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Decentralization and liberalization of seeds and plant genetic resources regulations in Europe: A Danish case study.

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Abstract

In a context of severe plant genetic diversity erosion, the regulatory framework of the European Union is perceived as a limiting factor for practices aiming to conserve cultivated biodiversity. To create more supportive frameworks, some EU member states liberalized seed trade and landraces cultivation at national or regional level. For this paper, a case study of the 2015 cereal and vegetable seed legislation reform in Denmark has been carried out. Interviews with stakeholders of the seed system, with farmers and project leaders impacted by this change and with key informant on the regulation, from NGOs and public authorities, have been done to collect. Inductive and deductive analysis methods enabled the themes and opinions of the interviewee to be extracted. Dialogue and lobby at decentralized scale appeared to have helped the implementation of the reform, thanks to the inclusion of the narrative for cultivated biodiversity conservation in the decision system. The reform created supportive framework for seed exchange between farmers and between gardeners, for the commercial and the non-commercial use of landraces and framed innovative seed system model, based on other trust building strategies. The new regulatory framework mainly decriminalized already implementing practices, but the lack of public support to the framed practices are hindering the creation of more positive effects. Nevertheless, Denmark has now one of the most tolerant legislation for seed trade and landrace cultivation, creating many ‘sidetrack’ next to the ‘highway’ of the formal seed system and proves that decentralization and liberalization of seeds regulations is possible.

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List of abbreviation

ABS= Access and Benefit Sharing

AU= *Aarhus Universitet* (University of Aarhus)

BEK= *Bekendtgørelse* (Law Order)

CBC= Cultivated Biodiversity Conservation

CSB= Community Seed Bank

DG SANCO= Directorate General for Health and Food Safety

DUS= Distinctness, Uniformity, Stability

EEA= European Economic Area

EU= European Union

FFA= Force Field Analysis

FSS= Formal Seed System

GIEE= *Groupement d'Intérêt Economique et Environnemental* (Group of Economic and Environmental Interest)

GNIS= *Groupement National Interprofessionnel des Semences et plants* (National Inter-professional Grouping of Seeds and Seedlings)

ICNCP = International Code of Nomenclature for Cultivated Plants

IFOAM= International Federation of Organic Agriculture Movements

ISS= Informal Seed System

ITPGRFA= International Treaty on Plant Genetic Resources for Food and Agriculture

LBST= *Landbrugsstyrelsen* (Danish AgriFish Agency)

MS= Member State

PBR= Plant Breeders' Right

PPB= Participatory Plant Breeding

PRM= Plant Reproductive Material

SEN= Seed Exchange Network

SSM= Soft Systems Methodologies

SWOT= Strengths, Weaknesses, Opportunities and Threats

TTIP = Transatlantic Trade and Investment Partnership

UPOV= *Union pour la Protection des Obtentions Végétales* (International Union for the Protection of New Varieties of Plants)

VCU= Value for Cultivation and Use

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1. Introduction

Seeds are the basic material of the global farming and food systems. They contain the genetic resources issuing from centuries of coevolution between plants and sedentary civilizations. It is also an essential input in agriculture, together with land and labor. Such long-lasting informal seed systems (ISS) based on seed exchange between farmers permitted the emergence of landraces. They are characterized by their “*adaptation to the environmental conditions of the cultivation area [...] and [their adaptation to] the uses, knowledge, habits, dialects and celebrations of the people who have developed and continue to grow it*” (Spataro and Negri 2013, p. 2422).

In the last century, the technological and scientific progress done during the Green Revolution, in the twentieth century, enabled researchers and companies to breed improved varieties, with advanced selection and multiplication techniques. Seeds became then of greater economic interests for companies and not anymore only for farmers. Whereas in the past, farmers themselves generated seeds improvement, nowadays in the global North and in important agricultural exporters, most seeds are purchased from private or public research in so-called formal seeds systems (FSS). (Louwaars 2002). These technologically improved varieties, called cultivars, are “*modern varieties [that] are bred to be genetically uniform to maximize production ability under those inputs that make the environment best suited to the crop as well as to meet the increasing demands of mechanized harvesting and handling, and meet supermarket quality controls*” (Negri et al. 2009, p.2).

Schematically, the evolution of seeds systems evolved from ISS to FSS in Europe in the last century. Four steps in seeds industry history has been defined by Pray and Ramaswami (1991, cited in Louwaars 2002):

- i) No seeds industry because no improved varieties (can be defined as a period of ISS)
- ii) Farmers start to use varieties from formal breeding but most seed is still produced by farmers
- iii) Introduction of private sector along with public enterprises, and
- iv) Most seed purchased; bred by private research (can be defined as a period of dominant FSS)

A complete shift from ISS to FSS required the ban of unimproved varieties use through education or regulation (Louwaars 2002). Thus, seeds and other plant reproductive materials (PRM) trade and cultivated varieties registration have been framed in many national and supranational regulations. In the case of the European Union (EU), the federal laws are ruling in 31 countries (the 28 Member States of the EU and the 3 other Member States (MS) of the European Economic Area (EEA), namely Iceland, Liechtenstein and Norway). This regulation is based on two main principles: (i) the registration of the varieties in a Common Catalogue and (ii) the certification of the seeds lots by official bodies (Winge 2012). To be registered in this Catalogue, a cultivated variety has to fulfil requirements of Distinctness, Uniformity, and Stability (DUS) and, for some species, of Value for Cultivation and Use (VCU). The structure of the EU law originates from the International Union for the Protection of New Varieties of Plants (UPOV) that established guidelines for cultivars registrations and plant breeders rights (PBR) in many European states before they were reunited under the EU

federal framework. These requirements being more adapted to the characteristics of cultivars, at least some landraces with no formal improvement cannot be certified and, thus, are forbidden for commercial use (Paavilainen 2009)

In the meantime, since the beginning of the 20th century, an erosion of plant genetic resources has been observed at a global level (FAO 2009a). The loss of landrace at regional scale has been also much documented (Hammer et al. 1996, Cebolla-Cornejo and Nuez 2007, Calvet-Mir et al. 2012, Spataro and Negri 2013). The causes of this genetic erosion are multiple and interlinked. Stagnation of selling prices of agricultural products and increasing production costs (Cebolla-Cornejo and Nuez 2007), changes in the nature of inputs in agroecosystems (Van de Wouw et al. 2009), natural disasters and allochthonous pests and diseases (Hammer et al. 2003, Cebolla-Cornejo and Nuez 2007), are among the main reasons of replacement of landraces by the higher-yielding cultivars. This replacement has consequence on agroecosystems, since cultivars need their environment to be adapted to their needs, thanks to inputs such as irrigation, synthetic fertilizers and pesticides (Moÿ and Kastler, 2009).

Furthermore, in the second part of the century, a trend of power concentration in the seed sector has also been observed. In 1985, the 9 biggest seeds companies represented only 12,5% of the seed market, and it raised up to 62% in 2012. The market share of the 5 biggest corporations even grew to 75% for maize, to 86% for sugar beet and to 95% for vegetables (Mammana 2014). The lobby power of these corporations allows them to benefit from government actions, creating a positive feedback for them (Howard 2009). This finding is alarming in regard with the theory developed by Heffernan et al. (1999) stating that an economic sector is no longer competitive when four companies control 40% of its share (Howard 2009).

Thus, strategies for cultivated biodiversity conservation (CBC), namely the specific, varietal, genetic and phenotypic diversity found in cultivated plants (Van de Wouw et al. 2009), and for Access and Benefit Sharing (ABS) of plant genetic resources must be implemented. Indeed, CBC is important, since safeguarding a wider genetic resources pool for agricultural species is needed for resilient farming systems facing environment and climate changes (Esquinas-Alcázar 2005). Moreover, the conservation of cultivated biodiversity enables to conserve associated cultural knowledge and traditions having an effect on crop productivity (Cox 2000, in Calvet-Mir et al. 2012).

To enhance the conservation of cultivated biodiversity, *ex-situ* and *on-farm* strategies can be implemented. *Ex-situ* conservation aims to keep individuals or small population out of their natural habitat, in an environment that protects them from any damages. First, seed banks, such as the Global Seed Vault, in Svalbard, Norway, and Fort Collins Seed Banks, in Colorado, USA, are facilities whose aims is to ensure a long-term and static conservation of plant genetic resources (Westegen et al. 2013). Their environment remains static and controlled, in order to protect them from damages, parasites, predators and diseases. Gene banks, zoological and botanical gardens, research institutes are the main stakeholders that implement such strategies (Hammer et al. 2003). On another hand, *on-farm* conservation is a rather dynamic management of plant genetic resources

in which the conserved agricultural varieties are cultivated and used by the farmers and gardeners who maintain it (Hammer et al. 2003).

Seed Exchange Networks (SEN), Participatory Plant Breeding (PPB) and Community Seeds Banks (CSB) are among the practices that can support both CBC and ABS. The principle of PPB is to involve multiple stakeholders into the breeding process, in order to better adapt the bred varieties to the different needs of these stakeholders (Chiffolleau and Desclaux, 2006). CSB are static conservation strategies that consist in collections of seeds done by farmers and gardeners (and other stakeholders if involved) whose first aim is to conserve locally and maintain cultivated biodiversity, in form of seeds and other PRM (Andersen et al. 2018). Finally, SEN implement conservation strategies by exchanging seeds between farmers and gardeners, in order to enrich the genetic pool of their own crop populations (Calvet-Mir et al. 2012, Pautasso et al. 2013, Coomes et al. 2015).

Moreover, in Europe, numerous networks and NGOs are supporting ‘seeds freedom’ initiatives and creating PPB programs and local CSB. Réseau Semences Paysannes in France, Red de Semillas in Spain, Rete Semi Rurali in Italy, Eco Ruralis in Romania and Arche Noah in Switzerland, Austria and Germany are among the most influential. These NGOs play also a lobbying role at the European Commission and at national and regional scale to build the case for conservation of cultivated biodiversity and the autonomy of farmers regarding seeds (Wezel et al. 2018).

At international level, the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA) established a framework in which the contracting parties can implement regulations that enhance both CBC and ABS. That is how, after having stated in its Council Directive 98/95/EC that *“it is essential to ensure that plant genetic resources are conserved”* and that a *“legal basis to that end should be introduced to permit, within the framework of legislation on the seed trade, the conservation, by use in situ, of varieties threatened with genetic erosion”* (1998, Preamble Paragraph 17), the EU implemented the Commission Directive 2008/62/EC, 2009/145/EC and 2010/60/EU for conservation varieties. These conservation varieties are registered regionally in a catalogue for which the requirements are less strict than for the commercial variety Common Catalogue. However, the cultivation of these conservation varieties is legally restricted geographically to its region of origin and limited in quantity (Winge 2012).

However, the outcomes of the regulatory framework on seeds marketing and cultivated varieties are discussed by ‘grassroots’ initiatives that make the link between these regulatory frameworks and the observed erosion of genetic resources. These laws are considered as hindering factor against in situ conservation of local and ancient agricultural, fruits and vegetables varieties. Indeed, as highlighted by Prip and Fauchald (2016, p.376), *“In light of the CBD and the ITPGRFA, EU legislation was softened through a derogation regime to provide better opportunities for conservation varieties, but the legislation remains rigid and the opportunities for farmers to save, use, exchange and sell seed and to promote crop genetic diversity remain narrow”*.

Thus, some NGOs and farmers try to circumvent these regulations to cultivate uncertified crops or exchanging certified varieties, such as Garden Organic in United Kingdom, Irish Seed Savers in Ireland and ProSpecieRara in Switzerland (Negri et al. 2009). Some of these practices end sometimes in judiciary troubles, like the one opposing *Kokopelli*, a French NGO of seeds swappers, and the seeds company *Graines Baumaux* in France (Winge 2012).

Between EU federal regulations and grassroots initiatives trying to circumvent them, some MS or regions adapted their regulation according to their local situations and to the federal directives. The first MS to have implemented such decentralized legislations is Italy, in regional laws for the protection of autochthonous genetic resources of interest to agriculture in Tuscany, Lazio, Umbria, Friuli-Venezia-Giulia, Marche and Emilia-Romagna between 1997 and 2008 (Bertacchini 2009, Mejias et al. 2016). Finland, in 2000, also implemented tolerant regulation for CBC, by facilitating the trade of landraces and their registration as ‘conservation varieties’ (Paavilainen 2009). Both cases in Italy has been reported to have successful outcomes in safeguarding landraces and having their cultivation developed on their territories (Paavilainen 2009, Mejias et al. 2016). Similar changes in national regulation has been implemented in Denmark in 2016, after the “Dialogue Forum on EU Variety Legislation” between the stakeholders of the national seed systems, from NGOs to professional breeders. This reform has been reported to be very tolerant for seeds exchanges and landraces cultivations by many NGOs (Seed Freedom 2016, Slow Food 2017).

The objectives of this Master Thesis are to understand what enabled these ‘tolerant’ adaptations of EU regulations, how they were implemented and how they affected the seed and farming systems of their countries. At the core of the Master Thesis will be studied the case of Denmark. The research aims to verify the following assumptions:

- i) The reform on PRM in Denmark liberalized seed trade and landraces cultivation in favorable way for CBC and ABS
- ii) Decentralization of EU regulation on PRM is achievable in any MS
- iii) Different strategies of decentralization can be implemented according to the local situations of seeds systems.
- iv) Decentralization of these EU regulations at national or regional scale induce positive outcomes for CBC and landrace cultivation.

To verify these assumptions, the following questions has been the basis of the research carried out for this Master Thesis:

How can PRM legislations be decentralized and liberalized towards cultivated biodiversity conservation in EU Member States?

- What enabled the reform in the Danish seed system context?

- What has been framed in the Danish PRM legislation that liberalized seed exchange and landrace cultivation?
- How these PRM regulations affects (and will affect) the Danish farming and seed systems and its stakeholders, as well as CBC and landrace cultivation?
- How did other EU MS implement decentralized PRM regulations and how did it affect local seed systems and CBC?

Researching what enabled the reform in the Danish seed system would provide the knowledge on whether it has been triggered by local specificities or not. If these characteristics are not singularities of Denmark, and can be found elsewhere, it would mean that it is possible to implement similar reforms in other MS or regions. The second research question aims to verify that the reform is indeed a liberalization of the EU regulatory framework, and to understand the opportunities framed in the new legislation. Then, looking for the improvements (or retrogression) that the reform brought to the Danish seed system is interesting to know to what extent such reform can be favorable for CBC and ABS.

Finally, researching the context, the content and the effects of the reform in other MS would substantiate the findings and patterns highlighted in the case of Denmark if similarities are found. Moreover, if it is rather differences in context and content that are found in comparing the cases, it would show that the case of Denmark is not the only pattern existing to create opportunities for CBC and ABS. It would confirm that different strategies exist in the liberalization of PRM regulation.

To answer these questions, a case study research has been carried out in the Kingdom of Denmark, more especially among the stakeholders of the national seed system, and among farmers that use landrace and uncertified seeds for their production (Yin 2009). Moreover, a comparative case study has been implemented between Denmark and other MS that established similar laws (Italy, Finland, as well as Austria and France), or that are trying to achieve this goal (Lithuania) (Goodrick 2016)

This Master Thesis has been carried out in the Department of Agroecology of Aarhus Universitet (AU), at Flakkebjerg Institute, Slagelse, Denmark. This research institute is leading a project titled “Vintage Vegetable Seeds Production” in which ancient Danish vegetable varieties of cabbage, peas and spinach with special traits of higher bitterness that may be beneficial for diabetic people (Thorup et al. 2018), are selected and multiplied. The aim of the project is to have these varieties more widely cultivated in the country in the next year. A better vision of the national regulations applying to these varieties is important for the achievement of this goal. One of the main focuses of this Master Thesis will be then to yield strategic insights for this project.

2. Methodology

To answer the research questions defined in the introduction, case study methods has been carried out thanks to semi-narrative interview done with stakeholders of the addressed farming and seed systems.

2.1. Research Strategy

As described in the introduction, the two research strategies used in this Master Thesis are the case study, implemented to study the PRM reform in Denmark, and the comparative case study, in order to compare Denmark together with EU MS that similarly reformed their PRM regulations

2.1.1. Case study of Denmark

The choice of a case study of Denmark as the first research strategy in this Master Thesis is motivated by the willingness to understand whether Denmark is a good example to follow for other EU MS and regions or not. Thus, a comprehensive research strategy taking into account the context, the content and the effect of these changes was needed in order to draw a complete picture of the situation of PRM legislation decentralization in Denmark and is made possible by the use of this research strategy. Moreover, the reform being quite recent and the seed systems being currently adapting to this reform, the studied topic is also an on-going phenomenon, easier to approach with case study (Yin 2009).

Thus, this case study of Denmark has been carried out considering the change in its PRM legislation as interlinked to the context of its farming and seed system, and the following evolutions in this very system as consequences of the reform, as described in Figure 1. The verification of these assumptions and the characterization of the links between context, content and effects will be thus one of the goal of this case study, as indicated by the red question marks on Figure 1.

The case study of Denmark will be focused on, considering the reform of the Danish AgriFish Agency (LBST, for *Landbrugsstyrelsen*) to liberalize PRM legislation in Denmark as the center of the studied phenomenon:

- a) The element in the political and agricultural context that enabled this change
- b) The content of the changes in the Danish regulatory framework
- c) The effects of these changes on the seed and farming system of Denmark

This case study has been carried out considering Denmark as an isolated seed system. Even if the Danish is very well integrated in a globalized seed system, this decision has been motivated by the facts, as it will be highlighted in the results, that no foreign stakeholders were involved in the Dialogue for the reform, and that the reform will mainly aim to impact the Danish seed system.

