



Universität für Bodenkultur Wien
University of Natural Resources
and Life Sciences, Vienna

Master Thesis

Analysis of the business models of selected biodiversity seed companies in Austria, Germany, Greece, and Slovenia

Submitted by

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in the framework of the Master programme

Organic Agricultural Systems and Agroecology

in partial fulfilment of the requirements for the academic degree

Diplom-Ingenieur

Vienna, November 2021

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Affidavit

I hereby declare that I have authored this master thesis independently, and that I have not used any assistance other than that which is permitted. The work contained herein is my own except where explicitly stated otherwise. All ideas taken in wording or in basic content from unpublished sources or from published literature are duly identified and cited, and the precise references included.

I further declare that this master thesis has not been submitted, in whole or in part, in the same or a similar form, to any other educational institution as part of the requirements for an academic degree.

I hereby confirm that I am familiar with the standards of Scientific Integrity and with the guidelines of Good Scientific Practice, and that this work fully complies with these standards and guidelines.

Vienna, 05.11.2021 Vincent PIPPICH (*manu propria*)

Acknowledgements

I would like to express my gratitude to the supervisor of this thesis Assoc. Prof. Dr. Ika Darnhofer. I appreciate the framework that she provided for this work. The clear guidance through the process served as an anchorage. Very helpful was the knowledge, that she conveyed with the introductory course on strategic management.

Special thanks go to Emil Platzer from ARCHE NOAH who initiated the project in which framework this thesis was written. He managed the project well and was always available for answering my questions.

I want to thank all the participants of this study, that were open for an interview and numerous questions.

I am grateful for my aunt, uncle, and sister who helped me with wording, spelling and grammar. I want to also thank Tobias B, Nils Z, David L, Miriam K and all fiends and flatmates who supported me wherever possible emotionally and morally.

Finally, I am grateful for my mother and father who gave me everything they could and made it possible for me to study in various cities. They left me freedom of choice and were supportive with any of my decisions.

Abstract

Plant genetic resources are an intrinsic value, yet their diversity is diminishing. This is partly a result of changes in agricultural production, where crop and vegetable farmers mostly use hybrid varieties, partly due to the legal framework, and partly due to the consolidation of the seed sector. Yet, there is rising interest in alternative varieties, in heirloom varieties, and in land races. Small- and medium-sized companies that breed, propagate and market these contribute to the conservation and use of plant genetic resources. Unfortunately, these biodiversity seed companies face constraints, both externally and internally. Externally, besides the consolidated and international market, the regulatory framework, they also face the challenge that breeding, and seed multiplication is skill, knowledge, and labor intensive. Internally, they often have a dual purpose – being economically profitable and pursuing social goals – which can create difficulties. The purpose of this thesis is to give insights into how biodiversity seed companies face these challenges. The research questions are: What strategies do biodiversity seed companies follow? What are their possible business models? And how do their managers perceive and overcome the obstacles present in the seed sector? To address these questions, the Business Model Canvas by Osterwalder and Pigneur is extended to include aspects that are specific to biodiversity seed companies. This tool was used to structure interviews with managers from ten biodiversity seed companies located in Austria, Germany, Greece, and Slovenia. Additional information, especially on the national context in which these companies operate, was gathered from the literature. The results show that the biodiversity seed companies follow quite diverse business models. There is no best practice example. Most focus on their value proposition and not primarily on customers. Many biodiversity seed companies form partnerships with each other. The interviewed managers found that the external obstacles, e.g., the demanding legal framework, were manageable. Biodiversity seed companies develop a niche on the seed market. They have a unique position, which is unchallenged by multinational seed companies.

Zusammenfassung

Pflanzengenetische Ressourcen sind ein intrinsischer Wert, doch ihre Vielfalt nimmt ab. Dies ist teils auf Veränderungen in der landwirtschaftlichen Produktion zurückzuführen: Bauern und Gemüsegärtner verwenden überwiegend moderne Hybridsorten. Teils sind gesetzliche Rahmenbedingungen und teilweise die Konsolidierung des Saatgutsektors verantwortlich. Dennoch steigt das Interesse an alternativen, alten und Land-Sorten. Kleine und mittlere Unternehmen, die diese züchten, vermehren und vermarkten, tragen zur Erhaltung und Nutzung pflanzengenetischer Ressourcen bei. Leider sind diese Biodiversität-Saatgutunternehmen sowohl extern als auch intern mit Einschränkungen konfrontiert. Extern gehören der konsolidierte und internationale Markt, die rechtlichen Beschränkungen sowie die hohen Anforderungen an Kompetenzen, Wissen und Arbeitsaufwand für Züchtung und Saatgutvermehrung zu den Herausforderungen. Intern kann eine zweiteilige Zielsetzung – wirtschaftlich profitabel zu sein und soziale Ziele zu verfolgen – oft zu Schwierigkeiten führen. Das Ziel dieser Arbeit ist es, Einblicke zu geben, wie Biodiversitäts-Saatgutunternehmen diesen Herausforderungen begegnen. Die Forschungsfragen lauten: Welche Strategien verfolgen Biodiversitäts-Saatgutunternehmen? Was sind ihre möglichen Geschäftsmodelle? Und wie nehmen ihre Manager die Hemmnisse im Saatgutsektor wahr und überwinden sie? Um diesen Fragen nachzugehen, wird das Business Model Canvas von Osterwalder und Pigneur um Aspekte erweitert, die spezifisch für Biodiversitäts-Saatgutunternehmen sind. Darauf aufbauend wurden Interviews mit Managern von zehn Biodiversitäts-Saatgutunternehmen aus Österreich, Deutschland, Griechenland und Slowenien geführt und mit Hilfe des Tools strukturiert. Zusätzliche Informationen insbesondere zum nationalen Kontext, in dem diese Unternehmen tätig sind, wurden der Literatur entnommen. Die Ergebnisse zeigen, dass die Biodiversitäts-Saatgutunternehmen ganz unterschiedliche Geschäftsmodelle verfolgen. Es gibt kein Best-Practice-Beispiel. Die meisten konzentrieren sich auf ihr Wertversprechen und nicht in erster Linie auf die Kunden. Viele Unternehmen für Biodiversitätssaatgut gehen Partnerschaften ein. Die befragten Manager fanden außerdem, dass die externen Hürden, z. B. die anspruchsvollen gesetzlichen Rahmenbedingungen, überschaubar waren. Biodiversitäts-Saatgutunternehmen erschließen eine Nische auf dem Markt. Sie haben eine einzigartige Position, die unangefochten von multinationalen Saatgutunternehmen ist.

Contents

1. Introduction and Problem Statement	1
1.1. Erosion of Plant Genetic Resources	1
1.2. The Role of SMEs in the Alternative Seed Sector	3
1.3. Scene of Biodiversity Seed Companies.....	4
1.4. Rediscovery of Biodiversity Seeds	5
1.5. External Challenges for Biodiversity Seed Companies	6
1.5.1. Development of a Consolidated Seed Market	7
1.5.2. The Regulatory Framework of the Seed Sector	9
1.5.3. Specialisation of Seed Business.....	11
1.6. Internal Challenges for Biodiversity Seed Companies.....	11
1.6.1. Strategy Challenge	12
1.6.2. Legitimacy Challenge.....	12
1.6.3. Mission Measurement Paradox	13
2. Aims and Research Question.....	15
3. Methods	16
3.1. Conceptual Framework	16
3.2. Selection of Biodiversity Seed Companies	20
3.3. Researching the Business Environment	21
3.4. Semi-structured Interviews with Biodiversity Seed Companies	22
4. Results	25
4.1. The Business Environment in Austria, Germany, Greece, and Slovenia	25
4.1.1. Austria: Legislation, Stakeholders and Public Awareness of Plant Genetic Resources.....	25
4.1.2. Germany: Conservation and Use of Plant Genetic Resources, Consumer Trends, Legal Situation and Obstacles.....	26
4.1.3. Greece: History, Maintenance and Marketing of Biodiversity Seeds	27
4.1.4. Slovenia: Breeding of Biodiversity Seeds, Stakeholders and Legislation	28
4.2. Overview of the Interviewed Biodiversity Seed Companies	30
4.3. The Strategy Framework	33
4.3.1. Mission Statement	33
4.3.2. Objectives.....	35
4.3.3. Impact Measures.....	37
4.4. Business Model Canvas	38
4.4.1. Customer Segments	38
4.4.2. Channels.....	39
4.4.3. Customer Relationships	39
4.4.4. Value Proposition and Revenue Streams.....	41
4.4.5. Key Resources	47
4.4.6. Key Activities	49
4.4.7. Key Partnerships.....	52
4.4.8. Cost Structure.....	53
4.5. Influence of the SARS-CoV-2 Pandemic	54

5. Discussion	56
5.1. Comparing the Business Environment	56
5.2. Company Size	56
5.3. Strategy: Mission Statement, Objectives, and Impact Measures	57
5.4. Business Model Canvas	57
5.4.1. Customer Segments	57
5.4.2. Channels	58
5.4.3. Customer Relationships	58
5.4.4. Value Proposition & Revenue Streams	58
5.4.5. Key Resources and Activities	59
5.4.6. Key Partnerships.....	59
5.4.7. Cost structure.....	59
6. Conclusion	61
References.....	63
List of Tables & Figures.....	77
Appendix I: Contact form (English).....	78
Appendix II: Contact form (German).....	79
Appendix III: Interview Guideline	80
Appendix IV: Data Protection Declaration (English).....	82
Appendix V: Data Protection Declaration (German).....	83

1. Introduction and Problem Statement

1.1. Erosion of Plant Genetic Resources

Many perceive **genetic diversity** as an intrinsic value. It is often used synonymously with ‘plant genetic resources’ (PGR), i.e., *“genetic material of plants, which is of value as a resource for present and future generations of people”* (Maxted & Kell, 2003, p. 32). According to Oldfield and Alcorn (1987, p. 206) there are three main reasons for conserving plant genetic resources. First all varieties serve as a bank of genes which can be inserted into future varieties. Second, these varieties are themselves gene complexes which are adapted to specific environmental conditions. Even if the older varieties often cannot compete with the yields of modern varieties, they can be improved by insertion of genes from other sources. And third, locally adapted varieties are important for people’s subsistence. This is especially meaningful in situations and/or places where modern varieties attuned to local conditions are not available.

Despite the widespread acknowledgement of the value of genetic diversity, this **diversity is eroding**. ‘Genetic erosion’ is the *“loss of genetic diversity between and within populations or varieties of the same species over time, or the reduction of the genetic basis of a species due to human intervention or environmental change”* (2(b) 2008/62/EC). Currently there is a loss of plant genetic resources in agricultural crops, at an ever-increasing speed (McDonald, 2001, p. 2). Varieties that were commonly cultivated in earlier times are getting lost and with them their genetic material. FAO (1997, p. 63) stated that 81 of its member states mention in their country report the problem of genetic erosion. Fowler et al. (1990) found that in the United States from the 7098 apple varieties documented in the period from 1804-1904 only 14% remain. With other crops the numbers are similar: 5% of cabbage, 9% of field maize, 6% of pea and 19% of tomato varieties can still be located (Fowler et al., 1990). Likewise, Hammer et al. (1996, p. 329) found that in South Italy in the 1980s only 30% of landraces remained, compared to the reference point 30 years earlier. These numbers seem alarming but at the same time additional factors influence the genetic diversity of agricultural crops.

The actual **extent of genetic erosion** in agricultural crops is unknown but is probably less pronounced than the numbers stated by Fowler et al. (1990). Heald and Chapman (2012, pp. 30–31) showed that multiple naming of the same vegetable variety led to exaggerated numbers of variety loss. In addition, Fowler (1994) argues that some varieties might not have disappeared completely, because they are conserved in seedbanks. In addition, new varieties may have incorporated parts of the genetic material of the often lost and forgotten ancestors – ‘heirloom varieties’ (Fowler, 1994). For heirloom variety there are many – also contradicting – definitions (Bayerische Landesanstalt für Landwirtschaft [LfL], 2019, p. 6; DiGiovanni, 2011, p. 593; Dwivedi et al., 2019, p. 2; ETTY & Harrison, 2015). In this thesis I refer to them as open-pollinated, non-hybrid, non-genetically modified breeds, that are commonly ill-suited for modern large-scale agriculture and were bred some time ago.

Generally, the transmission of genes from one breed to the next generation of breeds makes it difficult to know if genes are eroded. Nevertheless, this transmission is part of another important process, when trying to understand genetic erosion. This other process is called **variety replacement**. It is *“a result of the shift from traditional production systems dependent on farmer varieties to modern production systems reliant on commercial varieties”* (Prip & Fauchald, 2016, p. 364). The development of new varieties continues at approximately the same rate as older varieties are lost. The number of

varieties is therefore constant over time. Comparing 41 crops in the United States, Heald and Chapman (2012, pp. 30–31) found 6739 varieties that were in use in 2004, compared to 6429 varieties in 1903. The new breeds replace the older less suitable ones (FAO, 1997, p. 34). However, there is little genetic diversity within and between modern varieties (Meyer et al., 1998, p. 4). Farmers' 'landraces' on the contrary possess a high genetic diversity. They represent sets of populations or clones of a plant species which naturally and continuously adapt to the environmental conditions of their region (Art.2 (c) 2008/62/EC; Zeven, 1998, p. 137). In contrast to heirloom varieties, landraces are bound to a specific locality and not changed through breeding. Even if both types are valuable plant genetic resources, they are generally outperformed by modern breeds. Farmers therefore tend to replace heirloom varieties and landraces.

The **structural shift in agriculture** is a driver for genetic erosion. According to Veteto (2007, p. 121), both the decline of the number of farms and the lack of cultural continuity in family seed-saving traditions contribute to genetic erosion. Most landraces and heirloom varieties were handed down and maintained in families (Dwivedi et al., 2019, p. 442; Male, 1999). Hence, a decline of the number of farms contributes to genetic erosion. This process is connected to the structural changes in the whole agri-food system.

Only a very small share of the total variety diversity entered the **commercial food trade**. According to Mangelsdorf (1966, p. 374), on the level of species there are around 150 from originally 3000 species, which are and were used for food purposes in human history. These figures indicate that the number of varieties in commercial production and suitable for industrial agriculture is small compared to the total amount of varieties available for human nutrition. The cultivation of heirloom varieties and landraces is commonly less feasible compared to modern breeds. Their intrinsic value is overlooked or simply outcompeted by the direct financial benefits gained with modern breeds (FAO, 1997, p. 38). The tendency is to focus on those, whose production is most efficient and has the greatest return (Mangelsdorf, 1966, p. 374). As a result, those varieties that do not fulfil the new requirements of the commercial agri-food system are prone to get abandoned and their genetic material might get lost.

Past legislation of the European Union discouraged farmers and companies to propagate and cultivate landraces and heirloom varieties (FAO, 1997, p. 38). Before 1998 there was no legal recognition for them. With Council Directive 98/95/EC the EU aimed to allow the marketing of 'conservation varieties'. These include "*landraces and varieties that have adapted naturally to local and regional conditions and are threatened by genetic erosion*" (Directive 98/95 (art. 6(17) 2/3(i)), as well as 'varieties developed for growing under particular conditions', often called amateur varieties. The legal definition of amateur varieties is: "*Varieties with no intrinsic value for commercial crop production but developed for growing under particular conditions*" (Directive 98/95 art. 7(37) 2 (b)). Before there was no way to legally market these varieties. But council Directive 98/95/EC lacked application in the member states and till February 2009 not a single conservation variety could be marketed within the EU (Bocci, 2009, p. 33). Only after introducing Commission Directive 2008/62/EC the situation improved. With it seed companies were able to supply local markets legally with landraces and heirloom varieties. Indeed, Commission Directive 2008/62/EC allowed "*providing for certain derogations for acceptance*" for varieties "*threatened by genetic erosion and for marketing of seed and seed potatoes of those.*" The directive defines the criteria for the registration of landraces and heirloom varieties as conservation variety and/or variety developed for growing under particular conditions (Bocci, 2009, p. 34), and once they are registered, they can be marketed.

Even if laws were introduced to slow genetic erosion, there remain a range of barriers in the legal framework. Indeed, the current EU legislation presents several **restrictions for the ‘in-situ variety conservation’**, which is defined as *“the conservation of genetic material in its natural surroundings and, in the case of cultivated plant species, in the farmed environment where they have developed their distinctive properties”* (2008/62/EC art 2(a)). Four main restrictions can be identified. Firstly, like every other variety, conservation varieties can only be marketed if they are registered in the common catalogues (Council Directive 2002/53/EC art 3(1) and Council Directive 2002/55/EC art 3(2)). Even if there exists a market for unregistered landraces and heirloom varieties, commercial entities that aim to conserve plant genetic resources cannot offer them for sale. Secondly, to get the status of a conservation variety it must meet minimum requirements regarding the DUS-criteria (Winge, 2015, p. 16). The abbreviation DUS stands for 1. Distinctiveness: the plant must be different to already existing varieties; 2. Uniformity: all individuals of a plant should display sufficiently similar characteristics and 3. Stability: the traits unique to the variety must be stable after repeated propagation (European IPR Helpdesk, 2018, pp. 9–11). Varieties that are too heterogeneous cannot be registered (Andersen et al., 2016, p. 20; Winge, 2015, p. 20). Thirdly, Commission Directive 2008/62/EC sets limitations for acknowledged conservation varieties in production and marketing of their seed and planting material (Winge, 2015, p. 17): in one growing season it should not exceed 0.5% of the seed of the same species and no more seed should be produced than to cultivate an area of 100 ha. All conservation varieties of a species together should not account for more than 10% of the total area cultivated with this species (Andersen et al., 2016, p. 7). In Austria, these limitations till now have never been reached (AGES, 2017). Nevertheless, stakeholders are obliged to notify the authorities in advance about the size and location of their area for seed production and the amount of seed marketed (Winge, 2015, p. 17). Fourthly, the same directive states also that *“Member States shall ensure that a conservation variety must be maintained in its region of origin”* (Commission Directive 2008/62/EC art 9). This includes the production and marketing of seed/material. In Austria most commonly the whole country is denoted as ‘region of origin’ of individual conservation varieties, whereas in Germany mostly the individual federal states take that position. In summary, all restrictions impose administrative burdens on initiatives that aim to conserve plant genetic resources.

In conclusion, the actual extent of genetic erosion is unknown. The number of varieties cannot be taken as a measure. However, there is consensus that the process of genetic erosion is occurring (Prip & Fauchald, 2016, p. 364). The reasons for the reduction in genetic diversity are manifold and interrelated. Changes in agricultural production, breeding and policy can be seen as the main drivers of genetic erosion (Prip & Fauchald, 2016, p. 364; FAO 1997, p. 36). Thus, it is advisable to promote the access and conservation and use of plant genetic resources.

1.2. The Role of SMEs in the Alternative Seed Sector

A way to conserve plant genetic resources is to foster the development of a **diversified seed sector**, i.e., one not dominated by a few multinational corporations but rather based on farmers and small- and medium-sized enterprises (SMEs). SMEs are *“enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million”* (2003/361/EC annex art 2). FCEC (2008) states that a coexistence of two different systems – large commercial breeding companies and the smaller market or regional breeders and producers – seems possible, because each is targeting a completely different market. The solution

in this case would not be an either/or, rather an integrated approach. A step in that direction, would be to strengthen the position and facilitate the founding of SMEs in the seed sector.

Having several SMEs in different regions, would **tackle some of the problems** in the seed sector: they could breed varieties attuned to local conditions or adaptable varieties. Scholars see this as a strategy to tackle the influence of climate change on agricultural productivity (Messmer & Wilbois, 2015, p. 23). These breeds could be also suitable for organic agriculture and vice versa (Wirz et al., 2017, p. 57). At the same time, SMEs might contribute to conservation of plant genetic resources, with the commercialization of landraces, heirloom varieties and/or the breeding of ‘alternative varieties’ – modern breeds either attuned to particular management conditions (e.g., organic agriculture) or performing well under variable climatic conditions (e.g., extreme weather events). Alternative varieties are generally open pollinated and of non-hybrid¹ origin. Together with landraces and heirloom varieties they are summarized under the term ‘biodiversity seeds’. In this thesis, SMEs that breed, propagate and market them are referred to as ‘biodiversity seed companies’. Their practices contribute to the in-situ conservation of plant genetic resources and therefore slows genetic erosion (FAO, 1997, p. 40). In addition, a market served by many companies is most likely to fulfil all customers’ needs for an adequate and stable price (Scherer, 1994, p. 41). Currently, only a few biodiversity seed companies exist.

1.3. Scene of Biodiversity Seed Companies

It is helpful to divide biodiversity seed companies into **three groups**, depending on their historical background and form of organisation. Biodiversity seed companies commonly derive from (1) biodynamic organizations, (2) non-profit organisations for the conservation of plant genetic resources or (3) farms that specialized on seed propagation. In the following paragraphs, I will give a detailed view on each of the three groups with examples.

Biodiversity seed companies often have a **biodynamic background** and/or are funded by anthroposophical foundations. Modern conventional breeding increasingly develops hybrid varieties (Duvick, 1999, p. 264, 254, 228; E. Platzer, personal communication, 10.12.2020). Of conviction, biodynamic agriculture refuses their cultivation, even though currently farmers must sometimes resort to hybrids (Demeter e.V., 2021). The lack of suitable biodynamic varieties led to the development of breeding initiatives and biodiversity seed companies. Examples are Sativa Reinau (CH), Reinsaat (AT), Bingenheimer (DE), Dottenfelder Hof (DE). They started out as non-profit organisations and later began to propagate and commercialize varieties.

The second group of biodiversity seed companies has their **roots in the non-profit sector**. In Europe, initiatives which aim to conserve plant genetic resources were founded in the late 1980s to 1990s. Examples are Arche Noah (AT) and Dreschflegel (DE). Arche Noah’s initial goal was to maintain landraces and heirloom varieties ex-situ in a seed bank (E. Platzer, personal communication, 10.12.2020). Dreschflegel, which started off as VEN (Verein zur Erhaltung der Nutzpflanzenvielfalt e.V.), organized seed conservation in-situ: members cultivated landraces and heirloom varieties in

¹ F1-hybrids “result from crosses between two genetically different, highly inbred lines; [...] individuals usually possess increased vigour of growth, survival, and fertility” (Schlegel, 2003, p. 209). Seeds must be purchased every year, since these traits are not passed to the second filial generation (F2) (ProSpecieRara, 2018). Non-hybrid varieties on the contrary pass their phenotypic traits – changes are possible – to the following generations.

their home gardens, saved seeds and traded amongst them (VEN e. V., 2021). Later both associations started to commercialize their assortment. A bit different but also originating from the non-profit sector is Black turtle. It is a commercial project of Ackerdemia e.V. with an educational mission: they provide seed packages with landraces and heirloom varieties together with cultivation information (Ackerdemia e.V., 2021). Citizens contribute to conservation of plant genetic resources and learn about vegetable cultivation.

The third group of biodiversity seed companies started off as **farms**, which began to produce seeds. Their initial motivation was to gain seed sovereignty. Later, they expanded their seed production and specialized. Examples are Samengreißlerei (AT), Sortenwerkstatt Barbara Soos (AT) or Saatgutmanufaktur (DE). Commonly these are micro companies that commercialize landraces and heirloom varieties.

