IND's skriftserie nr. 51

Communicating Knowledge of Plant Genetic Resources to the Public

IND's skriftserie

Nr. 45 Vedkommende undervisning - for hvem?... (2016)

Nr. 46 Educational design in math and science: The collective aspect (2016)

Nr. 47 Det første år på Naturressourcer... (2016)

Nr. 48 Elevforudsætninger og faglig progression (2017)

Nr. 49 MatematikBroen - Fra Grundskole til gymnasium (2017)

Nr. 50 Study and Research Paths at Upper Secondary ... (2017)

Nr. 51 Communicating Knowledge of Plant Genetic ... (2017)

Other http://www.ind.ku.dk/skriftserie/

UNIVERSITY OF COPENHAGEN
DEPARTMENT OF SCIENCE EDUCATION

Communicating Knowledge of Plant Genetic Resources to the Public

- A study of demonstration projects in a grant-scheme in the Danish Rural Development Programme

PhD Thesis

Louise Windfeldt

Published 2017

Institutnavn	Institut for Naturfagenes Didaktik
Name of Department	Department of Science Education
Author	Louise Windfeldt
Titel / undertitel:	Vidensformidling af plantegenetiske ressourcer til befolkningen - Et studie af demonstrationsprojekter i en tilskudsordning under det danske landdistriktsprogram
Title / Subtitle:	Communicating Knowledge of Plant Genetic Resources to the Public - A study of demonstration projects in a grant-scheme in the Danish Rural Development Programme
Emnebeskrivelse:	A series of studies of the conditions for disseminating knowledge of plant genetic resources in museums and other Informal Learning Environments
Vejleder:	Marianne Achiam and Lene Møller Madsen
Afleveret den:	20. September 2016
Antal ord:	78.345 including appendices

Popular abstract

This thesis analyses how knowledge of plant genetic resources was communicated to the public through demonstration-projects in a governmental grant-scheme, which was part of the EU Rural Development Programme 2007 to 2013. The grant-receivers were museums and other Informal Learning Environments. Three studies were made using frameworks from educational research, communication theory, and network theory: At first an analysis of the conditions influencing the formulation of the grant-scheme was made, secondly a study of the grant-receivers' communication was conducted, and finally the cooperation between the grant-receivers was analysed. It was found that the potential to disseminate knowledge of plant genetic resources to the public through the grant-scheme was high but limited in scope due to the conditions that made it. With these limits the grant-receivers were successful communicators, and their diversity as well as cooperation between them were found to enhance the potential of learning and learners.

Recommendations are given to the work with plant genetic resources: It is important that international strategies and an overall national programme govern the conservation, growing and development of plant genetic resources. Informal Learning Environments can be successful communicators, and collaboration may increase efficiency, lower costs, and may also help building up stable, long-term relations and trust between stakeholders and the State.

Contents

ACKNOWLEDGEMENTS 6

1. ABSTRACT 7

2. INTRODUCTION 9

Objectives of the study 10

Overview of the thesis 10

Project history 11

3. CONCEPTUAL FRAMEWORK AND CONCEPTS 16

Previous research in raising public awareness of PGR 16

Didactic Transposition as a conceptual framework 19

Characteristics of Informal Learning Environments 24

The thesis and the use of concepts and frameworks 37

4. BACKGROUND AND METHODS 39

Plant Genetic Resources and policy 39

Methods 49

Analyses of data 57

5. FINDINGS 72

The educational potential of the grant-receivers in the Grant PGR 72

Summary of findings in the three papers 83

6. DISCUSSION 92

Discussion of findings **92**

Recommendations **104**

Discussion of frameworks, concepts, and methods **109**

Concluding remarks and perspectives for future research **115**

REFERENCES **118**

OVERVIEW OF PAPERS **127**

Paper 1: Transferring knowledge from a scholarly context to a policy context **128**

Paper 2: Communicating plant genetic resources for food and agriculture to the public **158**

Paper 3: Collaborative Networks as Institutional Support to Delivery of Environmental Services **184**

