro-food change.[2]

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1 Sven Beckert, Empire of Cotton: A Global History, New York 2014; Ulbe Bosma, The World of Sugar: How the Sweet Stuff Transformed Our Politics, Health, and Environment Over 2,000 Years, Cambridge 2023; William Cronon, Nature's Metropolis: Chicago and the Great West, New York 1991; Arturo Warman, Corn and Capitalism: How a Botanical Bastard Grew to Global Dominance, 2nd ed., Chapel Hill 2003.

2 Ernst Langthaler/Maximilian Martsch/Gabriel Tober, Conceptualizing Historical Commodity Studies: The Case of Soy, in: Carmona-Zabala et al. (eds.), Commodities in History: Theoretical Reflections and Empirical Case Studies, Crete 2023, 59 f.

In his 2018 book *The Magic Bean*, Matthew Roth argues that the success of the soybean in the United States was the cumulative result of a combination of long- and short-term contingencies that ultimately created a coordinated network of institutional, private, governmental, and entrepreneurial actors in a multi-step process that established a certain path dependency, which Roth calls the "soybean pipeline." This pipeline illustrates the dynamics of spatial and functional networking that enabled the transfer of knowledge from the niche to the regime – or, geographically speaking, from one end of the world to the other.[3] The process began with the involvement of the US Department of Agriculture in the early 1900s and ended with the anchoring of the soybean pipeline in the New Deal programmes of the 1930s.[4]

Building on Roth's analysis of the US soybean pipeline, I argue that a combination of political regulation, knowledge and technology, and commodification created a bottleneck in Austria that prevented the long-term adoption of soy in agriculture and industry. Although the bottleneck was temporarily widened under the authoritarian war economy of the Nazi regime, soy's socioeconomic embeddedness was insufficient to maintain its status during the postwar renewal.

A bottleneck is a narrowing that impedes flow from one side to the other. It symbolizes an overbalance of negative, constricting forces over positive, expanding forces. Moreover, the bottleneck metaphor also signifies the existence of a diverse public and scientific discourse at the base of the bottle, where ideas about socioeconomic change and innovation associated with the diverse potential of the soybean and its products circulate. At different points in time, these ideas gained sudden popularity and attention but ultimately failed to be integrated into the existing agro-food regime.

The paper is divided into four episodes, each representing a distinct period in which soy was embedded in processes of restructuring and transitional change.

First episode: The allure of the unfamiliar (1873–1880s)

The first episode focuses on early soy research in the Austro-Hungarian Empire and the formation of an initial niche network of experts. It identifies scientific and agronomic curiosity, along with the effects of the ongoing agrarian crisis, as the main drivers of soy's introduction to the West and brief popularity. However, weak links between the niche and the dominant regime, a lack of commercial outlets, and a general reluctance to make long-term commitments and investments were the main constricting forces that caused the initial 'soy craze' to lose momentum quickly.

3 Matthew Roth, Magic Bean: The Rise of Soy in America, Lawrence 2018, 7.

4 This article does not offer a symmetrical comparison but instead employs the comparative perspective as a pragmatic entry point and narrative device. A more systematic analysis of soybean development in the United States is provided elsewhere in this volume (see the contribution by Ernst Langthaler and Natalia Ryzhova).

Early soybean research – Friedrich Haberlandt

Starting points are not always easy to determine for historical studies, but in the case of soy it is rather evident. The pivotal event for soy research in Austria was the Vienna World's Fair of 1873. Among its many visitors was Friedrich Haberlandt, a 46-year-old botanist and agronomist from Pressburg/Bratislava who had recently accepted a position in Vienna as a professor of botany at the newly founded *k. k. Hochschule für Bodenkultur*. As he toured the exhibition grounds, he came into possession of different varieties of the soybean or 'Chinese oil bean', as the plant was commonly referred to at the time due to its East Asian origin.[5] This visit marked the beginning of Haberlandt's soybean research, which he would continue until his death in 1878. It is no coincidence that Haberlandt is regarded as one of Europe's soy pioneers, since his research laid the foundation for what I will call the *soy niche*.[6]

In 1875, Haberlandt planted the seeds he had acquired in the experimental garden of the *Hochschule für Bodenkultur*. The trials delivered promising results, and by using a relatively simple form of empirical breeding, he succeeded in isolating early-maturing varieties that performed well under the local climatic conditions.[7] Encouraged by the healthy growth of the early-maturing plants, he decided to continue his trials in the following years.

The second phase of field trials facilitated the creation of an expert network driven by scientific curiosity and the potential of agricultural modernization. In 1876, Haberlandt sent seeds of his successfully grown brown-red and yellow-coloured varieties to eight agronomists in different parts of the Habsburg Monarchy and beyond: Hungary, Moravia, Banat, Styria, Bohemia, Bukovina, and Prussian Silesia.[8] Among these eight participants were two estate owners, one head gardener, one estate administrator, one professor, two economists, and one senior official (*Hofrat*).

The dominance of estate owners and state-funded agricultural colleges highlights the importance of established regime actors in the initial formation of the soy niche. The aristocratic Attems family was one example of the involvement of distinguished regime players in its development, while another central actor was at the spearhead of state-funded research in Hungary: the Hungarian Royal Agricultural Academy located in the small town of Ungarisch-Altenburg [*Magyaróvár*]. The academy was involved in the field trials from the very beginning and formed an important node in the nascent soy network. Not only was it the former workplace of Haberlandt and several of his colleagues at the *Hochschule für Bodenkultur,* but it also had close ties to the Hungarian Ministry of Agriculture.[9]

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5 During his visit, Haberlandt acquired 20 samples of late- and early-maturing soybean varieties from China (13), Japan (4), Transcaucasia (1), and Tunisia (1). Friedrich Haberlandt, Die Sojabohne: Ergebnisse der Studien und Versuche über die Anbauwürdigkeit dieser neu einzuführenden Culturpflanze, Vienna 1878, 6.

6 It is likely that Haberlandt was already familiar with soy at this time, as he mentions a publication discussing the chemical composition of 'Chinese oil beans' dating back to 1872: A. Stöckhardt/Emmanuel Senff, Untersuchung chinesischer Oelbohnen, in: Central-Blatt für Agrikulturchemie 1/3 (1872), 348 f.

7 Haberlandt, Sojabohne, 6.

8 Ibid., 19.

9 The only participating state institution outside the Austro-Hungarian Empire was the Agricultural Academy in Proskau [*Prószków*], Prussian Silesia (which was later incorporated into the Agricultural University of Berlin), which already implied the transnational ambition of Haberlandt's soy research at this early stage.

Each of the trial participants was given detailed instructions by Haberlandt, ranging from sowing and care to the final harvest of the beans. Even though Haberlandt did not personally supervise the field trials, he passed along his practical knowledge and was constantly updated on their progress. In this way, he transferred his knowledge and methods to the estates of his collaborators. Haberlandt and his fellow campaigners were especially interested in the agricultural potential of soy. Hence, the involved actors meticulously recorded the number and variety of the planted seeds as well as their reproduction rate. In addition, they also commissioned chemical analyses of specific seeds.[10]

Chemical analysis was deliberately employed to enhance the scientific credibility of the research. Agronomists and botanists worked with organic chemists to improve seed selection and breeding, seeking varieties with high protein and fat content. The nutritional value of soy was a compelling argument for its integration into farming systems. Haberlandt himself was convinced that this integration would have positive effects on national welfare. He poetically called the soybean the "miraculous stranger," emphasizing the unmatched nutritional value of the legume while also hinting at the allure of the unfamiliar.[11]

The third round of agronomic trials starting in 1877 was the most extensive yet. Seeds were now also sent to Germany, Switzerland, the Netherlands, and the Croatian coast. The vast scale of the experiments was aimed at incorporating international scholars into the research network. At the same time, efforts were made to disseminate knowledge about the soybean through regional channels. Agricultural schools played a crucial role in linking institutional research to practical application. These schools were also involved in agricultural extension, educating the rural population about the latest farming practices, machinery, and crops.[12] The state school for agriculture in Kotzobendz [*Chotěbuz/Kocobędz*] participated in Haberlandt's field trials, distributing yellow soybeans and cultivation manuals among 191 primary schools across Silesia. The acclimatization attempts carried out by these schools were ultimately intended to encourage regional farmers to adopt soy cultivation on their lands.[13] State-funded institutions such as agricultural schools were the testing grounds for agricultural innovations. Through these channels, the soy debate gained momentum, and knowledge began to spread independently in regional circles among experts, extension agents, small farmers, and laypeople. The regional establishment of small-scale soy research signifies that the soy niche had become increasingly diversified and heterogeneous.

During this time, the soy debate reached a climax; one might speak of a short-lived 'soy craze'. Scientists and the public seemed extremely enthusiastic about the soybean's nutritional and economic potential and predicted a glorious future. The *Neue Freie Presse* hailed soy as "a highly remarkable plant, which by all accounts will soon take its seat among our cultivated crops."[14]

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10 Haberlandt, Sojabohne, 30. In *Die Sojabohne*, Haberlandt mentions an analysis of harvested soybeans conducted by K. Zulkovski, a professor at the chemical laboratory at the Technical University in Brünn [*Brno*], which certified a high content of natural fats and proteins.

11 Ibid., 113.

12 Jonathan Harwood, Europe's Green Revolution and Others Since: The Rise and Fall of Peasant-friendly Plant Breeding, London 2012, 17.

13 Wiener Landwirtschaftliche Zeitung, 24 May 1879, 218.

14 Neue Freie Presse, 3 April 1877, 4. This and all further translations of quotes into English are by the author.

In 1878, Haberlandt published the results of the large-scale trials in his magnum opus *Die Sojabohne*. Sadly, he did not live to see the success of his work, as he passed away the same year. With his death, the soy debate shifted to a more economic focus. The appeal of the unfamiliar – the botanical curiosity – was replaced by a more pragmatic, rational attitude.

The agricultural crisis as a catalyst of innovation pressure

Austria-Hungary was deeply affected by the onset of the agricultural crisis in the 1870s, which brought about a sharp decline in the global market price for cereals. The global grain market was oversaturated by rising exports from the settler colonies during the first food regime.[15] Estate owners – especially in Hungary, the breadbasket of the empire – were confronted with a downward price spiral and fierce international competition that threatened to impinge on their economic lifeline.[16] The need to diversify agricultural production to offset missing revenue therefore became more urgent than ever. The agrarian crisis thus provided an unprecedented chance to convince farmers and estate owners who were desperately looking for alternative cash crops of soy's adaptability and profitability. There was a certain pressure to modernize and innovate, reflected in the soy advocates' tendency to stress the "glorious" and "miraculous" potential of the exotic cultigen.[17]

One of the most energetic soy propagandists in the early 1880s was Count Josef Attems, whose Styrian family was among the largest landowners in the Austrian half of the empire. Attems was convinced that the 'Chinese oil bean' had a great future in Austria. In an article in the *Wiener Landwirtschaftliche Zeitung* from March 1881, he reported on his success with soybean cultivation.[18] The experiments had begun on a small field on the family's seed breeding estate in St. Peter near Graz. Encouraged by the positive results, the cultivated area was expanded year by year to a maximum of one hectare. The harvest amounted to 1,030 kg of brown and 1,840 kg of yellow soybeans, a remarkable yield confirming Josef Attems' assessment that the soybean was suitable for cultivation in Styria and all other regions where maize could be grown. Particularly interesting is the rational tone of Attems' cultivation report in which he tried to evaluate soy's economic potential. Due to their high protein content, he estimated that soybeans should fetch a significantly higher market price than potatoes and corn. Considering the need for protein-rich crops in livestock farming, soy certainly had the economic potential to push back starchy forage plants.