1.4. Rediscovery of Biodiversity Seeds

There is a **rising interest** in biodiversity seeds (Dwivedi et al., 2019, p. 445). The topic of conservation and use of plant genetic resources is getting public attention. Globally, various initiatives were founded with the aim to fight genetic erosion. In the United States for example there is a rapid growth of biodiversity seed companies such as Baker Creek Heirloom Seed Company or Terroir Seeds (Howard, 2015, p. 5). Additionally, amateurs start to save seeds, which is *“the practice including the growing, collection, storage, reuse, and/or exchange of seeds (and/or other propagating material)”* (Phillips, 2005, p. 39). This is only possible with non-hybrid varieties. Only they pass their phenotypic traits – changes are possible – to the following generations. Biodiversity seeds are predestinated to do so. In general, the topic of gardening and agriculture is gaining publicity. Conservation and use of plant genetic resources is connected to this trend since seeds stand at the start of the agri-food system.

Two main reasons contribute to the increasing interest in biodiversity seeds. Firstly, Dwivedi et al. (2019, p. 444) argue that their cultivation is a *“response to the increasing consolidation of the global seed industry”*. A shift to a **localized conservation** and use of plant genetic resources would give back control to stakeholders and contribute to making personal relationships among them. A more fundamental viewpoint is taken by Kloppenburg (2010, p. 385) – amongst many others. This group demands ‘seed sovereignty’ as a part of food sovereignty. For them it is the repossession of plant genetic resources and intellectual property for everybody. Seeds are a cultural asset of humanity or a human heritage, which should be available freely and not regulated at all (Wirz et al., 2017, p. 60). Initiatives like Kokopelli or Longo Mai for example reckon a registration of seeds as unnecessary (Wirz et al., 2017, p. 60). Kultursaat e.V. (2021) a breeder’s organization explicitly renounces any sort of legal protection. Others propose to finance breeding based on parity by all stakeholders (Wirz et al., 2017, p. 61). In sum, the cultivation of biodiversity seeds is a way to gain seed sovereignty since many of them are already a licence free.

The second major reason is the **perception of consumers**, that the produce of biodiversity seeds is more nutritious and tastier than that of modern commercial breeds. Davis et al. (2004) state that modern commercial varieties experience a loss in nutrient content. According to them there is a trade-off between quantity (in yield) and quality (relative nutrient content). Note that also cultivation methods (use of fertilizers, climate, etc) play an important role for the nutrient content of crops (Gouache, 2019).

The rising **interest in biodiversity seeds** contributes to the success of biodiversity seed companies. It seems that biodiversity seed companies serve a special niche on the seed market. Private gardeners – a customer segment of biodiversity seed companies – for example are motivated by the thought of contributing to the conservation of plant genetic resources (E. Platzer, personal communication, 10.12.2020). Additionally, they are often interested in biodiversity seeds, because they are different from the modern commercial varieties available in supermarkets. Biodynamic and organic farmers form another customer segment. Out of economical, ideological, nutritious, taste or other organoleptic reasons they prefer to cultivate biodiversity seeds. Moreover, biodynamic, and organic growth conditions are heterogeneous compared to conventional agriculture. Therefore, traits like variability can contribute to yield security (Wosene et al., 2015, p. 285; Zeven, 1998, p. 137). Market gardeners – the third customer segment – have similar motivations to purchase and cultivate biodiversity seeds (E. Platzer, personal communication, 10.12.2020). Additionally, their customers often prefer the diversity and uniqueness of products. Therefore, market gardeners sell vegetables grown from biodiversity seeds to satisfy their customers' needs. In sum, biodiversity seed companies seem to serve a niche on the market. Biodiversity seeds are rare, but the demand is growing.

Additionally, an internal factor contributes to the success of biodiversity seed companies: the **motivation of employees**. Many biodiversity seed companies originate in the non-profit sector and were initiated by engaged members. These voluntary members later became paid employees, which kept their intrinsic motivation to conserve plant genetic resources with their work (E. Platzer, personal communication, 10.12.2020). Biodiversity seed companies therefore share values with their employees and partners (E. Platzer, personal communication, 10.12.2020), which facilitates identification. Maren Uhmann for example from Dreschflegel GbR appreciates her engagement in the organisation for plant genetic resources (Uhmann, 2018). A synergy develops, which improves the overall performance of the company (Bullinger, 1996, p. 4).

In sum, the rising interest of stakeholders and community members in biodiversity seeds contributes to the success of individual biodiversity seed companies. Employees are usually intrinsically motivated, which increases the performance of biodiversity seed companies. Nevertheless, the market for biodiversity seeds is still a niche. So far, the seed sector in Europe is not diversified at all, and there are only a few biodiversity seed companies.

1.5. External Challenges for Biodiversity Seed Companies

The following three **external obstacles** – part of the business environment – were identified to threaten not only genetic diversity of agricultural crops but also the formation of biodiversity seed companies within the EU. (1) The market is consolidated and dominated by multinational competitors (Musselli Moretti, 2006, p. 5). In contrast to them, biodiversity seed companies act on a small scale and therefore have little influence regarding the legal framework, prices, and opinions. They must adapt themselves. (2) The regulatory framework of the seed sector is strict and elaborated on international and national level (European IPR Helpdesk, 2018). (3) Breeding is transdisciplinary and specialized (Repinski et al., 2011, p. 2330) and a time consuming and costly undertaking (Miedaner, 2010, p. 10).

All three obstacles are **interconnected**: The legal framework stimulates the formation of multinational corporations, which can then use their power to influence policy. Costs for registration of varieties and time requirements to develop new varieties are dependent on policy and favour multinational

corporations. It is mostly them, who possess the financial means to invest in breeding. In the following three sections I will explain the three external difficulties in detail.

1.5.1. Development of a Consolidated Seed Market

The seed market, dominated by a few multinational corporations, emerged progressively. **The history of the commercial seed sector** dates to the end of the nineteenth century and is marked by three important innovations.

First, the commercialization of the seed sector started with **improvements in plant breeding**. This happened in the early 1900s, simultaneously in different regions of Europe (Brandl, 2016, p. 137; Morris et al., 2005; Schlegel, 2018, pp. 59–60). Private entities started to develop new varieties by using new breeding methods, based on a rediscovery of Mendel's research (Barbieri & Bocchi, 2015, p. 791; Brandl, 2016, p. 138; Schlegel, 2018, p. 52). Soon government-owned institutes and government-financed universities participated in the breeding efforts (Brandl, 2016, p. 137). *"Breeding became scientific, complicated, expensive and difficult"* which made it difficult for farmers and amateurs to continue in this rapidly growing field (Schlegel, 2018, p. 59). Before, farmers used to cultivate landraces and heirloom varieties. However, these often had lower yields under optimal conditions compared to those that were introduced by the first breeders. For example, in north Germany yields increased by 60-90% with the cultivation of modern commercial varieties (Harwood, 2012, p. 37). Because of the substantial differences in yield, farmers started to purchase those and abandoned their landraces and heirloom varieties.

Second, the **discovery and commercialisation of hybrid crops** further speeded up the development process of new varieties. The potential of F1-hybrids had been recognized already early in the 20th century, but their distribution started slowly. In the United States the first marketing attempts for hybrid corn were made in 1916 by the Funk Brothers Seed Company (Kingsbury, 2009, p. 230). A few years later, in 1926, the first seed company with the exclusive purpose of developing hybrid corn varieties was founded: "the Hi-Bred Corn Company", later the "Pioneer Hi-Bred Corn Company" (Kingsbury, 2009, p. 235). By 1934 still less than 0,5% of the total corn area was planted with hybrid cultivars. This drastically increased, mostly through the success in increasing yields, to 56% by 1944 (Kingsbury, 2009, p. 237). Twenty years later, in 1965 almost 100% of the area planted with corn uses hybrids (Duvick, 1999, p. 6). Murphy (2007, p. 26) states that the yield of corn increased by 430% between 1920 and 1990. Hybrid varieties play a considerable role in these improvements. The global reach of hybrids is shown by Duvick (1999, 264, 254, 228): in Zambia 65% and in Thailand 60% of the corn area is cultivated with hybrids; in India over 60% of sorghum area is dedicated to hybrids. The numbers for Europe look similar: for example, in 2003 in Germany 50% of the rapeseed and 60% of the rye area were cultivated with hybrid varieties (Arncken & Dierauer, 2005, p. 5). These examples show the strong influence that the discovery of F1-hybrid crops has on the variety selection of farmers.

The third innovation is marked by the **spread of 'genetically modified crops'**. They have artificially altered genetic material, *"in a way that does not occur naturally by mating and/or natural recombination"* (2001/18/EC art 2(2)). In 1983 scientists developed the first genetically modified crop (Heinrich-Böll-Stiftung, 2019). Since then, crop performance improved substantially by adding genes conditioning traits such as herbicide tolerance, insect resistance, or virus tolerance (Hammer & Teklu, 2008, p. 37). As a result, a considerable number of genetically modified crops have been released and commercialised (Huang et al., 2002, p. 674). The large-scale agricultural cultivation started in 1996 in

the US and grew quickly afterwards (Hammer & Teklu, 2008, p. 37; Luger et al., 2017, p. 36). In 2015 globally, around 180 million hectares were cultivated with genetically modified crops (Heinrich-Böll-Stiftung, 2019; Luger et al., 2017, p. 37). Their significance within the EU is limited. Currently MON810 corn from Monsanto is the only permitted one. It is cultivated in Spain, Portugal, Czech Republic, Romania, and Slovakia with a slightly declining acreage (Luger et al., 2017, p. 36). However, besides the uncertainty regarding the consequences on humanity in general, genetically modified crops have far-reaching effects on the seed sector. Indirectly, because they further increase genetic erosion (Hammer & Teklu, 2008, p. 39). Directly, because the technologization of plant breeding increases costs, which are easier sustained by multinational corporations; SMEs on the contrary get superseded from the market (Meyer et al., 1998, p. 4). The financial requirements for breeding are further intensified by the introduction of patents on genetic engineering methods.

The development of breeding methods, the discovery of F1-hybrids and finally the genetic engineering methods made breeding a specialized business. As a result, the **seed market consolidated and internationalized**. What was once 30 different companies in the 1970s – after fusions and takeovers – became six companies in 2001 (Musselli Moretti, 2006, p. 5). According to ETC Group (2013) in 2011, the ten biggest seed producers controlled about 75% of the global seed market. The top four Monsanto, DuPont, Syngenta, and Groupe Limagrain had a market share of about 58%. Their share grew to approximately 66% in 2017, when Bayer took over Monsanto and became the biggest agrochemical corporation and seed producer worldwide (Shand & Wetter, 2019). With an annual turnover only in the seed segment of about 10.6 billion Euro in 2017, Bayer is the biggest seed producer worldwide (Shand & Wetter, 2019, p. 5). To illustrate the consolidation on a smaller scale within Europe: in Bavaria there are only eleven registered breeding companies today, compared to about 100 in the 1950s (Then, 2017). The seed sector experiences a reduction in the number of companies and the growth of individual corporations.

Multinational corporations use two types of **expansion strategies**. Firstly, they either buy out local seed companies or enter alliances with them (Tony Overwater, 2009). Secondly, they incorporate other business branches within the food value chain² like agrochemical production, breeding, and agricultural production (Kingsbury, 2009, p. 244). The goal of this strategy called ‘vertical integration’ is to bring together the stakeholders within a certain value chain, and in the end form a single corporation, which is a central authority. The aim of a vertically integrated corporation is to integrate production, processing, and marketing (Adelman, 1955; Mpoyi, 2003, p. 44; Prasertwattanakul & Ongkunaruk, 2018, p. 481). These strategies lead to these significant market shares by a few companies. Such large, integrated multinational corporations have the resources to influence governmental decisions to their own advantage (Howard, 2009, p. 1270). Their lobbying – influencing policymakers with the aim to enforce certain interests (Ahrens, 2007, p. 125) – is reflected in the legal framework of the seed sector.

² According to Kaplinsky and Morris (2000, p. 4) the value chain is the “*full range of activities which are required to bring a product or a service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use*”.

1.5.2. The Regulatory Framework of the Seed Sector

On international, European, and national level the seed sector is **highly regulated**. There is an international convention on variety protection since 1961 (with the last revision in 1991). It is named the UPOV-Convention, which was initiated by the intergovernmental organisation “International Union for the Protection of New Varieties of Plants”. The objective of this convention is to protect plant varieties as intellectual property. This means that a new variety is the property of the owner, which is allowed to charge licence fees from the users. This should enhance breeding. It also defines the characteristics that a new variety must possess. In addition to the ‘DUS-criteria’, it must be ‘novel’. It must not have been marketed before in the country, where the application takes place (European IPR Helpdesk, 2018). The international convention has 95 participating states, which adapted the convention in national law, including the European Union as federation (UPOV, 2020).

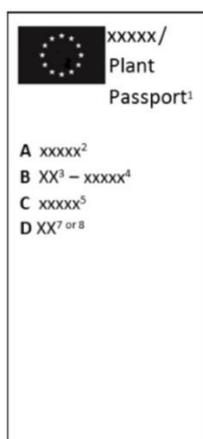
Within the EU the **protection of landraces and heirloom varieties** is defined through commission directive 2100/94/EC on “community plant variety law” from 1994. Since then, a variety can be registered and protected at EU-level by the Community Plant Variety Office (CPVO) in France (Louwaars et al., 2009). Agricultural crops can be protected for 25 years. Exceptions are potatoes, grapes, and trees with 30 years (2100/94/EC; European IPR Helpdesk, 2018). The directive includes two exceptions from plant variety protection, which are also part in the UPOV-Convention: The ‘breeder privilege’ allows the use of varieties for further breeding without liabilities towards the owner (Correa & Seuba, 2019, p. 284; Directive 2100/94/EC). This first exception is valid within the whole European Union. The second is optional and can be decided by each EU member state: The ‘farmers privilege’ grants farmers the right to reproduce varieties on their fields and reseed them. The farmers privilege can be applied to certain cultures – like cereals, where there is a common practice of farmers to save seeds and reseed them on their own land, without sales intention (European IPR Helpdesk, 2018). The exceptions leave space to continue long time practices of farmers and breeders. Nevertheless, new laws bring new limitations. Closely connected to plant variety protection is the registration of varieties.

To market a variety within the EU it must get **registered** in the ‘Common Catalogue of varieties of agricultural plant species’ or in the ‘Common Catalogue of varieties of vegetable species’ (Council Directive 2002/53/EC §3(1) and Council Directive 2002/55/EC §3(2)). As for granting breeder’s privilege, for market release a variety must fulfil the DUS-criteria (2002/53/EC art 4(1)). National institutions evaluate the three criteria in a 2-3 Year cultivation examination (BAES, 2020; BDP, 2020). Commonly only 10-30% pass (BAES, 2020; Bundessortenamt, 2020). A major constraint is that alternative varieties are often not uniform (Dawson & Goldringer, 2012, p. 94). In fact, heterogeneity and instability of traits support the adaptability to environmental conditions (Winge, 2015, p. 36). Additionally, varieties which are heterogenous and unstable are often genetically diverse (Dawson & Goldringer, 2012, p. 77). In conclusion, the registration in general and specifically the DUS-criteria foster genetic erosion and challenge entities that breed alternative varieties. But there are more legal obstacles.

In addition to the plant variety protection law, the Directive 98/44/EC on the legal protection of **biotechnological inventions** was introduced in 1998 (98/44/EC). It defines whether and how organic material or organisms can be patented. Since the introduction of that law, biotechnological methods and their products can be protected as intellectual property. The main part (90% in 2013) is given to genetically modified crops (Deutscher Bundestag, 2014, p. 6). Brandl (2016, p. 150) states that

currently genetically modified crops are not planted in noteworthy quantities in the European Union. Additionally, the patents given in the European Union are less comprehensive than for example in the US. Even if currently biotechnological patents are of little relevance to the European seed sector, international corporations try to push the broad patent application (Stafford, 2007) – often with success. Theoretically, the patent law applies only for traits of a plant. Whole plant varieties are explicitly excluded (European IPR Helpdesk, 2018, p. 13). Nevertheless, patents on genetically modified varieties and even conventional breed varieties were granted. In May 2013 for example the European Patent Office patented white bow tie-resistant paprika and chilli plants (Anonymous, 2014). Since then, every other variety that possesses that trait, falls under the patent protection, and is thus fully owned by Syngenta – the patent owner. In the best-case, patented breeding material can be used with a contract and the payment of a license (Börgermann, 2013, p. 1).

Companies that market seeds need a **plant passport** (see Figure 1 **Fehler! Verweisquelle konnte nicht gefunden werden.**). This is an official document for the trade with specific and regulated plant products (including most seeds). The registration involves an additional obstacle for seed producing or trading companies (AGES 2019). With the regulation (EU) 2016/2031 on ‘protective measures against pests of plants’ from 2016, EU member states are required to implement national phytosanitary regulations. The idea behind this passport is to better trace quarantine pests and stop them from spreading (AGES 2019). Since 14.12.2019 the plant passport is obligatory in Austria. Entrepreneurs, who multiply, or trade seeds need to apply once which costs approximately 300 Euro). After registration, the official plant protection service controls the company at least once per year for compliance. In Austria agencies of the particular federal state take over this task. Yearly costs of approximately 100 Euro accrue. The whole process means additional workload and costs for seed producing or trading companies.



- The words 'Plant Passport'¹
- Botanical names² (A)
- Country code of issuer³ (B)
- Registration number⁴ (B)
- Traceability code⁵ (C)
- Country of origin code (EU Member State or 3rd country)^{7 or 8} (D)
- Barcode or similar (optional)



Figure 1: Sample Plant Passport; (source: <https://www.land-scapeinstitute.org>)

Figure 2: Tomato fruits with Tomato brown rugose fruit virus (ToBRFV) infestation (source: EPPO (2020) EPPO Global Database)

The registration for the plant passport is tied to additional **pest controls**. For example, since 11th August 2020 PCR-testing for the Tomato brown rugose fruit virus (ToBRFV) (see Figure 2) is obligatory (AGES 2020). This happened according to the regulation (EU) 2020/1191 for ‘establishing measures to prevent the introduction into and the spread within the Union of Tomato brown rugose fruit virus (ToBRFV)’. The official plant protection service takes seed samples of all tomato and pepper varieties. The costs per test and variety amounts to approximately 90 Euro in Austria (Norbert Moser, personal

communication, 25.06.2021). Seed producers, who have many tomato- or pepper-varieties in their assortment incur considerable costs for this testing. The administrative burden and costs for such additional pest controls can also be a barrier for biodiversity seed companies who want to promote tomato and pepper varieties.

In summary, the regulation of the seed sector on international, European, and national level creates obstacles for biodiversity seed companies. Specifically, the plant variety rights, the registration procedure, the patent law, and the phytosanitary regulations are responsible. They complicate the access to plant genetic resources and prohibit the marketing of a range of biodiversity seeds. In the best-case breeding material can be used with a contract and the payment of a license (Börgermann, 2013, p. 1). These thereof generated costs and additional workload are considered as another hindrance for biodiversity seed companies.

1.5.3. Specialisation of Seed Business

Operating a seed multiplication and/or breeding company is a **time consuming and costly** undertaking (Miedaner, 2010, p. 10). The registration price of new varieties in Austria for example ranges from about 2000 Euro for vegetables to 4700 Euro for annual agricultural crops; 24 Euro of annual listing fees each year must be added (AGES, 2017). For the registration of conservation varieties, the fees are lower (132 Euro for vegetables and 225 Euro for annual agricultural crops) (AGES, 2017). In addition, costs arise when registering patents and enforcing the resulting rights (Arche Noah, 2020). The time from the start of breeding till the registration of a new variety takes eight to 13 years with conventional methods. This is due to biological circumstances and the examination period of the responsible authorities (Miedaner, 2010, p. 10). The resulting labour costs are dependent on the country. The mix of a strict legal framework and biological/technical circumstances require distinct knowledge and skills. For entrepreneurs they present an obstacle.

Plant breeding and partly also propagation is **transdisciplinary and specialized** at the same time. Not only are many fields involved, breeding also requires a high expertise in each field. Indeed, successful breeding requires knowledge in genetics, genomics, molecular and cellular biology, plant physiology, and agronomy, as well as specialized technology (Repinski et al., 2011, p. 2330). As necessary skill set – knowledge put into action – Repinski et al. (2011, p. 2334) mentions experimental design, analytical aptitude, data management, and statistics. All of which make a breadth and depth in education for breeders necessary. Thus, well trained employees are necessary to develop new varieties and skilled personnel might be an important factor for the success of breeding companies.

In summary, three interdependent factors present external constraints for biodiversity seed companies: (1) the consolidated and international market, (2) the strict regulatory framework and (3) the specialisation of breeding practice. Biodiversity seed companies often do not have the financial resources to cover the costs of complying with the legal requirements and withdraw from the market. As a result of this business environment, multinational corporations dominate the seed sector.

1.6. Internal Challenges for Biodiversity Seed Companies

Biodiversity seed companies are a special type of company, which are characterized by their dual and conflicting purpose. They are **hybrid organisations** (Hasenfeld & Gidron, 2005, p. 98). After the definition used for biodiversity seed companies, they can be classified as ‘social enterprises’ or as ‘socially responsible businesses’. Both types, besides maximizing profit, pursue non-profit goals

(Achleitner et al., 2007, p. 7). The primary focus, and whether profit is distributed to investors, differentiates the two sub-categories. 'Social enterprises' primarily *"meet social objectives rather than generate personal financial profit"* and profit is reinvested (Shaw & Carter, 2007, p. 419). Here the non-profit mission is explicit and central (Dees, 1998, p. 3). Whereas 'socially responsible businesses' include non-profit goals, but primarily generate profit and distribute it among investors (Achleitner et al., 2007, p. 7). Which of those subcategories a specific biodiversity seed companies meets is of minor importance for this thesis. Rather the fact is crucial, that they are hybrid organizations, that have two purposes – maximizing profit and pursuing non-profit goals like improving conservation and use of plant genetic resources.

The hybrid character creates **three challenges** for biodiversity seed companies. First, there is the 'strategy challenge' (Florin & Schmidt, 2011, p. 166), which *"addresses the integration and balance of public and private value"* (Sparviero, 2019, p. 238). The second is the 'legitimacy challenge' (Galaskiewicz & Barringer, 2012, p. 188). It arises from the difficulty that stakeholders have in categorizing biodiversity seed companies as for-profit or non-profit; Each category brings distinct expectations (Galaskiewicz & Barringer, 2012, p. 188). As a third challenge the 'mission measurement paradox' was identified (Ormiston & Seymour, 2011, p. 137): The measurement of non-profit goals and their impact is complex since they are often not quantifiable.

1.6.1. Strategy Challenge

The **strategy challenge** arises from the dual and conflicting purpose of biodiversity seed companies. On one hand they usually must be economically profitable and on the other they try to contribute to in-situ genetic conservation. In other social enterprises this often creates tensions (Adams & Perlmutter, 1991, p. 31; Cooney, 2006, p. 152). According to Sparviero (2019, p. 239) companies achieve economic goals best by being efficient. However, efficiency as a principle is often incompatible with non-profit actions. The solution lies in finding the right balance, *"so that these apparently competing for goals leverage each other to maximize operational efficiency and effective delivery of social/environmental value"* (Florin & Schmidt, 2011, p. 166). Biodiversity seed companies commonly try to do so by commercializing biodiversity seeds.