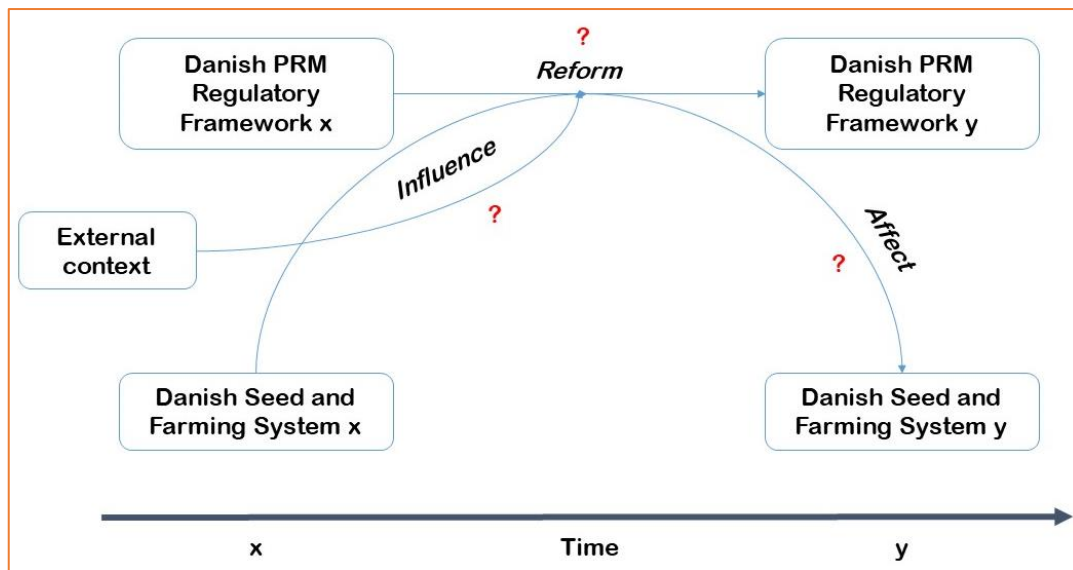


Figure 1: Interdependence between context/content/effects in Denmark case study

2.1.2. Comparative case study of Denmark and others MS

Together with the case study of Denmark, a comparative case study (also called comparative study of cases) has been carried out between the EU MS that implemented decentralized and liberalized PRM regulations throughout Europe.

The choice of substantiating the case study of Denmark with a comparative study of cases is motivated mainly by two reasons. First, during the research process, the existence of similar regulatory decentralization and liberalization on PRM (and of attempts to do so) has been highlighted thanks to literature and to the interviews carried out for the case study of Denmark. The implementation of these changes in these other contexts seemed to be different to the Danish one. Regarding the goals of this Master Thesis, it was thus of high interest to include the cases of these countries.

Moreover, since the changes in the Danish legislation are recent, a lack of step back on its effects on the seed and farming systems exists. Researching the effects of similar changes in Europe could have a prospective quality. Indeed, highlighting how farming and seeds systems changed in other contexts could help to know what long-term outcomes can be hoped from such liberalization in Denmark. The comparative case study will then be a tool to provide information on the effects of the changes in the context of Denmark.

The choice of the MS to include has been according to the criteria described in Table 1. The level of implementation, whether it is regional or national was not a criteria of exclusion from the list of MS to compare but another parameter to consider in the comparison. Any country that is still in the process of decentralizing PRM legislations as well as the countries that failed to would have been also considered in the comparative case study. Indeed, even if there is neither data to collect on the implementation of such laws nor on their effects, comparing the contexts that is enabling or that did not enable this implementation is still a relevant addition to the general picture of the research.

| | Countries | Level of implementation | Sources of information |
|---|------------------|--------------------------------|---|
| Countries that implemented decentralized regulations | Italy | Region | Literature (Bertacchini 2009, Mejias et al. 2016) |
| | Finland | Country | Literature (Paavilainen 2009) + Interviews |
| | Denmark | Country | Interviews |
| | Austria | Country | Interviews |
| | France | Country | Interviews |
| Countries that are trying to implement decentralized regulations | Lithuania | Country | Interviews |

Table 1: Countries compared in the Comparative Study of Cases

Thus, as described in Table 3, the context of these changes will be comparable between Denmark, Italy, Finland, Austria, France and Lithuania whereas the content and effects of the decentralized PRM legislation will be compared between Denmark, Italy, Finland, Austria and France.

The comparative case study will research, across context (Goodrick, 2014) and between the studied MS:

- a) Common patterns in farming and seed system context that ignite or disable the implementation of decentralized laws on PRM (in the case of the six compared countries)
- b) Difference between contents and implementation strategies of the decentralized PRM legislations (in the case of the five of the compared countries, Lithuania having implemented any change)
- c) Similarities and differences in the outcomes of the decentralized PRM legislation (in the case of the five of the compared countries, Lithuania having implemented any change)

2.2. Interviews

During this Master Thesis, 16 interviews have been conducted. These interviews are the main data sources to this report. The number of interviews were limited to amount of new information and new opinions expressed by the key informant. Interviews with other key informants were conducted until no more new insights emerged from interviews, and at this point, the situation will be considered as well enough documented.

2.2.1. Interviewed persons

Three categories of interviewees can be distinguished according to their role in the seed system and to the information sought from them: (A) key informants on law, (B) project leaders and farmers and (C) seed system stakeholders.

Key informant on law (A) are people that specifically work on regulatory question on seed trade and varieties certification in their countries. They can be part of NGOs, of certification bodies, of Ministries of Agriculture or researchers. Were interviewed as part of this category the persons, in the studied MS that:

- Wrote an article or a book chapter about the country's PRM regulatory framework in scientific literature
- Have been presenting the country's PRM regulatory framework in the Diversifood "Enabling Crop Diversity on the Market" workshop
- Have been actively involved in lobbying and dialogue for decentralized PRM regulations at their national scale.

Interviewing key informant on law was essential to have a competent and complete perception of the local regulatory framework, and on their context and history. In the category A, six persons has been interviewed for five of the studied MS, and the information they provided have been used to understand the context and the content of the reform.

Project leader and farmers (B) were interviewed in order to understand the effects of decentralized PRM regulations on CBC and landraces cultivation. Were selected as interviewees of this category, in the studied MS:

- the farmers that are involved in SEN, CSB or PPB practices
- the farmers involved in closed circuit seed systems, small-scale cultivation of uncertified varieties and conservation varieties cultivation
- the leaders of project aiming to contribute to CBC and landraces conservation by any of the above-mentioned practices.

The scale of the implemented projects was not a criterion of exclusion for project leaders interviewees. However, farmers working with grass and clover seeds were not interviewed, since it has been highlighted in the first steps of the data collection that the regulation of their trade remained unchanged. In the category B, four persons has been interviewed for two of the studied MS and the information they provided have been used to understand the content and the effect of the PRM legislations reforms.

Finally, **Stakeholder of the seed system (C)** that are not part of the categories A and B were also interviewed if:

- They have been involved in a dialogue or debate on the changes of their local PRM legislations,
- They are impacted by these changes.

They have been interviewed only in Denmark in order to obtain a multi-perspective overview of the context of the recent changes in regulations and of its effect on the seed system. They can be key informants from either seed certification institutions, seed breeding companies, agricultural research institutes or even lobbying group for FSS. In the category C, five persons has been interviewed and the information they provide have been used to understand the context and the effect of the PRM legislations.

Table 2 presents the distribution of the interviewed persons among the studied countries and among the categories defined above.

| | | Member States | | | | | |
|---------------|---|---------------|-------|---------|---------|-----------|--------|
| | | Denmark | Italy | Finland | Austria | Lithuania | France |
| Key Informant | A | 2 | 0 | 1 | 1 | 1 | 1 |
| | B | 3 | 0 | | 1 | | |
| | C | 5 | | | | | |
| TOTAL | | 10 | 0 | 1 | 2 | 1 | 1 |

Table 2: Key informant category interviewed in each studied Member States

2.2.2. Interview methods

The interviews has been carried out following two methods, mixed on-field to obtain the most relevant answers possible from the interviewees.

First, narrative interviews methods were used. They aim to explore a field that is not initially known by the interviewer, who must keep a posture of knowledge seeking, of genuine curiosity. The very first question of the interview must be opened enough for the interviewee to express his own story of the situation that is researched in a narrative and complex way. The ‘narration’ of the interviewee should not be interrupted and even encouraged to be continued by non-verbal or paralinguistic signs in order to keep their speech unaltered by the interviewer (Muylaert 2014).

Moreover, problem/theme centered interviews methodologies have been also implemented. They are often called ‘semi-structured interviews’ and follow a predetermined list of questions, in order to collect specific knowledge from the interviewee. The interviewer needs to keep flexibility in order to adapt the questionnaire and the interview process according to the answer given by the interviewed person (Longhurst 2016)

On the field, the two methods were in use. Interviews were usually started with a narrative question, except for the interviewee of the C category, where some details on their institutions and on their role in it were asked first, either in a formal or informal way. This very first question sought from the interviewee his perception of the local PRM legislation. The first topics addressed by the interviewed persons consist in a very valuable information, since they link them very closely to their local regulatory framework. When the interviewee finished to answer this first question, a theme-centered interview method was used in order to ask questions

on the topics described in Table 3 and that have not been addressed in the narrative answer. To get as much genuine information as possible from the informant, the non-verbal signs from the narrative interview methods has been used, to encourage them to go deeper in their answers.

2.2.3. Questionnaires

Since the information sought from the interviewed people were very different, as described in Table 3, the questionnaire for each of the interviewee's categories needed to be different. But, some similarities in the information needed has been observed. Table 3 describes the topics addressed by the questions in the interview questionnaires and to which category of interviewee they were asked to.

| Topics addressed during interviews | Key informant category | | |
|---|------------------------|---|---|
| | A | B | C |
| Opinion on the current PRM legislation in the interviewee's country | X | X | X |
| Status of the local cultivated biodiversity conservation | X | X | X |
| Specificities of the local seed and farming system that enabled this change | X | X | X |
| Opinion on further needed to support local CBC | X | X | X |
| Perspective on the future of the local PRM legislations | X | X | X |
| Context and origin of the regulatory change | X | | |
| Communication of the change to farmers and outside the country | X | | |
| Reason of the specific (or general) focus of the regulatory change | X | | |
| Tolerance of the authorities towards forbidden practices | X | X | |
| Benefit of the possibility to exchange seeds and grow non-commercial varieties | | X | |
| CBC practices implemented by the interviewee | | X | |
| Choice criteria for the implemented strategy | | X | |
| Advantages and disadvantages of the implemented strategy | | X | |
| Administrative requirements needed in the implemented strategy | | X | |
| Maintenance of the agricultural variety in the implemented strategy | | X | |
| Supporting and hindering factors in local legislation for the interviewee's activity | | X | X |
| Role and goal of the interviewee's institutions in the process of the regulatory change | | X | X |
| Role the interviewee's institution in CBC | | X | X |
| Regulatory need to support the interviewee's activities | | X | X |
| Perspective of the interviewee on conservation varieties | | X | X |
| Perspective of the interviewee on closed seed system | | X | X |

| | | |
|---|---|---|
| Perspective of the interviewee on non-commercial use of agricultural varieties | X | X |
| Perspective of the interviewee on heterogeneous material | X | X |
| Perspective of the interviewee on organic certified seeds | X | X |
| Role the interviewee's institution in the local seed system | | X |
| Involvement of the interviewee's institution in the regulatory change | | X |
| Relationship of the interviewee's institution with the other seed system stakeholders | | X |

Table 3: Topics addressed during interviews according to the key informant's category

The bolded question in Table 3 is the narrative one, the one aiming to get the opinion of the interviewee on their local PRM legislation, and maybe the most important one in term of significance of the answer for the Master Thesis researched topic.

2.2.4. Interview analysis methods

In order to extract information from the interviewees, most of them, when logistically possible and with the agreement of the interviewee, were recorded. It allowed interviews to be listened to several times. For the ones whose recording was not possible, exhaustive note taking of the interviewee speech has been practiced.

Two main interview analysis methods has been used in this Master Thesis, described by Mayring (2015) as “*the two central techniques of qualitative content analysis*” (p. 374), the inductive analysis, and the deductive analysis. Both of them aim to extract information from the interviews in order to form category and to identify theme addressed by them.

The main difference between both methods lays in the relationships between themes and meaning units. Graneheim and Lundman defined a meaning unit as “*a constellation of words or statements that relate to the same central meaning*” (2004, p.106), and a theme as a concept linking underlying meanings of different analytical units together, at an interpretative level.

Inductive analysis (also called ‘grounded theory method’) aim to identify theme from the meaning units found in the material collected in interview. This analysis has to be done without any preconceived ideas of what to find in there, in order to let the meaning unit and their aggregation into sub-categories and categories define the themes (Mayring 2015). On the other hand, deductive analysis (or ‘guiding terminology method’) works in an opposite way and aims to find meaning units in the collected material dealing with pre-defined themes and categories (Mayring 2015).

In the analysis method of the interviews performed for this Master Thesis, both methods were mixed. First, to be as close as possible to the opinion and theme addressed by the interviewee, an inductive analysis was

implemented. Then, a deductive analysis was added, in order to research specific themes that has not been identified by the inductive methods, and that have been defined as key themes for this Master Thesis.

The theme and opinions identified through this interview analysis methods were the basic material on which this Master Thesis has been build.

2.3. Data processing methods

In some cases, the themes and meaning units that emerged from the interview analyses have been processed through other methodological tools, that are described below. Even if the theme and meaning units extracted thanks to the interview analysis methods remain the main data used to write this report, the following methods helped to depict the context of the research, or to answer specific questions.

First, **rich picturing** has been used to ease the understanding of the context in which this Master Thesis had been carried out. This method comes from Soft Systems Methodologies, defined by Checkland as “*an organized way of tackling perceived problematical situations*” (2010, p. 192). Rich pictures intend to “*capture everything you know about a [...] situation without imposing any structure or analysis*” by “*a rich pictorial representation of the situation in all its messiness*” as defined by Armson (2011). In the context of this Master Thesis, it has been used to depict anything that is perceived to be part of the situation: things, ideas, people, connections, but also characters, feelings, conflicts and assumptions. It is only meant to be used by the researchers themselves, for their own understanding of the situation, because they are the only ones to be able to understand it without a long and useless explanation. That is why the rich picture cannot be found in this report. In this Master Thesis, rich pictures have been in use to have an overarching and pictorial summary and reminder of its context and of its assumed, and afterwards observed effect, in the case study of Denmark, but also for the comparative study of cases between Member States.

Then, **stakeholder mapping** has been used to understand the relationships between the stakeholders of studied seed system in Denmark. It aims to consider the power in the system and the level of interest in the project these stakeholders have and thus draw a better picture of an ongoing socio-political situation. It can finally, be helpful to understand and explain this same system, and for a project leader to organize a dialogue or yield strategic insights. This mapping has been done in a schematically and visual manner, in order to have an easily understandable picture of a given socio-political system (Newcombe 2002). Stakeholder mapping has been utilized in this Master Thesis in order to apprehend to complexity of the seed system, at European level, and more specifically at the Danish level, and has helped to understand the context of this research. To elaborate the map, specific questions dealing with the role of the interviewed stakeholder in the system and with their interest and perspective on CBC and non-commercial varieties cultivation have been asked.

Finally, to evaluate the different strategic insights developed for the Vintage Vegetable Seed Production project of AU Flakkebjerg Institute, in order to understand how viable they could be in the context of the Danish seed

systems and its newly changed regulatory framework, **Force Field Analysis (FFA)** have been carried out. It aims to consider the hindering force and supporting force that affects a strategy or a project, in its socioeconomic or natural environment. It permitted to identify the supporting forces on which a project can build on, and the hindering forces that needs to be resolved, avoided or fought (Armson 2011). FFA has been carried out without any weighting, since a more in-depth case context study would be have been needed to do so. The FFA have been elaborated thanks to the information about the vegetables varieties addressed by this project, and about the project itself, collected thanks to interviews with the local project leader. Moreover, the interviews carried out with stakeholders involved in the studied strategies provided insights on the hinderance and supports the strategies could have in their implementation.

3. Results: Case Study of the Danish PRM regulations reform

3.1. Structure of the Danish seed system

First, an overview of the seed system in Denmark will be provided, according to the available literature and to the outcomes of the interviews conducted with the stakeholders of this seed system, in order to understand the context in which the changes happened. In this part, the characteristics of the Danish seed system that enabled or limited the reform and its implementation will be highlighted.

3.1.1. Stakeholders of the seed system

The interviews carried out with the stakeholders of the seeds systems (categorized as C in the methodology) permitted to get a better picture of the structure of the Danish seed system, of the role of its stakeholders and of the relationships they have with each other.

Schematically, Figure 2 summarizes how the Danish seed system works and how its stakeholders interact with each other.

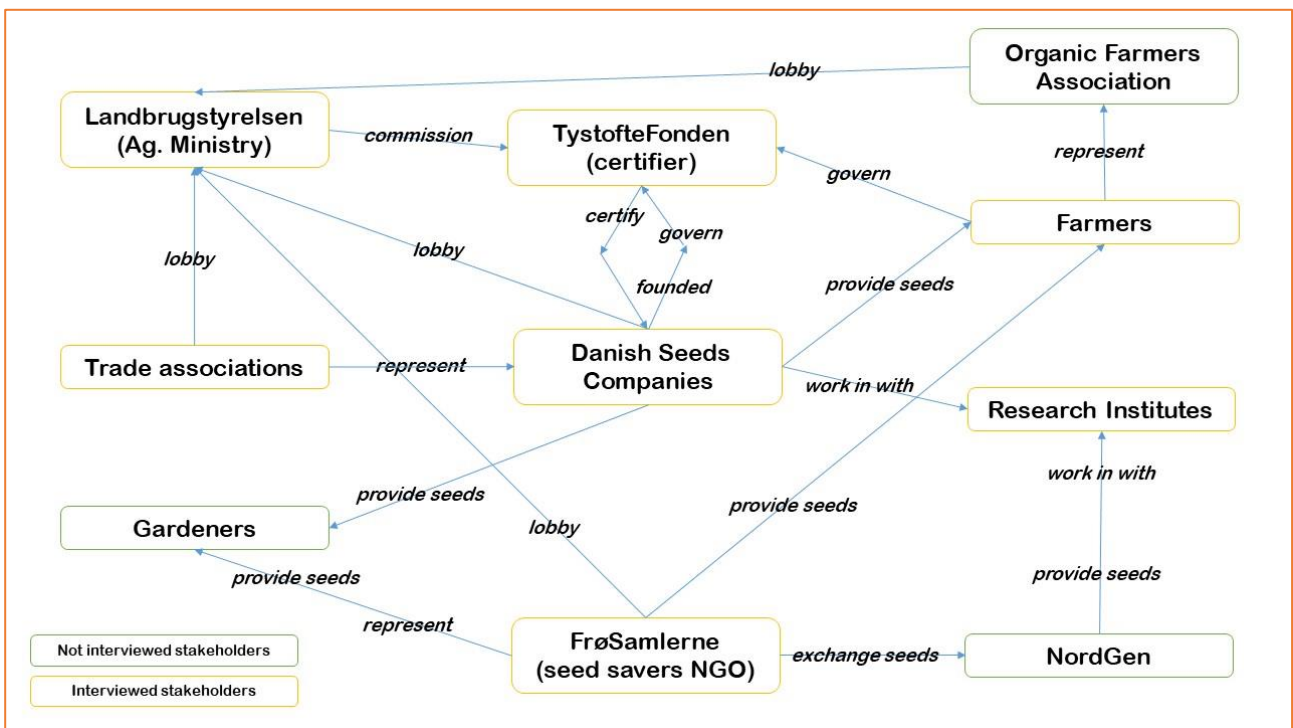


Figure 2: Relationships between the Danish seed system stakeholders

Danish Seeds Companies are in the center of the FSS in Denmark. Table 4 summarizes the main Danish companies involved in seed breeding and the agricultural and forage species they breed.

| | COMPANIES | CROPS |
|-----------------|----------------------|---|
| Large-Scale | Carlsberg | Spring barley |
| | Sejet Plant Breeding | Spring barley, winter barley, winter wheat |
| | Nordic Seed | Spring barley, winter barley, winter wheat |
| | DLF Trifolium | Forage grasses, red clover, white clover, fodder beet |
| | DSV | Forage grasses, red clover, white clover, |
| Micro-Companies | Maribo | Sugar beets, fodder beets, field pea, wrinkled pea |
| | Bio-Plant/Ølgaard | Leek, cabbage |
| | Eghøjgaard | Narrow leaved lupin |
| | Knold&Top | Swede, oil seed rape |
| | Reffstrup | Hop |
| | Kallehave | Pear, apple |

Table 4: Seed breeders in Denmark and their bred species. Modified from Solberg and Breian 2015

Even if numerous national breeding companies are present in the seed system, it is dominated by cultivars bred abroad. Indeed, in 2015, 423 cultivars were registered in the Danish catalogue, but only 177 (42 %) were bred in Denmark. The imported cultivars originated mainly from Germany (179), France (70), and the Netherlands (38). The importation from these countries even exceed the inner exchanges between Nordic countries (Solberg and Breian 2015). DSV is a quite special case, since the company is recorded as German, but many breeding activities occurs in Denmark and makes of this breeder one of the main actors of the national FSS. Moreover, farmer communities and local funds predominantly own DLF Trifolium, Sejet and Nordic Seed. The Danish FSS seems to be rather spared from the ongoing economic power concertation in the global seed system (Howard 2009, Mammana 2014). Different institutions, such as the Danish Seed Council or Dakofo, represent the interest of the companies of the Danish seed sector, as **seed trade association** and lobbyists. For example, the Danish Seed Council (*Brancheudvalget for Frø* in Danish) is managed together by seed breeders and by farmers, in order to lobby at national level for improved varieties and productivity in farming systems.