APPENDIX A: DETAILS OF GRANT-RECEIVERS' APPLICATIONS **207**

APPENDIX B: ALL GRANT-RECEIVERS **220**

APPENDIX C: INTERVIEW GUIDE **221**

APPENDIX D: CONCEPT MAPS FROM INTERVIEWS **222**

APPENDIX E: COHERENCE OF ELEMENTS, NEW CIRCLE MODEL **231**

APPENDIX F: CONCEPT MAP, DIDACTIC TRANSPOSITION **240**

Acknowledgements

I would like to take this opportunity to thank a lot of people who helped me through the PhD journey.
First of all, I will thank Lars Landbo from the Danish Ministry of Food, and Birgit Rønne from the National Museum of Denmark for believing in the project, getting me started, and encouraging me in numerous ways. I will also thank my supervisors, Marianne Achiam and Lene Møller Madsen. Interest in and support to my project have been crucial motivating factors. Also a great thank to all the people at the Department of Science Education, KU. Your supportive environment is outstanding.
I want to thank Marianna Bosch for inviting me to Barcelona on change of scientific environment and for continuous encouraging supervision. Also thank you to all the helpful people at and around Ramon Llull University for good company and excellent lunches.
However, my work would never have come to an end without numerous helpers: Lone Søderkvist Kristensen from Department of Geosciences and Natural Resource Management, KU, Morten Rasmussen from NIBIO, Søren Kjærsgaard Rasmussen from Department of Plant and Environmental Sciences, KU, Lila Towle from the Danish Seedsavers, Mads Randbøll Wolf, and Lars Ulriksen, Department of Science Education, KU (for peer-review), Massimo Soldano from Legal Knowledge Centre in Copenhagen (for guiding in the jungle of EU legislation), my PhD-fellows, and my extended family (for all sorts of support).

1. Abstract

This thesis analyses how knowledge of Plant Genetic Resources was communicated to the public through demonstration-projects in a grant-scheme, which was part of the Danish Rural Development Programme. The grant-receivers were museums and other Informal Learning Environments. I made three studies: A study of the conditions influencing the formulation of the grant-scheme, a study of the grant-receivers' communication, and a study of cooperation between the grant-receivers.

I found that the grant-scheme was based on scholarly knowledge. This knowledge was changed in the formulation of the grant-scheme in a political environment. Limitations to the knowledge were a result of the adaptation to EU's Rural Development Policy, which made it difficult to fulfil the aims of the grant-scheme as well as international obligations on FAO and UN levels. Furthermore, though central goals of EU's Rural Development Policy were fulfilled with the development of expensive quality food-products made from Plant Genetic Resources (PGR) it was difficult at the same time to raise public awareness of PGR in a way that reflected the most important core of the scholarly knowledge. The decisions to invite many diverse grant-receivers, to include an obligation for all grant-receivers to communicate, and to enhance cooperation between them were all successful and unique to the Danish implementation of this grant-scheme in the Rural Development Programme. This means that some of the aims of the grant-scheme were fulfilled, but most of them interfered with each other, hindering a proper implementation.

All in all the studies show that the potential to disseminate knowledge of PGR to the public through the grant-scheme was high but limited in scope due to the conditions that made it. With these limits the grant-receivers, were successful communicators. Their communication was coherent and well integrated in the institution. The grant-receivers were closely related to scholars, and they used many characteristics known to enhance science learning in Informal Learning Environments to make the abstract 'PGR' concrete for their visitors. The many diverse grant-receivers enhanced the potential of learning and learners, since all facilitated the same core message with the same overall purpose in many different places at the same time. The effect of this was enhanced by the grant-receivers' diversity and by working together in teams and network.

Recommendations are given to the work with PGR: It is important that international PGR-strategies and a national programme govern the conservation, growing, and development of PGR. Informal Learning Environments can be successful communicators, and collaboration may increase efficiency, lower costs, and may also help building up stable, long-term relations and trust between the Plant Genetic Environment and the State.

Dansk sammendrag

I denne afhandling analyserer jeg, hvordan viden om Plantegenetiske Ressourcer blev formidlet til befolkningen gennem demonstrationsprojekter i en tilskudsordning, der var en del af det danske landdistriktsprogram. Støttemodtagerne var museer og andre uformelle læringsmiljøer. Jeg udførte tre studier: Først undersøgte jeg de betingelser, der havde indflydelse på udformningen af tilskudsordningen, dernæst analyserede jeg støttemodtagernes formidling, og til sidst undersøgte jeg samarbejdet mellem dem.