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15 Harriet Friedmann/Philip McMichael, Agriculture and the State System: The Rise and Decline of National Agricultures, 1870 to the Present, in: Sociologia Ruralis 29/2 (1989), 93–117, 101; Mark Tilzey, Political Ecology, Food Regimes, and Food Sovereignty, Cham 2018, 99.

16 Harwood, Revolution, 21; Roman Sandgruber, Die Agrarrevolution in Österreich: Ertragssteigerung und Kommerzialisierung der landwirtschaftlichen Produktion im 18. und 19. Jahrhundert, in: Alfred Hoffmann (ed.), Österreich-Ungarn als Agrarstaat: Wirtschaftliches Wachstum und Agrarverhältnisse in Österreich im 19. Jahrhundert, Vienna 1978, 195–271, 250.

17 Haberlandt, Sojabohne, 113; Ernst Wein, Ueber den Anbau der rauhharigen Sojabohne in Bayern, Munich 1879, 50.

18 Wiener Landwirtschaftliche Zeitung, 16 March 1881, 160.

Estate owners' interest in soybeans led to a significant increase in seed stock. By 1878, seed availability had surged from 500–600 kg in 1877 to an estimated 50,000–60,000 kg.[19] In 1880, sixteen traders advertised soybean seed for sale, but its high cost – between 16 and 24 florins (fl.) per 100 kg – made it unprofitable as animal feed, especially since there was no established method of blending soy with other forage crops like clover or corn.[20]

For farmers, switching to a new crop was associated with high risks and costs. Not only was purchasing seed a major investment, it was also a bet on the future of the crop. The final yield of a new crop such as soy was impossible to calculate, not to mention whether a buyer could be found for the harvest. When using the harvest directly on the farm, for example as animal feed, the basic economic consideration was whether other fodder plants might offer the same utility at a lower cost.

Even though early soy proponents such as Haberlandt and Attems were eager to emphasize that soybeans were low-maintenance and resistant to pests and heat, and that the early-maturing yellow- and brown-seeded varieties were fully acclimatized to the wine and maize growing regions of the Austro-Hungarian Empire, acceptance among farmers and landowners remained low. This was primarily because the question of utilization remained unresolved.

For this reason, farmers initially only cultivated soy in smaller areas on a trial basis to better assess its properties and economic viability. The consistent result was that none of the farmers who experimented with soybeans in the late nineteenth century decided to adopt large-scale soybean cultivation on their farms. The soy debate thus went on until the participants could eventually decide on the future viability of the crop.

Although the summary of Attems' experimental soybean cultivation was consistently positive and the crop was predicted to have a bright future, the Attems family subsequently withdrew completely from the soy debate, with no evidence of their cultivation continuing. This example is indicative of the first phase of soy research and experimental growing: Even though the plant was considered suitable for cultivation, at least in the southern parts of the empire, there was one crucial element missing – the sales market.

Although the agricultural crisis prompted landowners to experiment with new crops and seek opportunities for diversification, it also limited their room for investments and their willingness to take risks. Most large landowners therefore eventually withdrew from soy experiments – at the very latest when the economic situation improved in the 1890s and agricultural prices stabilized once again. The supply of soybean seed on the market was correspondingly short-lived, and by 1890 only three commercial suppliers were left in business. The lack of a selling market was a clear obstacle to farmers' endorsement of the plant and one of the major reasons why the interest in soy faded, leaving it confined to a niche at the turn of the century. It is not surprising, however, that the soy debate would eventually resurface when the industry faced a scarcity of a vital component making up one-fifth of the soybean: oil.

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19 Wiener Landwirtschaftliche Zeitung, 1 March 1879, 84.

20 Edmund von Blaskovics, Die Sojabohne: Etwas über deren Cultur, Verwendbarkeit und Werth als Futtermittel, Vienna 1880. According to von Blaskovics, a major constraint on soy's use as animal feed was its price. The small cultivation area of soy resulted in a much higher market price compared to common forage like clover. Von Blaskovics therefore suggested adding soy as a high-energy supplement to more readily available types of forage. It could also present an alternative for regions with a shortage of inexpensive feedstuff rich in nitrogen and fats. Ultimately, the use of soy as forage for animal fattening never extended beyond experimental status in the Habsburg Monarchy.

Weak alliances and fading interest

After Haberlandt's death, his colleague at the *Hochschule für Bodenkultur*, Wenzel Hecke, continued his research as a "duty of friendship."[21] Hecke was a professor of agricultural economics and later appointed dean of the university. He coordinated and evaluated the next phase of cultivation trials with soybeans. In an open letter, Hecke called on all farmers who had carried out trials with soybeans to submit their reports to him. Just one year later, he summarized the results in a series of three articles in the *Wiener Landwirtschaftliche Zeitung*.[22] Hecke was also a consultant for the Imperial–Royal Ministry of Agriculture. In his dual function as a scientist and political advisor, he played a connecting role between niche scientific research and potential areas of practical application within the agricultural regime.

A key characteristic of the soy niche was that although it emerged at the fringes of the agro-food regime, it was supported and promoted by regime actors from the very beginning. These established regime actors had been involved in practical soy research on the side as a kind of intellectual hobby.

This loose connection between the actors began to falter when soy increasingly lost its novelty and was progressively demystified: Agrochemistry unravelled all its chemical components, numerous field trials made farmers familiar with the foreign crop, and botanists and agronomists even declared that the soybean was already fully acclimatized to parts of the Austro-Hungarian Empire.

The resulting question was what could be done with the soybean, and who would benefit from the introduction of the plant. The soy niche had to forge alliances with other academic fields and interest groups to emphasize its socioeconomic significance. A central argument in the publications by Haberlandt and his successors was that the consumption of soybeans could significantly improve the diet of rural and urban populations, especially the working class and the poor. Soy had the potential to close the protein and fat gap, which was a common feature of malnutrition resulting from a one-sided diet based on cheap carbohydrates. Furthermore, the increasing number of labourers in the industrial regions had high calorie requirements due to the physical strain of their work. Only very few working-class families could regularly afford to consume meat, which was considered the main source of quality protein at the time.[23]

Soy was presented as an ideal source of vegetable protein. Nevertheless, the scientific debate on soy was reduced to the areas of plant breeding and botany. There was no connection to the protein debate, which at the same time was playing an increasingly promi-

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21 Hecke was born in Reichenberg [*Liberec*], Bohemia, in 1824. He studied at the Agricultural College in Ungarisch-Altenburg [*Mosonmagyaróvár*] and was appointed as professor of agricultural economics at the *Hochschule für Bodenkultur* in 1872.

22 Wiener Landwirtschaftliche Zeitung, 1 March 1879, 84; Wiener Landwirtschaftliche Zeitung, 8 March 1879, 97–98; Wiener Landwirtschaftliche Zeitung, 15 March 1879, 109.

23 By the end of the nineteenth century, meat consumption was increasing, especially in cities. However, the lower classes mostly consumed low-quality cuts and cheap meat products. Roman Sandgruber, Die Anfänge der Konsumgesellschaft: Konsumgüterverbrauch, Lebensstandard und Alltagskultur in Österreich im 18. und 19. Jahrhundert, Vienna 1982, 153–171; Clara Nagele/Till Uschmann, Der Wiener Fleischkonsum 1830–1913, in: Friedrich Hauer (ed.), Die Versorgung Wiens 1829–1913: Neue Forschungsergebnisse auf Grundlage der Wiener Verzehrungssteuer, Vienna 2014, 51–70.

nent role in the emerging discipline of nutritional physiology.[24] In particular, the research by German nutritionist Carl von Voit made a significant impact in the academic community of the 1870s. At a physicians' congress in Munich in 1875, Voit presented a study in which he advised a daily protein intake of no less than 118 grams for a male labourer, half of which should be derived from animals, preferably through meat consumption.[25] The protein debate would have been a logical extension of the soy niche to expand the reach and connectivity of its research and agenda. However, the fact that this did not occur was characteristic of the nascent soy niche, which developed more in depth (regional embedding) than in breadth (scientific and social connectivity).

Furthermore, the links between the actors in the niche were relatively weak and underdeveloped. We can observe a high turnover of individuals and institutions joining and leaving the network. These fluctuations indicated unstable niche-regime alliances that impeded the development of a long-term agenda for soybean adoption.

The formation of the soy niche

The soy niche emerged in the late nineteenth century as a protected space. The actors involved were either scientists employed by state-funded institutions or estate owners and managers who could experiment with new crops as a secondary activity. The niche offered the setting for learning and experimentation in a supportive community.[26] Within it, knowledge about the soybean was circulated and multiplied through independent follow-up studies, correspondence, and publications.

This success was nevertheless temporary, since soy actors did not receive the acknowledgment and support of interest groups and scientific disciplines which were also concerned with matters of public nutrition at the time. Even though the soy network expanded and diversified, it remained relatively homogeneous at its core. Nearly all participants were active in the domains of agriculture or botany, and scientific debates mostly revolved around issues of cultivation and breeding. Ideas for practical applications such as troop provisioning, dietary supplements for the working class, or animal feed remained underdeveloped. This meant that the potential of soy remained largely unrecognized by fellow scholars and social activists. Although knowledge was constructed and circulated within the soy niche, it eventually dissipated due to the lack of perspective and outside support.

Furthermore, the economic potential of the bean was not pursued: Farmers who grew soybeans on a trial basis quickly abandoned their experiments because there was no market. Commercial processing and on-site use on farms were not explored. Although the agricultural crisis incentivized experimental cultivation, it limited the availability of capital and the willingness of entrepreneurs and estate owners to take risks.

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24 Kenneth J. Carpenter, Protein and Energy, Cambridge 1994, 77; Corinna Treitel, Eating Nature in Modern Germany: Food, Agriculture, and Environment, c. 1870 to 2000, Cambridge 2017, 96.

25 Carl Voit, Über die Kost in öffentlichen Anstalten, Munich 1876, 25; Carpenter, Protein, 89.

26 Julie Ingram, Framing Niche-Regime Linkage as Adaptation: An Analysis of Learning and Innovation Networks for Sustainable Agriculture Across Europe, in: Journal of Rural Studies 40 (2015), 59–75, 61.

Second episode: The rediscovery of soy – from a curiosity to a crisis product (1908–1920s)

The second episode is structured into three intertwined phases during which the soy question was revived under the prevailing issue of scarcity. The debate initially centred on a shortage of oils and fats for the industry; with the outbreak of the First World War, it increasingly became a matter of food shortages and self-sufficiency. Only after food security slowly began to improve in the early 1920s did public interest in soy and soy foods begin to fade again.

The oils and fats crisis as the catalyst of soy's revival

By the turn of the century, discourse around the soybean had gone relatively quiet even in scientific circles. The first flicker of renewed interest came in the wake of the Japanese victory in the war against Russia in 1905.[27] This outcome not only caused a geopolitical stir but also raised questions among nutrition scientists about the provisioning of the Japanese army. After the end of the war, the Austrian chemist Emanuel Senft published a widely noticed, three-part study on the rations of Japanese soldiers in the Viennese specialist journal *Pharmazeutische Post*. Senft analysed a large variety of Japanese army rations in terms of their nutritional value and ingredients, paying particular attention to foods containing processed soybeans. The idea of using soybeans to supply the army due to their high protein content and storability was not completely new; Haberlandt had previously already floated the same idea. But the Japanese victory against a major Western power framed soybeans in the context of military modernization. In addition, its success in the war secured Japan's influence over Manchuria, which facilitated the implementation of an imperial export-oriented expansion strategy for soybeans.[28]

Interest in Senft's study, however, was primarily fuelled not by jingoism or imperialism but by a global supply crisis in cottonseed oil. Soybeans offered a viable alternative for European oil producers, resulting in a first test shipment of Manchurian soybeans to Great Britain in 1907.[29] The key driver of this development was the industry's growing demand for oils and fats, particularly for the production of soap, paints, and margarine. Austria-Hungary experimented with soybean oil only a short time later, with the first deliveries arriving in the port of Trieste consisting of pressed soybean oil from British manufacturers. The Austrian media soon recognized the rising trade in soybean oil and acknowledged that the soybean

27 Christine M. Du Bois, The Story of Soy, London 2018, 46.

28 Carl Fruwirth, Die Sojabohne, in: Fühlings landwirtschaftliche Zeitung 64/3–4 (1915), 65–96, 65–66. Before the Russo-Japanese War, soybeans from Manchuria only went to Japan, but since then, through Japanese brokers, they were also shipped to North America and Europe. Hiromi Mizuno/Ines Prodöhl, Mitsui Bussan and the Manchurian Soybean Trade: Geopolitics and Economic Strategies in China's Northeast, ca. 1870s–1920s, in: Business History (2019), 1–22, 5. The ongoing economic struggle between Russia and Japan was reflected in the phenomenon of 'railway imperialism'.