TystofteFonden is the seed certifier and variety tester of the Danish seed system. TystofteFonden appears to be one of only private national certifiers (if not the only) in Europe. The Landbrugsstyrelsen has commissioned this mission to them from January 1, 2017, and the International Seed Testing Association (ISTA) has accredited their testing methodologies and infrastructures. Their recent installation (2016-2017) has been funded by public money, by numerous private actors, such as Syngenta Nordics, KWS Scandinavia, Sejet Plant Processing and DLF Trifolium, as well as by several private funds, such as Idagaardfonden, Pajbjergfonden and AbedFonden, Its economic viability is ensured by the price of the certification of the variety payed by the applicant. The governance of TystofteFonden is provided by a board of directors comprising one member of LBST representing the interest of the Danish farmers, a Danish and a foreign plant variety owner, a the Danish seed trading companies. The responsibility of TystofteFonden is to carry out VCU and DUS testing, and to certify other PRM or cultivars that will be grown in Denmark, according to the guidelines of UPOV and to the

Danish national guidelines. The Foundation shows only a little interest in CBC, since their role is only to certify.

FrøSamlerne (the Danish Seeds Savers Organization) is the main actor for CBC and ABS in Denmark. It volunteers to find, collect, record and conserve plant genetic resources by spreading the use of these plant genetic resources among members of the association and building knowledge. More than 900 people were registered as members of this NGO in 2016. The activities of the NGO, in addition to providing a network between farmers and gardeners for PRM exchange, are the organization of weekend courses on the topic of seeds and gardening and the lobbying at national and federal scale for CBC and ABS. Finally, the NGO manage one CSB in Jutland, where the varieties conserved, exchanges and used by its members are stored.

Landbrugsstyrelsen (LBST) is the Danish Agricultural Agency (also known under the name of Danish AgriFish Agency), a department of the Ministry of Environment and Food of Denmark. Its role is to promote “Green transition” in the Danish farming system by implementing regulations, subsidizing farming activities and implementing controls to enforce these laws. LBST comprises a seed and plant division, that is very involved in the operations of the Danish seed system. Indeed, LBST organizes twice a year a roundtable meeting including most of the actors of the FSS described in this chapter, namely the seed companies, their representative institutions, as well as the Organic Farmers Association.

NordGen is the Nordic Genetic Resource Center, whose goal is to secure and safeguard plant and animal genetic diversity as a valuable resource for future of food and agriculture. NordGen works as a co-operation between Nordic countries (namely Denmark, Norway, Finland, Iceland and Sweden). This institution has been involved in conservation plant genetic resources for more than 30 years, and animal genetic resources since 2008 (Danish AgriFish Agency 2016). NordGen’s responsibility is to make available the plant and animal genetic resources they conserve. NordGen also manages and operates the Global Seed Vault in Svalbard Island. The Seed Vault now contains more than one million deposits from almost 6.000 species and 76 different depositors (Svalbard Global Seed Vault 2018)

Finally, **Research institutes** such as Aarhus University Flakkebjerg Institute works very closely with crop improvement and is even involved in CBC. Indeed, some research projects such as the Vintage Vegetable Seeds Production, in which this Master Thesis has been carried out, aim to develop the cultivation of old local vegetables varieties that disappeared from their local farming systems or that are threatened to, by multiplying and selecting them on the site. Two vegetative field collections working in collaboration with NordGen exists in these research institutes, in the Faculty of Life Sciences of the University of Copenhagen for fruits and berries and at University of Aarhus, in Årslev for vegetable (Danish AgriFish Agency 2016).

Other local stakeholders, such as **farmers** and **gardeners** can be very interested in exchanging seeds and cultivating landraces, especially small-scale and organic ones, but they have very low influence at the scale of the Danish seed system but can benefit from their representation by FrøSamlerne and by **Økologisklandsforening**, the Danish Organic Farmers Association.

3.1.2. Status of plant genetic diversity in Denmark

A very few sources in English deals with the situation in Denmark on plant genetic resource availability and erosion, the main one being the Country Report on the State of Plant Genetic Resources for Food and Agriculture of the FAO (2009a).

Despite the involvement of Denmark in the Nordic co-operation of NordGen, Poulsen (2009, p.69) stated that “Denmark differs from the collaborating countries [of the ITPGRFA] in making fewer efforts on plant genetic resources work”, since the inventories at this date were not in-depth researched and the accessions from the 1970’s and the 1980’s mainly (Poulsen 2009).

In 2006, LBST launched a program to support and fund on-farm conservation projects. In 2006, 13 projects were selected and 8 million DKK (1 million Euros) has been dedicated to them. In 2008, a second call for proposal ended with eight supported project and 4 million DKK (500 000 Euros) dedicated by LBST. The term of “on-farm” is debatable in this case since the recipients of these subsidies were nurseries, farm museums and public institutions rather than farms strictly speaking (FAO 2009b).

As part of the region of ‘secondary center of biodiversity’ in Northern Europe, Denmark could be considered as similar to Germany regarding the situation of landraces availability and conservation strategies. According to Vavilov (1926), Germany is a secondary center of diversity (where diversity has an exogenous origin, from the primary centers of diversity, such as Mediterranean Europe) and thus has lower autochthonous genetic diversity. On the top of that, Germany had already lost 90% of its cultivated biodiversity at the turn of the millennium. Moreover, the strategy of plant genetic resources conservation is rather *ex-situ* thanks to a robust gene bank system. On-farm management of landraces is marginal and done by private individuals with a limited cooperation with seed banks and botanical gardens (Hammer et al. 2002). Unfortunately, the lack of available sources in English does not permit to confirm the assumption that Denmark and Germany are similar regarding CBC status.

Stakeholders from research institutes have highlighted the unavailability of certain landraces whose cultivation has stopped in Denmark for several decades, in the NordGen and other institutional seed banks. Some of these landraces can be still found in seed banks from neighbor countries, especially Germany and Sweden, or in the CSB of FrøSamlerne. Unfortunately, it appears that most of the landraces that disappeared from the Danish agricultural landraces are not available as well in *ex-situ* conservation sites and collections.

There is thus a need for supportive framework for CBC and ABS in order to safeguard the remaining material, that are mainly available in the FrøSamlerne CSB as well as in the NordGen Svalbard Seed Vault.

3.1.3. Key facts on the Danish seed systems

From the context dealt with above, numerous singularities in the Danish seed systems can be highlighted.

First, the national seed system is a very small world. On one hand, it is very small geographically, since all the interview of the category C informants (key informants on the seed system) has been carried out in Copenhagen

(in yellow on Figure 3), and in the municipality of Slagelse, in Vestsjælland (in red on Figure 3). Slagelse Kommune seems to be one of the hotspots of seeds breeding in the country since it is where TystofteFonden, AU Flakkebjerg Institute and of a production site of DSV are located. Moreover, this system is small since there a few actors involved and that every interviewed stakeholders appeared to know the other interviewees pretty well, either from the biannual get-together at the Landbrugsstyrelsen, or from other professional collaborations. This biannual meeting of the stakeholders with the public authorities highlights that many things in the national seed system, from the orientation of the legislation to its inner functioning, are based on dialogue. Indeed, evolutions and conflicts in the seed systems can be discussed between those concerned, on a regular basis. The weight of farmers in the decision systems is also important, since they are very much involved in the governance of many institutions and companies of the seed system are represented in the biannual roundtable.

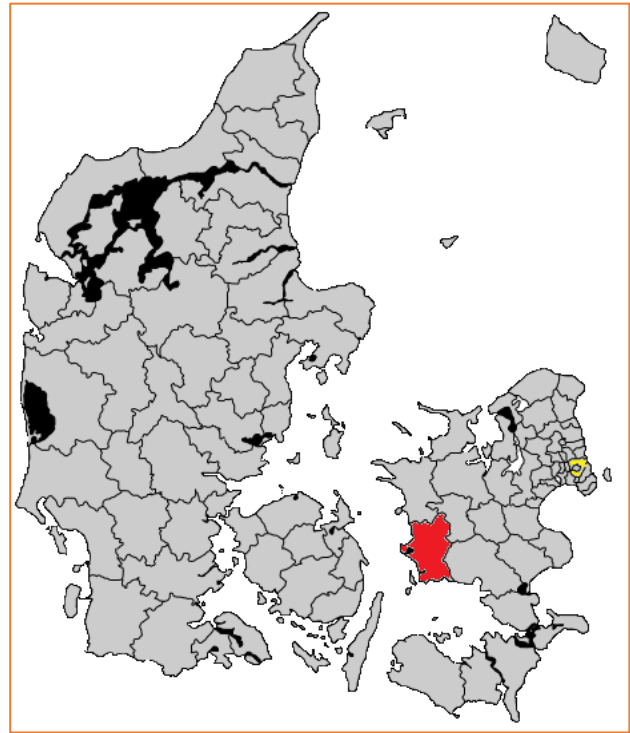


Figure 3: Locations of the main seed system stakeholders in Denmark (modified from en.wikipedia.org)

On the hand hand, the very specific private status of TystofteFonden and their close relationship of interdependence with seed breeding companies, whether they are Danish or not, could be considered as an important case of conflict of interest in this seed system. Moreover, its private status and its reliance on the price of its provision of PRM certification makes the price too expensive for grassroots movement and farmers to get all the landraces they use certified. The eased access to certification for companies that have the equipment to test seeds and the close relationship with the Fonden questions as well the fairness of competition between small- and large-scale institutions that are seeking for certification.

Finally, since most of the Danish seed breeding companies are position rather on grass and clover, as well as on a few vegetable species (spinach and chive), there would be no competitive and hindering lobby from these private actors against a liberalization of seeds trade and landrace cultivation that would address mainly vegetables and cereals. The absence of strong economic interest from Danish opens room for opportunities for vegetable and cereals to be traded and cultivated more freely.

3.2. Reform of the Danish PRM legislation

In this paragraph, the history behind the regulatory changes in the Danish regulatory framework, as well as the perspective and goals of the concerned stakeholders, will be described.

3.2.1. The ‘Dialogue Forum on EU Variety Legislation’

The changes in the Danish legislation on PRM originates from a concertation between the interested stakeholders of the seed system, titled ‘Dialogue Forum on EU Variety Legislation’ (*‘Dialogforum om EU-sortsløvgivning’* in Danish). This Forum took place at LBST offices during several meetings between 2014 and 2015, and were similar to the biannual meetings between the seed system stakeholders, and included ISS lobbyist, seed collectors and also, from March 2015, niche producers and NGOs (such as FrøSamlerne). This Forum took place in the context of the Organic Action Plan 2020 for Denmark and aimed to discuss how EU legislation can be amended to enable the production and trade of less uniform plant varieties without overriding the benefits of the existing system of control.

This Dialogue Forum is also an offspring of the dialogues that happened at EU level in 2013 on the legislation proposal made by the leading companies of the seed industry, through DG SANCO (European Commission Directorate-general for Health and Consumers Protection). The reform has been very discussed in Brussels, but the European Parliament has turned down this proposal. The dialogues it induced at national levels continued afterwards. In the Danish Dialogue Forum, 27 persons in total participated in at least one of the meetings of the Forum. Were represented in this Forum, by at least one person, the following institutions and stakeholders:

- TystofteFonden
- AU Flakkebjerg Institute
- NordGen
- Seeds breeding and agricultural companies: DLF Trifolium, DSV, Sejet, Seges
- Seed trade association: The Danish Seed Council, Dakofo
- The Danish Society for Nature Conservation (*Danmarks Naturfredningsforening*)
- Haveselskabet (NGO promoting gardening in Denmark)
- Økologisklandsforening (Association of Danish Organic Farmers)

Several individual farmers, as well as representative person of small-scale seed company and Danish gastronomy and food promoters were included in the Dialogue group.

The later inclusion of FrøSamlerne and other niche seed systems representative originates from a first change in the Danish law, issuing for this very same forum, that made the regulations in Denmark even stricter than the EU one towards the activities of seed exchange networks. In response to this tougher law, hundreds of complaints letter were send from gardeners, farmers and NGO members to LBST. The absence of FrøSamlerne and of any voices pleading for the cause of CBC was one supplementary reason of complaints. The number of

received letters convicted the Ministry to give voice to these silenced part of the national seed systems, and to integrated their narrative to the dialogue.

The inclusion of the narrative for CBC and ABS into a dialogue at national scale, and into the decision system of the Danish seed system has been highlighted by the pro-reform representative as a key event in the implementation of this reform. Lobby from the NGO and dialogue together with all the stakeholder of the seed system has been both essential tools to enable the reform to happen.

3.2.2. The ‘Highway’ and the ‘Sidetracks’: Goals and perspectives of stakeholders

The diversity of stakeholders taking part in this dialogue let it face diverging opinion towards the future orientation the Danish seed system should take. Interviews carried out with the Category C stakeholders has provided information about their goals in this dialogue, and about their opinions on the implemented changes.

FrøSamlerne and other ISS representatives’ goals in this Forum were to have more tolerant regulations towards seed exchanges and landraces cultivation. Indeed, they wanted to have the already implemented practices of small-scale farmers and seed collectors legalized, in order to sustain their activities. Their wish was to have regulations that enables both conservation and use of the threatened cultivated biodiversity. Moreover, the experience of the 2013 new EU seed regulation proposal let the NGO believed that a similar proposal could enter into enforcement in the following years, and would finally criminalize their activities. Lobbying for change at local scale is thus done to create more robust legislations at national and regional scale. Indeed, if numerous MS implement decentralized regulations, as many seed savers NGO and organic farmers association are lobbying for, driven by Arche Noah as front-runner, regulations would be less likely to be changed at federal level since it would force many countries to go backwards on their regulations. Micro breeding companies, as well as the Organic Farmers association has also interests in opening opportunities in the national regulatory frameworks, since authorizing new production strategies could benefit both environmentally and economically to the farming system. These stakeholders enabled farmers and gardeners that are interested in conserving and using cultivated biodiversity to have a voice in the negotiation at national scale.

For the seed breeding companies and their trade associations, the goal of this concertation was to try to find ways to introduce the newly framed heterogeneous material and conservation varieties cultivation into their business in order to tackle the issue of cultivated biodiversity erosion. The fact is that some of the interviewed person from formal breeding institutions do not believe that NGOs and individuals practicing seed exchange and cultivating unregistered landraces make a valuable contribution to CBC. Indeed, these grassroots movement are dealing with unimproved varieties that cannot fulfil the need of the farming system, in quantity and in processing quality. Interviewees consider FSS contribution to CBC greater, as it provides always newly improved varieties for farmers, with better agronomic and industrial characteristics.

Both large-scale breeding companies and legal institution believes in the efficiency of the formal Danish seed system that ensure high quality food, high yield and good economic performance for the sector, thanks the DUS, VCU requirements and to the PBR attached to the agricultural varieties. In this Dialogue, they were not particularly interested in CBC, as it is considered by grassroots movements, but rather by ensuring that the changes in law does not challenge their current operation strategies and the power of the sector at EU level.

Finally, for the governmental bodies and for TystofteFonden, the goal was to fulfil the wish of the other involved stakeholders in terms of regulatory changes, but mostly to maintain the existing certification and plant breeders' rights (PBR) system in place, since it gives yet satisfaction to most of the stakeholders and ensures a stable and performing Danish farming system. LBST had little more interest in implementing more tolerant rules towards CBC, since the Danish Ministry of Agriculture had to honor his commitments as signatory parties in the ITPGRFA and in the Nagoya Protocol.

As expressed by an interviewed stakeholder at TystofteFonden, the 'Highway' and the 'Sidetracks' is an allegoric way that clearly depict the vision of the Danish seed system by the stakeholders. The highway defines the 'mainstream' seed systems, the formal one, where cultivars certified in the Catalogue and protected by plant breeders rights (PBR) are grown in a large-scale commercial exploitation. On the other hand, the 'sidetracks' are the practices inspired from ISS that gardeners, farmers and NGO implemented to conserve and use the cultivated biodiversity.

In the Dialogue, the shared vision has been to authorize anybody to 'drive on' the sidetracks if they want, since the 'highway' cannot be outcompeted by these alternative roads that will be used by a minority of growers and representing a marginal niche economic sector. Both can grow and be flourishing markets (whether they are niche or large-scaled), and NGOs and grassroots movements did not seem to have the willingness to make the Danish FSS collapse.

The level of interest in CBC and the influence of the stakeholders in the context of this 'Dialogue Forum on EU Variety Legislation' are summarized in the stakeholder map in Figure 4 below. This figure has been elaborated thanks to the stakeholder mapping methodology (described in part 2.3). The level of influence and of interest for CBC has been deducted from the interviews with the named stakeholders, as well as from the perspective of the other stakeholders.