Mine resultater viser, at tilskudsordningen var baseret på viden fra forskere og praktikere. Denne viden ændredes, da ordningen blev udformet i et politisk miljø. Begrænsninger var et resultat af støtteordningens tilpasning til EU's landdistriktspolitik, og de gjorde det både vanskeligt at opfylde tilskudsordningens formål og Danmarks internationale forpligtelser i forhold til FAO og FN. Og selvom centrale mål af EU's landdistriktspolitik blev opfyldt med udvikling af dyre kvalitetsfødevarer, var det svært samtidig at øge offentlighedens kendskab til og interesse for Plantegenetiske Ressourcer (PGR) på en måde, der reflekterede den vigtigste kerne af viden om PGR. Beslutningen om at invitere mange forskellige institutioner til at søge tilskudsordningen, at gøre det obligatorisk for alle at formidle og at fremme samarbejdet mellem dem var til gengæld alle succesfulde og unikke faktorer i den danske implementering af denne tilskudsordning i landdistriktsprogrammet. Dermed blev nogle af tilskudsordningens formål opfyldt, men flere andre modsagde hinanden og hindrede derfor en optimal opfyldelse.

Alt i alt viser mine undersøgelser, at potentialet for at formidle viden om PGR til befolkningen igennem denne støtteordning var høj men havde begrænsede muligheder på grund af de betingelser, der skabte den. Med disse begrænsninger var støttemodtagerne succesfulde formidlere. De var tæt forbundet til forskere og praktikere, deres formidling var sammenhængende og vel integreret i institutionen, og de havde mange karakteristika kendt fra uformelle læringsmiljøer for at fremme naturvidenskabelig læring. Disse blev brugt til at gøre det abstrakte begreb 'Plantegenetiske Ressourcer' konkret for de besøgende. De mange og meget forskellige tilskudsmodtagere fremmede læringspotentialet, fordi alle formidlede den samme kerneviden med det samme overordnede formål på mange forskellige steder samtidig. Denne effekt blev yderligere forstærket af tilskudsmodtagernes forskellighed og af deres samarbejde.

På baggrund af mine undersøgelser kan jeg give følgende anbefalinger til arbejdet med PGR: Det er vigtigt, at internationale PGR-strategier og et nationalt program styrer bevaring, dyrkning og udvikling af PGR. Museer og andre uformelle læringsmiljøer kan være velegnede formidlere, og samarbejde kan øge nyttevirkningen, nedbringe udgifter og kan også hjælpe til at opbygge stabile relationer på langt sigt og tillid mellem staten og Det Plantegenetiske Miljø i Danmark.

2. Introduction

Plant Genetic Resources for Food and Agriculture are the plants we eat, and plants we grow as forages and for technical use. They include all varieties of actual or potential value (FAO, 2009). As this study concerns only food crops, Plant Genetic Resources for Food and Agriculture (PGR) are defined as 'the plants we eat'.

Mankind depends on having access to suitable plants for food by preserving the broadest possible variation. Different varieties mean different characteristics – not just in taste and nutrition, but also in growing properties. Thus PGR are also the "raw material indispensable for crop genetic improvement (…) and are essential in adapting to unpredictable environmental changes and future human needs" and thus to ensure sustainable growing and food for the future (FAO, 2009, Preamble).

The worldwide work of developing effective and sustained conservation and utilization practices of PGR requires political and economic backing, and it is organized through the Food and Agriculture Organization of the United Nations (FAO). 140 of 193 independent nations have signed the International Treaty on Plant Genetic Resources for Food and Agriculture (FAO treaty) (FAO, n.d. a) and all are responsible for conserving and using their PGR in a sustainable way (FAO, 2009).

But though PGR has a considerable long run impact on agricultural development and food security (e.g. Hoisington et al, 1999; Virchow, 1999), its role is not widely recognized or understood. FAO points out that "Greater efforts are needed to estimate the full value of PGR, to assess the impact of its use and to bring this information to the attention of policy-makers and the general public so as to help generate the resources needed to strengthen programs for its conservation and use" (FAO, 2010, p. 198). Hence, an important part of preserving PGR is to raise public awareness, which means to plan and carry out suitable public communication initiatives.

In Denmark the Ministry of Food, Agriculture and Fisheries (the Ministry of Food) coordinates the conservation and use of PGR. In 2006 it initiated demonstration projects on a series of Old Danish agricultural crops and fruit types worthy of conservation. One of the purposes was to raise public awareness (The Danish Ministry of Food, Agriculture and Fisheries [The Danish

Ministry of Food], 2012). Grants were given for testing plant-varieties and disseminating knowledge on the importance of PGR to the public with the participation of both farmers and several public institutions. As the experiences were positive, the 'Grant for demonstration projects about conservation and sustainable use of plant genetic resources' (Grant PGR) was embedded in the Danish Rural Development Programme, 2007 to 2013 (The Danish Ministry of Food, 2012). The first grants were allocated in 2008, and the last demonstration-projects closed in 2014.