1.6.2. Legitimacy Challenge

Closely connected is the **legitimacy challenge** (Galaskiewicz & Barringer, 2012, p. 188). Many biodiversity seed companies are rooted in the non-profit sector and later start to be a profit-oriented company, but a clear-cut classification is often difficult. Generally, social enterprises struggle to be held accountable and trustworthy, since they stand in between the two categories of non-profit and for profit (Austin et al., 2006, p. 3, 11). Each has its own mode of conduct, values, and goals. Partners and customers have different expectations and standards for those categories (Galaskiewicz & Barringer, 2012, 188). Yet, for social enterprises it is crucial that stakeholders perceive them as legitimate. They need to justify themselves: On one hand by demonstrating their *"legitimacy based on their ability to operate according to the moral logic of the seed market; [...] On the other hand, based on the moral logic of the social realm"* (McInerney, 2014, p. 165). Yet this double position might create a constant need for justification (McInerney, 2014, p. 165). A solution is offered by Sparviero (2019, p. 240): Companies should communicate frankly and clearly their strategy and action to stay aligned. This helps internally, to coordinate the team and externally, to illustrate stakeholders what to expect. Biodiversity seed companies can gain justification similar by providing clear statements about their mission and action.

1.6.3. Mission Measurement Paradox

In literature and entrepreneurial practice there are different definitions used to describe why a company exists and how it translates its values into action. For simplicity, the term '**mission statement**' will be used to describe "the why" (Witcher, 2020, p. 13). It is used to communicate core beliefs or purpose (Cady et al., 2011, p. 69). A 'mission statement' consists of one or more long term goals, which serve as a motivation for the team. 'Objectives' establish concrete action guidelines or ways of conduct. They are smaller and short term oriented than the goals defined with the mission statement (Sparviero, 2019, p. 244). Good objectives are usually 'specific', 'measurable', 'assign-able', 'realistic', and 'time-related' (SMART) (Doran 1981, p. 36). The targeted area where the objective aims to bring improvement should be 'specific'. It should be quantifiable or at least offer an indicator for progress ('measurable'). Additionally, an executing entity should be 'assigned'. The objective should be 'realistic' under the given circumstances and finally it is necessary to specify when the results can be achieved ('time-related'). Figure 3 shows the connection between mission statement, strategy, and objectives.

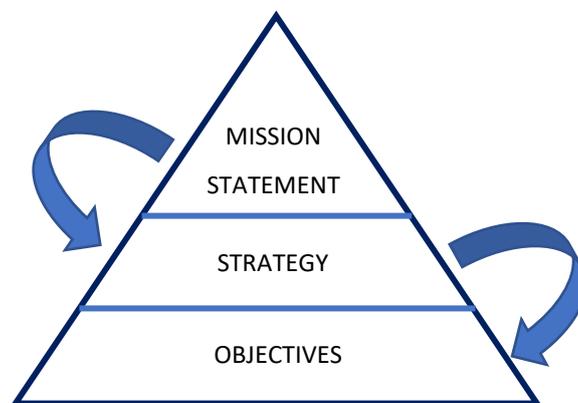


Figure 3: Relationship between mission statement, strategy, and objectives; Changed after Carpenter et al. (2012 p. 163)

The **mission measurement paradox** was identified (Ormiston & Seymour, 2011, p. 137). Social phenomena commonly are hesitant and depend on multi causal factors; change needs time to manifest (Austin et al., 2006, p. 9). This makes it difficult for social enterprises to measure their impact in the social realm. According to Sparviero (2019, p. 244) there is a disconnection between mission statement and objectives on one side and their impact measurement on the other. Financial success on the contrary belongs to business knowledge and is easy to communicate and quantify. As a result, the focus might shift to the latter. This process is called 'mission drift' (Ebrahim et al., 2014, p. 82). All of which make an adequate measurement of mission statement and objectives necessary.

Previously defined measures can evaluate non-profit mission statements. Evaluation creates space for reflection. It is a tool to keep account of specific activities and facilitates the adjustment of strategy. Reflection then offers a counterbalance to obstinate goal pursuit. In the case of biodiversity seed companies, a goal can be to conserve plant genetic resources. Therefore, companies could define assessment criteria in advance, how they see their mission accomplished. A possibility is to measure the number of varieties that are legally registered as conservation varieties, varieties developed for growing under particular conditions or alternative varieties. This type of evaluation helps to overcome the mission measurement paradox for biodiversity seed companies.

In sum, due to their hybrid organisational character, biodiversity seed companies face internal challenges. The most important ones are the strategy challenge, the legitimacy challenge, and the

mission measurement paradox. In view of the harsh business environment, it is crucial to balance between non-profit and profit oriented goals. The question remains how biodiversity seed companies solve the challenges in practice and why they are successful in their business environment.

2. Aims and Research Question

In academic literature there is much research about the consolidation and regulation of the seed sector and the resulting challenges that arise for breeding and propagation of plant varieties. Yet, no study analyses the **sector from the perspective of biodiversity seed companies**. Their importance and possibilities to cope with some of the challenges that arise from consolidation were discussed in earlier chapters. The **purpose** of this research is to give entrepreneurs an insight into how similar companies face the challenges of the seed sector. It can foster the foundation of start-ups, which contribute to the conservation and use of plant genetic resources.

The aim of this master thesis is to capture a range of strategies used by biodiversity seed companies. To cover a range of contexts ten biodiversity seed companies are included. Biodiversity seed companies in Austria, Germany, Greece, and Slovenia will be studied.

The research questions are:

- What strategies do biodiversity seed companies follow?
- What are possible business models of biodiversity seed companies?
- How do managers overcome the obstacles present in the seed sector?

3. Methods

To answer the research questions, a tool, based on the business model canvas is developed, to characterise the strategies of biodiversity seed companies. The tool was used to analyse and compare the insights from ten interviews with managers of biodiversity seed companies in Austria, Germany, Greece, and Slovenia. In the following section I will explain the concepts and their connections for the purpose of this thesis.

3.1. Conceptual Framework

For biodiversity seed companies to operate successfully they must overcome several challenges. In section 1.6 three internal challenges were identified: the strategy challenge (Florin & Schmidt, 2011, p.166), the legitimacy challenge (Galaskiewicz & Barringer, 2012, p.188) and the mission measurement paradox (Ormiston & Seymour, 2011, p.137). Externally, the harsh business environment creates difficulties (compare section 1.5), namely the consolidated and regulated international market (Howard, 2009; Shand & Wetter, 2019, p. 5). Consequently, biodiversity seed companies may need unconventional strategies to face these challenges and be successful. Figure 4 summarizes the conceptual framework.

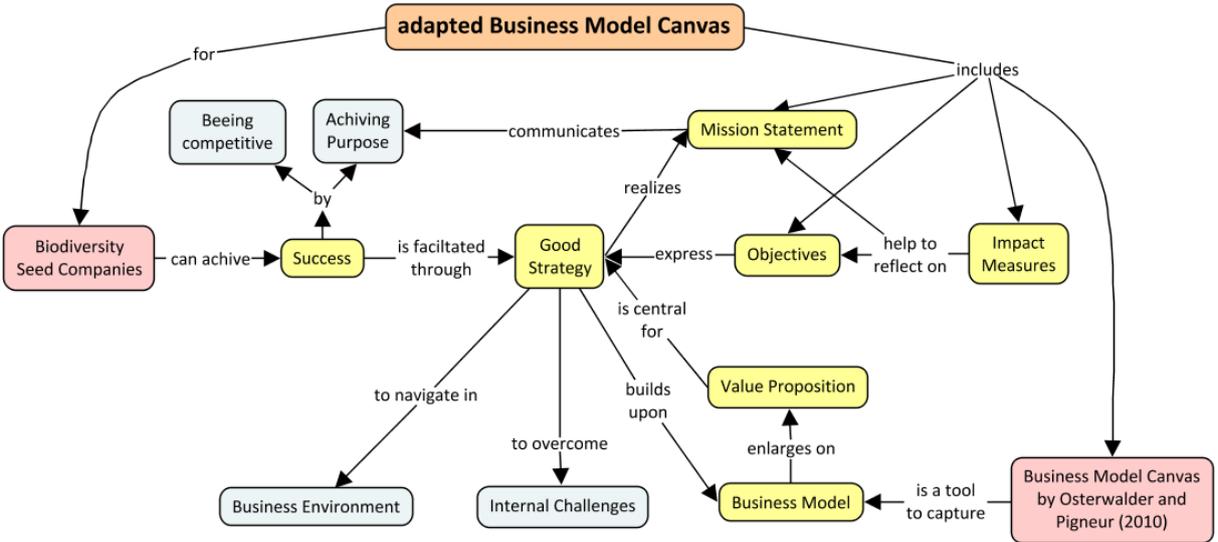


Figure 4: Concept map for the research

In literature the approaches to define ‘success’ vary. According to Toledo-López et al. (2012, p. 1659) for companies the survival on the market is the basic measure of their success. Nevertheless, studies like Walker and Brown (2004, p. 577) found that managers use both financial and non-financial criteria to judge their company’s success. They often perceive the latter as more important (Reijonen, 2008, p. 626; Toledo-López et al., 2012, p. 1659; Tregear, 2003, p. 1632). Success is therefore normative. The Oxford dictionary’s definition fits better to describe this character: It defines it as “the accomplishment of an aim or purpose” (Lexico Dictionaries 2010) which is in line with Jennings and Beaver (1997, p. 68), who relate success to business: “the sustained satisfaction of principal stakeholder aspirations.” This perspective is recognized by other scholars (Reijonen, 2008; Toledo-López et al., 2012, p. 1659). Thus, in this thesis define a company as successful if it is competitive on the market and achieves its purpose. That way both non-profit and for-profit goals of biodiversity seed companies are included.

For a company to **achieve its purpose** there are several steps necessary. First it can communicate its purpose and/or core beliefs through a 'mission statement' (compare section 1.6.3). The company then develops a 'strategy', which is expressed through concrete 'objectives' (Carpenter et al., 2012, p. 169). There is a cascading dependence and decreasing abstraction from mission statement, strategy to objectives (see Figure 3). A 'mission statement' functions as a top-level guidance, whereas strategy is more specific; 'objectives' provide a low-level guideline for a company's way of conduct (Carpenter et al., 2012, 170, 224). Mission statements are generally easy to formulate. What is more difficult is the design and implementation of strategy. Indeed, it is easier to formulate a goal or desired end state, but rather difficult to get there. It requires continuous action.

In general, '**strategy**' is approached differently depending on the subject area. Macmillan and Tampoe (2000, p. 14) define 'strategy' broadly as the "*Ideas and actions to conceive and secure the future.*" For them it requires thought about the future but also effective action in the present. Ohmae (1983, p. 92) analyses 'strategy' in relation to business. He conceptualizes it as "*the way in which a corporation endeavours to differentiate itself positively from its competitors, using its relative strengths to better satisfy customer needs*". Both definitions come close to what I conceptualize in this thesis, just adding a normative component: A good strategy creates sustainable competitive advantage relative to rivals through present action and future planning. It makes a company successful. Yet, this concept is little tangible, meaning it does not describe the factors that determine a good strategy.

Diderich (2020), Magretta and Porter (2012), Porter (1998) and Rumelt (2011) see **good strategy** as the reason for a company's success. All share that a unique 'value proposition' is central for a good strategy. These are the products and services that create value for the customers. It is designed to fulfil external needs (Osterwalder & Pigneur, 2010, p. 14).

The '**business model**' enlarges the concept of value proposition. It adds a "*rationale of how an organization creates, delivers and captures value*" (Osterwalder & Pigneur, 2010, p. 14) for customers and other stakeholders. It is the practical implementation of theoretical strategizing. According to Diderich (2020, p. 30) "*no strategy can survive and prosper without an underlying sound business model.*" An analysis of the whole business model describes in detail and better integrates the concept of value proposition and its connections to the big picture of a company (Diderich, 2020, p. 31).

The original **Business Model Canvas (BMC)** by Osterwalder and Pigneur (2010) is a successful tool to picture and summarize the business model of a company. According to Stenn (2017, p. 56) applying the tool helps to implement a shared language, improves teambuilding, and creates a basis for further innovation. It allows for comparability with existing business models. The Business Model Canvas is quite popular in research as well as in practical implementation: Till 2014, the template was downloaded over five million times, it was translated in over 30 languages, and used in over 250 universities (Stenn, 2017, p. 56). It comprises nine elements, which are depicted in one graphic (see Figure 5). It makes strategy tangible.

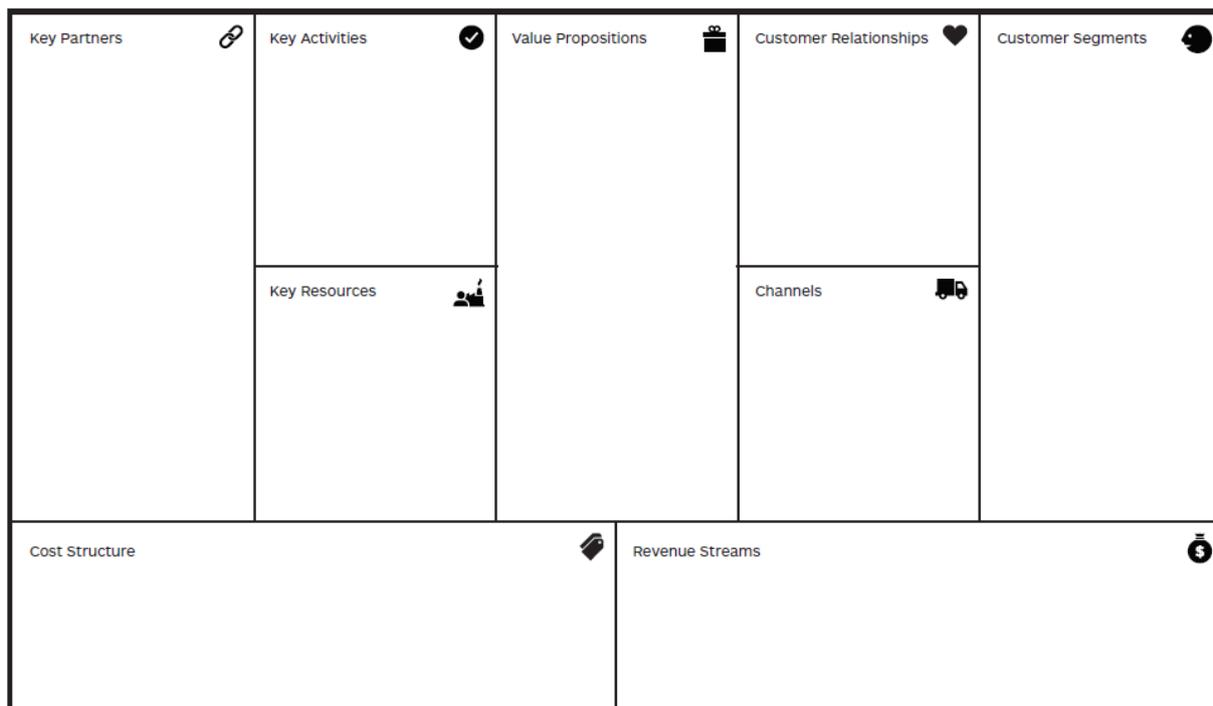


Figure 5: Business Model Canvas developed by Osterwalder & Pigneur (2010) design by Strategyzer AG

Nonetheless, the Business Model Canvas is not free from **criticism**, often pointing out aspects that may need to be covered in more detail. *“At least according to its authors, the Business Model Canvas is not only designed to frame for-profit companies”* (Sparviero, 2019, p. 237), but also for organizations, that *“have strong non-financial missions focused on ecology, social causes and public service mandates”* (Osterwalder & Pigneur, 2010, p. 264). Yet, the application in the non-profit sector and for social enterprises is problematic. The Business Model Canvas analyses companies isolated from their business environment. It puts insufficient emphasis on non-profitable aspects and their incorporation into social enterprises business models (Bocken et al., 2015, p. 69). Additionally, it does neither relate to the overall structure of the sector of a company (e.g., by incorporating competition) (Searle and White 2013, p. 53) nor to the legal framework (Leschke, 2013, p. 21; Sivertsson & Tell, 2015, p. 1966). All of which create difficulties when applying to the case of biodiversity seed companies. Hence, they require a holistic approach.

To **visualize and structure not only the business models** but also to gain insides on the strategy of biodiversity seed companies I suggest conducting research on the following twelve aspects:

1. The **Mission statement** explains why a company exists. It is used to communicate core beliefs or purpose and usually consists of one or more long term goals.
2. **Objectives** establish concrete action guidelines or ways of conduct. They are smaller and short term oriented than the goals defined with the mission statement.
3. **Impact measures** are predefined assessment criteria for both mission statement and objectives. They serve as a means of reflection.
4. **Customer segments** refer to the groups of people or organizations that the company aims to reach and serve with its products and services.

5. **Channels** describe how the company communicates and reaches its customer segments.
6. **Customer relationships** define the types of relationships the company establishes with the targeted customer segments.
7. The **Value proposition** describes the products and services that create value for each, and all groups of people listed in the customer segment.
8. The **Revenue stream** represents the cash generated from each customer segment.
9. **Key resources** are the important assets that the business requires to function.
10. **Key activities** describe the tasks that must be done for the business to work, such as production, problem solving, platform and networking activities.
11. The **Key partnerships** element describes the networks of suppliers and partners that make the business model function.
12. The **Cost structure** shows all costs that the operation of the business creates.

The **elements** one to three derive from the Social Enterprise Model Canvas (Sparviero, 2019). Number four to twelve derive from the original Business Model Canvas of Osterwalder and Pigneur (2010) (compare Figure 5). This tool is adapted to the specific situation of biodiversity seed companies and thus allows to take into consideration:

(1) The business environment represented through a consolidated and regulated international market: Defining desirable core beliefs and/or purpose as well as action guidelines offer an anchorage in a harsh environment. Not solely when difficulties arise, the team can remember the reason why the company exists. Making a clear mission statement therefore can serve as a motivation for the team.

(2) The blending of for-profit and non-profit values: biodiversity seed companies stand in between the categories of for profit and non-profit. Stakeholders have their pre-set standards and expectations towards each of those categories (Galaskiewicz & Barringer, 2012, p. 188). Therefore, to be held accountable and trustworthy, biodiversity seed companies should communicate their mission and objectives (Sparviero, 2019, p. 240). This is a viable way to justify themselves and gain legitimacy.

(3) The necessity of biodiversity seed companies to define their strategy: By making clear statements about mission and objectives, biodiversity seed companies can overcome the strategy challenge. Generally, strategy is quite abstract. In contrast, mission statements and objectives are easy to capture and together set the boundaries for strategy. If a biodiversity seed company defines its purpose and way of conduct, it can find the right balance (Florin & Schmidt, 2011, p. 166) between being economically profitable and contributing to conservation and use of plant genetic resources.

(4) The assessment of actions: biodiversity seed companies can evaluate economic goals according to economic indicators. These are easily communicated and understood. Achievements in the non-profit realm like conservation of plant genetic resources on the contrary are complex and difficult to measure. This creates a disbalance between for-profit and non-profit goals (Sparviero, 2019, p. 244). In the worst case a mission drift occurs (Ebrahim et al., 2014, p. 82). In the adapted Business Model

Canvas, the element 'impact measure' addresses this problem. It consists of predefined measures which primarily should help to evaluate non-profit goals.

3.2. Selection of Biodiversity Seed Companies

The selection criteria for the ten biodiversity seed companies are:

- To cover a range of business environments, four countries within the European Union are being selected. Austria and Germany represent central Europe. Their business environments are similar, and the interviews can be held in German. Greece and Slovenia will represent the southeast.
- They should have commercial interest (i.e., be a for-profit company).
- More than 25% of their turnover should originate from seed sales. The seed sales can be for amateur or professional purposes.
- They must have a range of biodiversity seeds in their assortment. To reflect on the range of seed markets the study includes companies with cereals seeds in their assortment and/or vegetable seeds and/or seed potatoes.
- They must contribute to conservation of plant genetic resources with their practices. They must either breed *alternative varieties* and/or propagate a range of landraces and heirloom varieties themselves or in partnerships.
- Interesting for this study is the alternative seed sector, which consists of SMEs that commonly serve customers on a regional or national level.

With the help of informants and internet research a preliminary list of 25 biodiversity seed companies that fulfil these criteria was compiled. They were first contacted per email in mid-March 2021 (see appendix I & II). The email contained information about the research and the data protection declaration (see appendix IV & V). Only three companies responded directly to the email, one of which accepted to give an interview. In late March, I called the companies to inquire about their willingness to give an interview. After the first round of calling three managers accepted the request. For most companies, it took two or three trials to reach a person that could take part in the interview. Especially with the larger companies this was a problematic issue. Usually, the secretaries answered the call and said that they would forward my initial email to the manager of the company, who would eventually come back to me if there was readiness for giving an interview. I called these companies in regular intervals, kindly asking them to respond to my request. Several companies declined the invitation for an interview (six managers stated that they were in sales season and had no time to give an interview, one was not interested, in one the manager was deceased, and it was unclear what would happen to the company, two never replied, despite numerous attempts at contacting them). Moreover, one company turned out to not have any biodiversity seeds in their assortment. The whole contacting period took about two months. In total eleven companies agreed to give an interview, and two companies agreed to answer the questionnaire in written form and were open for a later phone call to clarify uncertainties.

After interviewing the 13 companies, I **excluded** the data of **three companies** from the analysis: one just recently started to produce seeds, one only had a small share of income generated through seed sales, and one turned out to depend largely on donations.

In the end data of **ten biodiversity seed companies are analysed**. Together with information about the position of the interviewee, her or his pseudonym and the language of the interview they are summarized in Table 3. Most interviews were held with the managers of the organisation. In the case of Dreschflegel there is no head of the company. Instead, a shareholder was interviewed. Seven interviews were held in German, when citing from these interviews, the translations into English are mine.

Table 1: Interviewed companies and information about the interviewees

Organisation	Country	Interviewee Position	Language	Pseudonym
Dreschflegel GbR	Germany	Shareholder	German	Gerhard
Saatgut Dillmann	Germany	Manager	German	Torsten
Ellenberg's Kartoffelvielfalt GmbH & Co. KG & Biolandhof Ellenberg GbR	Germany	Manager	German	Michael
Verein ARCHE NOAH & Vielfalt erleben GmbH	Austria	Project Manager	English	Franz
Sortenwerkstatt	Austria	Manager	English	Barbara
Samengreisslerei	Austria	Manager	German	Stefan
ReinSaat KG	Austria	Manager	German	Heidi
Amarant s.p. & Amarant kooperativa d.o.o	Slovenia	Manager	German	Kerstin
Iris Garden Το περιβάλλον της Ειρήνης	Greece	Manager	German	Phillip
Oikos Seeds κωστακης μ. Γεωργιος	Greece	Manager	English	Adrean

3.3. Researching the Business Environment

To provide information on the **context** in which these companies operate, I will briefly describe the seed sector in these four countries, and the efforts to maintain genetic diversity. To acquire necessary information, I first did literature research in Scopus, Google, and Google Scholar. I used the key words: *seed sector, seed production, breeding, plant genetic resources, crop conservation, in-situ conservation, ex-situ conservation, on-farm conservation, gene bank, seed NGO* with the "AND" operator and *Germany, Austria, Greece, Slovenia*. The same I did with German keywords. The found articles and information on websites of official institutions were checked for their relevance.

In each country I found at least one **informant**, whom I could informally interview about the seed sector of the respective country. I had email exchanges, phone calls and zoom meetings. In Greece, I contacted Anastasia Vasileiadou, member of the NGO Peleti and Fotis Bletsos, a retired researcher and breeder at the National Agricultural Research Foundation (NAGREF) and Agricultural Research Centre of Macedonia and Thrace. In Slovenia, Vladimir Meglic from the Agricultural institute of Slovenia was

interviewed. Rolf Klein from the Bundessortenamt was questioned about the legal situation in Germany. In Austria, Alexander Lorber and Norbert Moser from the Amtlicher Pflanzenschutzdienst Wien and Klaus Schmid (vegetable farmer and starting seed multiplier) provided information about the country's seed sector. I also inquired about country specific information during the interviews with biodiversity seed company managers (compare section 3.3).