Despite divergent perspectives, the non-competing interests between the stakeholders of the FSS and of the grassroots movement made the dialogue forum's success in finding a common ground on which a reform could be implemented. Thus, from there, amendments to the laws framing the new PRM legislations in Denmark has been edited from September 2015 to December 2015. These regulatory changes mainly focus on vegetables, and, to a lesser extent, on cereals varieties. Not much liberalization happened on grass, clover and other forage PRM since seed breeding companies and their trade association (*Brancheudvalget for Frø*) did not see the competition to their business it could have generated in a favorable way.

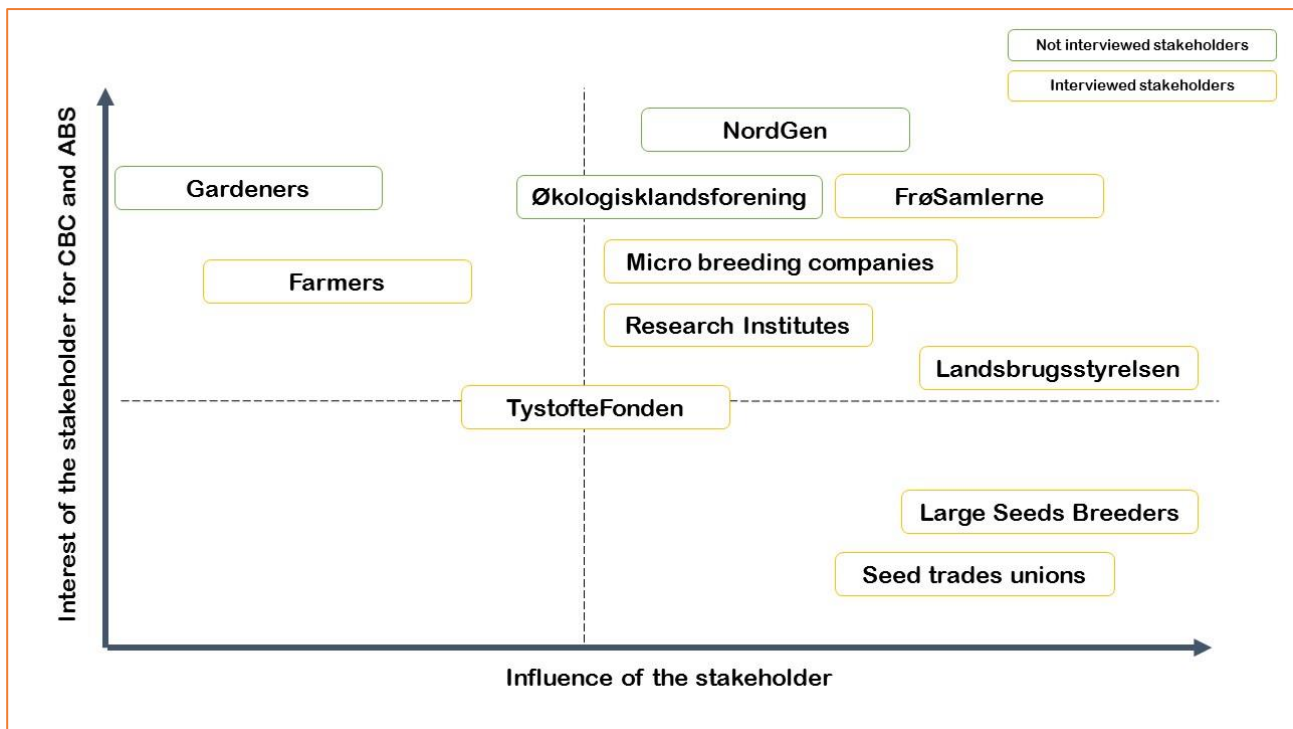


Figure 4: Stakeholder mapping of the Danish seed systems actors towards CBC

3.2.3. Amendment of the law

The changes in the law were contained in the amending *bekendtgørelse* (BEK, law order) no. 1033, no. 1034 and no. 1035 of the 3th September 2015, respectively dealing with cereal seeds, agricultural seeds (including clover and grass seeds) and vegetables seeds. The new regulations have been later translated into new law text, namely BEK no. 1511 (on agricultural seeds), no. 1549 (on cereal seeds), and no. 1550 (on vegetables seeds) of the 11th December 2015.

The specificity of the changes of the Danish law lays in the Article 2(a) of the Council Directive 2002/55/EC on the marketing of vegetable seeds, stating that:

“ ‘marketing’: shall mean the sale, holding with a view to sale, offer for sale and any disposal, supply or transfer aimed at commercial exploitation of seed to third parties, whether or not for consideration.

Trade in seed not aimed at commercial exploitation of the variety, such as the following operations, shall not be regarded as marketing:

- the supply of seed to official testing and inspection bodies,
- the supply of seed to providers of services for processing or packaging, provided the provider of services does not acquire title to seed thus supplied.”

The vision of LBST is that this list of non-commercial exploitation is not an exhaustive one, meaning that any other non-commercial cultivation strategy that is not forbidden elsewhere in this directive is possibly

implementable in Denmark. The new Danish regulation also focuses on the second part of the Article 2(a) stating that:

“The supply of seed under certain conditions to providers of services for the production of certain agricultural raw materials, intended for industrial purposes, or seed propagation for that purpose, shall no be regarded as marketing, provided the provider of services does not acquire title to either the seed thus supplied or the product of the harvest. The supplier of seed shall provide the certification authority with a copy of the relevant parts of the contract made with the provider of services and this shall include the standards and conditions currently met by the seed provided”

This regulatory provision, known as “closed seed systems” or “closed system” has been translated unchanged in the Danish regulation. Further details on both opportunities, and on the other cultivation and seed exchange strategies enabled by the newly modified will be provided in the paragraph 4.3.

If the Danish AgriFish Agency created this reform in the framework of the EU law, taking advantage of the grey areas that were existing in its provisions, it means that it can be done by any other MS willing to take a similar step.

3.2.4. Communication of the new regulations

In order to spread the word about the change in the national Danish regulations to hobby gardeners and farmers interested in the conservation of local and ancient agricultural varieties, various materials were edited and published by LBST, mainly in Danish

First, a report was published by LBST, in several languages. This report has been titled “Seed and cereal seed: Guidance for hobby gardener, seed collectors and companies on rules and practices for trade and transfer of seeds for non-commercial use and conservation”. Since the amendment of the Danish regulatory framework are not translated into English, this report, in its English version, is the main source of information on the topic, even if it does not have the same legal quality. It contains information about what is legal when it comes to the cultivation of any cultivated variety, and contains several paragraphs dealing with the causes of genetic erosion and with the need to conserve landraces and cultivated biodiversity (Landbrugsstyrelsen 2017). This report explains the current regulatory framework in Denmark and what can be done or should be done according to the level of certification of the varieties. At the end of the report, a diagram summarizes the type of certifications that a variety should have and the linked requirements that are needed to fulfill for commercial or non-commercial use. This diagram has been translated from Danish to English (and adapted to the needs of this report) in Figure 5.

Moreover, an explanatory postcard has been edited by the LBST (Figure 8, in Appendix A), and it transcribes the diagram from the above-mentioned report in a playful and colorful yes-no diagram. It starts with the question “What seed rules does apply to me?” (“*Hvornår gælder frøreglerne for mig?*”), and according to the answers given, it finally give a small statement on what can be legally done, and give links to the website of

LBST for further information and needed administrative procedures. It is thus addressed to those who would like to be involved in CBC and to be in good standing with current rules. Then, a representative person of LBST has carried out a presentation in one of the Diversifood “Enabling Crop Diversity on the Market” workshops in Tuusula, Finland, in November 2016, to communicate about the case of Denmark PRM legislation liberalization among NGOs member and representatives of other MS Ministry of Agriculture.

Even if this communication seemed to be quite efficient, the knowledge on the current regulations seemed to differ from one person to another. Indeed, during the interview, it appeared that if most of the stakeholders of the farming and seed systems knew about this decentralized and liberalized regulations in Denmark, the knowledge of the changes in the law was quite different. Depending on the situation and on the position of the interviewee in the seed system, the focus of their knowledge of the law was very different. Moreover, the lack of sources in English, apart the report from LBST and the few articles from NGOs’ websites, handicapped the communication of the case of Denmark outside the border of the Kingdom. But, even if the knowledge of the law was not equal among the stakeholders, it proves the genuine interest of the Danish AgriFish Agency in informing the farming and gardening communities of the reform, and in the changes it may bring in the farming and food systems.

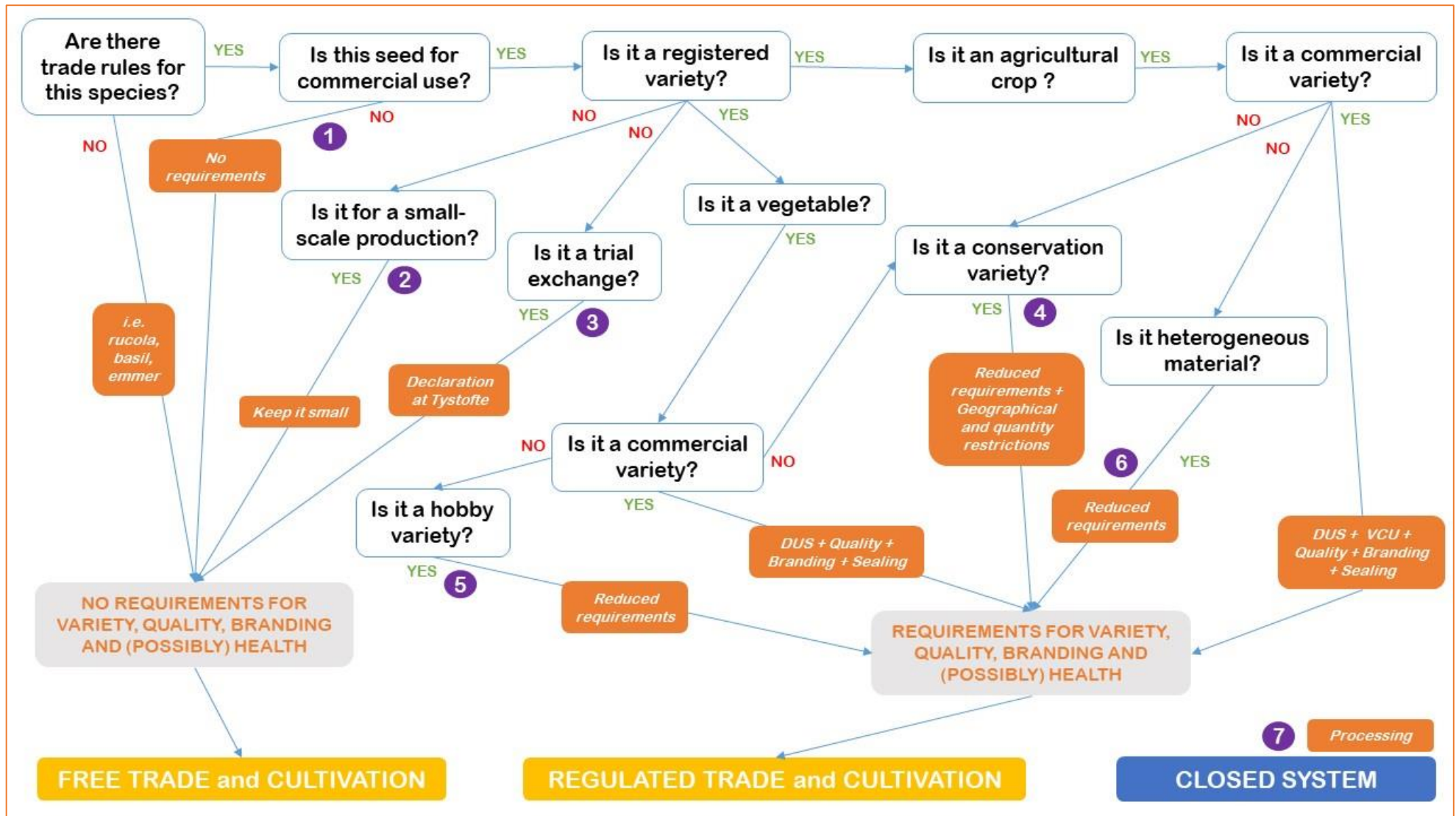


Figure 5: Trade and Exchange of Seed Possibilities according to Danish seed law. Adapted and translated from Landbrugsstyrelsen, 2017

3.3. Opportunities permitted by the Danish law

In this paragraph, opportunities for CBC, seed exchange and landrace cultivation enabled by the current Danish legislation will be further explored. Figure 5 (see previous page) summarize schematically the possibilities opened by the Danish PRM legislation and the requirements linked to every kind of trade and cultivation types. This scheme has been translated and adapted from the communication postcard edited by LBST (see Figure 6. Appendix A) and from a similar scheme, in Danish, from the *Frø og sædekorn* communication report from LBST. The numbers in the grey circles in Figure 5 indicate the sub-paragraph in which the seed trading or/and cultivation strategy case will be further explained.

3.3.1. Non-commercial use

As written in sub-chapter 3.2.3., LBST considers the list of non-commercial use of seeds of the Article 2(a) of the Council Directive 2002/55/EC as non-exhaustive. The report they edited adds to the two examples listed in the EU directives and thus extend the definition of non-commercial use. The examples added by LBST report are listed in Box 1.

- A family grows some vegetables and exchanges seeds of e.g. tomatoes, peas and chili with family, neighbors and friends.
- An entrepreneur creates a visiting farm with a large vegetable garden, where they build a collection of conservation and hobbies, primarily vegetables and herbs. There are pop-up events and courses in cultivation and use of the crops. Seeds were originally obtained via conservation networks, NordGen and private gardeners. Gradually, they are almost self-sufficient with seeds and plants and wish to resell them to visitors for private use.
- An association aims to preserve the cultivated diversity by, inter alia, to collect and grow old varieties and use them in the kitchen. Courses are held on how to collect their seeds themselves. Non-members are also welcome. Several members of the association have for decades developed improved plants / seeds. The seeds are delivered to NordGen. The seeds are exchanged between the members, possibly against payment of shipment, but is also sold on an increasing number of markets around the country.
- A couple of garden enthusiasts have started a group on Facebook, where both seeds and plants are exchanged, as well as sharing good advice and experiences about cultivation. The seeds are surplus of both self-produced (for example, on the basis of Grandma's pumpkin, as well as the peasants peas and beans) and bought seeds. It is customary to cover shipping costs and, in some cases, also pay too much demanded seeds and plants.
- A library has established a special scheme whereby citizens can borrow and exchange seeds of conservation and hobbies varieties. The citizen may could not deliver seed back nor in the same condition as received. There is no money involved. The library also includes plant and seed exchange days.
- A museum has a special unit for historical varieties of flowers and vegetables. They exchange seeds and cuttings with other museums. They sell seeds to visitors. The museum also hosts plant and seed exchanges for visitors.”

Box 1: Example of non-commercial use of seed given by LBST report (p.13)

As described in Box 1., this component of the law is more specifically dedicated to gardeners, private users of seeds, as well as small-scale *ex-situ* conservation strategies, authorizing them to exchange between each other

and to sell some to private individuals. Indeed, LBST consider that commercial trade and use of seeds is “*the commercial agricultural or horticultural production*”. Thus, selling and exchanging seeds of unregistered, hobby or even conservation varieties to gardeners is authorized without any conditions. There again, the list provided by LBST is not an exhaustive one and other non-commercial use strategies of PRM can be implemented, as long as they do not contradict the definition of trade by LBST.

This provision frees the exchange of seeds among farmers and develop a supportive framework in which gardener networks, seed savers networks, community seed banks, vegetative collection and other collective initiative for CBC can develop. It also acknowledges the contribution of gardeners, and of the member of such networks in plant genetic diversity safeguard, and that CBC as important for hobby activities as its it for professional cultivation

3.3.2. Commercial non-industrial use

Within the definition of non-commercial use by LBST, small-scale commercial use of varieties that are not registered in the Common commercial catalogue seems to be authorized.

Indeed, when the subject was addressed with the stakeholder from legal institutions, they clearly said that if a farmer wanted to sell some vegetable from landraces on a village market, or thanks to other alternative local food systems, LBST would not forbid such practices, as long as it remains at a small-scale. The provision of seed for such small-scale use can be done from conservation varieties, hobby varieties, or even unregistered material. Small-scale commercial use also include selling seeds as micro-breeding companies to private gardeners, from hobby, conservation or unregistered material.

In the postcard edited by LBST, two of the questions of the mind map are defining this difference (see Figure 6). The question “*Tjener du en skilling på dine frø?*” (do you earn any cents from your seeds?) does create any differences, meaning that the answer does not matter in any way. The difference is done according to the answer to the question “*Skal frøene bruges til en større produktion i et væksthhus, gartneri eller på friland?*” (Shall the seeds be used for a larger production in a greenhouse, horticulture or outdoors?). If the answer is no, any kind of exchange (or trade, if the seed owner get some cents from it), is authorized (“*så kan du bytte alt det du vil*” meaning “then you can exchange anything you want”).

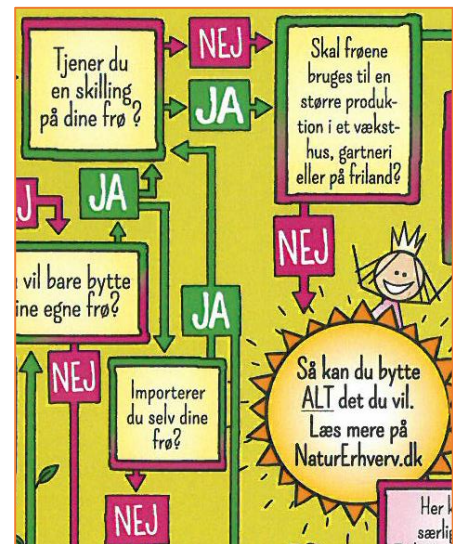


Figure 6: Part of the postcard edited by LBST

The difference between free and regulated trade of seeds is thus not anymore between commercial use and non-commercial use, but rather between industrial use and small-scale use. The question that raise from there is to know where the limit is between both. Not selling the agricultural

products to any warehouse and the absence of any intermediaries between the producer and the consumers (for both agricultural products and seeds) has been defined as a non-industrial use by one of the interviewees. Thus, this provision in the Danish law seems to be very well adapted to vegetables cultivation and commercialization for smallholders' market gardening that want to both use and conserve landraces.

But, the provision form non-industrial commercial use has been addressed by only a few stakeholders during interviews. It seems to rely more on the leniency of the law enforcement by LBST, than on the actual content of the regulations. Thus, a grey area persists in the regulatory framework of seed trade and commercial use of non-commercial varieties, in which landraces cultivation would be very dependent on possibly fluctuating enforcements. This provision is a major step forward for CBC and ABS because it can be uses by farmers and consumers involved in local food systems, CSAs and other innovative organizational model for food consumption. But to develop its use on-field and on-markets, the regulatory grey area around this provision must be cleared and the knowledge of its existence spread wider.