Objectives of the study

In this thesis I shall study dissemination of knowledge on PGR to the public through the Grant PGR, and the conditions that made it. The overall aim is to assess the grant's potential to communicate knowledge on PGR to the public.

To do so I will study the conditions which influence the formulation of the grant as they are expected to have an impact on the knowledge that can later be disseminated in the demonstration-projects. The grant-receivers and their demonstration-projects will be analysed to evaluate their potential to communicate PGR to the public. Also the cooperation between the grant-receivers will be analysed for the influence upon their work.

Through my studies I hope to clarify the conditions of the communication. The studies will finally serve as the basis for recommendations to policy-makers on how the dissemination of knowledge through the Grant PGR and national PGR-programmes, of which the Grant PGR is part, could be improved.

Overview of the thesis

My first study is based on knowledge from scientific papers, webpages and articles by scientists and practitioners, who define and develop the field of PGR. I analyse how this knowledge was transformed into the Grant PGR by the Ministry of Food, which set up the conditions for the grant-scheme. In this process the knowledge, values and practices were changed, and it influenced the knowledge that could later be disseminated in the demonstration-projects.

My second study analyses how knowledge of PGR was disseminated in the demonstration-projects. The aim is to evaluate the individual grant-receiver's potential to communicate PGR to

the public as well as the effect of many grant-receivers communicating knowledge of PGR at the same time.

In the third study I examine the grant-receivers' collaboration as this was one of the Grant PGR's purposes, and it was expected to influence the communication potential and the resilience of the institutions involved.

Figure 1 gives an overview of the back-bone of the thesis.

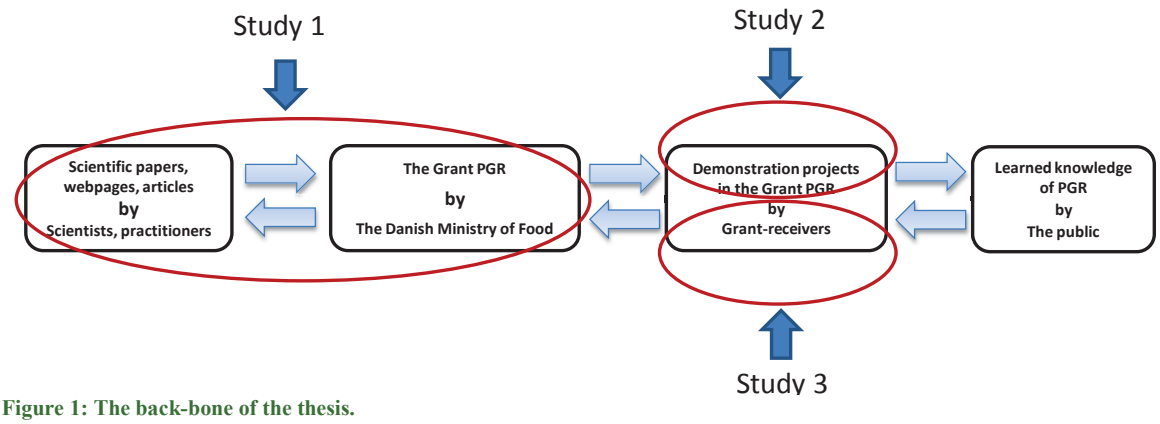


Figure 1: The back-bone of the thesis.

Project history

Prehistory

As a horticulturist and a science writer I had been working for some years with Nordic produce and projects related to New Nordic Food in the Nordic Council of Ministers, when in 2006 the Danish Ministry of Food started to give out grants for demonstration projects on Nordic food plants. In 2008 the Grant PGR became part of the Danish Rural Development Programme, and the communication objective of demonstrating PGR through the grant was to make the public understand the value of a great diversity of the plants we eat and the importance of conserving PGR (The Danish Ministry of Food, n.d. a).