3.4. Semi-structured Interviews with Biodiversity Seed Companies

To gather the necessary data, I used **semi-structured interviews**. After having been given permission, I recorded the interview, which allowed me to engage more actively in the interview (Adams, 2015, p. 500).

The companies that agreed on conducting an interview were asked to appoint a **competent person**. It is important that this person had in-depth understanding about the functioning of the company, and the organization of seed production, processing, and sales. In 8/10 cases the manager her/himself gave the interview. For ARCHE NOAH & the Vielfalt erleben GmbH a division and project manager was available. One of the long-term stakeholders of the GbR gave the interview on Dreschflegel. The position and background of interviewees ensure that assertions are representative for the company.

A **guideline** provided the necessary framework for semi-structured interviews. With its help reliable, comparable, qualitative data were generated to fill the modified Business Model Canvas. It directed the conversation and ensured that all the necessary information is collected. It consisted of a sequence of pre-formulated questions, which I asked at their given time (Adams, 2015, p. 496). The underlying principle for the formulation of the guideline was: *“So offen wie möglich, so strukturierend wie nötig”* [As open as possible and as structured, as necessary] (Baur & Blasius, 2014, p. 560).

The questions and interview topics were **ordered** so that they form *“the most likely and smoothest sequence”* (Adams, 2015, p. 498). I start with a trivial question, to make the interviewee feel comfortable (Adams, 2015, p. 498; Gläser & Laudel, 2010, p. 147). Then followed some relevant but non-threatening ones. Questions about costs and revenue came at the end. Even if the interviewee refused to talk about financial topics, this did not affect the outcome of the interview anymore. With the last question I gave the interviewee space for feedback and own thoughts. According to Gläser & Laudel (2010, pp. 148–149) this rounds the interview and leaves both parties with a pleasant feeling.

I did not follow the guideline strictly. Rather I strived toward a **flow of conversation**. The interviews were intended to be as natural as possible. In cases, the interviewees jumped between topics, I did not disturb the narrative continuity. In many cases they provided required information spontaneously. This approach is also suggested in literature (e.g., Adams, 2015, p. 498). The advantage is that the interview became more casual, both parties seemed to feel comfortable, and the answers were more authentic and reliable (e.g., Gläser & Laudel, 2010, p. 146). It was rarely the case that interviewees drifted off too far, only once I kindly interrupted and came back to the guideline.

In literature authors suggest to **constantly improving** structure and questions (e.g., Adams, 2015, p. 499; Gläser & Laudel, pp. 151–154). After a first test-interview, I revised the guideline. Then during the interview process I made smaller modifications. Two questions for example were reformulated to be more comprehensible and the order was changed for a better flow of conversation.

Building on the above theoretical considerations, the interview guideline had the following **structure**: First I welcomed the interviewee and thanked her/him for her/his time, introduced myself, described my research and the goal of this interview, gave a short overview on the questions, addressed the matter of confidentiality, asked for permission to record the interview. I then started the interrogation. At the end I thanked the interviewee again and give her/him a chance to ask questions her/himself. The full guideline at the time of the last interview is attached in appendix III.

Individual **questions were formulated** after the claim of Patton (1990, p. 295): They should be open, neutral, easy, and clear. Neutrality means that no answers are suggested through the way in which the question is formulated (Gläser & Laudel, 2010, p. 135). Depending on the type of interrogated information, questions can be divided into two groups. ‘Fact questions’ inquire verifiable (objective) data (Mayntz et al., 1978, p. 103). ‘Opinion questions’ on the contrary do not ask for the interviewees’ attitude or opinion (Gläser & Laudel, 2010, p. 122). Another possibility to categorize questions is whether they are formulated as open or closed-ended questions (Adams, 2015, p. 493). To find out single details I used closed-ended questions. For example: ‘Since when does the company exist?’ Questions like ‘Why do you think your customers come to you?’, are open ended. To fill the adapted Business Model Canvas and analyse the value chain, objective information about the company is necessary. Thus, for the purpose of this master thesis, I mainly asked ‘fact questions’, which can be open or closed ended. Table 2 summarizes the specific questions covering the twelve elements of the adapted Business Model Canvas.

Table 2: Interview questions that aim to collect information for the adapted Business Model Canvas

Elements of the adapted Business Model Canvas	Questions
Mission statement	What is the purpose of your company?
Objectives	How do you achieve this purpose? (Concrete steps?)
Impact measures	Do you assess the impact of your work? What specific indicators do you use?
Customer Segments	Could you please describe the types of people who buy your seeds?
Value Proposition	What kind of seeds/ planting material do you offer? What other products or services do you offer? Why do you think your customers come to you? What special value do you offer them?
Channels	Where do you sell your seeds (Store, online shop)?
Customer Relationships	Please describe the relationships that you have with your customers. E.g., do you know them personally? Are they involved in your company’s development?
Revenue Stream	What are your main sources of income? What share does each contribute to your revenue? (%)
Key Resources	What makes your company so successful? Please think e.g., of equipment, employees, knowledge/skills, or financial aspects.
Key Activities	What are the most important activities that ensure the functioning of your company? (e.g., production, Problem solving, Research & Development, Networking)

Key Partnerships	With whom do you cooperate? (Externals, like seed providers, delivery services etc.?)
Cost Structure	What are your most important costs? (e.g., fixed costs like salaries, rents, and machinery vs. variable costs What share does each have for your overall costs?

In case an interviewee could **not answer a question**, I first tried to reformulate the question or to give possible answer categories. This was the case when asking fact questions about specific numbers of e.g., varieties in the assortment. More than one interviewee did not know the answer, so I continued with the following question. After the interview I wrote an email with the kind request the provide missing information.

With all companies I conducted **online interviews**. Video conferencing offered an affordable way to overcome geographical barriers (e.g., Lo Iacono et al., 2016, p. 19). In Addition, contact restrictions because of the SARS-CoV-2 pandemic made the online setting convenient. I used software like Skype (Skype Technologies, 2003), Zoom (Zoom Video Communications, Inc. 2013), Microsoft Teams (Microsoft 2017), or WhatsApp (WhatsApp Inc. 2009) depending on the choice of the interviewee.

An **advantage of video conferencing** was that the interviewee stayed in a comfortable environment. Additionally, the time frame was less of a concern for both parties. Lo Iacono et al. (2016, p. 18) found that interviews tend to take longer. Nehls et al. (2015, p. 145) analysed the influence of video conferencing according to theoretical communication frameworks. He states that it is a viable method for qualitative data collection. Both visual and verbal clues can be transmitted. Therefore, the conduction of interviews with a significant share of fact questions seemed reasonable. The most important information could be transmitted verbally. Reactions and mood changes were less of a concern for the research.

Yet, there are **downsides to video conferencing**. Firstly, according to literature it is more difficult to create a connection (Evans et al., 2008, p. 322). Camera and screen create social distance. Hence interviewees might perceive them as hindrance to open up (Nehls et al., 2015). Yet, for interviews it is helpful to create rapport (Miller & Glassner, 2009, p. 127). Secondly, visiting the biodiversity seed companies and conducting the interview on site would have allowed to get a better impression. Visiting production facilities, storage and getting to know other employees could have helped to create a bigger picture of the company. The data would have become sound and the results of the research more reliable.

In sum, I developed a tool to identify the strategies of biodiversity seed companies, which I then applied on ten sample companies in Austria, Germany, Greece, and Slovenia. To gather the necessary data, on one hand I did an online and literature research on the countries' seed sectors and on the other I conducted semi-structured online interviews with competent representatives. The guideline consists of questions that inquire information on the twelve elements of the adapted Business Model Canvas.

4. Results

4.1. The Business Environment in Austria, Germany, Greece, and Slovenia

All four countries are **part of the EU** and have a similar legal background, even if there are a few differences. In the coming sections I give a short overview on the countries' seed sector, their history, and legal issues. This will provide a context allowing us to understand the efforts in conserving genetic resources and the context in which the interviewed biodiversity seed companies operate.

4.1.1. Austria: Legislation, Stakeholders and Public Awareness of Plant Genetic Resources

In Austria the **seed legislation** is based in the Saatgutgesetz from 1997 (BGBl. I Nr. 72/1997). In §65 of the Saatgutgesetz includes the 'Österreichische Sortenliste', which lists all registered varieties of agricultural crops and vegetables. While other seeds cannot be marketed, they can be multiplied for their own production, and the fruits of that varieties can be marketed (Saatgutgesetz §4(3)). Since the Saatgutverordnung 2006 (BGBl. II Nr. 417/2006) it is possible to register conservation varieties and varieties developed for growing under particular conditions. With status from 1. January 2021 in Austria 32 conservation varieties and 134 varieties developed for growing under particular conditions are registered (BAES 2020).

Different **governmental institutions** throughout the country are dedicated to the conservation and use of plant genetic resources. Frese et al. (2014, p. 9) sees potential for improvement in their efforts. There is a national strategy paper, but especially the implementation of the in-situ conservation faces difficulties (Frese et al. 2014, p. 5). Farmers are not sufficiently informed about existing programs and the legal background (K. Schmid, personal communication, 26.03.2021; Barbara). The capacities for public plant breeding are limited. In 2014 only a few persons in four different institutions are dedicated to breeding (Frese et al. 2014, p. 5). An advantage is the well-functioning and organized gene bank system (Frese et al. 2014, p. 10). The Austrian Agency for Health and Food Safety (AGES) maintains a network of small-scale gene banks throughout the country (AGES 2021).

There are only a **few commercial seed companies** in Austria, and most sell seeds of foreign companies. Only a few run breeding programs within Austria focussing on regional needs. The use of plant genetic resources by private entities is therefore rather limited (Frese et al. 2014, p. 10). Yet, in comparison to other countries from the initially contacted biodiversity seed companies nine out of 25 are situated in Austria.

Overall, the **demand for biodiversity seeds** is higher than the supply. Many suppliers have problems to cover the demand of customers. Stefan reported for example: *"So many people have already asked us [for seeds] and I'm always unsure. [...] Of course, I could grow even more, but I can't do it anymore"*.

NGOs are active within the country. They improve the conservation and use of plant genetic resources, including breeding. The biggest seed saving NGO, ARCHE NOAH has 17.000 members (Arche Noah 2021b). It maintains a gene bank with 5.500 accessions of agricultural and vegetable varieties (Arche Noah 2021a). Additionally, it creates political awareness, organizes various events, and maintains a network of seed multipliers.

Within Austria, **stakeholders' communication and cooperation** is good. NGOs, private companies, gene banks and research institutes cooperate for example in breeding programs. Saatgut Austria is a

union of 38 stakeholders, including private, and public institutes (Weninger 2016). One of their projects is to develop Austrian breeding lines, that are suitable for climate change (e.g., drought resistance) (Saatgut Austria 2021).

The Austrian **population** is increasing its awareness regarding plant genetic resources. Within the country the trend regarding sustainability, biodiversity and bio/regional products is pronounced (Frese et al. 2014, p. 8). The demand for diversity and quality rises and favours the use of biodiversity seeds in production (Frese et al. 2014, p. 9).

In sum, the existing stakeholders take their job seriously and work together. Public breeding programmes exist but need improvement. The use of plant genetic resources from the private side is still limited. The market for bioregional products is developed and does favour the use of plant genetic resources.

4.1.2. Germany: Conservation and Use of Plant Genetic Resources, Consumer Trends, Legal Situation and Obstacles

The German **government** is establishing and promoting the use of plant genetic resources and most stakeholders are aware of the importance of the topic. A national expert plan for the conservation and use of plant genetic resources exists (Frese et al. 2014, p. 58). A variety of measures are taken by different governmental institutions to identify the needs, actions and actors to improve the conservation and sustainable use of plant genetic resources; programs are in place to encourage the in-situ conservation by farmers (Frese et al. 2014, p. 58). The national gene bank system is organized. The information for genetic material for example can be found on the GENRES website³. Access to the material is possible. Besides the state, private actors are active in the use and conservation of plant genetic resources.

Germany has a long history in breeding and seed multiplication. The **seed sector is developed**. According to FAO (2018, p. 26). It is the world's fifth leader for seed exports. Additionally, it is the place with the most independent breeding activities. About 130 companies (mostly medium-sized) are active in breeding agricultural and horticultural crops. Most of the initially contacted biodiversity seed companies were located in Germany. Of all four countries the market is the biggest due to country size and population (C. Vollenweider, personal communication, 08.04.2021).

In Germany the participating **stakeholders** tend to **cooperate closely**. Most companies are part of cooperation for the promotion and funding of research projects (e.g., Association for the Promotion of Private Plant Breeding in Germany – GFP with 51 members from private and public side)(FAO 2018, p. 27). In addition, there are contracts about exchanges of genetic material between companies (Frese et al. 2014, p. 56).

The role of **consumers** is twofold. According to Frese et al. (2014, p. 54) there are two opposite trends visible on the German food market. On the one hand food retailing is consolidating. As a consequence, the market anonymizes. The (monetary) incentives for growers are higher. They focus on maximizing yield on the cost of diversity and other traits inherent to biodiversity seeds. This development is accompanied by consumers that tends to invest less time in the preparation of their foods (Frese et al. 2014, p. 56). The market share of convenience products is increasing. Its revenue almost doubled in

³ GENRES: Informationssystem Genetische Ressourcen: <https://www.genres.de/en/>

the last ten years (Ahrens 2021). Knowledge about the preparation of fresh vegetables on the contrary decreases; with it does the need for biodiversity seeds and their products (Frese et al. 2014, p. 53). On the other side there is a consumer segment that behaves the opposite way and invests time, money and energy in alternatives to the commercial food systems (FAO 2018, p. 37). Examples are the renaissance of weekend markets, the slow food movement, or bioregional and unpacked stores (Zoll et al. 2021, p. 640). All of which contributes to the demand for biodiversity seeds and their products. Gerhard stated for example: *“We have difficulties producing the quantities of seeds that our customers want”*.

The implementation of the EU **legal framework** In Germany is up to date (R. Klein, personal communication, 13.11.2020) Therefore, it is somewhat complex, as described in section 1.5.2. Only varieties officially registered are legal to trade (SaatG §3). ErhaltungsV §1 allows for registration, production and marketing of seed and planting material of important genetic resources. Within the country currently 55 conservation varieties and 161 varieties developed for growing under particular conditions are registered (Bundessortenamt 2021).

In addition, to the **obstacles** described in section 1.5 three issues seem problematic for the German biodiversity seed sector: (1) There is uncertainty of managers of seed companies with respect to the legislation (Sonnen, Bantle 2019, p. 3). New laws steadily complicate the situation. An example is the recent amendment for phytopathology requirements. Since 2020 PCR-testing for the Tomato brown rugose fruit virus (ToBRFV) is obligatory (compare section 1.5.2) (Gerhard, personal communication, 22.04.2021). (2) The introduction of property rights in Germany sets many breeders back on a narrow selection of varieties; if an acquisition of genetic material from a gene bank may trigger legal costs, breeders and multipliers will refrain from its use (Frese et al. 2014, p. 59). (3) Finally, there is a lack of an information system about the characterisation and evaluation of vegetable varieties (Frese et al. 2014, p. 59). This hinders breeders to use landraces and heirloom varieties for their purposes (Frese et al. 2014, p. 59).

In sum, in Germany the conservation and use of plant genetic resources is advanced. Many stakeholders recognize the importance of the topic and work together closely. The public awareness increases. Nevertheless, only few consumers link their knowledge about plant genetic resources to purchase decisions. The legal framework for breeding and seed trade is especially complex. If at all, it will take time until biodiversity seeds and their products to experience noticeable market presence.

4.1.3. Greece: History, Maintenance and Marketing of Biodiversity Seeds

Most **modern Greek varieties** stem from national breeding programs: They used heirloom varieties and landraces and crossed them with improved international varieties (Stavropoulos et al. 2006, p. 32). With the compilation of the first national catalogue in 1997 these varieties together with a few of the heirloom varieties that were cultivated extensively back then, entered the catalogue. (Adrean, personal communication, 30.03.2021).

Generally, like in any other European country only varieties registered in the national or European catalogue for agricultural crops and vegetable species can be marketed in Greece. In contrast to other European member states, **public crop breeding and research institutes** are responsible for most of the maintenance and production of ‘pre-basic’ and ‘basic seeds’ of these varieties. The institutes sell the ‘basic seeds’ to companies that multiply them and sell them to the farmers for cultivation (Fotis Bletsos, personal communication, 08.09.2021). These companies are legal maintainers of the varieties.

They pay a licence fee to the state for multiplying and marketing the propagation material. The multiplication is controlled and certified by the Greek seed propagation authority (Stavropoulos et al. 2006, p. 35). For any variety not in the catalogue, the marketing and propagation rights are exclusively in the hands of the state. Usually, the Greek Gene Bank and the crop breeding and research institutes are responsible for the maintenance of those (Stavropoulos et al. 2006, p. 35).

The conservation and use of plant genetic resources by the **state** is limited, due to inadequate funding of the organisations (Stavropoulos et al. 2006, p. 32). On one hand the evaluation of the material is inadequate, on the other hand the maintenance is inappropriate (Frese et al. 2014, p. 64). Too few seeds are kept and the time between multiplication for renewing germination rates is too long (Stavropoulos et al. 2006, p. 32; Cohen 2011, p. 66). Many of the ex-situ stored varieties are in danger of getting lost (Cohen 2011, p. 66). Additionally, since the introduction of Directive 98/95/EC and Directive 2008/62/EC only one conservation variety officially got registered (Ministry of Rural Development and Food 2019). There are alternatives to public seed conservation and maintenance.

The **commercial biodiversity seed sector** is small. The trend of diversity did not yet reach the country. Adrean said for example: *“Greece is way behind”*. Additionally, the country itself is relatively small in terms of size and population, hence few biodiversity companies can establish. In total four to five companies market Greek heirloom varieties and landraces (F. Bletsos, personal communication, 26.01.2021).

The Greek law does not forbid the conservation and use of landraces and heirloom varieties for **cultivation** (Stavropoulos et al. 2006, p. 35). Products of these plants can be traded including seeds for consumption. There is a common practice of farmers to recultivate seeds for their own purposes; By law these unofficial maintainers/ breeders are disfavoured by not being able to apply for government incentives (Stavropoulos et al. 2006, p. 32). Thanks to their practices a share of plant genetic resources could be conserved in-situ.

NGOs present another alternative. Examples are Peliti, Aegilops, and the Laboratory of Ecological Practice. They are interested in the conservation and use of Greek land races and heirloom varieties (Aegilops 2021). Their practices involve on-farm cultivation, proper variety evaluation, participatory breeding and the organisation of seed festivals dedicated to the topic of seed saving throughout the country (Kanellopoulou 2020, p. 146). Those are tolerated since they are on the margins of the law (Kanellopoulou 2020, p. 146). Here private individuals and different initiatives come together and mainly exchange seeds. Seed exchanges between growers and seed saving are common within Greece.

In sum, the state controls the conservation and use of plant genetic resources. Unfortunately, the funding of institutions is weak, hence the official biodiversity seed sector and the number of registered biodiversity seeds is small. Thanks to farmers, NGOs and privates a share of plant genetic resources can be conserved in legal grey zones.

4.1.4. Slovenia: Breeding of Biodiversity Seeds, Stakeholders and Legislation

Slovenia has a **high diversity** of landraces and heirloom varieties, which are adapted to a range of regional climatic conditions. There are various programs and organisations dedicated to the in-situ and ex-situ conservation of plant genetic resources (Frese et al. 2014, p. 113). In addition, there are efforts for increasing the diversity of crops through breeding (FAO 2016, p. 79).

Nowadays there are a few **public institutions** which engage in breeding. The number of breeding programs and breeders has decreased since the 1990s (Ivancic et al. 2003, p. 355). After the breakup of Yugoslavia, the seed trade was liberalised which resulted in rising competition with internationally developed modern varieties (Ivancic et al. 2003, p. 355). With the rapid opening of the country this change happened more abruptly and later compared to for example Germany and Austria. Even though the seed sector nowadays is dominated by the same large agricultural corporations as in other European countries, the handling of plant genetic resources is advanced in Slovenia (Frese et al. 2014, p. 113; FAO 2016, p. 38).

The participating **stakeholders work together** and are actively engaged in various projects (Frese et al. 2014, p. 113). The Gene Bank of Slovenia, which is under the supervision of the state, is well organized (Frese et al. 2014, p. 113; FAO 2016, p. 39). Measures for collection and conservation of plant genetic resources are in place. The NGO sector is dedicated to the collection and exchange of seeds (FAO 2016, p. 39). Individual organisations provide samples for the national Gene Bank, acquire external funding, and create a high degree of public awareness for the topic (Frese et al. 2014, p. 111). From growers' side, there is a demand for biodiversity seeds: home gardeners and professionals/farmers have increasing esteem of land races, heirloom varieties and alternative varieties (Frese et al. 2014, p. 113). All stakeholders cooperate in different projects and facilitate each other's work. In addition, there are private efforts for the conservation and use of plant genetic resources and the breeding of alternative varieties and finally the distribution of both.

In Slovenia, the market for biodiversity seeds is small. Yet, demand is growing. The biodiversity seed sector is developing (Kerstin, personal communication, 04.05.2021). During the research two biodiversity seed companies were identified in Slovenia which supply the national market with biodiversity seeds (Vladimir Meglič, personal communication, 23.11.2020). Both sustain a network of contracted farmers, which produce seeds for them (Kerstin, personal communication, 04.05.2021). The companies also maintain (participatory) breeding programs. Besides that, there exist a few small-scale breeders. In addition, Austrian companies influence this market by selling to Slovenian customers. Slovenian companies function as retailers (Kerstin, personal communication, 04.05.2021).

The **legal basis** for the registration and marketing of Slovenian conservation varieties is set with the Seed and Propagating Material of Agricultural Plants Act (adapted in 2002 and amended in 2009 regarding EU Directives 2008/62/EC and 2009/145/EC) (FAO 2016, p. 37). The rules for marketing and production are the same as within other European countries. For conservation varieties the whole country counts as region of origin. The rising interest and facilitation of applications results in an increasing number of registrations (FAO 2016, p. 37). At present 30 conservation varieties and 64 varieties developed for growing under particular conditions are registered in the Common European catalogues (compared to 2016: seven conservation varieties and 26 varieties developed for growing under particular conditions) (FAO 2016, p. 37).

In sum, the Slovenian seed market is dominated by multinational corporations. Nevertheless, the biodiversity seed sector is developing. It is sustained and supported by the government, NGOs, and private companies. Home gardeners and professionals increasingly cultivate biodiversity seeds. There is good communication between stakeholders. Research, conservation and public work and projects are often done in collaboration.

4.2. Overview of the Interviewed Biodiversity Seed Companies

After elaborating on the business environment, I will give an **overview** on the interviewed biodiversity seed companies. Table 3 provides information about the company's country of location, legal form, year of establishment (between 1990 and 2019), number of contracted farmers, staff headcount (13 on average) and annual turnover.

Table 3: Interviewed companies with their essential characteristics.