3.3.3. Exchange for trial and development

Another provision in the reform frames the possibility to exchange seeds between professionals as material for trials and research. The goal of this provision is to facilitate innovation and both informal and formal improvement of genetic resources as a cooperation between seed systems stakeholders. It also authorizes farmer to test if a certain variety can have a long-term commercial or agronomic value.

This exchange of PRM can happen between farmers or with seed breeders and research institutes in small amounts. To what extend the amount of exchanged seeds is small has not been defined in the regulation. After the exchange, the farmers can keep the exchanged seeds as long as they want and can even introduce the seeds they obtained in they populations (and make a commercial exploitation of it). The exchange of the same seed material can be renewed for several years, the maximum being three years in a row, but there is no limit in term of number of different exchanged materials. The only legal requirement when seeds are exchanged for trial and development is to notify this exchange to TystofteFonden, stating what is the exchanged variety, what is the goal of this test and what is the time during which the tests will be carried out.

For farmers interested in getting more independence from FSS, this provision enables to exchange almost as many seeds as they want with their colleagues, and thus to diversify their genetic pool through informal varietal improvement. It also decriminalizes a widespread practice among farming communities, without hampering in any way the use that can be done from the exchanged material. Finally, it opens legal opportunities in which PPB program can be launched.

3.3.4. Conservation varieties

LBST adapted the Commission Directive 2008/62/EC of the 20th June 2008 and 2009/145/EC of the 26th November 2009 on the agricultural species and vegetable conservation varieties into the Danish PRM regulations.

A variety can be certified as a conservation variety if it copes with requirements in independence, uniformity and stability more lenient compared to the certification for commercial varieties. Conservation varieties are also not tested for value of cultivation. A few other requirements must be fulfilled. The variety must be registered in NordGen, and NordGen must have accepted the responsibility of its long-term conservation. Varieties that are on the commercial catalogue list or that has been withdrawn from it in the past two years cannot be certified as conservation varieties. Finally, after the registration of the variety in the conservation Catalogue, there is no obligation for approval of seed before sale, nor for analysis by a laboratory. Application for certification must include:

- Variety name and characteristics description
- Results from any unofficial test carried out, and information from any responsible institution (e.g. NordGen)
- Information on practical experience with cultivation, multiplication and use
- Information about the region of origin of the variety

The information on the original region is important, since geographical and quantitative restrictions exist for conservation varieties cultivation, since it is restricted to its region of origin. The registration form for the application can be found on TystofteFonden website.

The ‘Dialogue Forum on EU Variety Legislation’ permitted to launch discussion for the creation of a common region for conservation varieties in the Nordic countries between Norway, Sweden and Denmark, that would extend the area of cultivation to more than a single country or region. TystofteFonden determines the quantitative restrictions and notifies every year the producers and maintainers of the conservation varieties how much seeds can be traded the next year. The total amount of seed per variety and per year shall not exceed the limits defined by the EU directives and translated in the Danish law orders.

This provision authorizes the cultivation of landraces that cannot cope with the commercial varieties certification, in a framework that is very similar to the rules governing certified varieties, the main differences being the lenient DUS, the quantitative and geographical restriction and the absence of PBR for the maintainer. This provision seems to address the needs of farmers (or networks) willing to conciliate both conservation and commercial cultivation of their landraces. But the absence of PBR, as well as the framed restrictions, seem to limit the possibilities for viable commercial use of these conservation varieties. The purpose of a conservation variety would thus only be the safeguard and the maintenance of the variety.

3.3.5. Hobby varieties

Hobby varieties are defined as “*varieties of vegetable that have no intrinsic commercial production value, but which are developed for cultivation under special conditions*” (Landbrugsstyrelsen 2017, p. 16). These special conditions include particular agro-technical, climatic or pedological conditions.

Hobby varieties must be registered in the national hobby varieties Catalogue, and similarly to the registration of conservation varieties, the application must include:

- Variety name and characteristics description
- Results from any unofficial test carried out, and information from any responsible institution
- Information on practical experience with cultivation, multiplication and use

The characteristics description and the test carried out the certifier must confirm that this variety has actually no commercial value, and comply with (lenient) distinctiveness, stability and uniformity tests. The registration form for the application can be found on TystofteFonden website. Once certified, the seed must be sold in sealed package whose maximum weight is determined, per vegetable species, in BEK no. 1550 of the 11th December 2015. The sales do not need the prior authorization by TystofteFonden but must comply with Danish and EU regulations.

This provision for hobby varieties mainly liberalized the trade of landraces for small-scale and micro-breeding companies. The hobby varieties appear to be dedicated to small-scale use and for gardening, and could be used, as well, within the framework of the small-scale commercial use.

3.3.6. Heterogeneous materials and populations trade

In the ‘Dialogue Forum on EU Variety Legislation’, voices advocated for more diversity in crops at field scale, in order to tackle the challenges of growing conditions variability in a context of climate change, and as a more environment-friendly strategy against weeds and pests. Agrologica, a small-scale Danish company whose activities are the maintenance and the breeding of plant genetic resources has been among these voices. This company, together with a couple of organic farmers, started to work with cereals populations from 2007, looking for crops with agronomic performance robustness and high baking quality (Thomle Andersen 2016).

Thanks to the initiative of Agrologica’s to candidate to the EU Commission’s temporary experiment of composite cross populations marketing, Denmark has become one of the first MS to test such heterogeneous material. This temporary experiment was conducted in the framework of a forecasted new regulations on organic seeds and varieties, that would integrate composite cross populations trade in their provisions.

The existence of this new ‘category’ of crops brought the need of framing it in the national regulations. This need was addressed during the ‘Dialogue Forum on EU Variety Legislation’. The possibility to trade such cereal populations has already been framed in the Article 13 of the Council Directive 66/402/EEC on the marketing of cereal seed, stating that:

“Member States may authorize the marketing of cereal seed in the form of blends of seed of various species, provided that the components of the blend complied, before blending, with the marketing rules applicable to them.”

Thanks to the transcription of this provision within the Danish PRM legislation, organic wheat, barley, oat and maize varieties populations can be traded as heterogeneous material in Denmark. Populations are defined by the Danish PRM legislation as:

“derived from a given combination of genotypes, considered as units in relation to their ability to be reproduced unchanged once they are established in a given production region with specific agroclimatic conditions and made by one of the following techniques:

- Crossover of five or more varieties in all combinations followed by collection and mixing of the offspring and subsequent seedling of the natural selection material for several generations.*
- joint cultivation of at least five varieties of predominantly foreign species, collection and mixing of offspring, repeated freshening and postponement of the natural selection material until no more plants of the original varieties are present.*
- crossing five or more varieties by means of crossing protocols that differ from the above in order to produce a correspondingly different population that does not contain varieties.”* (Landbrugsstyrelsen 2017, p. 18)

Applicants must send a notification to TystofteFonden, in which the description of the population, of its generation technique, of its characteristics (in term of yield, stability quality, performance, suitability for low-input cultivation, disease resistance, taste and color) are included, as well as the objectives of the breeding program and the production areas. A pack of seeds of the population must be joined to the application, in order to enable TystofteFonden to carry out the tests that will confirm the characteristics declared by the applicant. The registration form for the application can be found on TystofteFonden website. The heterogeneity of the population makes the tests’ results difficult to match with the given descriptions, so TystofteFonden never withdrawn any application in the past years and always certified the populations they tested.

This provision on heterogeneous material give of favorable framework to organic cereal and maize farmers to cultivate more diverse populations that would help them to cope with pests and disease, as well as the consequence of climate change.

3.3.7. Cultivation in a closed system

As explained in the paragraph 4.2.3, the amendment of the Danish regulation is based on rigorously accurate transcription of the Article 2(a) of the Council Directive 2002/55/EC on the marketing of vegetable seeds. In this article, the second paragraph states that the “*the supply of seed under certain conditions to providers of services for the production of certain agricultural raw materials, intended for industrial purposes, or seed propagation for that purpose, shall no be regarded as marketing*”. Thanks to this so-called “closed system”, where the supply of seeds is not considered as marketing, there is no need to fulfil the EU standard variety and seed certification. Uncertified material, as well as certified (non-commercial) seeds can be used, but still needs to meet some quality criteria researched by the processor.

It is thus possible for a food company, equipped with processing facilities, to contract one or several farmers to grow varieties of vegetable or crops that are not necessarily certified as commercial or ‘conservation’ variety. The only legal requirement in this case is to provide the contract linking the farmer(s) and the processor to the concerned national certifying body, TystofteFonden, in the case of Denmark.

LBST report (Landbrugsstyrelsen 2017, p,17) also states the scope of the delivery of seeds and other PRM in a closed system:

“The closed system is characterized by the fact that the person who cultivates the material does not acquire ownership of either seed / seed or harvested product. All rights remain with the owner of the seed (e.g. a miller or a producer of frozen peas). The cultivation takes place as a service. The breeder does not pay for the seed, and you do not pay for the harvested commodity. Instead, you pay for the service you buy in terms of land capacity and cultivation. The closed system can be used for both varieties on blacklist, including conservation types, hobbies, and varieties / materials that are not on blacklist.”

A contract must be signed between the farmers and the processor owning the PRM “*where standards and conditions must be stated*” (Landbrugsstyrelsen 2017, p,17). This contract is the basis on which the trust between both sides is built. If in the traditional FSS, the trust farmers have in the seeds they purchase comes from the certification of the variety and from the controlled sealing and branding of the package, the interdependence relationship between the owner and the grower in the so-called ‘closed seed system’ makes both certification and sealing unnecessary. Indeed, it is extremely important for the owner to provide seeds that can perform well on the growers’ fields, in terms of quality and quantity, since it will be the owner’s raw material for further processing. On the other hand, for the growers, the contract signed by the industry ensure a stable revenue from their services, as stipulated on the contract, with possible bonuses if some thresholds of quality or quantity are reached.

This provision frames a very innovation model of trust building in seed system, challenging the current mainstream one. Moreover, its implementation promises beneficial outcomes for both farmers and

breeders/processors, is favorable contract terms are negotiated. However, the need of processing of the agricultural product in a limiting factor.

3.3.8. Summarizing the Danish PRM legislation

The content the current Danish PRM legislation, after the 2015 reform, have a wide scope. Indeed, it opens new doors for farmers, gardeners, seed savers networks, NGOs and small- and medium-scale companies that want to conserve and use endangered plant genetic resources and ancient landraces. Moreover, it created different framework answering the need of many actors involved in CBC and ABS: the non-commercial use provision opens opportunities for gardeners, the small-scale commercial use for smallholders, conservation varieties for larger farming activities, heterogeneous populations for organic farmers and hobby varieties for micro-breeding companies. This diversity of provisions acknowledges the fact that contribution to CBC can be done by many stakeholders and through ‘strategies’ by framing their activities in the law. The PRM legislation remaining unchanged for the commercial varieties, and the requirements they must fulfil, it also answers the need of larger scale formal seed breeders and multiplies to have their activities sustained.

Thus, the ensures the ‘highway’ to stay as robust as it was, but still opens many sidetracks for conservation and use of non-commercial varieties. In addition to the ‘sidetracks’ defined and explained in sub-paragraph 3.3.1 to 3.3.7, other sidetracks have been opened. For example, there is several agricultural species, such as basil, emmer wheat and rucola (*Eruca sativa*), that are unregulated. Thus, no seed certification is need to cultivate any of the species’ varieties. Moreover, it is possible to cultivate regulated cultivars without any of the requirements framed for commercial varieties, if they are not cultivated for the purpose they were certified for. For example, the cultivation of soybean cultivars certified for grain production is not regulated if the soybean is cultivated for the sprouts. But, the ‘sidetracks’ remains limited to the use of vegetables and cereals, and the regulations on the use of grass and clover seed remains strict.

The Danish PRM legislation also acknowledges the fact that both conservation and use are important in the safeguarding of plant genetic resources. Indeed, the reform framed supportive provisions for the creation of niche seed and food economic sectors, that can be levers for the viability of the use of the endangered landraces, by providing maintainers and landraces farmers fair incomes for their activities. It also permits to bring landraces on market and on supermarket shelves, and thus, to possibly involve more consumers into the effort for CBC. This regulatory framework appears to be very supportive to CBC and ABS since it tackles challenges and opens opportunities in seed systems components that can really make differences.

Table 5 summarizes the requirements, authorized practices and the addressed producers for each seed trading or/and cultivation strategy.

| Type of regulation | Certification and administrative requirements | Species | Targeted audience | Aim | Commercial use | Danish specificity (compared to EU) | Comments |
|------------------------------------|--|---|---|---|---|---|---|
| Commercial varieties | DUS + VCU + PBR + Branded and sealed packages + Quality and Yield | Regulated species | Plant breeding companies + Farmers + Gardeners | Cultivation and Gardening | Yes | EU main seed system | |
| Closed system | Processing by the seed owner + Contract sent to TystofteFonden | Cereals and vegetables (as long as they can be processed) | Food companies + Farmers | Conservation and Cultivation | Yes | No | In use even before the reform |
| Conservation variety | Lenient DUS, geographic and quantity restrictions | Cereals and vegetables | Farmers | Conservation and (restricted) Cultivation | Yes (restricted quantities in region of origin) | No | Scandinavia possibly merged as 1 cultivation region |
| Heterogeneous material | Lenient DUS + VCU | Wheat, oat, barley, maize | Organic Farmers | Conservation and Cultivation | Yes | Not anymore (Denmark has been a test country) | |
| Exchange for trial and development | Notification to TystofteFonden | Cereals and vegetables | Farmers + Researchers + Plant breeding companies | Conservation and (restricted) Cultivation | Yes | Yes | |
| Hobby varieties | Lenient DUS, recognition of the special growing conditions + Branded and sealed packages with quantity limitations | Vegetables | Gardeners | Conservation and Gardening | No | No | |
| Small-scale commercial use | Direct selling to consumer | Vegetables | Gardeners + Small-scale farmers | Conservation and (restricted) Cultivation | Small-scale (no processing or intermediaries) | Yes | Dependant on the tolerance of LBST |
| Non-commercial use | None | Vegetables | Gardeners + Conservation | Conservation and Gardening | No | Yes | Added examples in the EU list |
| <i>Non regulated species</i> | <i>None</i> | <i>Rucola, basil, emmer, etc</i> | <i>Farmers + Gardeners + Plant breeding companies</i> | <i>Cultivation and Gardening</i> | <i>Yes</i> | <i>No</i> | |

Table 5: Summary of the different conservation strategies authorized in Denmark

3.4. Effects on the Danish seed system

Despite the short stepback there is since the regulatory reform in Denmark, some effects of the new regulations are already visible in the national seed and farming system. The most significant progress and issues are described in this chapter.

3.4.1. Aurion: example of a successful use of the closed system

The transcription of the ‘closed seed system’ provision from the EU directives into the national PRM legislation is seen as a Danish specificity by most of the interviewed stakeholder. Though, the ‘closed system’ was already in use in the Kingdom before the 2015 reform, thanks to its definition at EU level.

A company has been implementing this system for many years in Denmark. Aurion (whose logo is in Figure 7) produces muesli, porridge, flour and grains from many cereal and agricultural species (wheat, barley, durum wheat, emmer wheat, buckwheat, rye, spelt, einkorn, kamut, amaranth, sorghum, oat and millet), as well as from many Scandinavian cereal landraces (*purpurhvede, dalarhvede, hallandshvede, svedjerug* and *ølandshvede*), thanks to this system. All the products sold by Aurion are certified organic and many of them are also biodynamic. The company has asked a dispensation to LBST ten years ago in order to be authorized to work within the closed seed system, but they received no answer. The absence of specific authorization did not prevent Aurion to continue working within this system. Thanks to the reform, the practice is now legal in Denmark, and thus ensure the future of their economic system.



Figure 7: Aurion company logo

For the company, working with such system enables them to use and process any landraces they want, and it was the only available option to do so. They work currently only with uncertified varieties (and the Øland wheat, see next paragraph) that has been multiplied from seed banks accessions, or from private individuals.

Unfortunately, maintaining many landraces over the years in the closed system is an important burden. The long-term operation of maintenance depends, in the case of Aurion, on the motivation and passion for bakery and cereals of its founder. Aurion’s founder and employees must do everything by themselves, from the cleaning and processing of the seed, to the delivery to the farmers. Moreover, since the varieties are uncertified, the company does not get any direct economic return, out of the added-value of the processing and the inner higher quality (both baking and organoleptic qualities) for which they have been chosen. Aurion also relies on experienced seed multipliers to sustain their operation. The use of these landraces throughout the years has

modified the intrinsic characteristics, as Aurion's founder observed, and the varieties they use became different from the original material he obtained, thanks to informal improvement phenomenon.

For the farmers working for Aurion, the main advantage is that the contract binding them with the seed owner ensure very stable prices, kept independent from the variations of the cereal prices on the global market. Aurion must accept the quantity and quality of the harvest they are getting from their growers, and pay them anyway as it was stipulated on the contract. Moreover, the bonuses that farmers can obtain thanks to high yields or high quality makes this contract even more interesting for them. The win-win relationships that Aurion maintains with growers enables them to build long-term stable partnerships that are 30 years old with some farmers.

Aurion started as a micro-baking company and as sustained itself as medium-sized company over the last decades. Their products can be found in more than a hundred shops in Denmark. Its founder is also the chairperson of the Kornets Hus ("House of grains") that is now being build nearby the processing site of Aurion. Kornets Hus is aimed to have an educational purpose for private individuals to make the case of cereal landraces and underused species, as well as for chiefs, bakers and canteen managers, for which the *Hus* will offer special courses focusing on grain as a raw material for healthy nutrition.

The success of Aurion and the creation of the Kornets Hus highlighted that Danish consumers have a keen interest for cereal landraces, and that the 'closed seed system' can be successfully sustained over the years even with many different landraces. It is difficult to evaluate to what extent the reform has been supporting the activity of this middle-sized company, but concretely legalizing their operation strategy in their own country took them out of a regulatory grey area that may have been threatening on a long-term basis. The basis of the success of Aurion appears to rather come from the passion and skills of its founder for baking and breadmaking, and its motivation to breed cereals that fits to the company processing and organoleptic quality expectations.

3.4.2. Ølands wheat conservation variety: mixed results

After the reform of the PRM legislation, and the transcription of the EU conservation varieties directives in the national law, a first application in 2015, and then entry, for a conservation variety happened in Denmark. The Øland wheat variety has been registered as a conservation variety under the name of "Kornby Øland" in 2016. This landrace comes from the Swedish island of Öland and has very good baking qualities and high protein content compared to other wheat varieties. Its registration as a conservation variety enabled its flour to be sold in numerous market, as well as some Øland wheat bread in bakeries. Kornby Øland is also one of the varieties used by Aurion in the "closed seed system".