The aim of the grant-scheme was to protect plant genetic resources for food and agriculture (PGR) by giving support to projects which conserved and promoted the sustainable use of old Danish PGR worthy of conservation. At the same time suitability for environment friendly farming and food products could be tested. Furthermore the Grant PGR should increase public

awareness and interest in conservation of plant genetic resources and enhance the cooperation between stakeholders. The scheme would at the same time help Denmark to fulfil its obligations according to the FAO treaty on PGR and UN's Biodiversity Convention.
In 2009 I supplemented my work as a science writer with project-managing of one of these demonstration-projects in the Open Air Museum, which is part of the Danish National Museum. The museum demonstrated old varieties of grains, vegetables and fruit to their visitors, and through these projects I started to collaborate with farmers, universities, pometa (collections of fruit trees), NGOs, and other museums – I became part of the Plant Genetic Environment in Denmark.
Gradually my curiosity grew to learn more about the communication of PGR through all the very diverse demonstration-projects invented and managed by scientists and practitioners and often developed through their collaboration. How could the work be described, assessed – and maybe enhanced? This was the first idea of my PhD-project.

Development of the PhD-project

The Ministry of Food was interested in a scientific evaluation of the communication of PGR through the Grant PGR and co-funded the PhD-project as part of the national PGR action-plan 2011to 2013. The National Museum co-funded the PhD-project to get an analysis of activities connected to their exhibitions, and The Ministry of Culture had a fund for communication research which also co-funded the project. The last co-funding part was the University of Copenhagen. My knowledge as a horticulturist, and my skills as a science writer needed a didactic superstructure to cope with a scientific project like this, and cooperation with the Department of Science Education at the University of Copenhagen began.
The first title of the project was "The Museum as a Communicator of Plant Genetic Resources", and the initial description was an analysis of the activities to disseminate knowledge of PGR in Danish museums, which were part of the Grant PGR in the Ministry of Food. Design-based research would then be carried out in the Open Air Museum with for instance visitor studies, and

public learning could thus be evaluated.

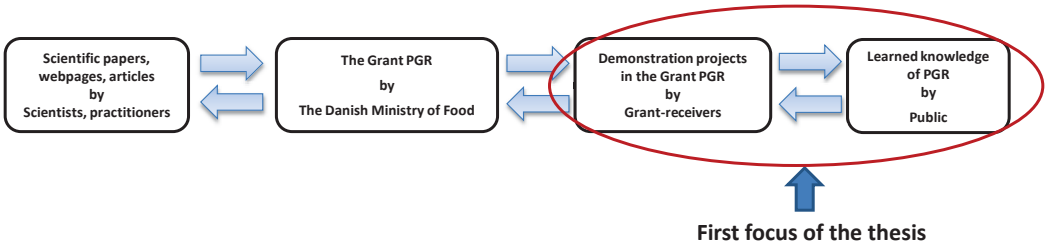


Figure 2: First focus of the thesis was on evaluating public learning of PGR.

I began by looking at demonstration-projects in the museums which were receiving the Grant PGR, and I soon discovered that most of them were made as teamwork involving other institutions – and all institutions had the obligation to communicate about PGR. Thus there were many projects in many institutions, all having some obligation to communicate PGR. This made me curious to look at demonstration-projects in institutions, which could be classified as a museum or an exhibition-site, and to find out whether there was a difference between the dissemination taking place in the museums and in the other institutions. As I wanted to find out, how museums and exhibition-sites involved and activated the public I needed a description of a museum to be able to select the projects, which could match this. I used the ICOM definition:

> *A museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment* (ICOM, n.d.).

It has been debated whether it is important for museums to be non-profit (see e.g. Bloch, 2004). For many years there have been private collections with admission fees, and though there are growing pressures on public museums to generate additional revenues, we consider them as museums. In practice, the definition of a museum also includes exhibitions where the focus is on communication, and the continuous way to work (from the collection of objects to the registration, conservation, research – and finally display in exhibitions) is not followed. Institutions which do not collect, conserve, or research objects but still work in the service of society and its development are perceived as museums. It can also be exhibition places without actual objects like for instance science-centres and natural parks. Donahue (2004) suggests that

"ICOM members strive to construct a strong inclusive vision of what constitutes a museum, focused on service to society" (Donahue, 2004, p.4)
From these discussions, the museum-definition, and the objective of the Grant PGR, I was now looking for places disseminating knowledge of PGR to the public in the service of society and its development.