29 Du Bois, Story, 46; Roth, Bean, 44; Mizuno et al., Mitsui Bussan, 11. The first test shipment of 100 tonnes reached Liverpool in August 1907, and just one year later, exports from Manchuria to Europe had grown to well over 1 million tonnes.

had become a serious competitor for established oilseeds on the global market due to its low price and ample supply.[30] What made soy appealing was its compatibility with existing cottonseed processing infrastructure, its relatively low price, and its versatility across multiple industrial applications.[31] The import of soybean oil led to a debate about customs duties in Austria, as domestic oil producers were afraid of being at a disadvantage due to competition from England. In the summer of 1909, Austrian oil producers wrote a memorandum to the Ministry of Trade expressing their concern about the growing sales of foreign soybean oil.[32] In the memorandum, the oil producers, led by Trieste-based cottonseed oil manufacturers, demanded an increase in import duties for soybean oil in order to mitigate the "danger of soybean oil for domestic oil production." The similarity between cottonseed oil and soybean oil, which resulted in analogous areas of use and made them direct competitors, was also noted. The manufacturers emphasized the outstanding properties of soybean oil:

> "Like cotton oil, it [soy oil] is above all an excellent cooking oil, which should also be suitable for the production of artificial butter and cooking fat, it provides a very good fuel oil and is perfectly suited for lubrication purposes due to its neutrality. Soap manufacturers also hope to obtain a cheap raw material from it."[33]

The memorandum eventually prompted the Ministry to conduct a special inquiry into the tariff classification of soybean oil. Due to its similarity to cottonseed oil, the proposal was to equalize the respective import duties. The customs issue remained unresolved, however, and the first soybean oil soon arrived from England. In 1909, there were at least two trial shipments of soybean oil from the port of Hull.[34]

Import volumes of raw soybeans via the port of Trieste were comparatively low and inconsistent. The Imperial–Royal Consulate General in Shanghai recorded a total export volume of 62 tonnes of soybeans to Austria-Hungary in 1910. In the following year, the volume dropped to near zero before rising to 102 tonnes in 1912.[35] The consulate's final assessment was nonetheless pessimistic: "For the Monarchy, the import of this promising product [soy] still seems unfeasible because of the high duty on legumes."[36] While soybeans were reclassified as oilseeds in Germany in 1910 and could thus be imported duty-free, they continued to be subject to the import duty for legumes in Austria-Hungary.[37]

The example of the fat and oil crisis shows how the inertia of the Ministry of Trade with regard to adjusting trade regulations and taxation prevented the import and thus the domestic processing of soybeans into oil. Although the oil-producing industry was keenly interested

30 Drogisten Zeitung, 23 July 1909, 264.
31 Ines Prodöhl, "A Miracle Bean:" How Soy Conquered the West, 1909–1950, in: Bulletin of the German Historical Institute Washington 46 (2010), 111–129, 119.
32 Drogisten Zeitung, 27 August 1909, 299–300. Soybean oil was subject to a lower duty rate than cottonseed oil (7.5 crowns per 100 kg compared to 40 crowns per 100 kg).
33 This and the preceding quote: Neue Freie Presse, 8 August 1909, 17.
34 William Shurtleff/Akiko Aoyagi, History of Soybeans and Soyfoods in Austria and the Austro-Hungarian Empire (1781–2020): Extensively Annotated Bibliography and Sourcebook, Lafayette 2020, 302.
35 Jahresbericht des k. u. k. General-Konsulates in Shanghai, für das Jahr 1912, Shanghai, 166.
36 Jahresbericht des k. u. k. General-Konsulates in Shanghai, für das Jahr 1911, Shanghai, 186.
37 Fruwirth, Sojabohne, 5; Prager Tagblatt, 22 July 1910, 10.

in the possibilities offered by soy, legal obstacles hampered the plant's establishment. Rather than a lack of industrial interest or technical feasibility, it was the absence of clearly defined and supportive institutional frameworks that impeded the formation of stable demand. Without tariff reforms or regulatory incentives, the potential uses of soy could not translate into broader market uptake. This tension between material potential and structural constraints on demand points to a recurring dynamic in the early history of soy in Austria-Hungary.

The soybean becomes a matter of sustenance – the First World War

With the outbreak of the First World War, imports of raw soybeans from the Far East were no longer an option for Austria-Hungary. After Italy joined the war on the side of the Entente, the subsequent naval blockade of the Adriatic Sea put a complete halt to the empire's maritime trade.

The soy debate was not settled but instead shifted to another area, since the question of economic independence was now much more pressing. The supply of everyday foodstuffs in general and stimulants such as coffee in particular became a growing problem as the war progressed.

Initially, soy was advertised as a substitute for coffee. Near Prague, the company Santosa produced a bean coffee made from soy, which it sold by mail throughout the monarchy. The company's advertising changed significantly during the war, and in one of its last newspaper campaigns, soy coffee was advertised as "war coffee."[38]

The tone of the soy debate also transformed in 1915: Soy was now increasingly associated with self-sufficiency and food security. It was also at this time that the debate split into two mostly separate camps: the popular camp, which considered soy to be the immediate solution to food shortages, and the scientific camp, which doubted the short-term impact of soybean adoption and questioned its general viability.

The contrast is manifest in two figureheads of the contemporary discourse. One was a leading expert in the field of plant breeding, Carl Fruwirth, while the other, Maurice Fürstenberg, was an amateur botanist and publicist from Styria.[39] Fürstenberg was the central figure of the populists proclaiming soy as the solution to all nutritional problems caused by the war. The global conflict was the catalyst that enabled the revival of the miraculous stranger: "The soybean was awakened from its slumber to new life – it is the World War that allows it to green and bear fruit again."[40] The foreword to Fürstenberg's 1916 booklet was written by none other than Gottlieb Haberlandt, son of Friedrich Haberlandt and professor of botany in Berlin. His appeal would end up becoming the guiding principle of the soy niche during the First World War: "The calm explanations of the man of science must find their echo in the loud call of the educated layperson."[41]

38 Prager Abendblatt, 3 March 1915, 8.

39 Fürstenberg even published two short booklets on the soybean during the war, one in 1916 and the other in 1917.

40 Maurice Fürstenberg, Die Einführung der Soja, eine Umwälzung der Volksernährung, Berlin 1916, 22.

41 Ibid., 1.

The basis of the popular camp within the soy debate consisted of small farmers and allotment gardeners who had little interest in macroeconomics or agrarian policy and were primarily interested in self-sufficiency and subsistence strategies. The actors involved were educated laypeople who acquired their knowledge through a trial-and-error approach and interpersonal exchange of know-how. This was not a centralized, unified organization, but rather a set of small regional groupings that communicated with each other through public lectures, articles in regional newspapers, and discussion groups. One of the most active regional actors was Edmund Pasternek, a teacher from Maxglan in Salzburg. From 1916 onwards, Pasternek wrote numerous articles, gave specialist lectures, carried out cultivation trials with soy, distributed seeds, and issued cultivation instructions.[42] The popular soy debate was mainly confined to the daily press and strongly inspired by the optimistic rhetoric of Fürstenberg's publications.

In contrast to the popular discourse, the scientific debate on the soy question continued to be largely concentrated in specialist journals, most notably the *Wiener Landwirtschaftliche Zeitung*. The most prominent actor in the scientific camp was Carl Fruwirth, who was not only a leading expert in legumes but had ample experience with soybean cultivation as well.[43] Fruwirth published several studies between 1914 and 1915 in which he discussed the use of soybeans.[44] He was less than enthusiastic about the propaganda writings of Fürstenberg, and his scientific assessment was much more cautious. In his review of Fürstenberg's soy booklet, Fruwirth taunted it as a "waste of paper" given the ongoing scarcity of resources.[45]

In a 1915 article in the *Illustrierte Landwirtschaftliche Zeitung*, Fruwirth argued against the expansion of soybean cultivation in Austria. The more northerly regions of the monarchy were generally unsuitable for cultivation, and the seed offered by the large European nurseries was not acclimatized for cultivation in Austria-Hungary. Nevertheless, he recognized the nutritional value of soybeans and suggested using existing stocks to offset the impact of food shortages in the short term.[46] Despite Fruwirth's active involvement during the war years, his scientific contributions were largely overlooked in the public discourse. Furthermore, his expertise also went unrecognized by the Ministry of Agriculture, which failed to consult him.

The government was the third player to engage in the soy question in the background. Driven by the dispute over soybean oil in the years before the war and the increasing supply shortages, the Ministry of Agriculture decided to intervene for the first time and carry out large-scale field trials with soybeans. The Committee for the Promotion of Medicinal Plant Cultivation was commissioned to carry out the trials. The leading committee members had backgrounds in medicine and pharmacology; none of them were involved in applied agriculture or had hands-on experience with soybean cultivation. The scientist in charge was

42 Salzburger Volksblatt, 15 November 1916, 5; Salzburger Volksblatt, 21 March 1917, 5. Pasternek gave several lectures on the cultivation of soybeans and overcoming food shortages in Salzburg and the surrounding region, e.g. in Hallein, Neumarkt, and Saalfelden in 1917.

43 Fruwirth had already carried out experiments with soybeans at the Agricultural College in Hohenheim and then continued his field trials at his farmstead near Amstetten.

44 Carl Fruwirth, Anbau der Hülsenfrüchte, 2nd edn., Berlin 1914; Carl Fruwirth, Hülsenfruchterbau, Friedrichswerth 1914; Carl Fruwirth, Oelfruchtbau, in: Wiener Landwirtschaftliche Zeitung 65/92 (1915), 681–683; Fruwirth, Sojabohne.

45 Wiener Landwirtschaftliche Zeitung, 20 February 1918, 103.

46 Carl Fruwirth, Die Sojabohne – jetzt, in: Illustrierte Landwirtschaftliche Zeitung 35/3 (1915), 13–14.

Emanuel Senft, who had caused a commotion in academic circles just before the war with his study on Japanese army rations. The field trials were carried out between 1914 and 1916, reaching their peak in 1916 with a total of 241 test locations spread across the Empire – except for Hungary. In the final report published in 1917, Senft concluded that "all excessive praise of soybeans and urgent recommendations for increased cultivation in Austria must be firmly rejected." This was a clear renunciation of the hopeful narrative of popular soy advocates. Senft further elaborated that these advocates "raise hopes in the widest circles that the plant is not yet able to fulfil." In summary, most field trials delivered mixed results or failed entirely. As a consequence, the committee reached the verdict that "soybeans can hardly be expected to bring about any changes or radical successes in Austria in the foreseeable future."[47] This clear statement put an end to the state's involvement in soybean research for years to come.