Kornby Øland remained the only variety that has been candidate to a registration as conservation varieties. Even if FrøSamlerne works with more than 200 landraces, they did not apply for any certification. Indeed, in

Denmark, the cost of any application is worth 400 euros, to cover the cost of the certification at TystofteFonden. It is thus impossible for the NGO to have many varieties registered, since their fund are limited. Moreover, neither LBST nor TystofteFonden get involved financially or logistically in the process of candidature and maintenance of the conservation variety. The maintenance has thus to be ensured by private individuals, companies or any other institutions, without any subsidies. The nature of the conservation variety, where the maintainer does not have any PBR, prevent the maintainer to be able to rely on constant yearly retribution from their work. The operation of conservation varieties in Denmark thus rely on the motivation of the maintainer to continue this activity even if they earn little money for that. The case of Denmark is very different compared to other countries, such as Netherlands where there is no registration fees or Sweden where the Ministry of Agriculture takes an active part in the maintenance of the varieties.

Unfortunately, it appeared that the maintainer of Kornby Øland variety ceased this activity in 2018. The reasons of this decision have not been found in the research process of this Master Thesis. The hypothesis that the difficulty to run conservation variety in the context of Denmark is a plausible one, that need to be confirmed, in order to develop framework that better support long-term maintenance of conservation varieties in the Kingdom.

3.4.3. Small-scale system and seed exchange

The main effect of the authorization of closed seed system, seed exchange between farmers and direct commercial use of uncertified varieties is the legalization, and thus, the protection of practices that were already implemented by smallholders and non-professional seed users. Nowadays, many small-scale seed breeders, such as Copenhagen Seeds, working primarily with vegetable landraces, sometimes registered as amateur seeds, can work legally and sell seeds to gardeners without any risk to be fined or prosecuted for their activities.

The effects of the authorization of small-scale commercial use of non-commercial varieties is difficult to evaluate, since it mainly happens through direct marketing, in which none of the interviewed institutions are involved. A survey among markets' direct sellers would be the best way to evaluate to what extent non-commercial vegetable variety are cultivated within this framework.

In the last years, many pop-up seed swapping events has been organized throughout Denmark, most of them being led by FrøSamlerne. These events bring together farmers and gardeners, members of the NGO or not. During these FrøPopups, exchange and trade of seeds happens, as well as many activities dealing with plant genetic resources conservation and use.

3.4.4. Consequence on the seed system

The change in the law and the subsequent transitions in the seed system made real the allegory of ‘the Highway and the Sidetracks’. Both farmers and consumers can now choose other way to purchase or obtain seeds and agricultural products: either buying commercial cultivars that would provide yields, uniformity and stability; or getting seeds from non-commercial varieties, answering interest in conservation and specific organoleptic qualities. Thus, farmers and consumers can still buy seeds and food from cultivars with the same inner agronomic and organoleptic qualities. But it gives them both other way to consume seeds and food, if they are willing to involve them in seed exchange, conservation varieties maintenance or direct food marketing.

Even if alternative consumption ‘sidetracks’ has been opened by the changes in the Danish regulation, there is no visible impact on the operations of the ‘highway’ seed system. The reform did not hamper the FSS ran by large-scale Danish companies, and their activities are still flourishing. For the small breeding companies that are somewhere in between ‘highway’ and ‘sidetrack’, the reform seems to be beneficial, since opportunities has been created at their scale of production.

For the ‘sidetracks’, the reform eased the bureaucratic and administrative requirements. It is easy to register conservation, amateur varieties as well as heterogeneous varieties. The documents that have to be provided with the application does not ask for many information (usually the name and origin of the variety, the name of the maintainer, the goal of the cultivation and the intrinsic characteristic of the variety), and are easy to find on TystofteFonden website. Moreover, TystofteFonden seems to be quite lenient in the test it carries out, since they only check if the sent seed lot matches with the description of the application (and the characteristics described by NordGen if they possess this variety in their collection).

3.5. Strategic insights for the AU Vintage Vegetables Seeds Production project

Recently, a group of scientists of University of Aarhus discovered that some ancient varieties of vegetable from Denmark, with higher bitterness in their organoleptic composition, might have beneficial impacts for people suffering of diabetes. The causal link between the bitterness and the patients’ health improvement is not sure yet, the health effect being possibly attributed to the effect of a higher part of vegetable in the diet, no matter their bitterness. (Thorup et al. 2018). Thus, further researches on the real effect of these varieties needs to be done. Yet, this encouraging result pushed forward the willingness to develop the cultivation of these varieties, especially varieties of spinach and cabbage. The selection and the multiplication of the bitter cabbage and spinach are now the focuses of a project whose project leader is the Department of Agroecology of Aarhus University, with the support of the AU Department of Food, NordGen and Vikima Seed. This project has been

titled “Vintage Vegetable Seeds Production”. Together with the cabbage and the spinach, another interesting Danish ancient variety has been found in a German seed banks, a variety of pea.

The recent changes in the Danish PRM legislations opens rooms for opportunities for this project. From the knowledge accumulated with interviews and readings, some strategic insights can be yielded. In this paragraph, 3 different scenarios of implementable strategies will be presented, together with a FFA. FFAs will describe the supporting and hindering forces of the strategy when it comes to the registration and the long-term conservation and use of these vegetable varieties.

3.5.1. Strategy A: Closed Seed System

The ‘closed seed system’ having been in use by Aurion for decades with success, this scheme can be reproduced for the cultivation of these ‘vintage’ vegetable varieties. The advantages of having the ‘closed system’ being that no certification is needed, the cultivation can be carried out at commercial scale, with stable outcomes sources for contracted farmers (if the contract is as favorable as it is with Aurion) and market opportunities for the company thanks to the value added by the processing (as described in paragraph 4.4.1), and to the inner quality of the landrace. On the agronomic point of view, a coevolution of the variety with the agricultural terroirs on which it would be cultivated, will sustain on the long-term the yield and the quality of the harvested vegetables, if a careful and skilled selection is implemented. In this case, the main issue is to find a processing method that would suit to the vegetable and to how it is consumed, without hampering its organoleptic qualities that make their specificity. Moreover, compared to the implementation of a closed seed system with cereal, the production of vegetable seedlings for the following generation would have to be a separated activity from the cultivation for raw agricultural products.

| Supporting Forces | Hindering Forces |
|--|--|
| <ul style="list-style-type: none"> - No need for certification nor registration at TystofteFonden - More stable outcomes for contracted farmers, if terms are as favorable as they are with Aurion - Possibility of a medium-scale or large-scale industrial commercial exploitation of the vegetables - Healthy traits of the varieties can create market opportunities - Dynamic PPB model that induces favorable improvement for the variety | <ul style="list-style-type: none"> - Need for an industrial processing at the company owning the seeds (that is hardly compatible with the nature of the species). - Maintenance of the grown variety in question: dependent on the motivation of the owner. - Need for knowledgeable people at the company to maintain the variety and select the seeds. - Harder to conciliate productions both raw agricultural products and seedlings for next generation for vegetable than for cereals - No seed quality criteria specified |

Table 6: FFA for Strategy A

3.5.2. Strategy B: Swedish Conservation list

Since Danish conservation varieties maintenance is not subsidized nor supported in any way by the national public institutions, it is hardly possible to sustain the long-term conservation and use of these varieties as it is currently. Even if the reason of the cessation of the conservation activity of the Øland wheat by its maintainer within this framework is not known, it shows the limits of the framework established by the new Danish PRM legislation on the topic. On another side of the Øresund, the Swedish Agricultural Agency seem to provide a better technical (and possibly financial) support to the maintenance of conservation varieties. Sweden and Denmark being possibly merged into a common conservation region, the registration of the varieties in Sweden would still enable farmers to cultivate them in Denmark in a near future. This strategy would also make the maintenance remain in farming communities, ensuring thus to continue an on-farm dynamic maintenance of the varieties.

The Swedish conservation variety list could be as well as a solution for the Øland wheat to be maintained as a conservation variety. Øland (or *Öland* in Swedish) being a Swedish island, there could be a genuine interest of the local authorities to conserve this indigenous variety.

| Supporting Forces | Hindering Forces |
|---|---|
| <ul style="list-style-type: none"> - Scandinavia possibly merged as one unique cultivation region: what is certified in Sweden can be grown in Denmark. - Long-term conservation supported by the local Agriculture Agency - Ownership of the variety remains within farming communities | <ul style="list-style-type: none"> - No large-scale commercial exploitation possible - Restrictions in quantity harder to deal with in a broader region, more farmers being possibly interested in cultivating these varieties - Loss of ownership of the variety by Danish farmers and seed system - Possible unavailability for Danish farmers if the “Scandinavia merge” fails - No seed quality criteria specified |

Table 7. FFA for Strategy B

3.5.3. Strategy C: Maintenance and certification by Danish seed company

This third and last considered strategy is more about the ‘highway’ of the formal seed sector than the ‘sidetracks’, by working closely with a Danish seed multiplier.

As the Danish companies dealing with vegetables in Denmark are small-scale multipliers, the production would not be a large-scale one, but remains big enough to enable commercial exploitation. It would also enable the PPB program to happen between the owning companies, researchers and the farmers (retailers could be

involved if they want a focus on the organoleptic trait of the vegetables) in order to breed these varieties in a way that would favor as good as possible all the stakeholders.

Unfortunately, the unpredictability of the result of the certification for the registration of the varieties in the Common Catalogue and of their commercial value on the market (in both seed and food systems) are hindering the chances of having these vegetables conserved and used in Denmark on the long term. But if there is a market value, it would guarantee a long-term maintainer

| Supporting Forces | Hindering Forces |
|--|--|
| <ul style="list-style-type: none"> - Possibility of a long-term maintenance of the variety if the variety presents a market value - Formal improvement provided by the company - Possibility of PPB with farmers and food industries to adapt the varieties - Healthy traits of the varieties can creates good market opportunities - Seed quality criteria specified | <ul style="list-style-type: none"> - Need for certification in the Common Catalogue : high costs per variety and possibility of have the certification refused. - Risks of takeover by bigger foreign companies and thus of loss of ownership on these local varieties - Exchange of seeds between farmers - Risks of having the varieties “abandoned” if economically not interesting anymore for the company |

Table 8: FFA for Strategy C

4. Results: Comparative Case Study of decentralized PRM legislation in other EU MS

To substantiate the example of Denmark, other EU MS that liberalized PRM legislation at national or regional level were researched. For this paragraph, a comparative case study has been implemented, without the in-depth study of both context and effects that has been performed for the Danish single case study.

Since the EU PRM regulations are mainly framed in directives, the national adaptations are thus quite different from one MS to the other. If the EU general directives are generally considered as strict by many grassroots movements and NGOs, only a few MS implemented regulations that are more lenient towards seeds exchange and landraces cultivation. In this chapter, some of the few countries that liberalized the EU PRM regulations will be studied:

Finland was one of the first MS to do so. After Council Directive 98/95 /EC of 14 December 1998 stated that there were “*conditions under which seed may be marketed in relation to the conservation in situ and the sustainable use of plant genetic resources*”, Finnish Parliament decided to include this provision in the national Seed Trade Act of 2000. In the following years has been implemented the Statute on Registration of Conservation Varieties (437/2001) and the Statute on Seed Trade of Landraces of Cereal and Fodder Plants (117/00), establishing a framework for the registration of conservation varieties even before this provision has been create in EU directives (Paavilainen 2009).

In **Italy**, the liberalizing reforms have been implemented at regional level. Tuscany was the first of the Italian *regione* to frame a law on the protection of indigenous genetic resources, in 1997. The Tuscan example triggered the interest of Italian scientific and political communities and since then, seven other regions have implemented similar regulations: Lazio in 2000, Umbria in 2001, Friuli Venezia Giulia in 2002, Marche in 2003, Campania in 2007, Emilia-Romania and Basilicata in 2008. According to Mejias et al., in 2016, four more regions were in discussions to implemented regulation similar to their neighbors’. These regulations are dedicated to conserve and support the use of ‘autochthonous genetic resources’ and of ‘autochthonous breeds’ (Bertacchini 2009). Finally, a national overarching law (46/2007) has framed the concept of conservation variety and defined what is authorized to do with these varieties in Italy (Mejias et al. 2016).

Then, in **Austria**, PRM legislation has always been very tolerant towards exchange of seeds from un-registered varieties, as framed in the Austrian Seed Law of 1997. This tolerance was even extended in 2016 thanks to the lobby of Arche Noah, in order to legalize practices that were already implemented by farmers, such as trade of un-registered material, and to offer room for new opportunities

The fourth MS that will be studied for its lenient PRM legislation is **France**. Two reforms to the Rural Code, the overarching text law on agriculture in France, happened in 2014 and 2016, following the concertation for

the Biodiversity Act, in which the provisions of the Nagoya Protocol on ABS of genetic resources has been discussed. The reform modified the possibility of exchange between gardeners and between farmers. An amendment to the Rural Code has been edited in the article 11 and 12 of Law no. 2016/1087 of 8 August 2016 « for the recovery of biodiversity, nature and landscape », integrating the new provisions.

Finally, discussions happened in **Lithuania** in the last years to liberalize PRM legislations, on the initiative of a NGO member. Even if the dialogue process was successful and yielded promising results for future PRM legislation liberalization, the proposed provisions have not been voted yet by the national Parliament.

In the following paragraph, the context of the regulatory reforms in Finland, Italy, Austria, France, and Lithuania, and their content and effects in Finland, Italy, Austria and France will be further described. They will be compared between each other and with the case of Denmark studied in chapter 4, in order to highlight similarities and difference between the efforts to improve CBC and ABS in regulatory frameworks.

4.1. Context and goals of regulatory changes

As highlighted in the case of Denmark, the context of a local seed systems is essential to be acknowledged in order to understand what made a PRM legislation possible at national (or regional) scale.

Dialogue seems to be a common trait to most of the reform that happened in the above-mentioned MS. As democracies, it seems obvious that one single person does not decide such changes by themselves. The Danish ‘Dialogue Forum on EU Variety Legislation’ had its equivalent in France with the two-and-a-half long-lasting debate on the so-called “*Loi Biodiversité*”. Similar dialogues happened in Lithuania and Finland. In these dialogues, the presence of representatives of seed breeding companies, farmers’ organizations, NGOs and grassroots movement sat together, under the supervision of representative of parliaments, ministries and governments. The inclusion of many different stakeholders in discussion, even when their interests differ, enabled to make compromises to yielded reforms and proposal that are satisfactory for most of them.

Reforms in Austria and Denmark, as well as the on-hold reform in Lithuania, originates from lobby activities from NGOs such as Arche Noah or FrøSamlerne. Indeed, similarly to the complaints from FrøSamlerne’s members and affiliates that convicted LBST to include the NGO in the dialogue, the campaign of Arche Noah triggered the 2016 changes in the Austrian Seed Law. In this case of Lithuania, it is the initiative of one single member of a similar NGO that brought the narrative of CBC and ABS to the table and launched such discussions at national scale. In Finland and France, dialogue respectively originates from scientific publication on CBC and from national political willingness to include many narratives in a large-scale reform. But in both case, the involvement of CBC supporters has been of great importance.

These examples highlight that lobby activities from grassroots movements and from NGO can have an impact at national scale, in triggering dialogue, and in bringing the narrative for liberalized seed exchange and landraces cultivation at the level where political decision is done. This lobby of seeds savers NGOs is pushed by their common willingness and their transnational collaboration to improve the robustness of national PRM legislation towards potential reforms at EU level, under the aegis of Arche Noah. The dedication of the people advocating for the PRM legislation reform in Lithuania shows also how much the motivation and the interest of the members of NGO, but also from policy makers, is essential. Indeed, the reason why the Lithuanian Parliament has not voted the proposal made by the dialogue group yet is the lack of interest of policy makers for the topics. Moreover, in Finland and in Denmark, the involvement of Ministry of Agriculture or state certification body employees has greatly helped the reforms to be implemented, because their care for both CBC and seed systems performances.

Another commonality that can be found in five of the six studied countries, is the fact that lobby has been done in small-scale seed systems. Indeed, just as Denmark, the seed systems are rather small in terms of number of actors in Austria, Lithuania and Finland. This characteristic of a seed system seems to make it easier to lobby, since it is the less there is stakeholders, the more it is convenient to find compromises between their divergent interests. Moreover, the absence of big private breeding companies seems to have help the dialogue. Unlike Denmark, where a few large-scale breeders are present (mainly on the sector of grass and forage), there was no Lithuanian or Austrian breeders that lobbied against the reform in their countries. Finland is an exception since the main seed companies in Finland, Boreal, is a publicly own company (Solberg and Breian 2015).

4.2. Regulatory frameworks

At national or regional scale, different reforms have been carried out, and the focuses of these reforms differ very much from one country to the other. These different focuses are described in this chapter.

4.2.1. Conservation varieties in Finland and Italy

Conservation varieties registration to safeguard landraces has been the focus in Finland and Italy.

In Finland, a framework has been established, in which landraces, old commercial varieties and old modified commercial varieties ('modified' meaning that cross-pollination and evolution of the cultivar have considerably changed the variety's intrinsic characteristics) can be registered as conservation varieties. From these conservation varieties, only seeds from landraces of the most commonly cultivated species can be traded. The registration of the conservation varieties is done through adapted DUS testing, with more lenient requirements, but the distinctness of the variety must be ensured. Expected germination standards for landraces seeds is lower than for commercial varieties, and endangered weed species seeds can be found in seed lots without precluding their quality standards fulfilling. The trade of the conservation varieties must remain within

the borders of Finland. Finally, and unlike Denmark, the maintenance, whether it is done by farmers or by NGOs, is subsidized with 450 euros per year when the cultivated area is more than one hectare (subsidies rates from 2009) (Paavilainen 2009).

The regulation in Italy is even more lenient towards conservation varieties. Even if there are as many regulations as there are regions that implemented reforms, major trends have been highlighted by Bertacchini (2009) and Mejias et al. (2016). Conservation varieties (called as well as ‘traditional plant varieties’ or ‘autochthonous breeds’) are defined as indigenous varieties or exogenous varieties that has been cultivated in the region for more than 50 years. A grey area in the laws allows the certification bodies to be very tolerant with these criteria and to accept testimony or written record as proofs to fulfil the ‘50-year-of-cultivation’ requirement. No DUS testing is required in the regional laws (except Tuscany), the only requirement is to be phenotypically distinguishable from another registered variety. Most of the regions are taking the responsibility of the safeguard of plant genetic resources, thus the registrations are free-of-charge for the maintainer. Regional regulations in Italy framed many rights for the user and the maintainer of these varieties. First, the person or group that emitted the proposal for a variety to be registered as ‘conservation varieties’ does not own any exclusive right on the use and trade of the seeds and agricultural products from this variety, no third party can claim any right on it. The regulations framed the possibility to create on-farm conservation networks within which the member can freely save, re-use and exchange seeds of conservation varieties in the region of origin. Some regions also authorize seed trade in small quantities (Mejias et al. 2016).