Defining 'the public' I limited the definition of the target-groups to ordinary museum visitors, e.g. citizens, garden owners, consumers and the like. Thus schools and professional visitors as farmers, chefs, or gardeners were not part of the target-groups I was looking at.
I studied the applications from all demonstration-projects, which had received the Grant PGR in the years 2008 to 2013. There were all in all 52 project-applications from 28 very diverse grant-receivers, which could be divided into eight groups:

Research Institutions	E.g. universities or research consultants
Pometa (plural of pometum)	Collections of fruit trees and fruit bushes grown for research and teaching purposes
NGOs	Non-Governmental Organizations, e.g. seed savers. This category has members (the organization) and at the same time visitors for activities made by the organization.
Companies	E.g. farms, vegetable companies, restaurants, nurseries, and producers of for instance marmalade
Open farms	Working farms open for public visits. This category is at the same time a farm and a museum with opening hours and communication for the public
Local Groups with Public Access	Local groups managing places with public access. This category has members (the local group) and at the same time visitors, as it manages a garden, a park, or a plantation with public access
Municipalities	Local administration units
Museums	Open-air museums and other museums with gardens or fields, e.g. manors

Table 1: The 28 grant-receivers could be divided into eight groups

Many of the grant-receivers had more than one demonstration-project, and activities and materials were often shared between the projects in the institution, e.g. activity-days, home-page, and guided tours. This made it more logic to focus on the grant-receivers instead of on single demonstration-projects. Furthermore many of the projects involved more than one grant-receiver, and enhancing cooperation between grant-receivers was one of the objectives of the Grant PGR. Thus my focus shifted from the design of single-projects to the diversity of grant-receivers and their cooperation in the Grant PGR. I decided to study how the Grant PGR as a whole communicated knowledge on PGR to the public in order to improve it. This also involved an analysis of the conditions that made the Grant PGR as they were expected to have an impact on the knowledge that could later be disseminated by the grant-receivers. Especially unfolding the analysis of the conditions for the Grant PGR has been a large-scale study of PGR-policies in FAO, EU, and Denmark. Visitor studies were not carried out, and thus knowledge from the visitors and how they interacted with the demonstration-projects did not become a part of the study. Thus, I did not evaluate the Grant PGR's *public learning* but the Grant PGR's *educational potential for the public*.

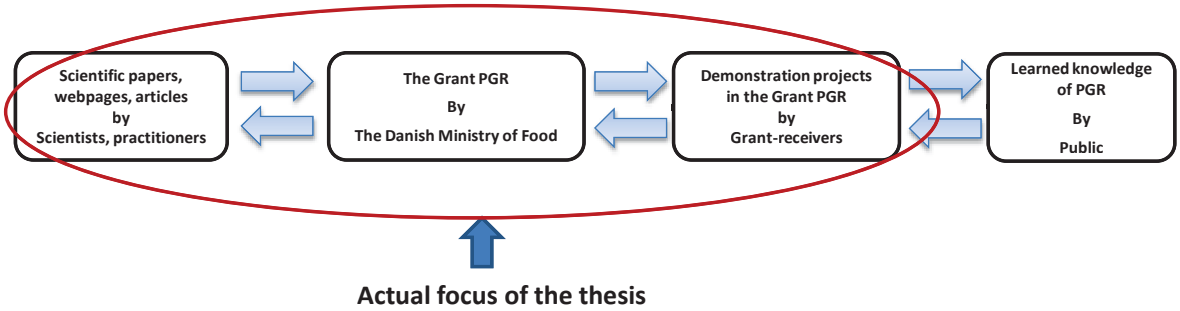


Figure 3: Actual focus of the thesis is on analysing the dissemination of knowledge to the public through the institutions in the Grant PGR, and the conditions which made it.

3. Conceptual framework and concepts

This chapter begins with a brief review of previous research on 'raising public awareness on plant genetic resources' to see, how raising awareness of PGR in the public has been described in scientific literature. This is followed by an outline of the most important frameworks and concepts used to manage the analyses of dissemination of knowledge on PGR. Finally, the three papers in the thesis are described with their use of concepts and frameworks.

Previous research in raising public awareness of PGR

To set the scene for an analysis of the dissemination of knowledge to the public I made a brief review of previous research in raising public awareness of plant genetic resources for food and agriculture. The search was made in three steps: At first (1) on the over-all notion: 'plant genetic resources (for) food (and) agriculture', then (2) on the literature from the first step that also covered 'raising public awareness'. Finally (3) I searched 'raising public awareness' without connection to 'plant genetic resources (for) food (and) agriculture'.