Organisation	Country	Legal form	Year established	Contract farmers	Staff head-count	Annual turnover	Size
Dreschflegel GbR	Germany	Partnership under the civil code	1990	19 shareholders	~39	2 - 10 mil Euro	small
Saatgut Dillmann	Germany	Sole proprietorship	1997	-	~10.5	2 - 10 mil Euro	small
Ellenberg's Kartoffelvielfalt GmbH & Co. KG & Biolandhof Ellenberg GbR	Germany	Limited partnership with a limited liability company as general partner & partnership under the civil code	1997 and 16th century	5-6	~10.5	2 - 10 mil Euro	small
Verein ARCHE NOAH & Vielfalt erleben GmbH	Austria	Association & limited company	1990 and 1997	~10	~7	≤ 2 mil Euro	micro
Sortenwerkstatt	Austria	Sole proprietorship agricultural business	2015	-	~1	≤ 2 mil Euro	micro
Die Samengreisslerei	Austria	Sole proprietorship agricultural business	2019	-	~2	≤ 2 mil Euro	micro
ReinSaat KG	Austria	Limited partnership	1998	30-40	~35	2 - 10 mil Euro	small
Amarant s.p. & Amarant kooperativa d.o.o	Slovenia	Sole proprietorship limited company	2007 and 2009	10-20	~5	≤ 2 mil Euro	micro
Irinis Garden Το περιβάλλον της Ειρήνης	Greece	Sole proprietorship agricultural business	1998	-	~5	≤ 2 mil Euro	micro

Oikos Seeds κωστακης μ. Γεωργιος	Greece	Sole proprietorship	1994	~50	~17	2 - 10 mil Euro	small
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The main **time for establishment** of biodiversity seed companies was in the 1990s (7/10). Before that time no biodiversity seed companies were known. Dreschflegel (1990) was one of the first in Germany. Gerhard said: *“In Germany there was no comparable competition at that time. In our area, no one else had that business model”*. In Central Europe other biodiversity seed companies followed in the 1990s and served the growing demand of biodiversity seeds of home gardeners and professionals. Part of the obstacles were already present back then, the rest emerged over time. The introduction of new regulations made it more and more difficult for start-ups. Nevertheless, the market grew in the 2000s. The established biodiversity seed companies grew with it and could adapt to the obstacles in place. In the recent five to ten years, biodiversity seeds experienced public attention and gardening, seed saving, and breeding got trendy. This called for the establishment of biodiversity seed companies in Austria. But the representatives reported difficulties and uncertainties. Stefan said for example: *“The legal situation is uncertain. It’s a thing when you build up a company and then it is limited from the outside by any legal complaint. Then you can close”*.

The **legal forms** of companies vary. The chosen legal form of each interviewed company depends on its history and the preferences of its stakeholders. For example, the founder of Amarant s. p., facing its rapid growth, decided to additionally start a limited company (Amarant kooperativa d.o.o.), to diminish her personal risk. Kerstin explained: *“But that became too much for me to be liable with my capital. [...] That’s why we founded the Amarant Kooperativa”*. Amarant s. p. oversaw the production, and Amarant kooperativa was mainly in charge of marketing and sales. On the other hand, two managers of long-established sole proprietorship businesses specifically wanted this type of responsibility. Phillip stated for example: *“I want to feel responsible for what I sell, and I don’t want to be hiding behind companies”*. Dreschflegel was founded by individual farmers which decided to ally in a partnership under the civil code (GbR). It has now 19 shareholders, which are individual agricultural businesses. They shared the same infrastructure (shipping) and made decisions in different working groups. Almost all members were also part of the association Dreschflegel, which is mostly politically active. For family reasons Ellenberg’s Kartoffelvielfalt was divided into two separate companies. One is the Ellenberg’s Kartoffelvielfalt limited partnership with a limited liability company as general partner. The other is the Biolandhof Ellenberg GbR. ARCHE NOAH started off as an association and only later the subsidiary limited company Vielfalt Erleben GmbH was founded. ReinSaat has been a limited partnership since 2007. Before it was a partnership under the civil code. The greatest share (6/10) was registered as sole proprietorship businesses. In sum, there is now fit-for-all. Solutions for individual situations exist. Additionally, the examples show that legal forms may change over time.

The companies were classified based on their **size**, i.e., the staff headcount and the annual turnover. According to 2003/361/EC annex art. 2, five companies were micro-size enterprises and the other five were small, none qualified as a medium-size enterprise. Contacting micro- and sometimes also small-size enterprises was more convenient for this thesis, since the responsible persons answered the call personally. This made it easier to get an appointment for an interview right away. From the initially contacted companies two qualified as medium-size enterprises. The secretaries of those forwarded the interview requests to their managers, but the request was then left without reply.

The number of **farmers contracted** by each company correlated with the staff headcount and company size. Mainly small- and partly micro-sized companies with a staff headcount higher than five had contracted farmers. Gerhard and Kerstin argued that having different climatical regions as advantages for the adaptation of seeds. Gerhard said: *“People then have the opportunity to take seeds that were produced in their region”*. In total five companies had farmers that produced seeds for them. Four companies had no agreements with farmers. Two of the interviewed companies were contracted by bigger seed companies to produce seeds for them.

The bigger biodiversity seed companies followed the **outsourcing** approach. They kept on doing the most important production steps themselves. Heidi explained: *“We make 95% of basic seeds of all batches”*. The later production steps were then often outsourced to specialized farmers/multipliers. Heidi elaborated further: *“We then pass [the basic seeds] to the companies we work with via a work contract”*. The later stages of multiplication require a larger area of land.

One company followed the opposite approach. Phillip said: *“I offer a prime example of **vertical integration**. From the seed to the final product and sales to the consumer, all steps happen in my company without interference from other companies”*. An advantage was that customers *“know what the product is and how it is produced”* (Phillip).

As possible **processes**, that biodiversity seed companies executed, breeding, variety registration, production, purchase from other producers and sales were identified. All companies sold their products to make profit. If companies marketed their products directly to the end customers (farmers or home gardeners) this was considered as well. Which company did what is summarized in Table 4.

Table 4: Processes executed by the sample biodiversity seed companies.

Organisation	Processes				
	Breeding	Variety Registration	Production	Purchase	Direct marketing
Dreschfliegel GbR	Yes	Yes	Yes	Yes	Yes (solely)
Saatgut Dillmann	No	No	No	Yes	Yes
Ellenberg’s Kartoffelvielfalt GmbH & Co. KG & Biolandhof Ellenberg GbR	Yes	Yes	Yes	Yes	Yes
Verein ARCHE NOAH & Vielfalt erleben GmbH	Yes (participatory)	Yes	Yes	Yes	Yes
Sortenwerkstatt	Yes	No	Yes	No	Yes
Die Samengreisslerei	No	No	Yes	No	Yes
ReinSaat KG	Yes	Yes	Yes	Yes	Yes
Amarant s.p. &	Yes (participatory)	Yes	Yes	Yes	Yes

Amarant kooperativa d.o.o					
Irinis Garden Το περιβόλι της Ειρήνης	Yes	No	Yes	No	Yes (solely)
Oikos Seeds κωστακης μ. Γεωργιος	Yes	Yes	Yes	Yes	No

Three **company types** are distinguished: firstly, those that executed all processes from breeding to sales in-house (6/10). All of them had contracted farmers. They had resources for breeding and their reputation and sales number were high enough to include externally produced seeds in their range. Secondly, those that qualified as single farm biodiversity seed companies (3/10). They were generally too small for breeding and just sold their own seeds. They lacked reputation and their turnover was much lower than two million Euro. Thirdly, pure retailers: the seeds were purchased from multipliers, bagged, labelled, and resold under the own brand (1/10).

4.3. The Strategy Framework

4.3.1. Mission Statement

Interviewees mentioned personal, for-profit, and non-profit aspects, when asked about the **mission** of their company. The non-profit aspect can be divided in social, political/ ideological, and environmental mission statements. A classification is often difficult. Many included more than one aspect. Additionally, assertions had different emphasis. The mission to increase local production of seeds can have for example a social and environmental aspect. Social as the connection among the local community is strengthened. Environmental, as there are short transportation distances. Torsten stated for example: *“Basically, we want to protect the environment with the seed production on-site and short transport distances”*.

For successfully managing a biodiversity seed company, the work of the managers should overlap with their **personal preferences**. Most managers (7/10) satisfied some inner need or tried to reach a personal goal through founding a company. Seeing their work as a calling helped to overcome difficult times. For Stefan for example his personal likes and his need for independence played an important role. He said: *“I really enjoy propagating myself, having to do with plants and flowers. [...] I started my own business because I want to keep doing everything that interests me and not having to go to work somewhere”*. Also, when questioning Heidi about the mission of her company she answered: *“Of course you do it also for yourself, because it is fun and a livelihood”*.

Next to personal preferences, interviewees put an emphasis on **economic sustainability**. Most of the biodiversity seed companies included this in their mission statement. In total seven interviewees made assertions on building a sustainable or crisis-proof business. Adrean wanted *“Oikos to be here after 200 years [and] continue the same”*. Barbara wanted to be able to make a living with the production of seeds. She stated: *“I would like to have for example the [...] half income of the seeds”*. Heidi said: *“Of course, that has to be well supported economically. Then it’s also fun”*. The quotes illustrate the importance of finance for the mission of biodiversity seed companies.

Yet, a ‘chase-the-money-attitude’ is hindering business success. The **financial aspect should not be overemphasised**. Gerhard said for example that *“everyone wants to make a living from it, but money*

is not the most important reason for a decision". Similarly, Stefan stated: *"Logically, I do not do that because I want to earn a lot of money"*. Thus, for most interviewees economic aspects were mostly a means for the purpose. Stefan elaborated further: *"I sell to finance my work"*. In sum, managers were aware that for sustainable business success, they needed financial planning.

An **exception** was ARCHE NOAH together with the Vielfalt Erleben GmbH. It is an association that founded a limited company for enabling seed sale. Hence, economic sustainability is of minor importance. The association was financed mainly by donations and serves as a back-up for the subsidiary company.

The interviewees saw a bigger purpose in the work they did, that goes beyond personal and for-profit aspects. Their companies **focussed on social goals**. All managers showed an altruistic attitude. They seemed to work for others. That way they gained integrity, justification and meaning. It helped them to deal with internal and external problems. Kerstin wanted to ensure for example the financial security of the contracted farmers. Likewise, Michael stated: *"It is important that everyone gets something from the money"* referring to the farmers he had sales agreements with. Three interviewees mentioned that they wanted to provide employment. Heidi includes the well-being of her employees in the mission of ReinSaat. Also, she felt responsible for other people. The given examples show the attitude of managers and how it motivated them. The social aspects of their mission statements were founded on their individual beliefs. These can be ideological.

A main criterion for biodiversity seed companies is that they breed and market biodiversity seeds. Most managers (9/10) considered this in their company's mission: conserving and enhancing the **use of plant genetic resources**. It has a social but also political/ideological aspect. Biodiversity seed company managers felt responsible for the conservation and dissemination of plant genetic resources. They propagated its use as a viable way for conservation. Franz stated for example: *"We (ARCHE NOAH) think that this genetic diversity has to be used to be conserved and that's why we try to also make it available as broad as possible"*. Adrean wanted *"the traditional Greek varieties to come back to the market today"* mainly because of their unique taste and the benefits for the people that consume them. Barbara saw *"collecting things, which are not existing anymore"* as part of her mission. For her *"maintaining varieties is some kind of culture. In society not a lot of people realize that it's a part of culture, varieties, seeds, agriculture in general"*.

The managers of the interviewed biodiversity seed companies shared a similar perspective on society. They were discontent with the situation. They perceived a disconnection between humans and nature. For them seeds presented a link to restore the relationship. Interviewees wanted to convince others of their point of view. In their company's mission they integrated this as **bringing people in touch with gardening, seed saving, and breeding** again. This goal has a social but also political/ideological aspect. Torsten stated for example: *"The goal is to support people with the production of healthy food and to motivate them to grow their own food"*. Similarly, Gerhard mentioned: *"It is better to let the people conserve varieties in-situ [...]. We always say: Save seeds and recultivate them. Give them to your neighbours"*. The statements show interviewees' urge to change the status quo. There was a related mission statement that aimed to change the overall structure of the seed sector.

The managers behind biodiversity seed companies wanted to **make food production independent** from multinational corporations and to increase the share of SMEs. In total seven of them intended to change in the current power division. For Michael for example *"freedom for seeds"* was important.

Phillip wanted “*Freedom from multinational corporations*”. Two of them specifically stated that they wanted to increase the share of locally produced seeds. In their opinion seeds of varieties produced on a regional level possessed adaptations to the climatic conditions and performed better on the long run. Kerstin said for example: “*The task is to make sure that we can make the most of the quality seed material for organic production in the local environment, as this is the only way to strengthen the natural resistance that plants pass from generation to generation*”.

An **environmentalist attitude** is often part of managing a biodiversity seed company. Managers felt responsible for the environment. Four Interviewees specifically mentioned the intrinsic value of nature and its protection in their companies’ mission statements. ReinSaat stated for example on its website that it wanted to support biodiversity. Additionally, Heidi had the mission to provide seeds for 300.000ha, which were produced on her own 3ha. Also, for Phillip “*the ecological rescuing of the planet*” was part of the mission of Irinis Garden.

The **results show** how interviewees integrated personal, for-profit, and non-profit aspects in their company’s mission. Even though financial goals played a role, the focus more often lay on non-profit goals. They were social, political/ideological, or environmental. All aspects depend on interviewees’ worldview. Largely they were similar. Connected to the mission statement, is the question what the managers do to fulfil the mission of their company (=objectives).

4.3.2. Objectives

It was difficult for managers to **differentiate** between the **questions five and six**: “What is the purpose of your company?” and “How do you achieve this purpose? (Concrete action steps?)” (see appendix III). The answers on question six were vague. When asking Kerstin about the concrete action steps of Amarant she replied: “*We currently have more than ten varieties in the variety list, some of which are still in the process, and we are constantly working on it*”. In retrospective, the misunderstanding about objectives came about unclear formulation of the question or missing follow-up questions. Still from interviewees assertions, indications about their objectives were derived.

Not all companies translated their mission statements through strategy into **objectives**. In some cases, the mission statement had no implementation. All interviewees included in their mission, that their companies cared for partners, employees, and other members of society. Only Heidi elaborated, what ReinSaat did concretely. She mentioned that the company cared for its employees, through providing a healthy lunch in the cantina and good payment. Also, she felt responsible for other people. That was expressed in an ethical foundation, on which the company was founded: relationships with partners and customers are honest.

Most of the other mission statements were implemented. Generally, the objectives did not follow the requirements of being SMART (compare section 1.6.3). None of them had a timeframe, only occasionally they were specific and hence were not measurable. They were generally realistic and assignable to an entity within the company. An example is **marketing biodiversity seeds** (including landraces and heirloom varieties). This objective partly implemented the mission statement ‘conserving and increasing the use of plant genetic resources’. Companies made biodiversity seeds available for a greater public and conserve them in-situ. This approach was shared by at least eight interviewees. Representative was Stefan’s statement: “*In order to maintain the diversity, sales exist [...]. Conservation through use. When seeds are distributed or marketed, they are also cultivated*”. Yet,

no manager concretised on this objective. E.g., how many varieties should be marketed in what time frame? Other objectives showed similar patterns.

Based on interviewees answers, combined with statements from other parts of the interviews, personal communication and information provided on the companies' websites, I make a rough **attribution of objectives**:

Biodiversity seed companies **used plant genetic resources for breeding**. Genetic diversity of crops eventually increases. This objective was mentioned by the companies with the necessary capacities. They either directly engaged in breeding (3) or in participatory breeding projects (2). On its website ReinSaat stated for example: *"The focus of the work is always on developing crops and making them available for commercial cultivation as well as for home gardeners"* (ReinSaat 2021). For breeding and maintenance, biodiversity seed companies often invested in internal storage facilities.

For conservation of plant genetic resources biodiversity seed companies maintained some sort of **gene bank**. Eight companies chose this ex-situ conservation approach, especially if they were engaged in breeding. Implementation and capacity depended greatly on individual needs. The number of varieties kept, the type of accessions, and conservation technology varied. Michael mentioned, for example, that the Ellenberg's Kartoffelvielfalt GmbH & Co. KG had an integrated potato laboratory with 150 varieties: *"From there we can fall back on our varieties, which we want to grow and which we grow in our own private conservation"*. Potatoes need special technology for conservation which is more complex compared to seeds. ReinSaat maintained *"an air-conditioned warehouse where seeds for breeding are stored"*. Before being able to market newly bred varieties and varieties for conservation, they require registration.

Thus, five interviewees stated that they wanted to **register conservation or new varieties** in the national and European variety list. This enabled biodiversity seed companies to work according to the law and protect plant genetic resources at once. E.g., Kerstin stated that her company's objective was to constantly work on the official registration of plant varieties. In all cases, this objective was missing concretisation. None of them mentioned a quantity and in what timeframe they planned to register varieties.

Besides conserving plant genetic resources in-situ and increasing genetic diversity of crops, companies also had **environmental objectives**. They worked according to natural principles. Three interviewees stated that they solely used organic or traditional farming and seed production techniques. Phillip believed for example: *"Our way of cultivating is organically certified, but it is about cultivating a traditional way"*. For many interviewees organic and traditional farming methods was something that they wanted to spread.

Seven companies were actively **disseminating knowledge**. They offered seminars, literature, or provided information material for their customers as part of their assortment or as a free offer. Barbara took time for customers' questions regarding seeds and gardening. Dreschfliegel encouraged people to save seeds themselves and spread them: *"Replant [seeds] yourself. Pass it on to your neighbors"* (Gerhard). They provided information on how to do so on their website or on personal request. The engagement went further.

Two companies, which were closely connected with associations (Dreschflegel e.V. and Verein ARCHE NOAH) implemented their political/ideological mission through **lobbying**. They wanted to improve the legal framework for seed production and breeding of alternative varieties by running campaigns, organizing events, and publishing articles. Dreschflegel stated on its website, that they wanted to redesign the development of legal regulations and social structures that had essentially caused the impoverishment of varieties (Dreschflegel e. V. 2021).

In a nutshell, marketing, (participatory) breeding, maintaining gene banks, registering conservation or new varieties, working according to natural principles, offering seminars, literature, or providing information material and political lobbying were objectives of biodiversity seed companies. The social part of the mission statement was rarely implemented. Additionally, objectives were often abstract; they did not follow the SMART criteria. All of which makes it difficult to effectively work with objectives and reflect on them. This has effects on the impact measures.

4.3.3. Impact Measures

Generally, when managers define objectives unclearly, they have **trouble to reflect** on them, evaluate their process and make appropriate corrections. Hence most interviewees did not have pre-defined measures. Yet, they came up with indicators during the interview. They fall again under the same categories as mission statement and objectives and measure both: for-profit values and non-profit aspects. The number interviewees who mentioned a specific impact measure is put in brackets.

Most impact measures refer to **financial parameters** which are easy to evaluate. With the help of these, managers monitored the financial status of the company. Number of sold seed packages/sales in general (5), number of customers and their return rate (4), turnover (2), and number and salary of employees (1) were mentioned. Stefan for example linked the impact of his companies work economically to the sales figures. Similarly, Franz stated: *“The main indicator, I think, is the number of seed packages that are sold”*. Kerstin was *“particularly interested in the data on customers who return every year”* or *“Purely in terms of sales and order/production volume you can see directly what is happening”* as reported by Torsten. For Heidi a measure was *“paying employees well”*. Besides for-profit measures there were a few non-profit ones.

Interviewees mentioned **social measures** which are abstract and difficult to evaluate. Managers mentioned the ‘well-being of their employees’ (1), ‘satisfaction of customers’ (4) and ‘the overall reputation of the company’ (2). Phillip stated for example: *“I consider my work to be successful based on customer feedback”*. Also, for Barbara *“the feedback of the people is a kind of measure”*.

In addition, interviewees mentioned several **measures** to map their **political/ideological** goals. As with the social measures interviewees answered with a similar degree of abstraction. Companies’ efforts to conserve plant genetic resources, increase crop genetic diversity and bringing people in touch with gardening for example were monitored through the ‘number of newly breed varieties’ (2), ‘number of registered varieties’ (2), ‘number of discovered varieties’, ‘number of varieties offered’ (1), ‘number of varieties in the gene bank’ (2), and the ‘growth rate of the organic sector’ (1). E.g., on the question which criteria Kasten used to measure his companies impact he answered: *„There are several. If I breed something new and it turns out to be a sound variety. The next building block is then the official approval and the last thing is that I can sell it with a certain turnover. Of course, also the search for old varieties or developing them further, or the discovering a new treasure”*. Barbara *“will evaluate [...] the breeding success”* according to the number of breed varieties. For Gerhard the success of specific

political campaigns was an important measure. He stated: *“Politically, it is harder [to weigh the success of our mission...] This bantam corn thing [...] That went really well back then”*.

In sum, the answers of interviewees show that most managers reflected little on the development of their long- and short-term goals. Most if not all managers indirectly monitored the financial situation of their company, but social, environmental, and political/ideologic goals were poorly measured. After enlarging on the purpose of the sample biodiversity seed companies and how this purpose is implemented and monitored, I now come to the actual Business Model Canvas as developed by Osterwalder and Pigneur (2010).

4.4. Business Model Canvas

4.4.1. Customer Segments

The **direct customers** that seed companies served were home gardeners (9), professionals such as farmers and market gardeners (9), farmers' unions (2), retailers (5) other seed companies in the case of contracted production (2).

Many biodiversity seed companies focused on the **final customers** of seeds: amateur and professional growers. The margin is higher, compared to selling to retailers or other seed companies. Gerhard argued: *“Our companies can only make a living from it because we have everything in our own hands. [...] you know, the retailers always earn the most”*. Dreschflegel and Irinis Garden took advantage by exclusively selling to home gardeners and professionals (no resale). This way the quality of products and brand is completely in the hand of the company. *“Then [... customers] know what the product is and how it is produced”*, Adrean claimed. Oikos Seeds exclusively sold to professionals and retailers. He took advantage of selling bigger quantities. The other eight companies served the mentioned customer segments in different proportions.

Interviewees rarely disclosed the **number of customers** even if they know it. Michael stated that his company yearly served several thousand customers. He did not want to reveal the exact number. Nevertheless, two interviewees were open and specified a number. Dreschflegel received yearly 40.000 orders, Oikos Seeds had 650-850 customers.

Managers did not systematically collect **information about their customers**, even though this data can be valuable for strategizing. However, all managers had a rough idea. Three gave further information on their customers like demographics, location, attitude, and purchase reasons. Stefan stated for example, that 70-80% were women of which ~90%, *“are older”*, approximately over 40. Gerhard said: *“We definitely sell 90% of our seeds in Germany. But once there was someone from Holland, someone from Spain. Most of them are Germans that emigrated at some point”*. Phillip reported: *“The people who buy are alternative people. They have an ecological awareness. (...) Most of them are people with a high level of political consciousness. (...) But there are also people without a political background who try to cultivate our seeds for health reasons”*. Franz thought that the customers of the Vielfalt Erleben GmbH were mostly *“people who love diversity”* which enjoyed the special qualities (like taste) inherent to genetic diversity.

In a nutshell, interviewees seemed able to assess their companies' customers. They were well informed about the type of customers and their number. Their demographics, location, purchase reasons and attitude were not necessarily known. Most of the data about customers were collected

through cursory observation, none of them had a systematic process. Interviewees intuitively made use of customer data.

4.4.2. Channels

When reaching out to customers the **internet** played an important role. Information was spread quickly through email newsletters and social media profiles. The internet also presented a viable way to sell seeds. Customers chose the variety according to pictures and information presented online. Barbara for example said: *“Marketing is now online”*. The effort was minimal. The biodiversity seed companies had their central storage, in which they kept their seeds (pre-bagged or bulk). Employees prepared packages according to orders and sent them mostly via postal mail. Bigger quantities were sent via haulier.