However, the field trials initiated by the Ministry of Agriculture during the First World War had two fundamental problems. Firstly, the seed sample was too small, with only two soybean varieties initially being tested: One yellow-seeded Manchurian variety from the Dresden nursery Gehe & Co., and a second yellow-seeded variety from northern China, which came from a soy food factory near Paris.[48] The selection of only two as yet untested soy varieties created a genetic bottleneck from the outset.[49] Secondly, the majority of the test fields were located north of the Danube in the Czech crown lands. Hungary did not participate in the field trials at all – an indication the growing dispute between the two parts of the empire.[50] This meant that there was a surplus of cooperation partners from areas that had already been classified as climatically unsuitable for soybean cultivation by nineteenth-century agronomists such as Friedrich Haberlandt, or more recently by Carl Fruwirth.[51]

These examples show that the soy question enjoyed a certain revival in the shadow of the war, though it did not produce a coordinated niche with a common agenda; rather, it generated a fragmented collection of several camps with different narratives and comparatively low levels of cohesion and cooperation. For the most part, popular discourse, scientific debate, and state involvement were completely separate from each other.

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47 This and the preceding quotes: Rudolf Kuraž, Anbauversuche mit gelbsamiger Sojabohne in Österreich. (Mit 10 Tafeln), Mitteilungen des Komitees zur staatlichen Förderung der Kultur von Arzneipflanzen in Österreich, in: Zeitschrift für das landwirtschaftliche Versuchswesen in Österreich 20 (1917), 177–211, 184. A lecture given by the chemist Leimdörfer on 20 March 1914 about the importance of oil cultivation for the national economy at the beginning of the war is highlighted as particularly influential in the report; for the text of the lecture, see Unsere Fettversorgung, in: Österreichische Chemiker Zeitung, 15 April 1915, 63–67.

48 Kuraž, Anbauversuche, 185–186. The factory near Paris was most likely Li Yu-ying's *Caséo-Sojaïne* in La Garenne-Colombes. William Shurtleff/Akiko Aoyagi (eds.), History of Soybeans and Soyfoods in France (1665–2015). Extensively Annotated Bibliography and Sourcebook Including Monaco, Li Yu-Ying (Li Shizeng), Society of Acclimatization, Lafayette 2015, 6.

49 Erich Stietz, Die Soja in der Weltwirtschaft: Ein Beitrag zur Ernährungs- u. Rohstoffwirtschaft der Erde, doctoral dissertation, University Gießen 1931. The ongoing war complicated the procurement of suitable seed material, which also indicates that no sufficient stockpile from previous cultivation trials existed in Austria-Hungary.

50 Ernst Langthaler, Dissolution before Dissolution: The Crisis of the Wartime Food Regime in Austria-Hungary, in: Richard P. Tucker et al. (eds.), Environmental Histories of the First World War, Cambridge 2018, 38–61, 50.

51 Later publications also criticized the conditions and methods of the cultivation trials. Wiener Landwirtschaftliche Zeitung, 9 March 1932, 113–114.

Enduring food shortages as a testing ground for soy foods

After the end of the First World War, the issue of shortages and food insecurity dominated the newly proclaimed Republic of (German-)Austria. Especially alarming was the shortage of much-needed coal and basic foods. Austerity and rationing remained the reality of life for most parts of the population even years after the end of the war. Food stamps, which were introduced during the war to manage shortages of essential commodities such as bread, flour, sugar, potatoes, milk, and fat, were issued by the state until the early 1920s. Only once the availability of consumer goods slowly began to improve was the use of ration cards gradually phased out.[52]

During this period of economic uncertainty and social hardship, a Hungarian food chemist developed an improved milling process for soybeans that opened up new avenues of commercial exploration. This invention solidified the re-evaluation of soy as a human food, causing other aspects of utilization to fade into the background. The creator behind this invention was László Berczeller, a 30-year-old nutritional chemist from Budapest.

In 1921, Berczeller developed a novel production method for a wholesome soy flour that retained the full fat content of the bean.[53] Berczeller soon found a strong financial investor in the Scottish chemist and entrepreneur Robert Graham, who was prepared to turn his invention into a product. Graham was already an experienced entrepreneur in the food business, having established the Veda Bread Company in 1900.[54] He and his staff were experimenting with the development of soy foods in Vienna to find a "nutritive, inexpensive food for the starving children of Austria and Central Europe", as Graham himself framed it in a letter printed in the *London Times*.[55]

The collaboration between Berczeller and Graham soon yielded its first results. In an article in the London Times on 28 September 1921, Berczeller reported on his soy research and introduced a range of soy-based products (bread, flour, and milk) to be launched under the biblical brand name 'Manna'.[56] The telling label represented the company's ambition to bring a revolutionary popular food to market that might help to fight hunger worldwide. In the article, Berczeller specifically claimed that soy products could be exported in large quantities from the production facility in Vienna to Russia to ease the hardship of the famine raging

52 Neues Wiener Journal, 15 January 1921, 3.

53 In January 1921, Dr. Ladislaus Berczeller applied for his first patent for a *Verfahren zur Veredelung von Sojabohnen* (process for improving soybeans) in Austria. He developed a process to remove "rancid and noxious substances" from the beans by treating them with steam before drying: Soaked or germinated soybeans are treated with saturated steam at 100 C for 10 to 20 minutes. They absorb only small amounts of water and should be dried before being processed as a whole into flour. The gentle distillation process preserved the albuminous constituents of the bean while greatly improving digestibility and taste. Nevertheless, the approval process dragged on for years, and the patent was not granted until 15 January 1926. It was filed under Patent No. 106346 and guaranteed legal protection for 15 years.

54 Veda produced an enriched bread made with malted wheat that resulted in a sweet flavour. It was quite popular at the time and is still sold in Northern Ireland today. Graham's influence and entrepreneurial background were clearly evident, as Berczeller's soy bread likewise contained malted grain and was described as having a slightly sweet taste similar to Veda bread.

55 London Times, 29 September 1921, 11. The letter was a response to a previously published article in the September issue of the same newspaper entitled *Manna*.

56 London Times, 28 September 1921, 11–12. In the Bible, *manna* was the food sent from God to save the starving Israelites on their march through the desert.

there.[57] This lofty promise must be dismissed as a publicity stunt, however, for at the time Berczeller and Graham were far from having an efficient facility to implement large-scale production of soy foods in Vienna. Moreover, all the required soybeans would have had to be imported, since there was no domestic cultivation in Austria.

Manna bread was launched in 1921 and could be bought without rationing cards.[58] The price was initially set between 40 and 50 crowns per loaf (320 grams). The food factory *Stumpf & Söhne* in the Vienna district of Hietzing produced the bread on commission for the *Mannabrotgesellschaft* established by Robert Graham. The key selling point of Manna bread was that it delivered higher nutrient content for a competitive price.[59] Yet the product was unable to fulfil this promise, as it was around 50 per cent more expensive than regular bread due to rising inflation.[60] Even though it had a higher nutritional value, it ultimately failed to win over consumers.

Overall, the success of Manna bread seems to have been short-lived, since there are no references to the company's operation or newspaper advertisements to be found after 1922. The commercial failure of Manna bread as well as legal and interpersonal disputes appear to have been the reason why Berczeller and Graham eventually decided to go separate ways.

One plausible explanation for the product's lack of success may have been the traumatic experiences of war food shortages and rationing. Since bread and flour had been subject to rationing measures from 1915 and the supply situation continued to deteriorate until the end of the war, a wide variety of substitute products were introduced to the market. Under the name *Kriegsbrot* (war bread), scarce cereal flours were replaced by surrogates such as corn, potatoes, or – during the worst times – sawdust.[61] The memory of austerity and inferior substitutes continued to affect the collective consciousness even after the war, and a new food product using an exotic bean as an additive to bread thus likely held little appeal for consumers. Even though the high nutritional value and wholesomeness of soy flour as a low-cost meat substitute were advertised, Manna bread was burdened with the stigma of an ersatz product.[62] Another factor was the dire economic situation in postwar Austria and the increasing devaluation of the crown currency. The inflation rate reached a high point between the summer of 1921 and 1922. During this time, monthly consumer price increases reached

57 William Shurtleff/Akiko Aoyagi, Laszlo (Ladislaus) Berczeller – History of His Work with Soyfoods and Edelsoja Whole Soy Flour (1871–2020): Extensively Annotated Bibliography and Sourcebook, Lafayette 2020, 23. Interestingly, Ukraine is one of the main producers of soybeans in Europe today.

58 Christian Mertens, Die Auswirkungen des Ersten Weltkriegs auf die Ernährung Wiens, in: Alfred Pfoser/Andreas Weigl (eds.), Im Epizentrum des Zusammenbruchs: Wien im Ersten Weltkrieg, Vienna 2013, 162–171, 163. Due to its soy content, Manna bread could be sold freely and was not affected by the rationing measures. At the time, food stamps regulating the distribution of bread were still being issued in Vienna. Ration cards were introduced in the Austro-Hungarian Monarchy as early as 1915 to manage supply problems caused by the war.

59 Wiener Allgemeine Zeitung, 16 November 1921, 9. The first mention of *Manna Brot* came a few weeks earlier: Reichspost, 23 October 1921, 9; Deutsches Volksblatt, 23 October 1921, 7.

60 Deutsches Volksblatt, 22 January 1922, 9.

61 Langthaler, Dissolution, 52–53.

62 J. Fiehe, Über Sojabohnen und Sojabohnenbrot, in: Zeitschrift für Untersuchung der Nahrungs- und Genußmittel (1925), 45–51, 51.

a peak of 38 per cent. Food was especially affected, highlighted by the fact that food price subsidies constituted up to 55.6 per cent of government spending.[63]

The creation of the soybean bottleneck

The three phases outlined above illustrate the revival of the soy question and the soy niche. It is evident that new actors and institutions were embracing soy and discussing it as a solution to the growing supply crisis. Soy was first integrated into a global trade market as a source of oil and fat and then re-evaluated as a human food during the war. However, the intensive debates by various interest groups did not lead to the formation of a clear development path by which soy found its way into the agro-food regime. Rather, there were numerous setbacks and inhibiting factors that contributed to the formation of a bottleneck preventing the widespread adoption of soy.

The first of these was the reluctance of the Austro-Hungarian government to act during the global oils and fats supply shortage. The unresolved issue of customs clearance for raw soybeans and soybean oil was a source of uncertainty for the domestic oil industry and discouraged entrepreneurial initiatives to explore the industrial use of soybeans as an alternative source of oil. The result was that other European countries such as England, France, and Germany were able to develop a competitive advantage over Austria-Hungary. Secondly, although the division of the soy debate into different camps ensured widespread exposure among the public as well as among experts, it resulted only in limited cohesion and coordination between the actors. Thirdly, the postwar collaboration between Berczeller and Graham is a concrete example of a failed regime-niche alliance. It was the first time that a marketable soy product was introduced in Austria, but the commercialization attempt ended in a dispute between the two involved parties, who could not agree on the direction and profitability of the company. Over the next few years, Berczeller continued to try to capitalize on his soy patents and find new investors, while Graham withdrew from the Austrian soy business.

Third episode: Renewed state involvement and commercialization attempts – *Edelsoja* (1924–1930s)

The drivers behind the soy debate in the late 1920s were the quest for national independence in the oilseed and animal feed sectors on the one hand and the rising cost of living in the wake of the 1930s economic crisis on the other. These factors once again provided a window of opportunity for soy.

63 Peter Eigner (ed.), Österreichs Wirtschafts- und Sozialgeschichte im 19. und 20.Jahrhundert: 175 Jahre Wiener Städtische Versicherung, Munich 1999, 144.

The introduction of the state soybean breeding program

In 1924, soybeans were included in the state breeding program for special crops. This meant that the acclimatization trials with soy were now supervised by the Federal Institute for Plant Cultivation and Seed Testing in Vienna under its head commissioner, Dr. Fritz Drahorad.[64] The chief plant breeder became Anton Brillmayer, who had been conducting trials with soybeans on a farm in Platt, Lower Austria, since 1920 and had successfully isolated high-yielding varieties.[65] After the Lower Austrian Chamber of Agriculture became aware of Brillmayer's promising work, he was approached by Drahorad. Their combined efforts facilitated the expansion of experiments, which resulted in the registration of several acclimatized soybean varieties by the end of the 1920s.