In both countries, within the geographical and quantitative restrictions, and similarly to the case of Denmark, commercial use of the agricultural products originating from these conservation varieties has been authorized. As shown in Table 9, the implementation of the conservation varieties legislation in Finland, Italy and Denmark are quite different, but each of these strategies are meant for a commercial, though quantitatively limited, exploitation of these autochthonous varieties.

| | Finland | Italy | Denmark |
|---|----------------------------|----------------------------|--|
| DUS requirements | Lenient | None (Lenient in Tuscany) | Lenient |
| Scale of geographical restrictions | Country | Region | Denmark (possibly Scandinavia in the future) |
| Charge of registration | | None | 400 euros |
| Subsidies | 450 euros/year | | None |
| Commercial exploitation | Yes (quantity restriction) | Yes (quantity restriction) | Yes (quantity restriction) |

Table 9: Comparison of the provisions for conservation varieties between Member States

4.2.2. Small-scale use and gardening in France and Austria

In Denmark, the tolerance of the definition of the non-commercial and small-scale commercial use of seeds opens rooms for opportunity for those wanting to use unregistered or amateur varieties for private- or market-gardening. France and Austria produced different provisions for small-scale use, with mixed results.

France has been less successful in implementing such tolerant laws. In this case, “*the transfer, supply or transfer, made free of charge, of seeds or plant reproductive material from cultivated varieties of public domain varieties to non-professional end-users not intended for commercial exploitation of the variety*” has been authorized, as stipulated in Article 11 of the Biodiversity Act. This provision legalized implemented practices but created new constraints since seed exchangers have now to comply with sanitary requirements. Moreover, the exchange against money has been authorized if one of the two involved parts is an NGO. Unfortunately, the *Conseil Constitutionnel* (French legislative institutions responsible for verifying the constitutionality of laws) considered that limiting this authorization to one single type of organization is contrary to French Right. Thus, this provision must be re-voted. NGOs such as Réseau Semences Paysannes were also very critical towards this Article, since they saw limited effects to a reform presented as a tremendous step forward and because they wished the exchange against fees to be authorized for any type of organization. New debate will happen during Autumn 2018 in order to resolve the unconstitutional part of the law and to consider the doubts raised by the NGO.

In Austria, amateur varieties have been the focus of the main changes for smallholders and non-professional users. There, the requirement for the registration of amateur varieties must be kept as lenient as possible and the certification testing is even unnecessary if the application includes results of previous testing (even unofficial ones) and a sufficient description of the variety. For these varieties, seed and PRM exchange is possible, and the tolerance of the Austrian authorities appears to be as high as in Denmark.

However, in both French and Austria cases, the FSS representatives has raised the need for sanitary requirement as a red flag in the concertation and debate for the reforms. It ended up with partially tolerant legislations that closed as many doors as it opened opportunities for gardeners and small-scale professional users in France, and difficulty to exchange and trade PRM of conservation and amateur varieties of fruit trees in Austria.

4.2.3. Farmers’ seed exchange in France and Austria

In France, the exchange of seeds of uncertified material between farmers has been authorized first within the Group of Economic and Environmental Interest (GIEE, “*Groupement d’Intérêt Economique et Environnemental*” in French), thanks to the 2014 reform of the Rural Code. These GIEEs are group of farmers that are locally carrying out agroecological projects, from methanization units building to local food systems creations, with technical and economic support of the Ministry of Agriculture and local agricultural chambers. Even if only

of few of them are specifically dealing with the conservation and use of landraces, seeds exchanges have been authorized between the members of every GIEE. The second reform, in 2014, suppressed the obligation to belong to a GIEE to be able to practice seed exchange between farmers. This authorization can now exist within the framework of “Farming mutual aid” (*entraide agricole* in French), that formalized, for fiscal reasons, the exchange of service and material in a farming community. These exchanges of material, services and seed must be recorded in a notebook that can be controlled by law enforcers. In this framework, it is authorized to exchange any seed material, except for seed produced under seed multiplication contracts. With the exchanged seeds, commercial exploitation is authorized, without any distinction between small-scale and industrial use as Denmark did.

In Austria, the changes in the national seed act in 2016 authorized farm saved seed to be re-used by the farmers, when it comes from conservation varieties, amateur varieties or un-registered material. Moreover, the fees for re-seeding does not have to be payed by farmers. Like France, exchange of seeds of non-registered variety between farmers and with seed users is authorized if it aims to safeguard plant genetic resources. This exchange can happen against money since 2016 but faces quantitative restrictions. The use of rare agricultural species listed in the Austrian Agri-Environmental Program is subsidized up to 200 euros per hectare. So far, this provision only concerns cereals species and cannot be applied to vegetables or fruit tree species.

Finally, Denmark seems to be the only member that had a specific focus on the closed seed system. Discussion are happening in Finland to include this EU provision into the national regulations but concerns about the lack of seed supply compared to demand, and about the difficulty to find market opportunities for the agricultural products are hindering its implementation.

4.3. Effects on seeds and farming systems

In Finland and Italy, the framing of conservation variety certification enables many landraces to be safeguarded, thanks to being registered as such. In Finland, up to 15 landraces has been certified as conservation variety in the first couple of years after the reform, and one to two varieties enters the Finnish conservation catalogue every year since then. In Tuscany, in 2016, 463 arboreal and fruit tree species as well as 68 herbaceous species have been registered as conservation varieties, after almost 20 years of implementation. The early framing of conservation varieties in the Finnish and Italian regulations lighted the way ahead for the EU directive for conservation varieties that has been implemented a couple of years ago. The representative person of the national food safety authorities that has carried out the regulatory changes in Finland has been very involved in the process of the creation of these EU directives. Both countries have been thus life-size test of the provision on conservation varieties, and the successful results participated to legitimate their extension at federal scale.

Many provisions in the Austrian, Finnish, French and Italian regulations aimed to legalize the practices already in use, within farming and gardening communities. Before these reforms, seed exchangers and landraces growers had to rely on the leniency of the enforcement bodies, very variable between MS. Indeed, on behalf GNIS (National Inter-Professional Grouping of Seeds and Seedlings), many controls have been carried out on-farm in France, and the farmers implementing still-forbidden practices would have been prosecuted. Unfortunately, the grey areas in previous regulations has been erased but also shifted. The nuance between small-scale commercial use and industrial use of unregistered varieties in Denmark and the difference of enforcement they receive as well as the lack definition of the “small” exchangeable quantities of seeds between farmers in Denmark or Austria are new regulatory grey areas grassroots movements could benefit from, but on which the enforcement leniency would be necessary.

Moreover, giving farmers the possibility to maintain landraces, within the framework of conservation varieties, and to exchange seeds with fellow growers in an important recognition of their preponderant role in CBC. It acknowledges the fact the practices inherited for ISS, such as exchanging and selecting seeds in a coevolution process, are important contributors to CBC. It is important step forward towards ABS and plant genetic resources re-appropriation in EU.

Finally, as wanted by some seed savers NGOs throughout Europe, the robustness of national regulations towards potential upcoming stricter EU regulations has been improved by the reforms in these countries. The effort of national reforms for improved robustness of national regulations has been helped by the Diversifood “Enabling Crop Diversity on the Market” workshops that has been held throughout Europe in the last couple of years. During these workshops, the cases of the countries that decentralized and liberalized regulations has been presented, as well as the situation of seeds systems in other countries. For the information delivered during the presentation, recommendations have been made to implement similar reforms in the participants’ countries. This robustness is even more important as regulations’ focus differs a lot from one country to another. Thus, a EU reform that would go against these national would be even harder to implement.

5. Discussion

5.1. Limits and advantages of the methodology of the research

The research for this Master Thesis has been carried out on the assumption that the statements of Nagoya Protocol and ITPGRFA are trustworthy: it is important to safeguard plant genetic diversity, to ensure ABS of agricultural varieties, to create opportunities for alternative seed systems in order to improve sustainability and resilience in food, seed and farming systems. It was not the goal of this Master Thesis to challenge these statements, even if some of the interviewed stakeholders seem to not share this point.

Being an ‘outsider’ in the Danish seed system has been advantageous since it has eased the conversation with interviewees to get insight from them, maybe even easier than if I had been an ‘insider’. Indeed, taking a ‘naïve’ curiosity posture to collect as much knowledge as possible from the stakeholders may have made them confident in the fact that I would use the information they provided only for this research and not in some ways that would harm their business or their activities. Unfortunately, my limited knowledge of Danish has been a barrier to data collection, since not every interviewee spoke good enough English, to be as precise and wordy as they might have been in their native language.

The most important limit of the study may be the few information collected on the effects of the Danish PRM legislation reform on the farming and seed system. The two main reasons of the lack of data on this topic are:

- The low number of interviews carried out with farmers: this low number of farmers interviewed is explained by the unavailability of most the contacted farmers, the difficulty to get contact of farmers working with landraces or implementing practices benefiting to CBC and the language barrier that may have existed during the interviews
- The recentness of the reform: it makes its effects yet hardly visible at national scale and need more long-term study to evaluate its impacts on the conservation and availability of plant genetic resources. Follow-up studies in a few years would be able to better highlight the changes in the seed and farming systems.

It was the reason why a comparative case study with other Member States has been carried out in this Master Thesis. Indeed, some countries had already implemented tolerant reforms one to two decades ago, and the effects on their local seeds and farming systems was thus easier to study. The hypothesis was that the results of the comparative case study may have had a prospective quality towards what could be the effects of the reform in Denmark. But the observed differences between MS on the strategy and the focus of the reforms hampered the prospective quality of this comparison. Thus, the comparative case study has also been focused on what makes such reforms possible and on how the amended laws adapted to local seed and farming systems.

In this comparative case study, it was not possible to carry out interviews in every country, because of the unavailability of local stakeholders contacted during the data collection period. Thus, data collection had to rely on other sources, especially literature in the case of Italy.

Then, as an agroecology student, I did not have the right methodological tools to extract information from the law text. The addressed law in the case study being written in Danish, it has been another barrier to the extraction of information from the law orders. In order to still get information about the regulatory framework, interviews with knowledgeable persons on the topic (Category A interviewees) has been carried out, and literature (Bertacchini 2009, Paavilainen 2009, Mejias et al. 2016) has been reviewed. Unfortunately, these data sources are much more subjective than the law text themselves.

Finally, some doubts can be raised on the reproducibility of the research carried out for this Master Thesis. Indeed, the interview methods and interview analysis are difficult to reproduce, on field, because they are very linked to the experience, to the posture and to the approach of the researcher, making the used methodology a rather personal approach to the topic. The hardly reproducible methods thus impacts the trustworthiness of the research (Graneheim and Lundman 2003). Moreover, this research, done between March and September 2018, is a snapshot of the situation of seed systems and seed legislations in Denmark and in Europe at this time. This report is thus a material extremely linked to its time, and findings that are there described could be quickly obsolete, even more considering the political and regulatory aspect of the work. These limits in reproducibility and time-span of the results are corollary to the research strategies in use: case study and comparative case study (Yin 2009, Goodrick 2014). They appeared to be the best strategy to approach holistically the researched situation at the beginning of the Master Thesis, and despite their limits, they remain the best methods that could have been used.

5.2. Seed systems

Thanks to the knowledge gathered about the seeds systems in Denmark and other MS, their evolution and the perspective of their stakeholders, interrogations on the paradigms and on the basic values that founded the current seed sector have been raised. These questions are further explored in the following sub-paragraphs.

5.2.1. Alternative seed systems: A matter of scale and competition?

In Denmark, the nuance between industrial and small-scale commercial use of non-commercial variety in the implementation of the new PRM legislation highlights the base on which this reform was built: as long as it remains at the scale of a niche economic sector, alternative seeds systems will be tolerated in Denmark. This tolerance exists as long as the alternative seed system does not challenge or hamper the existing private economic seed sector. Grass and clover species have been indeed discarded from these reform, because of the

threat of having the population of improved varieties ‘contaminated’ by landraces through cross-pollination and because of the possible competition it could have been. On the other hand, the creation of more tolerant legislations towards vegetables and cereals may have been enabled by the absence of strong breeding companies working with these species and their counterargument during the dialogue

The recognition and the decriminalization of CBC practices were exactly what FrøSamlerne and other pro-reform stakeholders lobbied for. It was not in their intention to make the Danish formal seed sector collapse, but just have their ‘sidetracks’ liberalized. In other countries, such as France, the strength of seed companies dealing with cereals and vegetables made conflictual any debates happening on the liberalization of the PRM legislation, until the ‘Biodiversity Act’ debate of 2016 in the French case.

These observations question the scale on which ISS can re-develop. At the time of the research, the situation in Denmark is well balanced, and the ‘highway’ and the ‘sidetracks’ co-exist peacefully. But what if the ‘sidetracks’ became more and more popular among consumers? Would the seed companies see this growing competition as a problem for their own business? Would the representative of the private breeding lobby for more regulations to control the flow on the sidetracks?

Alternative seed systems cannot grow too much and need to stay “under the radar” to be viable in Denmark. But a rapid development could lead to a regulatory framing of the alternative practices, in a similar way to the development of organic agriculture over the last decades. What was a niche market driven by a few pioneer has developed to become a strong economic sector, still efficient as an environment-friendly agricultural system. Unfortunately, the recent evolution towards Organic 3.0, as theorized by the International Federation of Organic Agriculture Movements (IFOAM), seems to orient the organic sector towards a ‘greener’ version of the current agricultural systems, forgetting on the way the social and economic model the pioneer linked with the organic production (Arbenz et al. 2015). An up-scaling of alternative seed systems in Europe would need to avoid the hazards experienced by organic farming, by, for example, keeping it as diverse as it in Denmark, with many different ‘sidetracks’.

5.2.2. Terminology and trust in seed systems

The semantics used to qualify plant genetic resources, the way trust is built in farming systems as well as the fulfilling of consumers needs and wishes appeared to be at the very basis of the FSS that was studied.

Differences on the terminology of plant genetic diversity indeed appeared between the interviewed stakeholders. Indeed, the differences between the terms ‘cultivars’, ‘varieties’ and ‘landraces’ were not the same according to the position of the interviewee in the seed system.

For this research, the term ‘variety’ has been considered biologically as a taxon. Indeed, within one agricultural species several varieties can be found, whether they are formally improved, or not. The varieties with formal

improvement were considered as ‘cultivars’ (whether they are hybrids or not), and the ones without as ‘landraces’. The semantic separation of ‘variety’ between ‘landrace’ and ‘cultivar’ was shared by many of the interviewed NGO representatives. On the other hand, representative from seed breeding companies, seed trades unions and certification bodies seem to have a complete different perception. The term ‘variety’ appeared to designate only the ‘taxonomic varieties’ that successfully passed the certification test and that are registered in the Common Catalogue. Anything that would not have an agronomic value from their perspective, such as heterogeneous populations, was not named as a variety. The concept of ‘landrace’ was even unknown from some of them.

Even if a fair part of these semantic difference could be attributed to translations and differences between languages, they participate to the difference of perception of CBC. Thus, with the terminology of the private sector representatives, if improved varieties are constantly produced by a breeding company, the company indeed participate to the conservation, and even to the creation of cultivated biodiversity. On the other hand, those who maintain landraces and other agricultural populations do not contributed to it because they keep using old varieties that have lower agronomic value (and present high risk of ‘contamination’ of the improved ones). This is how some representative of the formal seed sector can consider seed exchange and landraces cultivation as not beneficial for CBC.

Trust building between stakeholders of the seed system is another basis of the EU law on PRM. The certification and the registration in the Common Catalogue establishes this trust between the breeder and the grower, and ensure that the farmers get the variety they payed for, with high yield and sanitary quality. But the need of certification to build trust is due to the separation of growing and breeding activities between two entities in contemporary farming systems.

But it is not the only way to create trust. Closed seed system builds trust on the contract linking the seed owner and the farmer. In SEN, trust is created by the tacit contract between the members of a network sharing similar goals and visions. In closed system and in SEN, trust is not placed on the reproductive material itself, because the informal evolution it will undergo in the exchange and selection processes will change it considerably. This material may become very different from the original one, as observed at Aurion, or even unnamable. The trust must then be place in others, and in their ability to conserve the valuable traits of the used populations through meticulous selection methods.

A tacit trust also exists between the breeders and the consumers since many breeding sector representatives highlighted the goal of providing food in quality and quantity to the end-user. EU regulations are also built to fulfil the need of consumers (Van der Meulen 2013). But the fact that modern improved varieties allowed and supported by the EU regulatory are better for the consumers is questionable. A probable link between improved cereal cultivars and the increasing prevalence of gluten intolerance (also called celiac disease) in the population

has been highlighted by Van den Broeck et al (2010). What is the objective of formal improvement then, if not providing consumers with healthy and quality food?

5.2.3. FSS and CBC: antagonists paradigms?

In nowadays seed systems, FSS businesses and companies, and on the other hand, CBC practices implemented by grassroots movements and farmers appear to be rather antagonist considering their orientations and goals.

Indeed, in the last centuries, a separation between breeding and growing activities occurred in seed and farming systems. This separation has been accompanied by a shift in seed breeding interest from farmers' maintenance of agricultural varieties for their food and income to formal improvement for breeders' income (Louwaars 2002). This trend has been maintained and aggravated by agricultural treadmills, as theorized by Cochrane (1993)

Agricultural treadmills are circular phenomenon happening at different levels of the farming system, following positive feedback loops models. For example, the technological improvement of agricultural techniques and the consequent rise of food production triggered a decrease in food prices (since food demand is rather inelastic). To be able to live correctly of their activities, increasing yield was needed for farmers. Thus, they had to rely on science and on the technological innovations that formal improvement can provide to increase their yield repeatedly, in order to be able to cope with constantly decreasing food prices. Moreover, seeds use by farmer also follows one of these treadmills, since the decreasing knowledge of seed saving and seed exchange, due to the generalized use of reproductive material breed off-farm, leads farmers to rather opted for the same improved varieties, jeopardizing on-farm conservation and seed exchange practices even more. Then, the power of such firms enables them to have a strong influence in lobbying for governmental actions that are beneficial for them. Policies that are favorable to their activities creates a positive feedback loop that makes them even stronger. (Howard 2009).