First step: I searched the Danish Royal Library's online search engine 'REX', using the words 'plant genetic resources food agriculture', which resulted in almost 6000 scientific papers in peer-reviewed journals. They were addressing themes that could roughly be divided into 3 categories: *genes*, *plants and resources,* and *agriculture and growing.* Far the majority of the papers had *genes* as a central topic.

Second step: Following this I made a search adding the words 'public awareness' to 'plant genetic resources food agriculture', since the phrase 'public awareness' is widely used by FAO, e.g. "Public awareness is the key to mobilizing popular opinion and to generating and sustaining appropriate political action nationally, regionally and internationally" (Commission on Genetic Resources for Food and Agriculture, 2012, p.83), or "Public awareness and the roles that specific target audiences can play in sustaining plant genetic resources should be considered when developing any PGRFA activity" (Commission on Genetic Resources for Food and Agriculture, 2012, p.84). FAO defines actions to raise awareness, e.g. "Communicating effectively about the

many benefits that PGRFA can bring to food security and sustainable livelihoods" (Commission on Genetic Resources for Food and Agriculture, 2012, p.83) or "to bring information of the full value of PGRFA … to the attention of policy-makers and the general public" (Commission on Genetic Resources for Food and Agriculture, 2012, p.84). This could be done by e.g. using "various media and through additional mechanisms such as street fairs and school initiatives" (Commission on Genetic Resources for Food and Agriculture, 2012, p. 61).

The search resulted in 56 peer-reviewed papers, and in addition to the 3 categories of subjects mentioned above, a new category of subjects connected to *policy* appeared. This is due to 'raising public awareness' being used in policy-papers as the 'Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture' cited above (Commission on Genetic Resources for Food and Agriculture, 2012). The majority of papers fitted into this category with subjects as economics, international law, treaties, intellectual properties and sustainable development. The majority of the papers mentioned the International Treaty on Plant Genetic Resources for Food and Agriculture (FAO-treaty) in the title.
One of the titles contained 'public awareness'. The paper presented findings from Switzerland on public knowledge of the concept of biodiversity and of plant species' richness, using a questionnaire (Lindemann-Matthies & Bose, 2008). This means that the paper looked at the result of disseminating knowledge of biodiversity to the public, but not at the communication process. Only few of the other papers addressed 'public awareness' as a concept, but either focused on making farmers aware of growing PGR (e.g. De Boef, Thijssen, Shrestha, Subedi, Feyissa, Gezu, Canci, Ferreira, Dias, Swain & Sthapit, 2012) or making others aware of farmers' knowledge of the subject (e.g. Nilsen, Subedi, Dulloo, Ghosh, Chavez-Tafur, Blundo Canto & de Boef, 2015). The papers addressing 'public awareness' all mentioned the need to raise public awareness, though it was not a theme of the actual paper. For instance: "Last but not least, public awareness of this great biological resource will have to be increased" (Gepts, 2006, p. 2289) or "… the institutionalization of measures for creating awareness through appropriate media on the values and value addition implicit in the conservation and sustainable use of PGRFA is sacrosanct" (Mba, Guimaraes, Guei, Hershey, Paganini, Pick & Ghosh, 2012, p. 31).

So, though it is acknowledged in the reviewed literature that it is important to raise public awareness of PGR, and that measures for creating awareness through appropriate media should be institutionalized, I was not able to find investigations or evaluations of how knowledge of PGR is disseminated to the public. Thus, there was no established scientific field with a defined theoretical framework for analysing dissemination of knowledge on PGR.

Third step: Finally I searched 'REX', using the words 'raising public awareness' (in title, from 2000 to 2012). This resulted in 49 scientific papers in peer-reviewed journals. Far the most were related to raising public awareness of health issues in order to make the public aware and act in special ways (e.g. Kosmas et al., 2010). Others dealt with for instance raising public awareness of pollution (Wolfe, 2001), also with the intention to make the public aware and take action.

As the objective of my studies was looking at the potential of raising public awareness - but not necessarily action - through dissemination of knowledge, I turned to frameworks from educational research: *Didactic Transposition* and *Informal Learning Environments.* The framework of *Didactic Transposition* was used as a backbone binding the thesis together, and the framework of *Informal Learning Environments* was a prerequisite for seeing the grant-receivers as science education settings. These frameworks will both be explained in the following. Furthermore, *Didactic Transposition* is used in Study 1 to understand the transformation of 'Scholarly knowledge of PGR' into 'knowledge to be disseminated in the Grant PGR' (see Paper 1, fig. 2).