A major advance in Brillmayer's cultivation trials was the large variety of cultivars. Seeds from different regions were tested, including American and Chinese varieties.[66] Brillmayer even exchanged ideas with Chinese experts on breeding methods and varieties.[67] In Austria, cultivation was considered viable in all regions where maize reaches maturity. Extremely early-maturing varieties and varieties for green fodder production were also tested in harsher conditions and at higher altitudes. By 1928, a network of 20 soybean seed propagation stations in Lower Austria, Upper Austria, and Styria had been established. The breeding stations affiliated with the Federal Institute for Plant Cultivation and Seed Testing also transitioned to growing only yellow-seeded varieties suitable for industrial utilization.[68] By 1933, the institute had supplied soybean seed to 609 farmers, and a range of 102 soy varieties was subject to continuous testing.[69] The institute had apparently learned from the mistakes of the soybean cultivation trials during the First World War and concentrated its efforts on climatically suitable growing locations and marketable cultivars.[70]

In 1929, Brillmayer and Drahorad published an informative soy booklet containing all necessary practical information for farmers and interested laypeople. In the foreword, the authors stated that the circulating misinformation about the plant and the large number of inquiries they received from farmers over the years had prompted them to write the book. Accordingly, the focus was less on scientific completeness and more on compiling a practical guide informing readers about care, benefits, and potential uses of the plant.[71] This was a general trend; in the course of the 1920s, the soy debate gradually shifted in the direction

64 Fritz Drahorad was the former assistant to Tschermak von Seysenegg at the *Hochschule für Bodenkultur*, and worked intensively with soybeans himself. Franz Anton Brillmayer, Die Kultur der Soja in Österreich, Vienna 1947, 13.

65 The origin of the seeds with which Brillmayer began his experiments in Platt in 1920 is curious. According to his statement, the seeds were the contents of a matchbox he received from a prisoner of war returning from Siberia after World War I. Ibid., 12.

66 Fritz Drahorad/Franz Anton Brillmayer, Die Sojabohne, ihre Bedeutung, Kultur und Verwendung, Vienna 1929, 46.

67 Brillmayer, Kultur, 13.

68 Österreichisches Staatsarchiv (ÖSTA), Archiv der Republik (AdR), Bundesministerium für Land- und Forstwirtschaft (BM.f.Land.u.Forstw.), 1187 c, 1717/1933. Black and brown varieties were excluded from breeding for industrial purposes because they led to an unwanted dark colouring of the flour after milling.

69 ÖSTA, AdR, BM.f.Land.u.Forstw., 1187 c, 1717/1933.

70 Drahorad/Brillmayer, Sojabohne, 39.

71 Ibid.

of market utilization and economic benefits, while the primarily scientific aspects of soy research remained confined to academic circles. The aim was to convince farmers and industrialists of the economic and nutritional benefits of domestic soybean cultivation.[72]

The Federal Institute for Plant Cultivation and Seed Testing worked in close cooperation with the Ministry of Agriculture and Forestry; archival records document a lively interinstitutional exchange. The profitability of soybean cultivation in Austria in particular was a constant topic of discussion.[73] Expert assessments regarding soybean cultivation were now consistently positive, emphasizing the economic benefits for farmers since plant protein had a very high market price and could also be used as a feed additive on farms. Soybeans provided the greatest possible amount of high-quality nutrients per area without degrading the soil and without adding additional labour and machinery costs. The institute's soy promotion campaign was particularly successful with small farmers in the lower Alpine regions who tried growing soy on a small scale for green fodder and protein feed – though the success rate was rather mixed.[74] Small-scale soy farming in Upper Austria was finally abandoned completely in 1934, as it was impossible to consistently achieve reliable harvests.[75]

Since yields were inconsistent, many farmers decided against storing part of their soybean harvest as seed and instead sold it on the market for a high price. Selling it as animal feed was not lucrative since Austria was flooded with cheap soybean meal from abroad at the time, making it economically unviable to compete on that market. The practice of using dried soybeans as animal feed was not widespread in Austria either: As early as the late 1920s, soybean meal was one of the cheapest protein feeds available on the market.[76] For this reason, the soybean breeding operation in Platt was scaled back, as there was little demand for seed. Only around 1,000 kg of soybean seed could be sold each year.[77]

Besides its use as protein feed, Brillmayer and Drahorad argued that it would be even more efficient to use soy directly as human food than to "send it through the animal body." [78]

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72 Ibid., 11.

73 ÖSTA, AdR, BM.f.Land.u.Forstw., 1187 c, 1717/1933, 1–2.

74 Drahorad/Brillmayer, Sojabohne, 83. Some experiments were carried out with black-seeded soybean varieties, which were particularly suitable for green fodder production in the low mountainous regions of the Alpine foothills due to their bushy growth. In contrast to the USA, the use of green soy plants for silage was not field-tested in Austria. Only a few feeding trials were carried out over the years, and even at the end of the 1920s, von Blaskovics' study from 1880 was still regarded as the reference work.

75 Heinrich L. Werneck, Die naturgesetzlichen Grundlagen der Land- und Forstwirtschaft in Oberösterreich: Versuch zu einer Pflanzengeographie und -Ökologie, in: Jahrbuch des Oberösterreichische Musealvereines (1934), 165–440, 304; Arnold Kornfeld, Die Ölbohne oder Soja, Hamburg 1935, 22. In addition, many soy plants were affected by a bacterial disease.

76 Ernst Langthaler, Die beschleunigte Modernisierung. Österreichs Agrarentwicklung zwischen Krise und Boom (1930–1960), in: Hannes Stekl (ed.), Österreich – was sonst? Ernst Brückmüller zum 70. Geburtstag, Vienna 2015, 204–228, 209. Since 1922, Austrian agricultural policy has pursued a course of moderate agricultural tariffs. The specific import numbers for soybean meal and cake are not available for Austria since animal feed and oilcakes were each summarized in a single category. What can be deduced from the figures, however, is that imports of feed meal and oilcake far exceeded exports, and that the import figures increased annually. Bundesministerium für Handel und Verkehr (ed.), Statistik des auswärtigen Handels Österreichs im Jahre 1929, Vienna 1930, 61.

77 Brillmayer, Kultur, 14–15.

78 Drahorad/Brillmayer, Sojabohne, 61–62.

Brillmayer was one of the advocates of Berczeller's full-fat soy flour, as it contained all the valuable nutrients of the soybean, including not only fat but also important vitamins and lecithin. The other option was the milling of oil extraction residue into so-called vegetable protein flour. This soy flour had a lower nutritional value and calorie count, but the previously extracted oil could be used for various industrial purposes, making its use more flexible.[79] Austria ultimately took the path to commercial use of full-fat soybean flour, with the processing of soybeans into two different raw materials, oil and cake, assuming a subordinate role.[80]

Drahorad published a two-part article on soybean cultivation in Austria in the *Wiener Landwirtschaftliche Zeitung* in April 1932. Although he maintained a positive attitude towards the expansion of soybean cultivation in Austria, he nevertheless concluded that "[…] considering the current agricultural crisis and the low price of foreign soy, large-scale cultivation can only be advised if the yields per hectare warrant profitability."[81]

Profitability was the biggest obstacle, as the yields per hectare and the lack of domestic selling opportunities made farmers reluctant to adopt soy. The Federal Ministry of Agriculture and Forestry therefore concluded that soy only had a chance in Austria if its oil could be processed and utilized domestically.[82] From 1925 onwards, Austria imported an increasing amount of soybean oil.[83] Throughout the 1920s, soy oil could be purchased via the commodity exchanges in Hamburg and Trieste.[84] The import figures more than tripled within a few years, from 891 tonnes in 1925 to 3,788 tonnes in 1928. Soy oil imports even surpassed those of coconut oil and palm oil for several years. The constant supply of Manchurian soybeans kept global market prices low. Moreover, production was able to meet the rising global demand: Until 1928, Austria did not import notable amounts of raw soybeans, which also indicates the lack of a domestic processing industry. Drahorad was convinced that the best way to overcome the agricultural crisis was the "conquest of the domestic market", which included breaking away from import dependencies.[85] Striving for national autarky was a programmatic demand that derived from the experience of hunger during the First World War and gained popularity during the interwar period. The aim was not to increase competitiveness on the world market but to protect domestic agriculture from excessive dependency on external suppliers and thus strengthen the national economy.[86]

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79 Ibid., 19.

80 Ibid., 28. By contrast, oil extraction played an important role in Germany. The *Hansamühle* in Hamburg, the largest soybean-processing oil mill, was able to process around 300 to 400 tonnes of raw beans a day. The extracted oil was mainly used in soap and margarine production, while the meal was sold as animal feed for the dairy industry and pig fattening.

81 Wiener Landwirtschaftliche Zeitung, 9 April 1932, 114.

82 ÖSTA, AdR, BM.f.Land.u.Forstw., 1187 c, 1717/1933, 2.

83 Stietz, Soja, 38–39. By the late 1920s, Germany had transitioned from being a net importer of soy oil and meal to becoming a net exporter and one of the main suppliers of soybean products in Central Europe. Already by 1927, soy cake was the most-fed oilcake in Germany's livestock industry.

84 William Shurtleff/Akiko Aoyagi, History of Soybeans and Soyfoods in Italy (1597–2015): Extensively Annotated Bibliography and Sourcebook, Including Soyfoods in Italian-Style Products from Other Countries, Lafayette 2015, 116. Soybeans were directly processed in the oil industry in Trieste. Italy was one of the main suppliers of soybean oil and cake for Austria, as the foreign trade records show.

85 Wiener Landwirtschaftliche Zeitung, 16 April 1932, 123.

86 Frank Uekötter, Die Wahrheit ist auf dem Feld. eine Wissensgeschichte der deutschen Landwirtschaft, 2nd edn., Göttingen 2012, 190–191; B. Heinze, Die Entwicklung der Sojabohne oder Kaffeebohne (Soja hispida Mönch) und ihre Verwendung, in: Naturwissenschaften 4/32 (1916), 478–480; Susanne Heim, Forschung für die

Although the cultivation of oilseeds and animal feed was to be increased in Austria, no incentive program for soybean cultivation was introduced to offset market disparities in the form of direct subsidies or fixed purchase prices. The development of the soybean cultivation area was correspondingly modest: Brillmayer spoke of around 5 hectares in 1928, including small farms and breeding stations in Lower and Upper Austria as well as Styria.[87] The International Institute of Agriculture in Rome estimated a total area of 64 hectares by 1930 for Austria.[88] The problem was not the lack of tested quality seed but the missing incentives for small farmers to switch to the new crop.

Kupelwieser's Edelsoja

The failed market launch of Berczeller's soy flour put a stop to further commercialization attempts with soybean products in Austria for the time being. Berczeller himself sought success abroad, travelling through Europe in the mid-1920s and trying to convince policymakers and entrepreneurs of his manufacturing process. He went to London, where he met Winston Churchill at a soy foods dinner, and made his first trip to the Soviet Union. He was also welcomed personally by Benito Mussolini, who hosted a soybean dinner and was captivated by the idea of substituting wheat with soybean flour to ease supply shortages.[89] In the end, Berczeller did not have to travel far to find a new business partner with whom to revive his soy endeavours in Austria. More precisely, his new associate turned out to be a long-time colleague at the Physiological Institute of the University of Vienna, Dr. Ernst Kupelwieser.