With the pause of most markets and fairs due to the **SARS-CoV-2 pandemic**, the internet as a channel gained importance. Since March 2020 the personal contact has diminished whereas electronic contact has increased. The quote of Barbara exemplified the situation: *“Because of Corona all the markets are closed. So, I installed this web shop. [...] This business changed so much with Corona. I really think I have to build up a new thing. Everybody was home last year. This networking over Instagram got bigger in percentage with the relationship with my customers”*. It shows how the pandemic also influenced the seed business and how the companies adapted in this case their channels to keep in touch with their customers.

Nevertheless, **not all customers were experienced** in handling the internet. For Stefan especially the older generation kept *“having problems with the online shop because it isn’t easy for them”*. Some customers preferred information in printed form and offline purchase possibilities on markets and in shops.

The **channels** to reach out to customers were website (7), Instagram/Facebook profile (7), printed media (catalogue, prospects) (4), and fairs (4). For sale eight companies used their own online shop. Six mentioned the possibility to order via telephone or email. Three had their own shop and two had a stand on the local market.

4.4.3. Customer Relationships

Recurring customers were helpful for biodiversity seed companies since they offered some security in planning. Managers got indications about expected revenue. They made estimations of what quantities to multiply and bag. Gerhard stated for example, that Dreschflegel had the *“rule to bag between 120 and 140% of the number [...] of the previous year sales figures”*. In total, nine interviewees stated that their companies had many or mostly recurring customers ($\geq 50\%$). At the time of the interview, Stefan could not say which percentage of customers was recurring. He stated: *“In my business, this is of course too early to say, because I can observe this in the shop if I want to. There are repeated customers”*. In seed business customer retention plays an important role.

The **type of customer relationship** developed more and more in the direction of electronic and automated communication and service. It facilitated the work of biodiversity seed companies. For those that served home gardeners, it was an assistance. A high quantity of orders was processed through automated services. Employees prepared packages accordingly and most other tasks were taken by software. E.g., Stefan stated: *“This is a total relief for me. I don’t have to write all the emails anymore [... customers] order seeds, then I finish it, and they get response emails generated by the*

system". In total, seven interviewees asserted that their customer relationships were mainly electronic and automated.

Unfortunately, the use of the internet led to **increasing anonymisation** and resulted in a disconnection of customers and biodiversity seed companies. Thus, it is important to nourish the relationship. Heidi said for example: *"We show more employees in the catalogue and get positive feedback because customers see that people stand behind the company"*.

In contrast, there are three companies that preferred to maintain mostly **close/ personal relationships** with their customers. Kerstin said for example: *"We have close contacts with our customers because in addition to selling seeds and seedlings, we also answer their questions and help them find solutions to their problems, so that we are available to them throughout the year"*. These generally served customers (retailers, farmers unions, other seed companies) that purchased seeds in bigger amounts. The number of orders was relatively small.

Additional **face-to-face contact** with customers was often required for maintaining contact with all customer segments. Especially for customers that were not used to the internet or preferred communication in person, maintaining a shop on site or having a market stand is useful. It was often the only possibility to stay in contact. Most managers were aware of that. Seven companies had at least partly face-to-face contact with their customers.

Personal assistance as part of customer service was important for biodiversity seed companies. It was used as a tool to acquire and retain customers. All companies offered possibilities for personal assistance via telephone, email, Facebook, or Instagram. Two companies operated an online forum for Q&As. Gerhard mentioned for example: *"Personal advice is available by phone twice a week in the evening for 1-1.5 hours. We also have a forum that is attached to our online page"*.

Requesting feedback from customers helps to improve products and services and gives a direction for development. Nevertheless, biodiversity seed companies generally did not make use of this tool. Customers rarely provided feedback themselves, since the time between purchase of seeds, cultivation and finally consumption of the fruits is long. Customers mostly forgot about providing feedback. Managers interpreted this issue like Torsten: *"Their silence is praise enough"*. But uncertainty remained. No biodiversity seed company requested feedback regularly. Two did it on an irregular basis, and eight stated that they were not doing so at all.

In rare cases, that **customers complained** about the service or product, biodiversity seed companies showed a problem-solving attitude and good will. The additionally generated costs were marginal, and it facilitated customer retention. Torsten mentioned for example: *"If [...] something does not germinate, we try to do causal research, but at some point, we send another bag and it's fine"*. In total six companies treated customer complaints similarly. Good will was an effective way to deal with customer complaints. Stefan explained it well when he said: *"If people are not satisfied, they get a replacement. [...] It doesn't hurt me. I'm not arguing at all. [...] They're really happy about that"*. Four interviewees did not make statements on customer complaints.

To sum up, the interviewed biodiversity seed companies had at least 50% recurring customers. The type of customer relationship depended mostly on the number of customers served and the individual order volume. Additional factors, like manager's preferences were also decisive. The sample

biodiversity seed companies maintained mainly electronic and automated relationships, but all companies offered personal assistance via telephone, email, Facebook, or Instagram. Feedback was rarely requested or received, and goodwill was generally the response to complaints.

4.4.4. Value Proposition and Revenue Streams

The biodiversity seed companies did not put the customer segments at the **heart** of their business model, but rather their value proposition. They stand for specific values and customers purchase because they are in accordance with these values. Heidi captured this pretended contradiction: “we don’t grow what customers want, but we still grow what customers want”.

Biodiversity seed companies **offered** their customers products and services, and with it immaterial values. They specialized (main income source) in one of three types of seeds and planting material: (1) vegetables (including herbs and flowers) (2) potatoes, and (3) cereals. Each of these categories has its own characteristics for multiplication and marketing. For example, Ellenberg’s Kartoffelvielfalt GmbH & Co. KG only multiplied potatoes. Michael explained the situation: “I realized that each of these [seed types] is a work area itself. [...] It was enough for me to develop and preserve potatoes”. Seven companies specialized in vegetables, two in cereals. Flowers and herbs were added to the range, because they “are not so regulated by the plant variety law” and, “people are interested when you are at the market. Flowers and herbs are a part of the home garden. People just love it and that’s why they’re there” (Stefan). All interviewed companies marketed – with different shares – vegetable, herb, and flower seeds for amateur purposes (sale in portion bags) since they are the least regulated.

The **revenue streams** illustrate that biodiversity seed companies follow two different strategies. On the one hand, some specialized in seed sale (3/10) “Today Oikos is a seed company 100%”, said for example Adrean. They had no or few other products in their range. On the other hand, were biodiversity seed companies that diversified (7/10). They had a broad product range with supplement products and even other economical branches. The revenue streams generated from seed sales of four biodiversity seed companies ranged from 34% to 100%. On average, seeds and planting material contributed to 65% to the revenue of the sample biodiversity seed companies. The exact figures can be found in Table 5.

Table 5: Products, services and values offered by each biodiversity seed company.

Organisation	Type of seeds/ planting material (% of revenue)	Additional products & services (% of revenue)
Dreschfliegel GbR	Vegetables, herbs, flowers, onion sets (>99%) ~800 varieties	Literature (<1%)
Saatgut Dillmann	Vegetables, herbs, flowers, pastures (50%) ~250 varieties	Garden design (45%) Seeds for sprouting and gardening tools and materials (5%)
Ellenberg’s Kartoffelvielfalt GmbH & Co. KG & Biolandhof Ellenberg GbR	Seed potatoes 35%, Vegetables, herbs, flowers (<10%) (~150 varieties)	Table potatoes (55%) Supplement products (<1%)

Verein ARCHE NOAH & Vielfalt erleben GmbH	Vegetables, seed potatoes, herbs, flowers, cereals (~75%) ~450 varieties	Show garden, food and drinks, seedlings, literature, gardening tools and material (~25%)
Sortenwerkstatt	Vegetables, herbs, and flowers (34%) ~90 varieties	Seedlings and berry plants (33%) Food products (33%)
Die Samengreisslerei	Vegetables, herbs, and flowers (50%) ~250 varieties	Vegetable boxes ('Community supported agriculture') (30%) Seedlings (20%) Seminars (<1%)
ReinSaat KG	Vegetables, herbs, flowers, seed potatoes, bulbs, onions sets and shrubs (>99%) ~700 varieties	Literature (<1%)
Amarant s.p. & Amarant kooperativa d.o.o	Vegetables, herbs, flowers (60%) ~400 varieties	Food products (20%) Seedlings (10%) Gardening tools and material (5%) Seminars, presentations, and publishing articles (5%)
Irinis Garden Το περιβάλλον της Ειρήνης	Cereals, vegetables, herbs, flowers (40%) ~40 varieties	Food products (40%), Animal feed (20%) Seminars (>1%)
Oikos seeds κωστακης μ. Γεωργιος	Cereals, vegetables, herbs, pastures, flowers, seed potatoes and set onions (100%) ~1000 varieties	-

For enlarging their product range nine of ten biodiversity seed companies offered **additional products**. Possibilities were seeds for sprouting, gardening tools and material, seedlings, literature, vegetable boxes, seedlings, berry plants, and food products. Those are general products that are connected to seeds. E.g., Torsten: *"In the range we have is what fits to seeds: biological pesticides also from the region, [...] fertilizers [...] raised beds, greenhouses"*. An exact allocation of which company offered what and to what extent it contributed to the revenue is summarized in Table 5. Next to products biodiversity seed companies make other offers.

The **number of varieties offered** depended on the focus and capacity of the company. Generally, the bigger the company (in terms of revenue and staff headcount) the bigger the assortment. Each variety has its own multiplication procedure, which requires labour. More work force and/or contracted farmers need to be paid. The company needs to generate more revenue. In total companies offered between 40 and 1000 varieties of seeds, on average ~440. Exceptions can be explained through seed trade, which requires less workforce than trade. A company highly engaged in seed trade therefore

may have more varieties, but a smaller staff headcount. For example, Oikos Seeds, which purchased most seeds.

Services connected to breeding, seed multiplication and gardening are possibilities for biodiversity seed companies to diversify. They are commonly compatible with managers preferences, skills, and knowledge. This presents not only economic benefits but can be a fulfilling occupation. Torsten started his business in 1997 because of *“the fun of garden design”* and began only in 2009 to sell seeds. *“Seeds are now the main topic”*, he said. In total five companies offered services like seminars, presentations, publishing articles, foods and drinks for visitors, a show garden and garden design. In some cases, services also fulfil marketing purposes. Stefan said: *“The cooking classes continue. [...] My wife [...] likes to cook with the rarities that we grow, to photograph and to make her own recipes. We also put that on the website to give a taste of the varieties”*. The services contributed from 0 to 45% to the revenue stream of the companies. On average their share was approximately 7%.

For handling a successful biodiversity seed company, it is crucial to offer **immaterial values**. They serve as criteria for customers’ purchase decisions. They range from specifications about their seeds, to intangible or ideological values. For simplicity and comparability, I condensed several similar/overlapping values which are summarized with their number of assertions in Figure 6. The companies’ individual values can be found in Table 6.

Table 6: Immaterial values asserted by interviewees

Organisation	Values
Dreschflegel GbR	<ul style="list-style-type: none"> Diversity of varieties: possibility to choose Broad assortment: possibility to purchase everything in one place Seeds of landraces and heirloom varieties Seeds of unique/special varieties Seeds of varieties suitable for home gardeners Reproducible seeds (non-hybrid) of open pollinating varieties Support a non-profit mission Authenticity Fair price High quality Organic certification Regionality
Saatgut Dillmann	<ul style="list-style-type: none"> Diversity of varieties: possibility to choose Seeds of landraces and heirloom varieties Seeds of unique/special varieties Seeds of varieties suitable for home gardeners Reproducible seeds (non-hybrid) of open pollinating varieties Fair price High quality

	(Partly) organic and Demeter certification (Regionality)
Ellenberg's Kartoffelvielfalt GmbH & Co. KG & Biolandhof Ellenberg GbR	Diversity of varieties: possibility to choose Seeds and planting material of unique/special varieties Fair price High quality Organic and Bioland certification
Verein ARCHE NOAH & Vielfalt erleben GmbH	Diversity of varieties: possibility to choose Seeds of varieties suitable for home gardeners Reproducible seeds (non-hybrid) of open pollinating varieties Support a non-profit mission High quality Organic certification Regionality
Sortenwerkstatt	Seeds of unique/special varieties Seeds of varieties suitable for home gardeners Reproducible seeds (non-hybrid) of open pollinating varieties Authenticity High quality Organic certification Regionality
Die Samengreisslerei	Diversity of varieties: possibility to choose Reproducible seeds (non-hybrid) of open pollinating varieties Authenticity High quality Organic certification Regionality
ReinSaat KG	Diversity of varieties: possibility to choose Reproducible seeds (non-hybrid) of open pollinating varieties Authenticity Very high quality Organic and Demeter certification
Amarant s.p. & Amarant kooperativa d.o.o	Diversity of varieties: possibility to choose Broad assortment: possibility to purchase everything in one place Seeds of landraces and heirloom varieties Fair price High quality

	Organic certification Regionality
Irinis Garden Το περιβάλλον της Ειρήνης	Diversity of varieties: possibility to choose Seeds of landraces and heirloom varieties Reproducible seeds (non-hybrid) of open pollinating varieties Organic certification Regionality
Oikos seeds κωστακης μ. Γεωργιος	Diversity of varieties: possibility to choose Seeds of landraces and heirloom varieties Fair price High quality (Partly) organic certification

The asserted values were **realized to different extent**. Not necessarily each value was fully developed. It depended on the perception of managers. An example is authenticity, which was asserted by five interviewees with different interpretations. For Katherina it meant being *“a real producer and a small producer”*. Heidi, on the contrary, thought that ReinSaat is *“not just any company, but people of flesh and blood who enjoy what they do. The trust is just there”*. Finally it depends on customers, and what is valuable for them.

Not all interviewees mentioned all their values in the interviews. The data derive from interviewees' statements and companies websites. There are chances that information is missing. Heidi for example took only very little time to answer the question about the value proposition of ReinSaat. The role of perception and the incompleteness of data make a comparison difficult.

Eight of the researched companies claimed **diversity of varieties**. For customers this means that they can choose from a wide assortment. They offered many varieties within a vegetable group. E.g., the Dreschflegel GbR sold 80 different tomato varieties. Many customers prefer this diversity and the possibility to choose. Stefan stated for example: *“On the one hand, I believe that people care about diversity [...] and I tend to focus on it”*.

In addition, two interviewees thought that their companies had an especially **broad assortment**, where customers can purchase all necessary seeds for gardening. Gerhard said: *“You first have to try to make the range as wide as possible”*. He referred to the number of vegetable species offered. Kerstin thought that many customers wanted to buy everything in one place, that's why Amarant made this offer.

Offering only **reproducible seeds** (non-hybrid) of open pollinating varieties is a point that six interviewees put forward. This allows customers to save seeds themselves. ReinSaat for example wanted to make available regionally adapted, seed-stable (open-pollinated) crops (ReinSaat 2021). However, two companies also offered hybrid varieties to their customers. They argued: *“Some customers want them (hybrid varieties) too”* (Torsten).

Three companies specifically claimed that they offered varieties **suitable for home gardeners** through e. g., a prolonged harvest time. Franz stated for example that the Vielfalt Erleben GmbH offered around 60 varieties in the *“Hausgartenline, (...) which were identified to be very well suited for home*

gardeners". Of particular interest are **varieties** that have special or **unique** tastes, colours, and shapes. The quote of Gerhard: *"In the herb area, we have (...) very unusual things that you otherwise rarely get"*, was representative.

Regionality was asserted by seven companies. The interpretation of this term varied. Saatgut Dillman traded only seeds produced in Europe. Four companies specified their whole country as a region. Phillip said that people purchase seeds because that way the money stayed in the country and people like him could continue to produce seeds. Customers of Dreschflegel, Sortenwerkstatt and Samengreisslerei felt certain that the seeds were produced in a certain place or region. *"People then even can purchase seeds that were produced in their region"* (Gerhard). For him that was advantageous *"because seeds develop regional adaptations"*.

Three interviewees emphasised that they want to provide their customers a variety of **landraces and heirloom varieties**. Amarant for example wanted to offer *"varieties that are interesting to customers. A particular emphasis is on Slovenian varieties, [... that] have been cultivated for decades on farms and gardens and are at risk of disappearing"*.

Organic certification for breeding and/or multiplication is another value that eight companies claimed. Additionally, two of them were part of farmers unions. *"ReinSaat was created as an organic and biodynamic seed and breeding organization"*, advertised Heidi. Two companies offered at least a share of organic or Demeter certified seeds. Therefore, all biodiversity seed companies were associated with the organic sector.

Eight companies claim to offer their customers seeds of **high quality**. ReinSaat for example had internal quality standards. The germination rate was approximately ~20% higher than compulsory by law. In addition, they offered seeds with consistent varietal identity and purity and had well-tried varieties. *"The quality must be right: health, germination ability [and] the quality of the vegetable varieties themselves has to be 100%"* Heidi said. In addition, four of the interviewees thought that their companies charged **fair prices**. Customers purchased with them because they offered *"coherent value for money"* (Torsten).

ARCHE NOAH/ the Vielfalt Erleben GmbH and Dreschflegel offered their customers the possibility to **support their mission**: Conserving plant genetic resources. Through purchasing seeds customers get a product and help the association. Franz thought that customers bought because *"they also want to support the work of the association. (...) They think it is a good idea to conserve this cultivated diversity and (...) they can help us with this mission"*.



Figure 6: Values offered to customers and number of assertions.

In summary, the surveyed biodiversity seed companies asserted to offer their customers immaterial values that can be assigned to twelve value propositions. The values themselves depend on managers and customers' perception. Due to the methodology, there might be missing points. To create and offer these to their customers, biodiversity seed companies resorted to key resources.

4.4.5. Key Resources

Key resources can be **classified** according to the four categories of Osterwalder and Pigneur (2010, p. 35) into financial, intellectual, physical, or human.

The biodiversity seed companies depended little on **economic resources**. Gerhard illustrated the situation: *"Business expenses play almost no role for us"*. Only Heidi mentioned an economic key resource. For her a good economical foundation was important. She also stated: *"but that shouldn't be number one"*.

Intellectual resources influenced to a small extent. Gerhard argued: *"the production, if you are willing and not completely stupid, you can learn"*. Nonetheless, handling a biodiversity seed company requires skills and knowledge (compare section 1.5.3), also about the legal framework. Gerhard Krebs said: *"When someone starts, you should deal with the laws. They won't fully apply while you are little, but you should know them. But when you become bigger and better known and we are relatively well known, then you simply can no longer afford certain things"*. Intellectual key resources have in common that they need time to develop. Hence, other interviewees mentioned knowledge about seed production and running a seed business (2) as a key resource. Adrean said: *"I think knowledge is the most (important resource)"*. For Phillip his handicraft skills for adapting his machinery to the processing needs of different cereals were a key resource. Once these skills and knowledge are acquired it requires time and patience for it to bear fruit.

Steady and good quality helps building up **reputation**. Franz thought that the good reputation of the company or of the brand ARCHE NOAH were a key resource: *"The reputation in Austria [is a key resource ...]. Most of the people know what our mission is and who we are"*. The development of intellectual resources is generally time consuming. Nevertheless, they seemed reasonable for the success of biodiversity seed companies.

Similar important were **physical resources**. Two interviewees mentioned their company's internal gene bank. Franz, for example, thought that *"the thing that makes us special is the collection we have, where we can choose varieties from"*. For Heidi a tailored value chain and machinery for processing and packaging seeds were crucial. Also, Stefan mentioned: *"Technology, equipment is important, if you want to clean seeds, you need the technology for it. [...] The thresher was such an important, central thing, like the wind sifter"*. For him this was a key resource because for a long time he has been facing problems with cleaning his seeds. Still *"there is a lack of 10% cleaning options for crops. Here I face limits"*, he said.

Nevertheless, relatively **little equipment** was required, especially at the beginning. Barbara said: *"I use household accessories rather than special seed cleaning machines"*. Investment in equipment came over time and till then there were certainly possibilities to balance a lack in technology. Stefan stated for example: *"I want to establish a cooperation with another seed company. I also have colleagues in the Weinviertel. [...] Maybe I could work with them too. [...] To get it completely clean, I must send it somewhere. But that is just the beginning"*.

The greatest need was for **human resources**, because of the labour intensity of breeding and seed business (compare section 1.5.3). Multiplication, cleaning, packaging, marketing, and shipping involve and depend largely on human resources. Managers' assertions showed this connection. Eight interviewees stated that their employees were to a great extent responsible for their company's success. Michael said for example: *"We have a good team now. Those who work are all great"*.

Others referred to employees' and managers' **specific attributes**. For Gerhard for example, passionate and reliable employees and shareholders were crucial as well as the right chemistry between the shareholders of the Dreshfelgel GbR. He said: *"It is also important for us that we have employees who are fully committed with their heart and soul. [...] After a certain period of time, people have to work independently"* and *"It stands and falls with the people. That is the most important thing. The chemistry between people must be right. [...] We must be able to rely on each other"*. Passion/ enthusiasm or enjoyment of working with seeds was mentioned by four more interviewees and two more stated, that reliability was important. E.g.: *"A certain reliability for our customers [is important]"* (Michael). Flexibility was crucial for two interviewees: For Kerstin *"above all, the flexibility of the workforce"* was a key resource. Curiosity was stated twice. Adrean thought for example *"all our interest to learn more"* was important. For him also the ability of long-term thinking and planning was crucial for his success. He said: *"If you are in the seed business you don't think about time. If you take time out of your head the seed business is clearer"*. Two interviewees mentioned family support as a key resource. About his wife Stefan told for example *"She is always involved with a lot of thoughts and that is really important"*. These examples show how much biodiversity seed companies depended on human resources.

Emphasis was given to attributes like **patience, persistence, and assertiveness**. Six interviewees mentioned these. When asking Barbara about the sources for her company's success she answered: *"I am persistent"*. Building a business takes time. Gerhard told: *"It took 10 years to become a sure-fire success"*.

Managers' beliefs and convictions are also part of human resources. For at least seven interviewees their mission/vision motivated them intrinsically. Torsten answered, when asking him about the sources for his company's success: *"To a certain extent the vision"*. Other interviewees did not state their mission/vision directly as a source. Nevertheless, from their emotional and confidential

expression, it becomes evident. Adrean wanted *“Oikos to be here after 200 years”* and *“the traditional Greek varieties to come back to the market today”*. Because for him the *“Greek future is in the past, regarding seeds and varieties”*. This was said with confidence. The last part he repeated five times throughout the interview. The number and type of nominations illustrate the importance of human key resources for biodiversity seed companies. Finally, the least important category seems to be the financial one.

The **essence** is, that the resources that managers perceived to be key resources depended on the situation of the companies. However, some resources were seen as key by most interviewees. Due to the intensity of work, human resources played the most important role. These are followed by intellectual ones, because breeding, seed multiplication and marketing required skills and knowledge. Physical resources were less important at the beginning, but over time and with growing quantities of seeds and planting material more machinery was needed. Finally, economic resources were of minor importance for business success. Figure 7 illustrates the importance of each resource category by its relative size.