Farmers networks and grassroots movements implementing practices to improve CBC and ABS aim to avoid these treadmills and to re-empower farmers in seed breeding. They aim to mitigate the current plant genetic erosion by using, for gardening or farming purpose, the remaining landraces on their territories. Moreover, bringing back farming and breeding activities closer together, would increase the ownership of farming communities of the varieties they grow, to cope with ABS of plant genetic resources. Unfortunately, the existence of such alternative systems is limited by the regulations, framed to maintain the constant headlong rush of the formal breeding system.

But the EU, aware of the urging issue of plant genetic erosion implemented laws that aimed to close this gap. Conservation varieties directives are perfect examples of provisions that are somewhere between the two paradigms. The aim of these provision is to conciliate the CBC practices and the existing certification and catalogue system. But still, the restrictions in quantity and in area limits the development of these varieties on

the long term and confines their cultivation to conservation purpose. “*Either we conserve or we use, we cannot do both*” told Réseau Semences Paysannes (2018) on the subject, frustrated by the limited possibilities of use of the conservation varieties. The example of conservation varieties shows how difficult it is for FSS to tackle the issues of ABS and CBC.

But there is room for cooperation between FSS and CBC strategies, thanks to small-scale breeding companies, that can implement PPB programs together with farmers (and, possibly, processors) that could benefit to each other. Small-scale breeders could thus ensure market opportunities in a very competitive seed sector in which they could easily collapse, and farmers could develop, thanks to formal improvements infrastructures, modernized varieties that benefits to them agronomically, culturally and environmentally.

5.3. Importance of locality in agricultural policies

The observations of the seed systems in Denmark and in the other studied MS and of the regulatory frameworks that governs them highlighted an important fact: the efficiency of a reform towards ISS and CBC is very much linked to the local farming systems context. Indeed, in Denmark, the implementation of the provisions for conservation varieties is being hindered by the cost of certification at TystofteFonden and by the lack of technical or financial support of public authorities. On the other hand, the authorization of seed exchange among farmers in France has been framed in the context of existing structure, first in GIEE farmers’ groups, and then, within the framework of ‘farmers mutual aid’.

Moreover, as theorized by Vavilov (1926), geographical disparities exist in Europe toward autochthonous plant genetic diversity. The Mediterranean Basin is considered as a primary area of diversity, with higher amount of autochthonous resources than the rest of the continent named as secondary area of diversity, where most of this diversity comes from the primary area. This trend can be found nowadays, in the differences of registered conservation varieties between Tuscany and Finland that respectively framed it in their legislation in 1997 and 2000. Since then, more than 500 varieties have been registered as conservation varieties in Tuscany (Mejias et al. 2016), and not more than 40 in Finland (Finland having twice as much population as Tuscany and being 15 times bigger in area).

However, for such diverse areas in terms of autochthonous plant genetic resources and in farming and seed systems context, there is only one common federal regulatory framework, governing these systems in 28 countries and for more than half-a-billion people. How can such common regulation acknowledge and adapt to these differences? How can the EU regulations answer the local needs of smallholders, consumers and gardeners for the conservation and the availability of plant genetic resources, when most of its principles originates from UPOV guidelines (Gilliland 2010)?

Decentralized regulations seem more likely to address the concern for CBC and landraces cultivation, since it could enable the creation of local structures and the framing of public organizational system that would tackle locally the issues linked to plant genetic erosion. Decentralized regulations would also be a solution to reintroduce more democracy into the decision system of PRM policies, or at least to rebalance the influence of stakeholders in public debates at local scale, following the experience of dialogue in Denmark, France and Austria.

Finally, as highlighted by Hammer et al. (2003), migration and rural exodus are major threats to plant genetic resources conservation, since the rural populations migrating to cities or to other countries often abandon the agricultural landraces they co-evolved with on their territories. Malet (2017), during his investigation in the tomato sector, also highlighted that one of the main cause of tomato farming abandonment (and ultimately of rural exodus) in sub-Saharan Africa was the competition of cheap tomato paste imported from Europe and China. Thus, the high productivity of agricultural systems in Europe (for example), partly permitted by the improved cultivars on the seed market, does not only create plant genetic erosion on their territory, when farmers shifts from landraces to high-yielding cultivars, but also exports it to other continents, indirectly, together with their cheap food.

The question of the need for economic protectionism on agricultural products to protect out-competed territories on food prices can thus be raised. Taxes on imported processed food or agricultural raw material could be beneficial to protect the agricultural populations and the cultivated biodiversity of developing countries and also strengthen their farming and food economy. For EU, reintroducing protectionism is a kind of taboo in the public debate, but localized solutions such as local currencies, labels or local food systems and community-supported agriculture could help the long-term viability of landraces cultivation and CBC practices.

5.4. Implications for agroecological transitions

As stated by Wezel et al. (2018), seed and landraces are resourceful for agroecology, as sources of autonomy, independence and resilience. Thus, the liberalization of the regulation governing their registration and use may have a positive effect on agroecological transitions.

5.4.1. Dialoguing and lobbying at decentralized scale

The changes in France, Denmark, Finland and Austria owes a lot to the multilateral dialogue that happened between stakeholders of the seed system. The question of implementing tolerant regulations thanks to dialogue has been addressed in a publication by Bragdon et al. (2009) who developed a theoretical framework to implement agrobiodiversity policy based on stakeholders' perspective and recommendations.

These multi-stakeholder dialogue seems to be a basis to achieve viable changes in seed systems, but there is a need for interest for the local opinions in the governing bodies. The example of Lithuania highlighted this fact: dialogue and lobby for decentralization and liberalization yielded a regulatory proposal that has not been voted yet by the national Parliament because of a lack of interest of parliamentarians for the topic. In Finland and Denmark, the reform has been supported by the important involvement of individuals within ministries of agriculture, who organized and lead the dialogue in their countries. This motivation of the public authorities to reform seed laws may not be an essential condition for the success of the dialogue, but it is an important catalyst.

The examples explored by this Master Thesis, and especially the one of Denmark, shown that lobby from grassroots movements and NGOs can be as powerful as those of private breeding companies. This lobby at national scale has been heard by public authorities and has been the solution to bring the narrative of CBC and ABS in the debate of PRM in the Kingdom.

The cases of Italy, Denmark, Finland, France and Austria proves that a decentralization and a liberalization of PRM legislation is achievable, and that lobby, dialogue and public authorities interest for the topic are the better catalyst to such reforms. The implementation of lenient regulations on PRM in these five countries are important successes for seed savers NGO, but can these liberalized policies really make a difference for agroecological transitions? To what extent are policies efficient for agroecological transitions?

Indeed, even if the decriminalization of the practices linked to CBC and ABS is an important step forward, only a few of these regulations framed a support (scientific, financial, technical or only political) to CBC and ABS practices. In the case of Denmark, the involvement of public authorities on the topic does not seem to be much bigger than before the reform. Indeed, registration and maintenance of conservation varieties and heterogeneous material remains in the hand of the local maintainer, similarly to any maintenance done by a private breeding company: it is extremely dependent to the motivation and to the technical and financial means of the maintainer.

Then, the maintenance, the use and the conservation of plant genetic resources remains the ‘responsibility’ of farmers, gardeners, seed savers NGOs, grassroots movement and seed conservation banks. These networks have been given more rights and opportunities to implement some practices that were mostly already in use. But it seems that, similarly to agricultural landraces and their growers, farming systems and the laws that govern it co-evolve dynamically, constantly adapting to each other, and to the change in society and environment that impact their operation. Hopefully, this coevolution can lead to increase the population involved in CBC, whether they are gardeners or farmers. The success of the seed exchange pop-up events organized by FrøSamlerne could be considered as a first visible expansion triggered by the reform in the Kingdom of Denmark.

5.4.2. Future perspectives of EU seed systems and regulations

Both seed systems and agricultural policies that govern them will have to tackle several issues in the near future, mainly linked to the environmental changes of the 21st century and to the evolution of technology and economy in agriculture.

Indeed, technological innovation in plant breeding, through genetic modification of plant material, is already practiced in many countries (one GMO variety of potato has been tested for several years in Denmark, without any success in obtaining certification). In Europe, GMO cultivation is not authorized in every country, but debates are frequently happening to legalize their cultivation in the MS. On the other hand, the recent reforms of the EU PRM legislations towards organic agriculture and heterogeneous cereal populations are encouraging and open many opportunities for seed exchanges and landraces cultivation, thanks to the eased bureaucracy and the authorization of such practices. In the case of Denmark, the ongoing procedure to create a common region for conservation varieties in Scandinavia would be an important improvement for their cultivation. Moreover, the experience accumulated during the test period of heterogeneous population in the Kingdom is promising.

Nevertheless, concerns about the regulatory frameworks of the newly integrated MS in Europe, such as Romania, Bulgaria and Croatia, has been expressed by the interviewed NGOs representative. Indeed, these countries had to or will have to comply with EU directives with PRM trade and PBR, and thus have an inverse trajectory compared to Denmark, France, Finland, Italy, Austria and Lithuania. Arche Noah is involved in the public debate in Romania, Croatia and Bulgaria, in order to maintain the regulatory specificities (or establish new ones) of these countries for conservation of local plant genetic diversity.

The need for robustness in national and regional regulations that seed savers NGOs would like to achieve in Europe appears to be useful, considering the debate arounds free trade acts, such as the Transatlantic Trade and Investment Partnership (TTIP). If signed and ratified, such agreements would challenge the EU to adapt their agricultural policies to ensure fair competition and effective free trade between both parties. The signature of the TTIP would question the model of seed registration in Europe. The American seed systems is based on patents filed on specific genes or traits and is much more harmful to ABS and CBC than the European. A patchwork of decentralized regulations in Europe would increase the robustness of the whole EU regulations on seed systems towards potential future changes.

But the main challenge seed systems will face may rather come from their environment. Indeed, climate change and environmental crises are and will be a major disturbance for seed and farming systems. Changes in pedoclimatic conditions, more frequent and longer drought periods, disappearance of pollinators and of beneficial organisms, appearance of exogenous pest and diseases are major issue that need an increased adaptability from agricultural varieties. Moreover, the loss in food quality, due the increased amount of CO₂

in the atmosphere, is a major threat for human nutrition and public health (Smith and Myers 2018). Indeed, because of the 'junk food effect' defined by Loladze (2002), the concentration of essential nutrients, such as zinc and iron, is decreasing in most of the agricultural plant species. This decrease has also been observed for some proteins.

Researching and developing the use of landraces with specific nutritional or agronomic traits would be thus extremely important if these trends are persisting, nay aggravating, hence the absolute need to safeguard them. But their integration in farming and food systems will have to be eased by regulations, while ensuring their availability and their 'public' ownership.

6. Conclusion

Denmark, thanks to the reforms that happened in 2015, can be considered, in 2018, as the country with the most tolerant rules for seed exchange and cultivation of non-commercial varieties in the European Union.

Indeed, many ‘sidetracks’ for alternative seed systems have been opened: seed exchange between gardeners and between farmers has been authorized, certification requirements have been made more lenient for conservation varieties, heterogeneous material and hobby varieties. The reform also framed innovative organizational structures, such as the closed seed system, creating new models for trust building between stakeholders in the seed sector. The specificity of the Danish seed regulations is that they address a wide scope of issues and practices. Indeed, they open opportunities both for gardening and farming, both for non-commercial and commercial exploitation of plant genetic resources. The diversity of the framed provisions acknowledges the diversity of practices existing in alternative seed systems and in the use of plant genetic resources, needed to enhance the plant genetic resource safeguard as well as farmers’ empowerment.

The case of Denmark, as well as those of Finland, Italy, Austria, France and Lithuania, prove that it is possible, thanks to dialogue between stakeholders and to motivation for change, to implement PRM legislations that can contribute to the conservation and use of plant genetic resources and that are widely accepted among the diversity of stakeholders of the seed systems. Indeed, the laws in Denmark, Italy, France, Austria and Finland acknowledge the need for organizational systems that support CBC and ABS, as provisioned by ITPGRFA and Nagoya Protocol, and created them, with different focuses, in their regulations.

Decentralization, rather than the modification of the EU regulations, has enabled the reforms, since seed savers NGOs, grassroots systems, and farmers organizations and their narratives appeared to weight more in political decision systems at national and regional scales, than it does at federal scale. Indeed, seed systems at national or regional scales are easier to change, since they involve a limited number of stakeholders. Moreover, changes at decentralized scale can better cope with the local economic, agronomic and environmental context of the farming and seed system they govern. Dialogues, that happened in most of the studied MS, enabled the creation of viable regulatory framework, on which agreements has been found between stakeholders.

But, even if dialogue and lobby actions happen, the implementation of the reform relies very much on genuine motivation and interest of public authorities for the topics of CBC and ABS. Moreover, the existence of such laws has been permitted by the goodwill of the formal seed sector, as long as the framed provisions do not hamper seed companies’ business or create unfair competition situations. Thus, the extend of the opened opportunities remains limited in term of commercial exploitation. The niche economic sectors authorized by the studied reforms have to remain alternative ‘sidetracks’ to the mainstream ‘highway’ of the formal seed sector. This limitation in scale could hinder their contribution to the safeguarding of cultivated biodiversity if they cannot up-scale out their niche.

Moreover, even if such reform creates a favorable framework for the practices benefiting to CBC and ABS, it generally only decriminalize practices that were mostly already implemented. The tolerant legislations rarely provide supplementary support, in term of subsidies or technical advices. The studied reforms also do not challenge the operation of FSS and the provisions of the EU regulatory framework, despite the trend in plant genetic resources erosion and decreased ABS in farming systems they contribute to. But, reforming FSS, or giving even more market opportunities to the practices legalized by the laws described in this Master Thesis, would be much more complicated. Indeed, political initiatives towards in this direction would face a strong opposition.

The characteristics that enabled the reform in Denmark, and in the other studied MS are not specific to their context. Thus, reform towards seeds trade and landraces cultivation liberalizations can be implemented anywhere else. Indeed, lobby from NGOs and dialogue between seed system stakeholders can happen in any other country. Both are however slightly dependent to the motivation of CBC supporter and to the interest of the local authorities for the topics. To be able to implement this dialogue in small-scale system and to avoid the arguments of private breeders to weight to much, decentralization at regional scale, as it has been done in Italy can be helpful.

Finally, as shown by the case of Denmark, many 'sidetracks' can be opened, according to the local farming systems and to the availability of plant genetic resources. In the EU, opportunities exist in the directives framing the operation of the seed system. Indeed, non-commercial use and use in closed systems of uncertified varieties can be authorized as stated in the Article 2a of the Council Directive 2002/55/EC, as well as exchange in small amounts of such varieties' PRM for trial and research as written in the Article 7 of this very same directive. Newly implemented regulations on seeds from and for organic agriculture (Arche Noah 2018) and projects of new regulations on heterogeneous material after trials in several MS (Labarthe et al. 2018) might open even more opportunities for MS to implement regulations that are beneficial to CBC.

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Appendix

A. Seeds and varieties regulations postcard

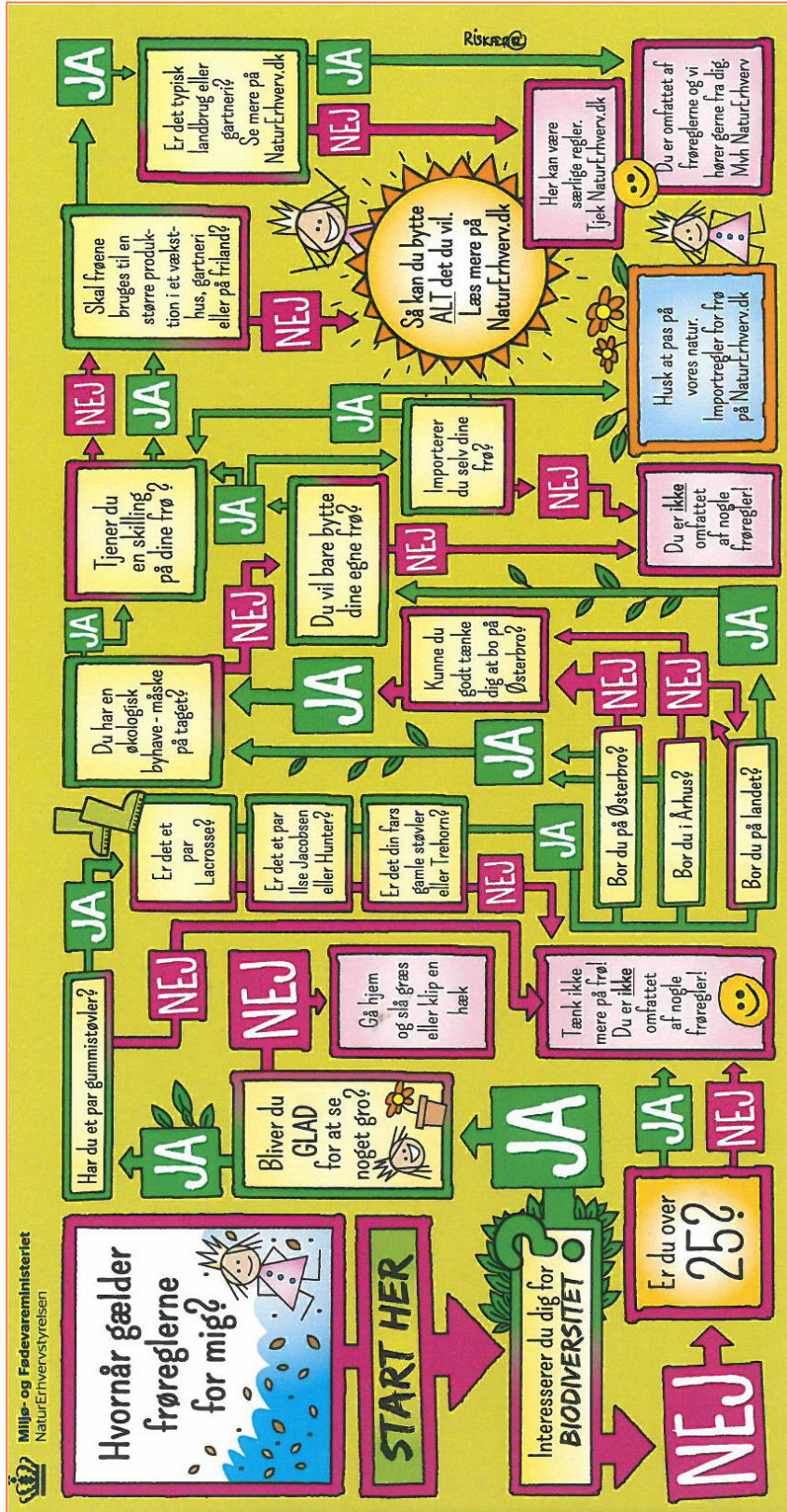


Figure 8: Postcard on the new PRM regulation edited by Landbrugsstyrelsen



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