Berzceller's Austrian patent for the production of full-fat soy flour was legally approved in 1926 and immediately sparked brisk academic interest. Several scientific papers dealing with the potential of soy flour from a nutritional and economic point of view were published. One of the hot spots of research was the Physiological Institute of the University of Vienna. Besides Berczeller and Kupelwieser, the institute's director Prof. Dr. Arnold Durig and Dr. Helene Wastl were among the first to write about the possibilities of soy flour.[90] In a 1926 article, Wastl endorsed the introduction of soy flour as a public food with economic reasoning.

> "Since Austria's domestic production of foodstuffs is far from sufficient, imports play an important role. In particular, animal products with their high prices are one of the largest items in our negative trade balance since the war. At the same time, the peace-

Autarkie: Agrarwissenschaft an Kaiser-Wilhelm-Instituten im Nationalsozialismus, in: Susanne Heim (ed.), Autarkie und Ostexpansion: Pflanzenzucht und Agrarforschung im Nationalsozialismus, Göttingen 2002, 145–179, 147. In the German agricultural policy of the interwar period, the demand for autarky in the oilseed and animal feed sector was supported by similar arguments.

87 Drahorad/Brillmayer, Sojabohne, 13.

88 Institut International D'Agriculture, Le soja dans le monde, Rome 1936, 263.

89 Shurtleff/Aoyagi, Berczeller, 7.

90 A. Durig wrote an unpublished article in December 1926 entitled *Soya als Nahrungsmittel*. Helene Wastl, Das Sojamehl als Nahrungsmittel, in: Fritz Löw (ed.), Arbeiten ueber das Berczeller'sche Sojamehl, Vienna 1928, 1–7.

time standard of living in Austria for the majority of the population is still inadequate, and this is especially true for the protein standard."[91]

Wastl's emphasis on a rational economy highlighted the importance of a balanced trade regime to maintain a well-fed population and improve economic output. Consumption of soy flour could improve people's nutrition thanks to its wholesomeness and high nutritional content (protein, fat, lecithin, vitamins, etc.). This applied especially to financially disadvantaged social strata, which were more severely affected by the economic problems after the First World War. In this context, Wastl stressed the significant price advantage of soy over meat as a protein source. She therefore saw the greatest potential of soy flour as an additive in bread, the most important popular food.[92] Yet even if soy flour could address this nutritional gap, its acceptance depended on whether consumers and institutions recognized it as a viable and desirable substitute. Demand was therefore not only economically but also culturally constrained.

In 1926, Wastl and Berczeller jointly published an article in the *Wiener Medizinische Wochenschrift* entitled *On the Nutritional Question of Europe*.[93] In its very first sentence, they tellingly defined national nutrition as a "border area between nutrition physiology and economics."[94] The overall goal was to combine scientific knowledge from both research areas to optimize the diets of the general population in both economic and nutritional terms. While the joint publication did not focus on the use of soy flour, it provided statistical evidence that the nutritional situation in Europe had barely improved since the end of the First World War. The solution, the authors argued, could only be a general reduction in the cost of wholesome basic nutrition.

Scientific study of the soybean convinced Ernst Kupelwieser that the commercial development of soy products and their sale had enormous potential. He met with Berczeller several times to explore the possibility of entrepreneurial collaboration.[95] After securing the patent rights for Austria from Berczeller and meeting with various potential investors, Kupelwieser finally managed to strike a preliminary deal with the Viennese food manufacturer Wetzler & Co. in August 1927. The agreement set the terms for the foundation of the *Österreichische Soja-Ges.m.b.H.*[96]

The new product would be called *Edelsoja*, with this name deliberately chosen to counteract the war stigma of soy flour as a substitute commodity. The prefix '*edel*' (noble) signified the premium and refined quality of the new product. The Austrian Soybean Association

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91 Helene Wastl, Das Sojamehl als Nahrungsmittel, in: Wiener Medizinische Wochenschrift 76/41 (1926), 1209–1214, 1213.

92 Ibid., 1213.

93 Ladislaus Berczeller/Helene Wastl, Zur Ernährungsfrage von Europa: Separatdruck aus der "Wiener Medizinischen Wochenschrift" 1926, Nr. 48 und 49, Vienna/Leipzig 1927. The article was republished as a booklet in 1927.

94 Berczeller/Wastl, Zur Ernährungsfrage, 3.

95 Kupelwieser Privatarchiv (KPa), Letter from Ernst Kupelwieser to Franz and Marianne Kupelwieser, 21 September 1926. At the time, Ernst Kupelwieser was in a financial predicament. He came from one of the great business families of the Austro-Hungarian Empire, but the end of the monarchy ushered in the family's financial decline. This placed additional pressure on Ernst to support his parents financially and try to preserve the family wealth. His employment as an assistant and lecturer at the Physiological Institute gave him a secure basic income. However, Kupelwieser was not particularly interested in a scientific career and therefore in search of alternative sources of income.

96 KPa, Letter from Ernst Kupelwieser to Franz Kupelwieser, 12 August 1927.

advertised for it with the slogan "The soybean, boneless meat and milk of the Far East for 4,000 years. Adapted to European taste, *Edelsoja* is a new food for us."[97]

The product launch was accompanied by a large-scale media campaign.[98] Kupelwieser was also able to secure the support of the Union of Austrian Women's Associations (*Bund Österreichischer Frauenvereine*) and the Federal Cooking Academies (*Staatliche Kochlehranstalten*) with the intent to appeal to the primary consumer group: housewives. The strategy was not to establish *Edelsoja* as a direct competitor to meat, eggs, or dairy products, but rather to promote soy flour as a nutrient-rich and cheap supplement. The packages sold in stores were therefore accompanied by small recipe booklets explaining how to use *Edelsoja* to refine well-known dishes, ostensibly enabling housewives to save money without any of the family members noticing a difference in taste.[99]

Overall, the market launch of *Edelsoja* did not generate the sales that Kupelwieser and his partners had hoped for. Although the women's associations in particular beat the advertising drum for the new product, the response from private customers was mixed. Availability was also a significant problem affecting sales figures, since only a few stores in Vienna carried the product. The company remained in business, however, and by 1933 a new factory was opened south of Vienna in Schwechat: the so-called *Edelsoja-Werke*.[100] It is confirmed that *Edelsoja* was continuously available on the market, as indicated by numerous mentions and recipes in newspapers. It is nevertheless difficult to assess how successful the product really was. Sources suggest that soy flour was used primarily in public institutions, hospitals, and communal kitchens, with little evidence of significant demand among private households.[101] This lack of private consumption illustrates the structural limits of demand that persisted despite nutritional promise and institutional support – limits shaped not only by economic conditions but also by cultural preferences and ingrained food habits.[102]

The divided soy niche

One major constraint for the introduction of soybean cultivation and processing in Austria were differing views on the right path to success. The Federal Institute for Plant Cultivation

97 KPa, Inscription on the photograph of the Austrian Soybean Association's exhibition booth.

98 From the beginning of November 1928, the same advertising text was placed in numerous daily newspapers. Die Edelsoja: Ein neues Nahrungsmittel, in: Tagblatt, 11 November 1928, 9; Ein neues Volksnahrungsmittel, in: Neue Freue Presse, 1 December 1928, 12.

99 Neue Edelsoja-Gesellschaft G.m.b.H. (ed.), Das kleine Edelsoja-Kochbuch, Munich 1937. After the product was launched in 1928, the cookbook was published in multiple editions. Soja-Vertriebs G.m.b.H. (ed.), Wiener Voll-Soja Rezepte, Berlin 1939.

100 After negotiations with Wetzler Co. broke down, Kupelwieser signed a partnership agreement with the German industrial group Schneider in late 1928. This partnership not only increased the capital of the *Edelsoja* company but also financed its move to a new factory.

101 KPa, Letter from Ernst Kupelwieser to Franz Kupelwieser, 19 February 1928. There is no reliable information regarding the production capacity of the *Edelsoja* plant. Taking the old plant in Leobersdorf as a benchmark, the maximum production capacity would have been in the range of 3,000 kilograms of soy flour per day, assuming the new facility was still operating with a single steamer and mill. Despite the increased production capacity provided by the new factory in Schwechat, sales were likely well below capacity.

102 Uwe Spiekermann, Twentieth-Century Product Innovations in the German Food Industry, in: Business History Review 83/2 (2009), 291–315, 295.

and Seed Testing was the institutional embodiment of agrarian state policy, which held that domestic production should be encouraged through a continuous cycle of seed improvement by way of systematic field testing along with agricultural extension based on economic rationality. Farmers were to be convinced that integrating soybeans into their crop rotation and using them as an alternative source of protein feed was a sensible way to increase soil productivity and counterbalance the financial pressure of the agrarian crisis by reducing dependence on volatile international markets. Interventions by the state in the form of direct cultivation subsidies and fixed sales prices were not part of this approach, and the growing debate about national self-sufficiency in the oils and fats sector was not yet translated into a concrete action plan for agrarian policy. State interventionism in the agricultural sector did not begin until 1931 with the introduction of Dollfuß's "agrarian course."[103]

Kupelwieser with his *Edelsoja* brand envisioned a very different approach, focusing less on self-sufficiency and more on market-oriented demand, especially for processed foods. In fact, the *Edelsoja* company imported nearly all of its resources, at least in its early years. The first deliveries of soybeans were procured through the Hamburg-based company *Kunerol* and transported to Vienna. Kupelwieser was confident that domestic cultivation would eventually follow suit with growing demand. Planning ahead, he began collaborating with regional farmers to test soybean varieties suited for flour processing, offering them a guaranteed sales outlet. In this regard, he clashed with the systematic and considerate approach of the Federal Institute for Plant Cultivation and Seed Testing.

In 1932, Kupelwieser submitted two memoranda to the Ministry of Agriculture and Forestry presenting his commercial plans and vision for Austria's soy future.[104] In them, he justified the import of raw soybeans by stating that "domestic agriculture did not grow the varieties that are suitable for industrial processing." He thereby indirectly criticized the government's soybean research program for not responding to economic interests.

To verify and evaluate Kupelwieser's statements, the Ministry asked Drahorad for commentary – and in his reply, the disparities between the two parties became apparent. Drahorad questioned Kupelwieser's credibility by exposing his misinformation and salesmanship. He also criticised the reliability of Kupelwieser's cultivation trials, even calling them "primitive." In his opinion, they did not reflect common agricultural practice, as they were not carried out systematically and merely based on single-year results.[105] In Drahorad's opinion, Kupelwieser's actions significantly undermined the work of his institute by favouring imports and distributing unsuitable foreign seeds.

In addition, attached to Drahorad's written commentary was a confidential side note in which he disclosed Kupelwieser's business ties to Yugoslavia. Many of the cultivation tests for the *Edelsoja* product were being conducted using the variety Reiner 17, which originated in Manchuria and was cultivated on the family estate of Fritz Reiner near Osijek. The

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103 Ernst Langthaler, Der gespaltene Bauernstand – Bruchzonen von Landwirtschaft, Agrarpolitik und ländlicher Gesellschaft, in: Stefan Karner (ed.), Die umkämpfte Republik: Österreich 1918–1938, Innsbruck 2017, 259–268, 261. With the end of the postwar crisis economy in 1922, Austria adopted a liberal trade policy with moderate tariffs, which was also intended to mitigate the poor performance of domestic agriculture.

104 Unfortunately, the original memoranda dated 31 July 1932 and 4 December 1933 are lost. However, a comprehensive account by Kupelwieser from 24 October 1933 has survived in which he summarized his concerns. ÖSTA, AdR, BM.f.Land.u.Forstw., 1187 c, 31534-36.

105 ÖSTA, AdR, BM.f.Land.u.Forstw., 1187 c, 1717/1933, 4

Edelsoja company had supply contracts for soybeans with the Reiner estates in Yugoslavia. Furthermore, Fritz Reiner's son Hellmuth was a shareholder in Kupelwieser's enterprise, which constituted a clear conflict of interest in Drahorad's eyes.[106] The result of the dispute was that Kupelwieser had to agree to cultivate yellow soybeans from the breeding facility in Platt on his contract estates.