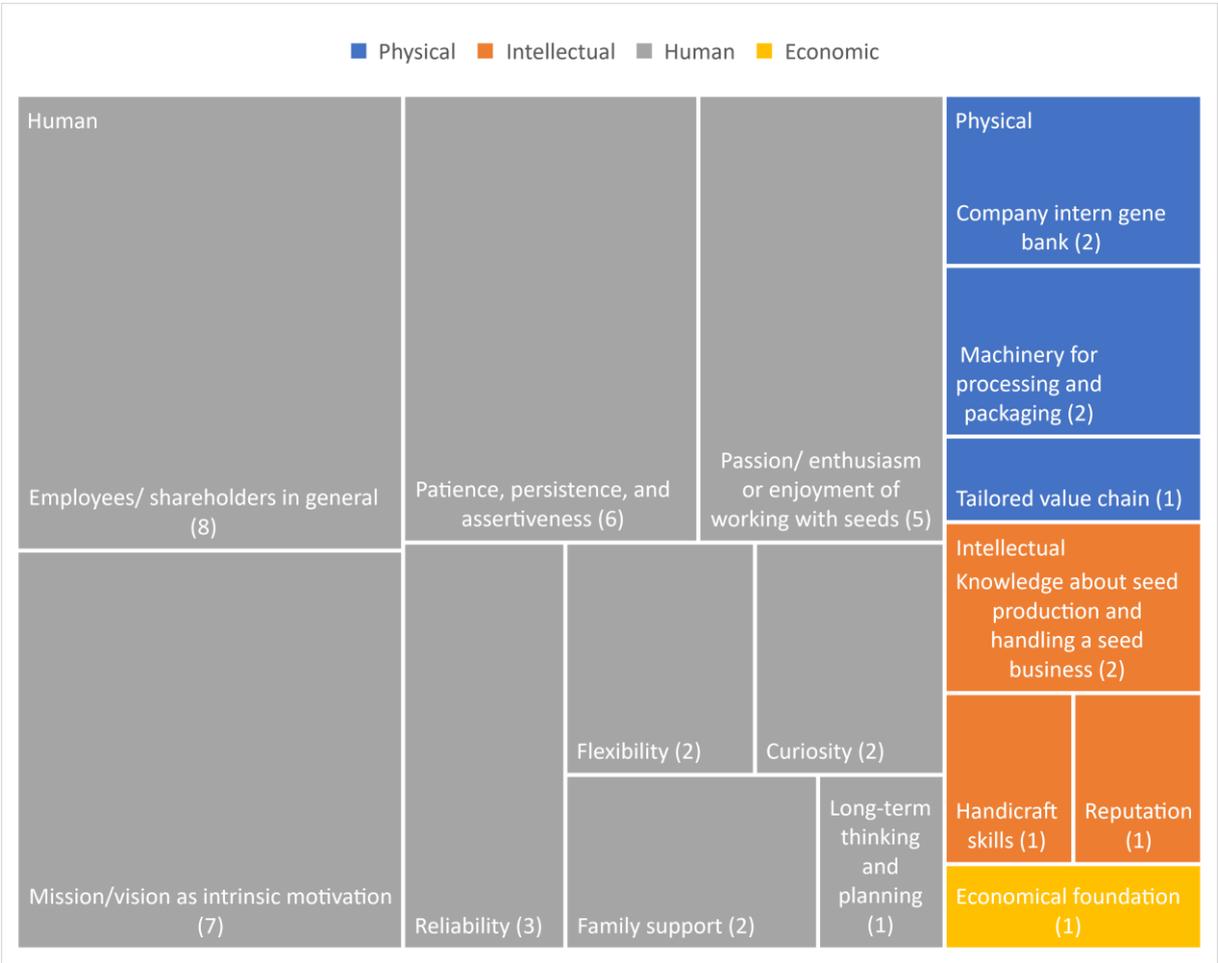


Figure 7: Tree map of key resources. The number in brackets and size of the boxes indicate how many interviewees mention each activity.

4.4.6. Key Activities

Key activities refer to the most important things that biodiversity seed companies must do to be successful. Osterwalder and Pigneur (2010 p. 37) categorize them as platform/ networking, production

and marketing, or problem-solving activities. The data indicate and Figure 8 illustrates that for biodiversity seed companies all three types are similarly important.

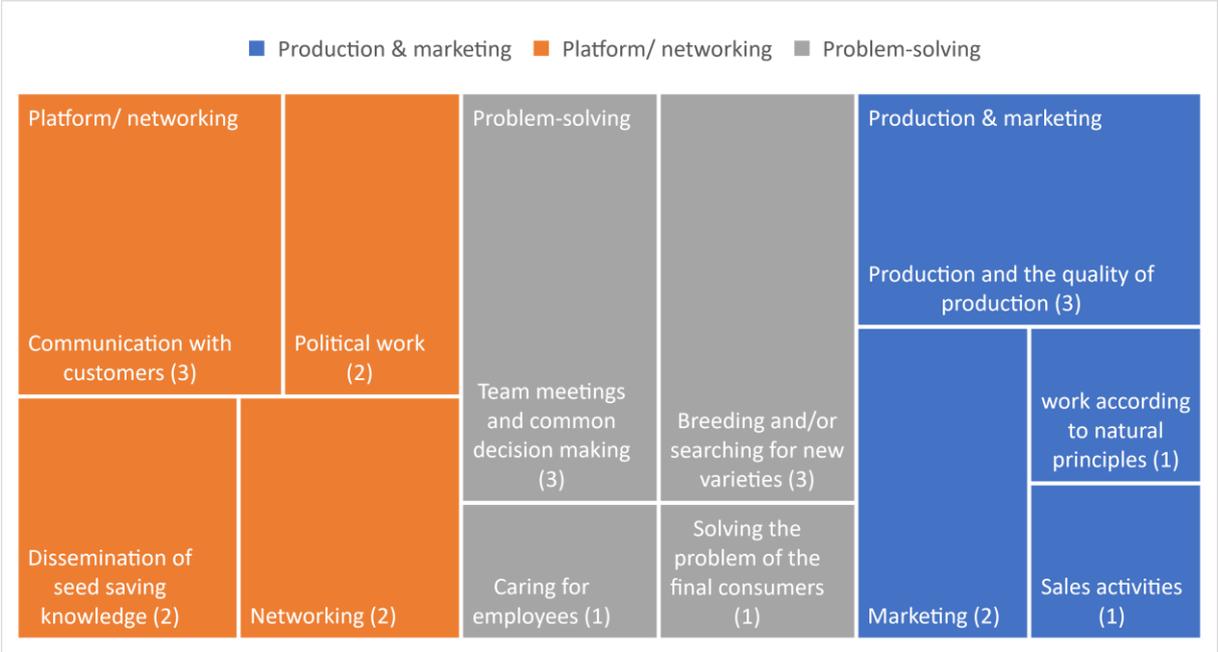


Figure 8: Tree map of key activities of the sample biodiversity seed companies. The number in brackets and size of the boxes indicate how many interviewees mention each activity.

Building connections and nourishing relationships with partners and customers falls under the category of **platform/ networking**. Interviewees mentioned communication with customers (3). Conveying the companies’ values, sales conversations, and service are all part of customer communication. They are essential for the success of biodiversity seed companies. Michael asserted: *“The dialogue with the customers is very, very important”*. Similar, two interviewees explicitly mentioned networking. Heidi said for example: *“We are at Biofach or Bio-Süd. But a lot of people come by because they want to notice one”*. The importance of partnerships in seed business, I will explain in detail in section 4.4.7.

Also, under platform activities falls **political work** (2). Gerhard stated for example when asked about the key activities of Dreschflegel: *“The political work that we do [...] through the association”*. It indirectly influenced the company, by modifying the business environment. An important networking activity of the Dreschflegel GbR and Irinis Garden was the **dissemination of seed saving knowledge**. In this sense Gerhard declared: *“We not only pass on seeds, but also the [knowledge] how to save seeds. The seminars were still running [before the SARS-CoV-2 pandemic]”*. The examples given show why managers thought that networking activities were important for their company’s success. Additionally, they mentioned other points

Almost similar important were **production and marketing** related key activities. They refer to designing, producing, and delivering a product to customers (Osterwalder and Pigneur 2010 p. 37). Multiplying seeds and marketing them is a main part of the work of most biodiversity seed companies. Hence for them *“the production and the quality of production”* (Franz) was a key resource. He referred to process planning. It gets increasingly important with size, staff headcount and involved

stakeholders. The more people are involved in a process, the more arrangements must be made. Therefore, the planning of production and its quality is a key resource for biodiversity seed companies.

Also, biodiversity seed companies were all (at least partly) **certified organic**. Thus, they must work according to natural principles. Michael said for example: *“You have to work with nature. This is important”*. Managers must adhere to the principles introduced by IFOAM (2006) and noticed by European regulation (EC) 834/2007. (The latest amended was in 2018 (EU 2018/848), which will be valid from 01.01.2022.) As Gerhard put it: *“The companies that do this (multiplying seeds) are also subject to the organic law”*.

After production come **marketing and sales activities**. For Franz this included *“the service for the customers, how they can buy”*. The Vielfalt Erleben GmbH operated an online shop through which most of the seeds were sold. Hence when problems occurred it *“is a motive for some people not to buy any more”* (Franz). Stefan and Barbara just recently improved their marketing. Stefan stated: *“It is important that the online shop is well presented. We have already put a lot of effort into the homepage, visually”*. With marketing they basically referred to advertisement. Both seemed to produce more than they can sell. For them the presentation was a way to gain customers. Still, they lacked reputation. The reason is that they were comparatively young. Dreschflegel on the other hand was already well established and did not engage in any specific marketing activities. Gerhard mentioned: *“In 2005, 2007 we stopped advertising because it became a sure-fire success. [...] Today we have more of the problem producing the quantities of seeds that our customers want”*.

Next to production and marketing activities interviewees asserted a few **problem-solving** activities. Breeding and/or searching for new varieties are ways to fulfil requirements of growers or consumers. The traits inherent to biodiversity seeds can satisfy specific customers' needs. There is increasing demand for varieties with special traits (form, colour, taste, etc.) or varieties that are adapted to specific conditions (organic agriculture, drought, etc.). Michael believed that it is important to *“continue to search for or develop old varieties or discover a new treasure [...] to increase diversity”*. A total of three respondents mentioned breeding and/or searching for new varieties as a key activity. For them it was a way to gain customers by solving their problem.

In **Greece** there was a **lack of awareness** for biodiversity seeds and their products. Here Adrean still saw a conflict between the needs of growers and final consumers: The growers wanted mainly high yielding varieties. According to him, if prices were calculated per kilo, biodiversity seeds and their products would have difficulties on the market. Yet, consumers were increasingly interested in taste, form, and colour. One of his key activities was therefore focusing on the needs or solving the problem of the final consumers. He said: *“I look for what is better for the consumer”* He was trying to figure out how to bring together the growers with the consumers.

Decision making, and collaboration within the company are the basis for a frictionless execution of activities. They are part of the company's internal policy. Three interviewees cited team meetings or shared decision making as a key activity. Adrean asserted: *“We make a meeting here every Monday”*. All employees were included in the decision-making process. If there was consensus *“you would be much more effective”* he argued.

With **caring for employees, it is similar**. Taking employees seriously and being responsive to their needs is important. Heidi left their employees space for personal development. They could choose

positions once they were in the team: *“We also make sure that the people are satisfied with what they do and with their free time and that they are respected as a person and that they have space to develop”*.

But **activities are not everything**. Gerhard made an evident example: *“Many things influence. Luck: you get two, three customers who are enthusiastic and have a certain environment in which they advertise you and it runs”*. The assertion illustrated that many factors were not under managers' influence.

In sum, the interviewees named key activities related to production and marketing, problem-solving, and platform/ networking. For biodiversity seed companies they seemed of similar importance. Kerstin concluded well when she says: *“Every part of the process is important and needs to be done. Even a good marketing strategy will fail, if it does not have well-organized production and logistics behind it”*.

4.4.7. Key Partnerships

According to Osterwalder and Pigneur (2010 p. 38) **four types of partnerships** can be distinguished. Those are: (a) Coopetition: strategic partnerships between competitors, (b) Buyer-supplier relationships to assure reliable supplies, (c) Joint ventures to develop new businesses and (d) Strategic alliances between non-competitors. A clear-cut differentiation is often difficult. Partnerships play a part in business models of the researched biodiversity seed companies. Nine of ten interviewees thought that their companies have key partnerships.

The biodiversity seed sector comprised only a hand full of companies. Managers knew each other and formed a network. Eight interviewees mentioned other seed companies as their key partners. Heidi explained: *“You work on the same thing, and you also complement each other in a certain way”*. These relationships were primarily **(a) strategic partnerships between competitors**. They had a variety of advantages. Partners shared infrastructure like web-shops. Stefan said: *“I also sell my seed packs through ARCHE NOAH. They also have an online shop”*. They may help each other in difficult times. Gerhard explained for example: *“You just need to have the flu for a week, when you have seedlings, you need someone to take care of it”*. Additionally, they were contact persons when problems occur. Partners can help with their knowledge in finding solutions. They provided services for each other; machinery can be shared. Stefan for example had a college, where he could clean specific seeds with equipment, he hasn't had himself. He said: *“I have a colleague in the Weinviertel (region in Austria). They also have cleaning equipment. [...] I used this the first years”*.

There can also be **(b) buyer-supplier relationships between biodiversity seed companies**. For Adrean foreign seed companies were crucial, because *“this is where we get our profits”* he stated. OIKOS Seeds resold seeds from major international and domestic producers and to Greek retailers and farmers. The quote of Heidi illustrated the relationship between many biodiversity seed companies: *“We are all not that big and grateful that when we run out of a variety and a partner has it, we can buy it there. We appreciate each other, but we also need each other”*.

Clear (b) buyer-supplier relationships were mentioned by ten interviewees. These can be contract farmers (5). Franz stated that key partners are *„the farmers that produce seeds for”* the company. Alike, Michael named *“the producers”*. Furthermore, both mentioned the resellers of their seeds and planting material. For example, *“those companies that are selling our seeds [...] and this supermarket*

chain” Franz considered as key partners. Three interviewees mentioned courier services or hauliers. Michael said for example *“Our main haulier is very important. He is reliable [and] sends [our products]”*.

An interesting example, where cooperation developed into a **(c) joint venture** was the Dreschflegel GbR. Gerhard described the joint venture: *“There are currently 19 companies in the GbR, all of which are independent horticultural companies, legally independent organic companies that produce seeds. Each of us has a business [...] that makes seeds and is a stakeholder at Dreschflegel GbR”*. The advantage was that each member individually manages her/his farm but shares labour and cost intensive marketing infrastructure. In addition, members helped each other wherever possible. The reach of political activities is higher when it is organized within a group. The decision making on the contrary can be time intensive and often compromises must be found.

Another type of relationship is a **(d) strategic alliance** of organizations that work towards the same goal. For biodiversity seed companies these were seed associations. Interviewees mentioned them three times. Gerhard said for example: *“With ARCHE NOAH, with Pro Spezie Rara Switzerland and Germany with VEN with VERN. We work closely with them when it comes to political measures”*. Seed associations had additional functions. For Stefan *“ARCHE NOAH always offers opportunities to get in contact with new colleagues”*.

The only **exception** was Irinis Garden. The manager Phillip declared: *“I don’t have other external partners”* besides the courier service, which for him was not a key partner. He preferred to work on his own and integrate all production steps in his business.

In summary, most biodiversity seed companies had various partners. Key partners were seed associations (3), other seed companies (8), contract farmers (5), hauliers/courier services (3), and resellers (2). Biodiversity seed companies created alliances to optimize their business models. They helped each other and reduced risk, through for example contract production.

4.4.8. Cost Structure

Nine out of ten interviewees gave information regarding their **cost structure**. Only two gave relative numbers. The others provided an order in which their costs occur (see Table 7). Generally, many factors had an influence: number of employees, contract farmers, own land, etc. Yet, some patterns are visible.

The number one cost for biodiversity seed companies was **labour**. Eight companies asserted that employees were their biggest expenses. As stated in section 1.5.3 seed multiplication is labour intensive. This connection reflects itself in the costs. The only exception is a trading company that purchased seeds from multipliers and resold them. Here seeds and planting material were the cost number one.

For starting a vegetable seed business, little **investments** are required. Seed multiplication is mostly manual work, Gerhard described the situation: *“You do not work on a large scale, and you will not buy a quarter-million tractor to plow. It’s all allotment gardening. [...] I crawl on all fours and pull that (weeds) out”*. Additionally, there are many do-it-yourself-solutions. Barbara built a greenhouse for seed multiplication herself. At the time of the interview, she was *“investing into the future”*. *“Now I will buy a new one”* she said. Hence investments and maintenance become relevant if the company plans to expand. Reinsaat for example was constantly growing and investing in new equipment like

green houses and machinery. Heidi said: *“We have just completed a greenhouse that is 100m long and 10m wide”* and *“We have a room where we have different machines”*.

Multiplication of **cereals and potatoes** requires mechanisation and land for cultivation from the beginning. Companies that focus on either of them have higher shares of investment costs. Yet, the sample biodiversity seed companies showed that also here other possibilities existed. One company outsourced most of its multiplication (e.g., contract production, seed purchases) and Phillip adapted and maintained machinery himself. Therefore, there were fewer costs for investment and maintenance.

Other possible **fix costs** were investments & maintenance for machinery and buildings, services (e.g., packaging, tax consultant, insurance, website support, agricultural services, graphic design, printing), rents for buildings and land, and certification costs (e.g., organic label, memberships in farmers unions). Mentioned **variable costs** were energy (petrol and electricity), seeds and planting material from contract farmers and for resale, resources for production (e.g., fertilizers, pots, cultivation soil).

In a nutshell, many factors influence the cost structure. Labour was the biggest position for biodiversity seed companies. Investment costs for starting a vegetable biodiversity seed company are lower than those for one specialized in potatoes or cereals.

4.5. Influence of the SARS-CoV-2 Pandemic

Since the interviews were conducted during the SARS-CoV-2 pandemic, I will briefly explain its **influence** on the biodiversity seed sector and companies. Many managers mentioned the topic.

Due to the pandemic the **demand** for biodiversity seeds was growing. Interviewees reported growing sales numbers. The Vielfalt Erleben GmbH for example had 47% more turnover in January 2021 compared to January 2020. Similarly, Torsten told: *“You can observe directly what’s happening on the sales and order, production quantity, [...] with the gardens due to Corona. People discover vegetable growing”*.

A second influence is visible in the changes regarding **marketing**. Companies that were previously marketing their seeds through offline channels like markets and shops, experienced revenue setbacks. Many of them had to shift to distance marketing. Stefan explained: *“Now it’s Corona, there are no markets. [...] Everything is handled online”*.

Table 7: Ranking costs from most important to least important, for nine interviewed biodiversity seed companies (Amarant did not provide information.)

Company Rank	Dreschflegel GbR	Saatgut Dillmann	Ellenberg's Kartoffelvielfalt GmbH & Co. KG & Biolandhof Ellenberg GbR	Verein ARCHE NOAH & Vielfalt erleben GmbH	Sortenwerkstatt	Die Samengreisslerei	ReinSaat KG	Irinis Garden Το περιβόλι της Ειρήνης	Oikos seeds κωστακης μ. Γεωργιος
1	Employees	Seeds and planting material (~50%)	Employees	Employees	Employees	Employees (~40%)	Employees	Employees	Employees
2	Resources for production	Employees (~20%)	Investments & Maintenance	Seeds and planting material	Resources for production	Resources for production (~40%)	Investments & Maintenance	Energy	Rent
3	Services	Rents (~10%)	Energy	Services	Energy	Investments & Maintenance (~15%)	Resources for production	Investments & Maintenance	Seeds and planting material
4	Investments & Maintenance	Investments & Maintenance (~5%)	Seeds and seed potatoes	Rent	Investments & Maintenance	Energy (~2,5%)	Energy	Rent for land	Energy
5	Energy	Energy (~3%)	Services	Investments & Maintenance	Seeds and planting material	Rents (~2,5%)	Seeds and planting material	Certification	Certification
6		Certification (~1%)		Energy			Services	Resources for production	
7		Services (~1%)					Certification		

5. Discussion

5.1. Comparing the Business Environment

The findings from the interviews with biodiversity seed company managers and the prior research about the **business environments** overlap to a great extent. While all four countries are part of the EU and are bound to its legislation, there are pronounced differences in the implementation. Differences also exist in terms of private, government and NGO support for the conservation and use of plant genetic resources. This is visible for example in the number of officially registered varieties. Compared to other countries and its size, the situation in Austria is exceptional (32 conservation varieties and 134 varieties developed for growing under particular conditions (BAES 2020)). Germany and Slovenia also list a considerable number of varieties in their national catalogues. In Greece the situation seems less promising. A major problem there is the lack of communication between stakeholders and absence of funding (Frese et al. 2014, 64-65). In accordance with the findings of Frese et al. (2014) national governments influence the conservation and use of plant genetic resources.

The differences in **public awareness** about plant genetic resources between countries are difficult to evaluate since limited data on the topic is available. Interviewees could only speculate, but according to them, the public paid increasing attention towards the use of plant genetic resources in all four countries. Nonetheless, the importance of biodiversity seeds for the countries' overall food production is minor in terms of quantity. A trend emerges, but it is slow. If at all, diversity of varieties and their seeds need time to reach conventional agriculture and retail. Looking at the market trend from the perspective of an individual biodiversity seed company the situation still offers possibilities for establishment and growth.

5.2. Company Size

Out of ten interviewed biodiversity seed companies, five were **micro-sized**. One would expect that most are micro-sized followed by small- and medium-sized companies. This company structure can be observed in most countries' production and service sectors. In Germany for example approximately 80% of the companies in these sectors are micro-sized followed by 16% small and 3% medium-sized enterprises (Gude 2019, p. 529). A similar company structure (~93% micro, ~6% small and ~1% medium-sized), can be observed in the EU (Oppermann 2018).

Possible explanations for this **company structure** in the biodiversity seed sector might be the internal and external challenges (compare section 1.5 & 1.6). They inhibit the foundation of biodiversity seed companies. Already established ones were better off and even had better chances for growth. Another explanation lies in the labour intensity of seed multiplication and customers preferences. To be successful, biodiversity seed companies should have a relatively broad and deep assortment. Nonetheless, building up such a seed range requires work force. For micro-size enterprises this presents an obstacle especially at the beginning. As a third possibility, this divergence can be due to the used sampling method (internet research, snowball sampling). In literature this is called representation error: *"the failure of survey statistics to adequately represent the target population"* (Menold 2014, p. 105). Micro-sized companies miss reputation. Small and medium-sized companies are favoured, which results in the number of sample biodiversity seed companies. The last explanation influences, but in sum, it is reasonable, that the sample company structure is representative for the

biodiversity seed sector. Biodiversity seed companies are impeded by law and depend on customers' requirements.

5.3. Strategy: Mission Statement, Objectives, and Impact Measures

Interviewed managers were able to state their **mission statements** easily. They came up with personal, for profit and non-profit aspects. Yet, the focus was on the latter. Goals are classified as social, political/ideological, or environmental and have altruistic aspects. For managers an altruistic attitude provided a source of meaning and energy in difficult times (Block 2013, p. 29). Hence it helped them to navigate safely in the business environment.

Objectives on the other side were little acknowledged by the interviewees. Either mission statements were not considered within the objectives, or they do not formulate them concretely. They generally lacked a timeframe and hence were seldom measurable. However, having measurable goals is the basis for reflection and if necessary, course corrections. Missing them might expose companies to the danger of mission drift.

Additionally, most biodiversity seed company managers primarily named financial **impact measures**, on which basis they evaluated success. In literature this is one of the traps of social enterprises, which facilitates a follow-the-money-attitude and abandons social goals and values (Sparviero 2019, p. 244).

Contraindicative is that for most managers **money** only was a means for the purpose. They related non-profit missions to economic activities: applying business knowledge on the conservation and use of plant genetic resources. A synergy develops.

In sum, the results show that managers took little time to develop a theoretical framework for their companies' strategy. Fortunately, the biodiversity seed sector experiences growth, the demand is growing. All of which strengthens established biodiversity seed companies.