The consolidation of the soybean bottleneck

The consolidation of the soybean bottleneck occurred because of two critical constricting factors. Firstly, intense international competition from inexpensive soybean oil and meal made it impossible for domestic production to compete with global market prices. Farmers were not offered alternative outlets for soy products in the form of green fodder or soybean meal for livestock production or the option of selling soybeans to the domestic oil industry. Secondly, the large-scale introduction of *Edelsoja*, the first commercial full-fat soybean flour in Austria, was not successful. The reasons for its failure were complex, but once again, fragile regime-niche alliances ultimately led to unstable corporate governance and market strategy. The product failed to win over its key consumer group – housewives – and alternative market sectors proved equally unable to generate the desired sales figures.

Fourth episode: The rise and fall of the 'Nazi Bean' – Wehrmacht to UNRRA (1935–1950)

With the annexation of Austria by Nazi Germany, soy became an important fuel for the German war machine. However, the foundations for its adoption had already been laid in the prewar period with Kupelwieser's *Edelsoja* and the state's breeding program. During the National Socialist era, the soy bottleneck widened, and the bean temporarily moved from the niche into the regime.

The integration of the soybean into the Nazi war economy

Kupelwieser worked as a private entrepreneur until 1935. During this time, the German chemical company *I.G. Farben* started its soy program and experimented with soybean cultivation in the Balkans.[107] The German management was looking for factories that could process these soybeans, initially as subcontractors. Ernst Kupelwieser entered into negotiations with *I.G. Farben* no later than 1935. He initially became an external consultant and then an employee of the company, with the German corporation paying him RM 1,000 per month

106 ÖSTA, AdR, BM.f.Land.u.Forstw., 1187 c, 1717/1933, 7.

107 Joachim Drews, Die "Nazi-Bohne:" Anbau, Verwendung und Auswirkung der Sojabohne im Deutschen Reich und Südosteuropa (1933–1945), Münster 2004, 168; Ines Prodöhl, Globalizing the Soybean: Fat, Feed, and Sometimes Food, c. 1900–1950, Abingdon/New York 2023, 101.

for his collaboration. From 1935, Kupelwieser regularly travelled between Berlin and Vienna on business, exchanging information with representatives of the *I.G. Farben* group.[108] The company was deeply entrenched in the economic plans of the Nazi regime. Development of an exploitable and reliable source of fat and protein was a top priority in the National Socialist supply system, not least with regard to the war economy. The fact that these plans had been pursued for a long time is evident in the speed with which they were implemented after the annexation of Austria by Nazi Germany. Only a few days after the *Anschluss* in March 1938, the first purchase order from the German Army High Command arrived in Vienna: On 18 March, just seven days after the German troops crossed the border into Austria, the *Wehrmacht* ordered 400 tonnes of whole soy flour and 500 tonnes of soybeans for the year 1938.[109] A fixed purchase price of 460 schilling per tonne of soybeans and about 1,000 schilling per tonne of flour was agreed upon, and the order volume thus amounted to 230,000 schilling for the soybeans and 400,000 schilling for the soy flour, a total of 630,000 schilling. The delivery deadline for the beans was set between the harvest and the end of February 1939. The soy flour was to be delivered between January and the end of March 1939, with a minimum of 50 tonnes per month.[110] Considering the scarce documented production numbers of *Edelsoja*, it seems plausible to say that the magnitude of this German order easily surpassed all previous sales figures.

In addition, the *Wiener Edelsojawerk G.m.b.H.* was founded with a share capital of RM 200,000. The new company was now an official subsidiary of *I.G. Farben*, which sent Dr. William Bening from Berlin to Vienna to act as managing director together with Ernst Kupelwieser.[111] The entry in the commercial register lists "manufacture and distribution of soy products" as the company description. The date of 9 December 1938 is provided for the company's foundation, and its articles of association were concluded on 28 November.[112]

The integration of Kupelwieser's soy project into the *I.G. Farben* group can be explained in the context of the reorganization of the Southeast European economic zone since the 1930s.[113]

Austria's role in supplying the Wehrmacht

The so-called *Ostmark* was one of the expansion territories for soybean cultivation. An article in the supplement of the *Neuigkeits-Weltblatt* in December 1939 was entitled *The Ostmark, the soy basket of the German Reich*.[114] It mentioned the organized expansion of soybean cultivation in the *Ostmark* as a cornerstone of the Reich's fat and protein strategy. Within two years, the cultivation area was expanded from 70 hectares in 1937 to 800 hectares in 1939,

108 KPa, Written statement by Ernst Kupelwieser, 5 April 1946.

109 KPa, Purchase order German Army High Command, 18 March 1938.

110 KPa, Purchase order German Army High Command, 25 March 1938.

111 Neues Wiener Tagblatt, 21 December 1938, 16.

112 Wiener Stadt- und Landesarchiv, Sig.: 2.3.3.B78.27.237.

113 Drews, "Nazi-Bohne", 204–205. Particularly important is the establishment of the Central European Economic Forum (MWT) as a German trade association with the aim of creating a unified economic area in Eastern and Southeastern Europe. *I.G. Farben* assumed a leading position in the MWT.

114 Neuigkeits Weltblatt, 17 December 1939, 29. The article is signed "Ing. R.", most likely referring to Ing. Rossek, head of the Viennese *Sojaring*.

and the harvest was used almost exclusively to produce soy flour for human consumption. The *Neuigkeits-Weltblatt* article also emphasized the soy plant's capacity for nitrogen fixation, which greatly improves soil quality. The argumentation therefore not only focused on financial incentives but also included sustainable aspects of soil management. How could farmers disagree when soy cultivation was both good for the wallet and good for the soil?

A major difference in the organization under the National Socialists was that cultivation contracts guaranteed farmers fixed purchase prices for their harvests. This system was managed by *Sojaring* in Vienna, a central organization installed in 1937 which took over the function of promoting and organizing soybean cultivation and processing in Austria. *Sojaring* was also responsible for the testing and distribution of seeds; its director, Ing. Friedrich von Rossek, described the organization as the "single agency between producer and buyer."[115]

Soybean processing would become even more important for Austria than cultivation. Vienna developed into a hub for soybean deliveries from the Balkan states. Large silos were built in Austria to store the beans, which arrived by ship via the Danube or by train from the Balkan countries, especially Romania.[116] They were then processed into whole soy flour and soybean oil directly in Vienna in two large factories: the aforementioned *Edelsoja* factory and a second plant established on the southern outskirts of Vienna in 1937 under the name *Dr. Winkler*.[117]

Although there are no documented import figures for Austria after the start of the war, the few national trade records published after the *Anschluss* reveal the shift of foreign commerce to the Balkans. Between January and March 1939, 689 tonnes of soybeans were imported to Austria, all of them coming from Romania.[118] This represented a significant increase in raw soybean imports from before the National Socialist takeover: In 1937, only 179 tonnes had reached Austria over the border. The importance of the *Edelsoja* company and Ernst Kupelwieser's affiliation with *I.G. Farben* was already tangible in that the soybeans came exclusively from Yugoslavia.[119] Furthermore, *Wiener Edelsojawerk G.m.b.H.* and *Sojaring* reached an initial agreement under which the processing company agreed to purchase the entire domestic soybean harvest at fixed prices in 1937.[120] This agreement established the system of cultivation contracts in Austria, which would become the central instrument of agricultural policy under the Nazis.[121]

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115 Völkischer Beobachter, 21 February 1943, 6.

116 A Vital German Supply. The Magic Bean, in: London Times, 23 April 1940; Ortrun Veichtlbauer, Braune Donau: Transportweg nationalsozialistischer Biopolitik, in: Christian Reder/Erich Klein (eds.), Graue Donau – Schwarzes Meer, Vienna/New York 2008, 226–245, 234. Under the Nazis, the Viennese Danube port of Albern was developed into a transshipment hub for agricultural goods from Southeastern Europe. Ina Markova/Stefan Wedrac, "Hamburg des Ostens"? Der Ausbau des Wiener Hafens in der NS-Zeit, Vienna 2023, 68.

117 Pharmazeutische Post, 7 August 1937, 366; ÖSTA, AdR, BM.f.Land.u.Forstw., 1187 c, 18073 – II/1/39.

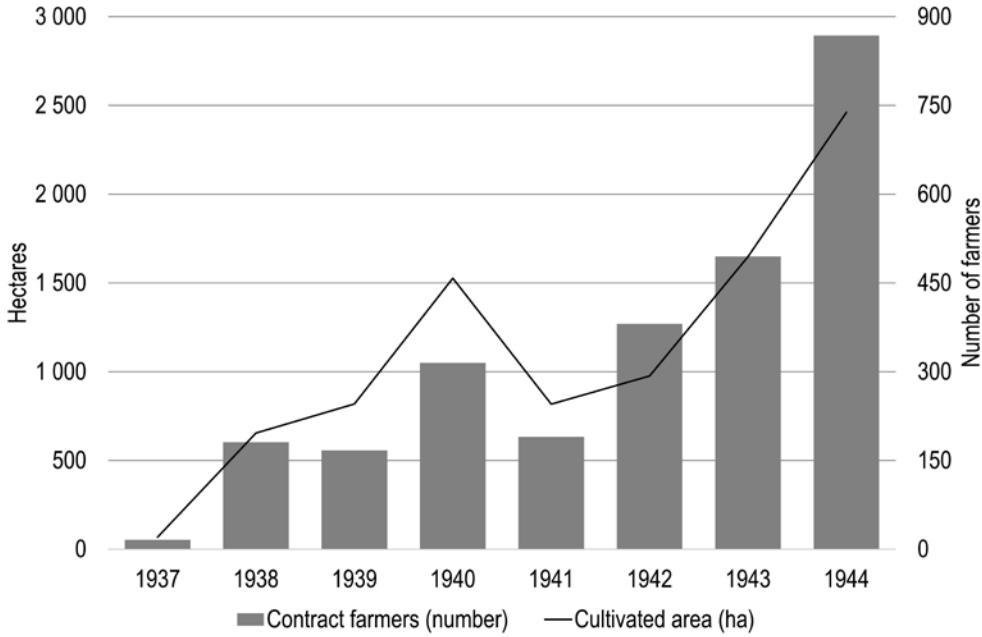
118 Ministerium für Wirtschaft und Arbeit (ed.), Monatshefte der Statistik des Außenhandels Österreichs, März 1939, Vienna 1939, 60. In addition, 15 tonnes of soybean oil were directly imported from Manchukuo.

119 Bundesministerium für Handel und Verkehr (ed.), Monatshefte der Statistik des Außenhandels Österreichs, Dezember 1937, Vienna 1938, 27. At this time, Austria still imported a considerable amount of 7,006 tonnes of soybean oil per year, nearly 90 per cent of which came directly from China. Denmark contributed 577 tonnes.

120 Neues Wiener Tagblatt, 6 August 1943, 4.

121 Farmers who wanted to grow soy had to register with *Sojaring* in order to enter into a cultivation contract. Once registered, the contract farmer would receive the necessary seeds, inoculant, and cultivation instructions. This system remained in place until the end of the war. Völkischer Beobachter, 12 January 1945, 3.

Figure 1: Soybean cultivation area and number of contract farmers, 1937–1944



Source: Brillmayer, Kultur, 1947, 17.