5.4. Business Model Canvas

5.4.1. Customer Segments

According to Osterwalder and Pigneur (2010, p. 20) customers comprise the **heart** of the business model. Everything else is carefully designed around the needs of customers. Hence, the collection and use of customer data is valuable for companies. Knowledge about customer segments is the basis for choosing the right channels and designing the value proposition.

Yet, for biodiversity seed companies, customers were **not primary**. They rather focussed on their value proposition which simultaneously fulfilled their goal to conserve and distribute plant genetic resources. Since the characteristics inherent in these genetic resources are what customers want, they indirectly served the needs of customers. The fact that customers were not at the centre of their attention is also evident in other respects.

Generally, the findings show that managers had a **rough idea** about their customer segments, yet none of them provided a detailed description as suggested by Osterwalder and Pigneur (2010, pp. 20,21). Neither did managers collect customer related data systematically. They rather used that information intuitively. The little emphasis put on customer related data strengthens the assumption, that customers are secondary.

5.4.2. Channels

The **internet** was increasingly used as a channel for both advertisement and sales purposes of biodiversity seed companies. The outreach is higher. The potential of the internet as a channel has been documented in diverse publications (e.g., Hoffman et al. 1995; Jarvenpaa and Todd 1996). Especially during the SARS-CoV-2 pandemic, it was often the only possibility for biodiversity seed companies to stay in contact with their customers. The findings are in line with what authors argue about overall e-commerce during the pandemic (e.g., Bhatti et al. 2020).

Though, using the internet as exclusive channel might be **problematic**. Certain customers prefer offline channels; they would be out of reach. Publications confirm an influence of age on the preferred channel (Lian and Yen 2014). The barriers for older customers are personal values and tradition (e.g., preference for a sales conversion) as well as risk (uncertainty about the functioning of online shopping). Even though the trend develops towards the use of internet channels, still most effectively appears the mix of online and offline channels. That way different customer segments of all age-groups can be reached.

5.4.3. Customer Relationships

Sales to home gardeners were often completely **automated** with the advantage of work facilitation on one hand and the disadvantage of increasing anonymization on the other. Yet, biodiversity seed companies found a way to counteract the negative effect by authentic presentation. As a result, biodiversity seed companies recorded mostly recurring customers. The advantages were discussed widely in literature. Ehrenberg and Goodhardt (2000) argue for example that it is cheaper to retain customers, compared to constantly acquiring new ones. Or, according to Shoemaker and Lewis (1999) loyal and satisfied customers may act as information channels and link friends or relatives to the company. Most managers were aware of this and hence invested time and resources in their customers through for example offering personal assistance.

Acknowledged was also the importance of **good will**, when handling customer complaints. Its value could be proven empirically by Knox and van Oest (2014). Managers applied this knowledge intuitively with great success.

5.4.4. Value Proposition & Revenue Streams

The value propositions were **consistent**. Three main specialisation possibilities were identified: (1) vegetables (including herbs and flowers) (2) potatoes, and (3) cereals. Besides focussing on one of these seed and planting material categories, it was common for the interviewed biodiversity seed companies to widen their product range. As suggested by Osterwalder and Pigneur (2010, p. 22) services and products should cater to the requirements of specific customer segments. In the case of biodiversity seed companies their value propositions were well tailored for home gardeners and professional growers. This supported the brand/ identity of the company.

Several **immaterial values** served as criteria for customers' purchase decisions. The results show that they were realized to different extent and largely depended on managers' perception. Likewise, customers perceive values differently. Almoatazbillah (2012) found for example that values depend on age, marital status, home location, and price. A disconnection between intended value and perceived value is common in many sectors (Åkesson 2007).

Biodiversity seed companies either **diversified** their assortment or **specialized** solely in seeds. According to literature, for-profit and non-profit organizations can “*reduce their revenue volatility through diversification*” (Carroll and Stater 2009). Also meta-analyses support the correlation (Hung and Hager 2019). Farm businesses show similar results, with the difference that a diversification only slightly increases total revenue (Hansson et al. 2010, p. 269). Often the additional effort is high. Yet, for social enterprises an opposite correlation was found (Guan et al. 2021, p. 17). The authors state that maintaining a single or smaller number of revenue streams will be beneficial for social enterprises. For a substantial share of the biodiversity seed companies their history influences their development. Many of them started off as farms and only later focused on seed multiplication. The findings indicate that a specialisation might be advantageous. Nonetheless, the sample size is too small to give a recommendation.

5.4.5. Key Resources and Activities

No study analysed the key resources of comparable companies so far. The results are difficult to compare with other sectors. Yet, they offer insights about **key resources of biodiversity seed companies** and confirm that (1) seed multiplication is labour intensive, (2) breeding, seed multiplication and marketing require skills and knowledge which can be acquired, (3) for stating a diversified vegetable seed business little investments are necessary, (4) with increasing production, machinery investment and thereby economical resources become more important.

Knowledge about management is universal also in seed business. According to Kohlert (2005, p. 7) successful entrepreneurs are persistent because companies take time to establish. This is in line with the findings from the interviews. Many managers confirmed patience, persistence, and assertiveness as key resources.

Like with key resources, also **key activities** have not been studied for comparable companies. Quality was asserted and according to managers substantially contributed to business success. Studies like Cravens et al. (1988, p. 301) verify this connection. Yet, its role is less important than proclaimed by some interviewees (Phillips et al. 1983, p. 41). Overall, it was found to be beneficial to balance between production and marketing, problem-solving, and platform/ networking key activities.

5.4.6. Key Partnerships

The importance of **partnerships** is explicit. For biodiversity seed companies it is likely to form partnerships with each other even though they are competitors. Coopetition is found to reduce risk on one hand (Osterwalder and Pigneur 2010, p. 38) and improve competitiveness on the other (Gnyawali et al. 2008). Especially in sectors with only a few competitors, coopetition has more beneficial effects on partners (Ritala 2012, p. 319). This justifies the network of partnerships among biodiversity seed companies. The business environment research showed that the biodiversity seed sector comprised only of a handful of companies. Many managers knew each other and formed partnerships. Beneficial for partnerships is also that the demand for biodiversity seeds is high and even growing. There is space for growth.

5.4.7. Cost structure

The variety of business models of biodiversity seed companies impede the comparability of **cost structures**. Also, the existing literature body does not provide any studies for comparison. Many

factors influence like outsourcing, machinery, own land, and buildings. One key finding may be of interest for entrepreneurs: starting a vegetable seed business requires little investment.

6. Conclusion

Regarding the internal challenges, firstly it is difficult to tell whether or not the sample companies were experiencing a **mission drift** from non-profit to for-profit goals. On one hand managers made clear statements about their company's mission and asserted, that money is just a means for the purpose. On the other hand, they lacked measurable goals. Measures for the impact of their work were targeting financial aspects. The managers' attitude towards money was not based on such financial facts. Some companies have existed since more than twenty years, and we do not know if their original mission is still the same as in the years of the foundation. Considering that the interviews show a snapshot of the situation makes a conclusion on this topic difficult.

Secondly, seed business truly is a **time consuming and costly** undertaking which hinders start-ups. Labour costs for breeding and maintenance of varieties are high. This is why, mainly for SMEs it is a challenge to maintain a broad and deep seed assortment and develop new varieties. In the long run the biodiversity sector might suffer. Varieties are getting lost, and innovation is limited.

Prior externally, the **multinational competitors** were identified as a major threat for biodiversity seed companies. But it was found that they do not directly compete. Customers of biodiversity seed companies are organic/biodynamic farmers, market gardeners and home gardeners, interested in the traits specific to biodiversity seeds and/or local seed production. These customer segments are still small but growing. Therefore, biodiversity seed companies serve a developing niche on the seed market. They possess a unique position, which is unchallenged by multinational seed companies.

Similar, even though widely dreaded, the obstacle presented by the **legal framework** is manageable. When starting a seed business entrepreneurs are bound to the law. They should be aware of it, yet it does not fully apply for them. As long as they are still small, they are outside the range of authorities. No one takes exception if seed multipliers market small quantities of unregistered varieties. The legal framework becomes important when the company's reputation and revenue grow.

The assumption, that **strategizing** is important could not be held. At least from a theoretical standpoint managers missed a framework for their companies' strategies. The formulation of a clear mission is something all had in common. Yet, this mission is only partly translated into concise objectives. The focus foremost lay on the day-to-day business. Nevertheless, this did not inhibit the success of biodiversity seed companies. Even without strategizing they seemed to fulfil their purpose and were competitive. An elaborated theoretical framework appears less important compared to the practical arrangement, represented through the business model.

The **business models** of biodiversity seed companies **are diverse**, there is no best-practice example. Many routes lead to managing a seed business successfully. The choice depends foremost on the preference and attitude of the manager. Primarily it should suit her/him. Yet, certain key resources are emphasised: Patience is required in any leading position. It takes time to establish a successful company. Additionally, many obstacles accumulate especially at the beginning. Fortunately, financial, and physical resources play a minor role during this time. For vegetable seed multiplication only little mechanisation and equipment is required. Creativity masters most challenges.

Managing any kind of company also entails **responsibility**, more so when people are deployed. Biodiversity seed companies experience it intensified. As social enterprises do, they too work in service

of a bigger purpose. With their work they contribute amongst others to the conservation and development of plant genetic resources. The samples show that a responsive attitude is helpful.

For **marketing** the internet and especially social media platforms are suitable. Customers can follow the development and offers of companies. The range increases, customers can be retained. For biodiversity seed companies this presents an ideal opportunity. More and more they start to use the internet as a channel for advertisement and sales. In times of the SARS-CoV-2 pandemic, the total sales and especially the online sales increased, which also indicates their present relevance. Yet, there are customer segments that prefer offline channels. Biodiversity seed companies consider this by offering ordering with registered mail or sales via market stands and shops.

Finally, **networking** is important for business success. Biodiversity seed companies form partnerships with suppliers, retailers, shipping services, but also with competitors. The advantages are numerous. Partners help and complement each other.

The biodiversity seed sector is small, but the demand is high and growing. All aspects together pave the way for engaged entrepreneurs.

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List of Tables & Figures

Table 1: Interviewed companies and information about the interviewees	21
Table 2: Interview questions that aim to collect information for the adapted Business Model Canvas	23
Table 3: Interviewed companies with their essential characteristics.	30
Table 4: Processes executed by the sample biodiversity seed companies.	32
Table 5: Products, services and values offered by each biodiversity seed company.....	41
Table 6: Immaterial values asserted by interviewees	43
Table 7: Ranking costs from most important to least important, for nine interviewed biodiversity seed companies (Amarant did not provide information.)	55
Figure 1: Sample Plant Passport; (source: https://www.landscapeinstitute.org)	10
Figure 2: Tomato fruits with Tomato brown rugose fruit virus (ToBRFV) infestation (source: EPPO (2020) EPPO Global Database).....	10
Figure 3: Relationship between mission statement, strategy, and objectives; Changed after Carpenter et al. (2012 p. 163)	13
Figure 4: Concept map for the research	16
Figure 5: Business Model Canvas developed by Osterwalder & Pigneur (2010) design by Strategyzer AG	18
Figure 6: Values offered to customers and number of assertions.	47
Figure 7: Tree map of key resources. The number in brackets and size of the boxes indicate how many interviewees mention each activity.	49
Figure 8: Tree map of key activities of the sample biodiversity seed companies. The number in brackets and size of the boxes indicate how many interviewees mention each activity.....	50

Appendix I: Contact form (English)

Dear Sir or Madame,

my name is Vincent Pippich, I am currently working for ARCHE NOAH in the framework of the project 'Balkan Beets', which is funded by the Gene-Ethical Foundation (Germany) and coordinated by Emil Platzer, ARCHE NOAH (Austria). As part of the project, we want to support the establishment of biodiversity seed companies in Southeast Europe. To do so, we are compiling a catalogue about business and organizational models of existing biodiversity seed companies in Europe. The aim of the catalogue is to provide information on a range of strategies and organizational structures of successful biodiversity seed companies, to organizations and individuals who would like to contribute to the conservation of plant genetic resources in the Balkans by starting a company.

As you are managing a well-established and successful biodiversity seed company, I would like to ask you if you would be willing to share your expertise during an interview. The aim is to describe biodiversity seed companies such as (company name) in two pages (see attached the example for ARCHE NOAH). On the first page the 'Business Model Canvas' is used to describe the business model, and the second page illustrates the organizational structure of the seed production and distribution. I will also use the data in my Master Thesis (at the University of Natural Resources and Life Sciences, Vienna).

I would be very grateful if you could spare about one hour of your time for an on-line interview in the coming weeks (for your information, please find attached the Questionnaire as well as the Data Protection Declaration). Your insights into what makes a successful biodiversity seed company would be very useful for entrepreneurs who want to maintain diversity of agricultural crops through local & traditional varieties in Southeast Europe.

We are looking forward to learn more about your organization,

Vincent Pippich & Emil Platzer

Association ARCHE NOAH Austria

Appendix II: Contact form (German)

Sehr geehrte Damen und Herren,

Im Rahmen des Projekts ‚Balkan Beets‘ soll die Gründung von Biodiversität-Saatgutunternehmen in Südost Europa gefördert werden. Dazu soll ein Katalog erstellt werden, der die Geschäfts- und Organisationsmodelle von erfolgreichen Biodiversität-Saatgutunternehmen in Europa darstellt. Das Projekt wird von der Gen-ethische Stiftung (Deutschland) finanziert und von Franz Platzer, ARCHE NOAH koordiniert.

Als LeiterIn eines etablierten und erfolgreichen Biodiversität-Saatgutunternehmen, möchte ich Sie fragen, ob Sie Ihre Expertise im Rahmen eines Interviews teilen möchten. Ziel des Interviews ist es, das Geschäftsmodell und die Organisation von Ihrer Saatgutmanufaktur auf zwei Seiten (Vorlage siehe Anhang) darzustellen: auf der ersten Seite werden wesentliche Aspekte (Aktivitäten, Kunden, Vermarktungswege, etc.) anhand des ‚Business Model Canvas‘ erfasst. Auf der zweiten Seite wird die Organisation der Saatgutproduktion und Verkauf dargestellt. Die Informationen aus dem Interview werde ich primär für den Katalog des ‚Balkan Beets‘ Projektes verwenden, aber auch in einer Masterarbeit an der Universität für Bodenkultur in Wien.

Ich wäre Ihnen überaus dankbar, wenn Sie unser Vorhaben unterstützen könnten. Das Interview würde ca. eine Stunde dauern. Wir könnten es bei Ihnen vor Ort in Mössingen-Öschingen führen, aber auch Online über Zoom oder Skype, ganz wie Sie es bevorzugen. Wenn möglich, würde ich das Gespräch gerne auf Englisch führen, da der Katalog und die Masterarbeit ebenfalls in englischer Sprache verfasst werden. Zu Ihrer Information darf ich Ihnen den Fragebogen (Englisch) sowie eine Datenschutzerklärung zusenden (siehe Anhang).

Die Einblicke, die Sie uns in ihr erfolgreiches Unternehmen gewähren, wären sehr hilfreich für Jung-UnternehmerInnen, die auch in Südost Europa die Diversität von Saatgut durch Landsorten und alte Sorten erhalten möchten oder sich mit der Züchtung alternativer Sorten beschäftigen.

Wir freuen uns, mehr von Ihrem Unternehmen zu erfahren,

Vincent Pippich & Emil Platzer

Verein ARCHE NOAH

Appendix III: Interview Guideline

Dear Mr/s. XY,

thank you very much for participating in creating a biodiversity seed company catalogue. The catalogue will illustrate possible organisational structures of biodiversity seed companies. The goal of this interview is to understand and capture the business model of your company as well as how you organize the production and sales of seeds.

The interview will take about one hour. I will start with some general questions about your organisation. I will then ask questions to find out how you organize your seed production and processing and sales. After that I will ask about your customers, products, and services. I will also ask financial questions; Here I do not expect absolute numbers, just relative estimations, i.e., share of total revenue or cost.

Your personal data are protected. Nothing you say today will be quoted with your name. Please remember you are not obliged to answer any question, if you don't want to. You can stop the interview at any time. Do you have any questions regarding confidentiality? For later work steps, I would like to ask you if I have your permission to make an audio recording of this interview?

Start recording; “OK, [respondent name], thanks for letting me record this”

Introduction/ Warm-up Questions

1. How long have you been working for company XY?
2. Since when does the company exist?
3. What is the legal form of the company?
4. What kind of seeds/ planting material do you offer?

Main Part

5. What is the purpose of your company?
6. How do you achieve this purpose? (Concrete action steps?)
7. Do you assess the impact of your work? Do you use any specific indicator?
8. Please describe how you organize your seed production.
 - a. From where do you get your primary material/ seeds? (e.g., contract farmers, own production).
 - b. How do you process the seeds? (e.g., cleaning, packaging, quality evaluation, storage)
 - c. Where do you sell and deliver your seeds (Store, online shop)?
9. Could you please describe the types of people who buy your seeds?

10. Do you offer other products or services besides seeds?
11. Why do you think your customers come to you? What special value do you offer them?
12. Please describe the relationships, that you have with your customers.
E.g., do you know them personally? Are they involved in your company's development?
13. What are the most important sources for your company's success?
Please think in terms of equipment, employees, knowledge/skills, or financial aspects.
14. What are the most important activities for the functioning of your business?
Think about categories like Production, Problem solving, Research & Development, Networking
15. With whom do you work together (externals, like seed providers, delivery services etc.?)
16. What are your main income sources? What share does each contribute to your revenue?
17. What are your most important costs? What share of overall costs does each of them make up?
(Fixed Costs like salaries, rents, and machinery and Variable costs)
18. Would you rather say that your company tries to...
 - (1) offer unique type off seeds, which allows you to charge high prices,
 - (2) serve specific customers that are interested in heirloom varieties and landraces,
 - (3) mix of (1) and (2),
 - (4) other option

Ending Question

19. Are there important aspects, that you missed, or that came short during the interview? Do you want to add anything?

Conclusion

Thank you very much for taking your time to answer my questions. I will evaluate the results and fill the Business Model Canvas during the next days. I will send you this pre-version with the request to correct and comment if necessary. By the end of June, you will receive a sample of the catalogue.

If you have any further remarks or concerns, please do not hesitate to contact me. You can revoke your consent till July 31. 2021.

Appendix IV: Data Protection Declaration (English)

Thank you very much for agreeing to an interview for the preparation of a biodiversity seed company catalogue within the framework of the project Balkan Beets⁴. The data of the interview will also be used as part of a master thesis at the University of Natural Resources and Life Sciences, Vienna.

According to the Austrian Data Protection Act (§ 7 Abs. 2 Ziffer 2 DSG) we seek your consent to use the information from the interview in the biodiversity seed company catalogue and in the master thesis. Due to the nature of the catalogue, the results will be published referring to your company's name. However, you as informant will stay anonym.

We will send you the two pages summarizing the information you have provided to us for approval before we include it in the catalogue. The catalogue will be published with the information that you have approved.

Some excerpts from the interviews might be used in the master thesis, however these will be pseudonymized. Your name will be replaced by label, that is only known to the interviewer (Vincent Pippich).

To enable data analysis, I request your permission to record the interview. The audio files and any transcripts thereof will be deleted upon completion of the master thesis.

You can revoke your consent at any time with effect for the future. If you withdraw your consent, we will no longer process your data from that point in time. We will delete any (still) stored data.

If you have any questions regarding this survey or questions regarding data processing for the biodiversity seed company catalogue, please contact the person responsible for this study: Emil Platzer (Emil.platzer@arche-noah.at; ARCHE NOAH, Obere Straße 40, 3553 Schiltern).

For fundamental legal questions in connection with the data protection regulation DSGVO/FOG and student research, please contact the data protection officer of the University of Natural Resources and Life Sciences, Vienna, Mag. Jürgen Gruber (datenschutz@boku.ac.at). You also have the right of appeal to the Austrian data protection authority (e.g., via dsb@dsb.gv.at).

I hereby agree to the use of the interview data in the context of the biodiversity seed company catalogue and the master thesis.

Place, Date, Signature

⁴ Capacity building for crop biodiversity-based entrepreneurship and community biodiversity management in South-Eastern Europe by the association ARCHE NOAH (www.arche-noah.at) and financially supported by the Gene-Ethical Foundation (www.gen-ethische-stiftung.de).

Appendix V: Data Protection Declaration (German)

Vielen Dank, dass Sie einem Interview im Rahmen des Projekts Balkan Beets⁵ zustimmen. Ihre Teilnahme an diesem Projekt erfolgt freiwillig. Sie können jederzeit ohne Angabe von Gründen das Interview beenden oder einzelne Fragen nicht beantworten, ohne dass Ihnen dadurch Nachteile entstehen.

Nach dem österreichischen Datenschutzgesetz (§ 7 Abs. 2 Nr. 2 DSG) bitten wir Sie um Ihre Zustimmung, die Informationen aus dem Interview im Katalog der Biodiversität-Saatgutunternehmen und in der Masterarbeit, die an der Universität für Bodenkultur Wien eingereicht werden wird, verwenden zu dürfen. Aufgrund der Art des Katalogs werden die Ergebnisse unter Bezugnahme auf den Namen Ihres Unternehmens veröffentlicht. Allerdings belieben Sie als Informant anonym.

Für den Katalog werden wir die Information aus dem Interview in zwei Seiten zusammenfassen. Innerhalb einer Woche nach dem Interview senden wir Ihnen diese zwei Seiten zu und bitten Sie um eine separate Genehmigung. Der Katalog wird nur mit den von Ihnen genehmigten Informationen veröffentlicht. Für die Masterarbeit könnten einige Auszüge aus dem Interview verwendet werden. Diese Auszüge werden jedoch pseudonymisiert, d.h. Ihr Name wird durch eine Kennzeichnung ersetzt, die nur dem Interviewer (Vincent Pippich) bekannt ist.

Um die Datenanalyse zu ermöglichen, bitte ich Sie um Erlaubnis, das Interview aufzuzeichnen. Die Audiodateien werden nach Abschluss der Masterarbeit gelöscht. Nur die pseudonymisierten Transkripte werden aufbewahrt, entsprechend der Aufbewahrungsfrist für Forschungsdaten.

Sie können Ihre Einwilligung jederzeit mit Wirkung für die Zukunft widerrufen. Ein Widerruf hat zur Folge, dass wir Ihre Daten ab diesem Zeitpunkt nicht mehr verarbeiten und insbesondere (noch) gespeicherte Daten löschen.

Bei Fragen zu dieser Umfrage oder zur Datenverarbeitung für den Katalog wenden Sie sich bitte an die für diese Studie verantwortliche Person: Emil Platzer (Emil.platzer@arche-noah.at; ARCHE NOAH, Obere Straße 40, 3553 Schiltern). Bei grundlegenden rechtlichen Fragen im Zusammenhang mit der Datenschutzverordnung DSGVO / DSGVO und der studentischen Forschung (FOG) wenden Sie sich bitte an den Datenschutzbeauftragten der Universität für Bodenkultur, Wien, Mag. Dr. Jürgen Gruber (datenschutz@boku.ac.at). Sie haben auch das Recht, sich an die österreichische Datenschutzbehörde zu wenden (z.B. über dsb@dsb.gv.at).

Hiermit stimme ich der Verwendung der Interviewdaten im Rahmen des Biodiversität-Saatgutunternehmens Kataloges und der Masterarbeit zu.

Ort, Datum, Unterschrift

⁵ Kapazitätenentwicklung für auf Biodiversität basierendes Unternehmertum und Management der Saatgut Diversität in Südosteuropa“ Umgesetzt durch den Verein ARCHE NOAH (www.arche-noah.at), finanziell unterstützt von der Gene-Ethical Foundation (www.gen-ethische-stiftung.de).