Under the heading *A Vital German Supply. The Magic Bean*, the *London Times* reported in April 1940 that "the soya has become vitally important to Germany from the food, the economic, and the military standpoints." The newspaper specifically mentioned the widespread use of *Edelsoja*, further writing that "at the end of the Polish campaign, Nazi official circles were boasting in Berlin that without the soya it would not have been possible for the German Army to advance so quickly as it had done."[122]

Whole soy flour became an integral part of institutional provisioning. The *Wehrmacht* was the main recipient, but the DAF, the German Labour Front, likewise relied on soy flour to feed workers and forced labourers.[123]

The army used soy flour mostly as an additive in field kitchens to reduce the need for meat, similar to the legume-based *Bratlingspulver*. On long campaigns, it proved especially effective due to its storability.[124] A report in the *Badener Zeitung* from November 1942 described the supply of Rommel's Afrika Corps, stating that soy flour was one of the concentrated supplements carried by the army on its campaign.[125]

A high-level functionary at *Sojaring,* chief agricultural advisor Hans Kusatz, did not miss the opportunity during a workshop with representatives from the oil and fat sector in Vienna

122 A Vital German Supply: The Magic Bean, in: London Times, 23 April 1940.
123 Völkischer Beobachter, 1 March 1941, 9; Prodöhl, Globalizing, 104.
124 Völkischer Beobachter, 6 June 1944, 6; Drews, "Nazi-Bohne", 185.
125 Badener Zeitung, 4 November 1942, 2.

in early 1943 to proudly announce that Austria's flourishing soybean cultivation was "completely bought up by the Wehrmacht."[126] Kusatz continued to be a key factor in the organization of soy cultivation in Austria under the Nazi regime until the end of the war. In the final months of fighting, he appealed to farmers to "plant soybeans" (*bauet Sojabohne!)* as a "decisive contribution" to the final *Kriegserzeugungsschlacht* (war production battle).[127]

The graph in Figure 1 shows the strong expansion of soybean cultivation under the administration of *Sojaring* in Austria, which reached its peak in 1944.[128]

Soy products in the postwar food aid program by UNRRA

Immediately after the Second World War, soy came to the attention of the public media once more, and the soy question briefly flared up again. The *Wiener Zeitung* even spoke of a "new soy craze."[129] However, most of the production facilities were destroyed during the war, including the *Edelsoja* plant, which was hit during an air raid.

Just a few months after the end of the war, the *Sojaring* organization resumed its work to strengthen soybean cultivation as a crucial factor of the nutrition economy.[130] Under the slogan "Grow soybeans", it attempted to persuade farmers to sign new cultivation contracts.[131] In general, the Federal Ministry of Agriculture and Forestry sought to secure the population's fat supply as quickly as possible by promoting the cultivation of oilseeds. To this end, producer prices were fixed and an oil premium was introduced in combination with the return of oilcake for the livestock industry.[132]

Anton Brillmayer, who had worked as an agricultural advisor in the south of France for some time during the war, also returned as a supporter of the continuation of soybean cultivation. To this end, he wrote three popular books about the bean, all richly illustrated with drawings to familiarize readers with every aspect of soy in an accessible fashion.[133] Scarcity and rising food prices were the dominant issues during the immediate postwar period. The overall food situation in Austria was appalling, and Austria was therefore included in the aid program of the United Nations Relief and Rehabilitation Administration (UNRRA) as early as 22 August 1945. The first UNRRA aid shipment arrived in April 1946, containing 1,026 tonnes of soy flour from the USA along with other foodstuffs, clothing, and medical supplies.[134] Soy flour continued to be an essential part of the relief food shipments over the

126 Neues Wiener Tagblatt, 21 February 1943, 6. Johann Kusatz was a former department head of the regional farmers' association (*Landesbauernschaft*) of *Donauland* in Linz.

127 Völkischer Beobachter, 12 January 1945, 3.

128 For brief context illustrating the success of soy in the USA, soybean cultivation had already reached roughly 4 million hectares there by 1942: Roth, Bean, 2018, 122. For a detailed comparison with the US figures, see the contribution by Ernst Langthaler and Natalia Ryzhova in this volume.

129 Wiener Zeitung, 6 June 1946, 4.

130 Arbeiter-Zeitung, 4 September 1945, 3.

131 Agrarische Post, 20 December 1947, 2.

132 Niederösterreichischer Grenzbote, 21 September, 4.

133 Franz Anton Brillmayer, Die Bedeutung der Soja für die Ernährung Österreichs, Vienna 1947; Brillmayer, Kultur; Franz Anton Brillmayer, Wunderpflanze Soja, Vienna 1947.

134 Arbeiterwille, 14 April 1946, 2.

following months, and the *Wiener Zeitung* strove to avoid stigmatizing it as a substitute, instead promoting its wholesomeness.[135]

With soy rice, a new refined product was introduced to the market that mixed soy flour with rice flour, resulting in a starchy product that was more suitable for soup garnishes and the production of various types of pasta and baked goods. Although most newspapers tried to emphasize its positive cooking properties, one paper ran the headline "We'd rather have pork."[136] This title encapsulates the acceptance of soy products during the postwar period: As long as no alternative products were available, people consumed soy – but as soon as the food and supply situation improved, meat was back on the table.

The *Dr. Winkler* soy factory in Vienna resumed limited operations after the war, launching an appeal to the population to deliver soybeans to designated exchange points and have them ground into soy flour.[137] In contrast to Winkler's production facilities, however, the *Edelsoja* factories had been destroyed during the fighting. Kupelwieser attempted to revive the company, but struggled to secure the necessary investments and retrieve the remaining machines and assets from the Soviet-occupied zone.[138]

In 1949, the Federal Ministry of National Nutrition announced that the supply situation in Austria had eased considerably, partly owing to the steady provision of fats and oils from the USA.[139] This is evident in the decline of the public soy debate. From 1949, the use of soy flour and the cultivation of soybeans were no longer a topic in the newspapers. The soy debate thus flared up for only a few years after the war in response to the protein and fat supply crisis before subsiding again as the socioeconomic situation steadily improved.

The widening of the bottleneck

During the years preceding the war and the German annexation of Austria, we can observe a widening of the soybean bottleneck. With the expansion of domestic cultivation in the *Ostmark* and the development of Vienna as a processing and transport hub, soybeans became an integral part of the Reich's war economy and agro-food regime.

The transformation of soy from a niche crop to a staple was facilitated by a concentrated effort by the Nazi regime that involved centrally managed distribution of certified quality seed and the introduction of cultivation contracts with price guarantees. This system both incentivized and pressured farmers into growing soybeans, as the goals of agricultural production were set by the planned economy. The second factor contributing to the widening of the bottleneck was the fact that the *Wehrmacht* became the primary consumer of soy products. In military rations, factors like smell, taste, and appearance were of secondary importance while price, nutritional value, and shelf life were the key considerations. *Edelsoja* did not have to

135 Wiener Zeitung, 6 June 1946, 4; Wiener Zeitung, 13 June 1946, 4.

136 Neue Zeit, 17 January 1947, 3.

137 Neues Österreich, 19 October 1947, 6.

138 KPa, Letter from Ernst Kupelwieser to Hertha Sprung, 19 February 1951. In personal letters, Kupelwieser accused Winkler of being entrusted with the administration of the "soy matter" by Krauland's Ministry for Asset Protection and Economic Planning after the war, and claimed that his company thus received preferential treatment. Kupelwieser also asserted that a large part of the oil industry was in "Eastern hands."

139 Vorarlberger Nachrichten, 3 February 1949, 1.

compete for the favour of consumers in the free market but was integrated into institutional provisioning as an efficient and rational hidden food.

After the war, the bottleneck narrowed again relatively quickly. Although soy became an important source of fat and protein during the supply crisis, particularly in the context of UNRRA aid deliveries, it was once again stigmatized as a substitute product once the food supply steadily improved by 1950. Meat would become the driver of the postwar consumer society.

Conclusion: Framing soy's failure as a bottleneck issue

This paper assesses why soy was not integrated into the Austrian agro-food system until the 1950s despite multiple efforts. The failed adoption of this Far Eastern crop is framed in terms of a 'bottleneck' that impeded the flow of knowledge from niche to regime, and thus the formation of a coherent development pathway. The bottleneck was not purely technological or institutional; it was equally one of demand, which remained fragmented and culturally constrained across three distinct use cases: human consumption, livestock feed, and industrial processing.

Emerging from late nineteenth-century agronomic research, the soy niche developed into a dynamic experimental space shaped by an ever-shifting network of diverse actors including experts, publicists, aristocrats, and the general public. The niche served as a breeding ground where soy was cultivated as a novel solution to regime problems and periods of crisis. However, the fluidity of the actor network highlights the inherently experimental and unstable nature of the niche, where innovation thrived but lacked strategic anchoring. These niche dynamics also reveal that early enthusiasm was not supported by sustainable institutional or market structures, exposing the vulnerability of innovation driven primarily by novelty rather than by sustained alignment with consumer preferences or practical end-use demand.

The second episode highlights how conflicting views and expectations surrounding the soybean contributed to the formation of the bottleneck. In the years preceding the First World War, soy was rediscovered amid the oils and fats crisis, with soybean oil regarded as a substitute for scarce cottonseed oil. The war itself further emphasized soy's nutritional value as a food source during growing supply shortages. This phase illustrates how crises can act as short-term catalysts for innovation uptake, albeit without leading to lasting systemic change.

The third episode outlines the consolidation of the soybean bottleneck. Scientific advancements were undermined by insufficient cohesion and coordination among individual actors, institutions, and state policy. The absence of a coherent coalition or strategy meant that soy remained a fragmented innovation shaped more by reactive than proactive logic. Even amidst the economic crisis, soy advocates struggled to find a unified direction – a challenge amplified by the misalignment of state and private economic interests. The push towards autarky and increased agricultural regulation contrasted sharply with the entrepreneurial endeavours of Kupelwieser's soy foods company *Edelsoja*, which targeted budget-conscious housewives but failed to achieve market acceptance. *Edelsoja* exemplifies the disconnect between top-down economic goals and bottom-up consumer practices, a major obstacle to reframing soy foods as a premium supplement rather than a mere substitute product.

The fourth episode explores the temporary widening of the soybean bottleneck under the Nazi regime's drive for national autarky. Soybeans were integrated into the National Socialist economy as part of the *Erzeugungsschlacht* for fat and protein, reflecting regime interventionism tailored to the specific demands of wartime mobilization with limited social embeddedness. The expansion of soy was thus contingent on a narrowly defined political-economic context and lacked resilience beyond the conditions of scarcity and mobilization.

After the war, deliveries of soy products through the Allied food aid programme helped alleviate humanitarian hardship, but soy foods once again failed to gain acceptance among the population. They were widely stigmatized as relief food and regarded as inferior substitutes. As the economy recovered and purchasing power rose, soy fell out of favour while meat reclaimed its status as the preferred protein source. This negative consumer perception further tightened the bottleneck, pushing soy back into niche status. It is a reversal that highlights the symbolic dimension of food choices: Associated with hardship and deprivation, soy struggled to establish cultural legitimacy as a desirable protein source in times of prosperity – a central pattern in the early history of soy foods in Austria.

Overall, the study illustrates the complex dynamics of agro-food transitions through the lens of a single crop. The introduction of new crops into agro-food regimes is rarely a straightforward or clearly defined process. The case of soy in Austria highlights how the processes of regime transition create critical junctures where innovations must become anchored within existing structures to avoid being sidelined or rejected. Without such anchoring, innovations remain fragile and prone to failure even if their initial reception seems promising. The 'success' of a crop depends not only on its functional benefits but also on sustained demand across sectors, cultural acceptance, institutional support, and coherent coordination among societal actors. It results from a shifting interplay of facilitating and impeding factors that manifest in diverging policies, agendas, strategies, and narratives. These combinations give rise to distinct developmental trajectories that can vary significantly between countries. The soybean was successfully integrated into the US agricultural system in the first half of the twentieth century; it also became an essential commodity for the German oil industry during the interwar period. In Austria, however, although there were glimpses of a breakthrough, it ultimately remained a failure story of untapped potential – at least until the second half of the twentieth century.