I also used other frameworks in the three studies which are briefly described here:

- *Communication theory* is used in Study 2 to assess the coherence of the dissemination of knowledge on PGR by looking at the content, target-group, sender, communication-environment, media and design of the communication, which are interrelated to fulfil the objective and give effect (Ingemann, 2003) (see Paper 2, fig. 2).
- A combination of three different frameworks is used in Study 3 to be able to analyse different aspects of networking: (1) The *cooperative, coordinative and collaborative networks* (Mandell, Keast and Brown, 2009) is used to distinguish between three intensities of networking. (2) The *governance network* (Sørensen & Torfing, 2005) is used to understand relations between the

state and a number of diverse partners in private as well as public institutions and civil society. Finally (3) the framework of *Collective Impact* (Kania & Kramer, 2011) is used to unfold how to make networking operational (see Paper 3).

Didactic Transposition as a conceptual framework

I needed a theoretical framework to overview the process. Since the overall aim of the thesis is to study dissemination of scientific knowledge and conditions of knowledge-dissemination, I will briefly elaborate on, how science education and dissemination of scientific knowledge have been described and researched in different scientific environments.

A traditional science didactical approach has its origin in *the didactic triangle* (see fig. 4) originating in classic Greek rhetoric. This has been developed in many ways to explain for instance the learner's motivation, the teacher's aims, the social context of the classroom, the school, the society, and other conditions influencing the teaching and learning of science.

In France, science education was formed in the 1970's from Didactics of Mathematics and Didactics of Experimental Sciences at several universities with a national network. With the point of departure in the classic didactic triangle they emphasized the difference between pedagogical research, which is not dependent of the contents that are taught, and didactical research, which is specific to the contents (Clément, 2006). The same split in the science education community is described by Duit, Gropengießer, Kattmann, Komorek, & Parchmann (2012), who call the two positions *student-oriented* and *science-oriented.* They argue, however, that "it seems that progress in student understanding and learning is only achieved if there is a balance between the two perspectives" (Duit et al., 2012, p. 16). Against this background Duit et al. (2012) developed the *Model of Educational Reconstruction* with the key assumption that "curriculum developers' awareness of the students' point of view may substantially influence the reconstruction of the particular science content" (Duit et al., 2012, p. 19).

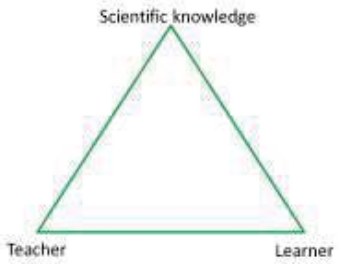


Figure 4: The didactic triangle

Central to this model is that scientific knowledge as it is understood and used by scientists is not readily understood by people outside the scientific world. This has also been described by others

in science education research. Layton, Jenkins, Macgill, and Davey (1993) observed how people use knowledge actively by 'filtering' the information that is relevant to them, and they rework the knowledge to make it meaningful to them. Accordingly scientific knowledge is not the same as the knowledge that is taught in the classroom – it is deconstructed and reconstructed to make it teachable (Chevallard, 1985; Layton et al., 1993).

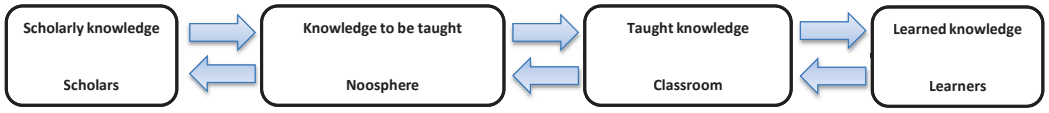


Figure 5: The model of Didactic Transposition (after Chevallard & Bosch, 2014)

Chevallard, working with teaching of mathematics, developed this process into a model of *Didactic Transposition.* This model primarily formulates the need to consider that the knowledge, which is taught in school, is generated outside school and moved – 'transposed' - to the classroom because of a social need of education and diffusion of the scientific knowledge. To do so, it has to go through a series of steps, where it is deconstructed and rebuild into the next step. The steps between the scholarly knowledge and the knowledge taught in the classroom is for instance the 'knowledge to be taught', which describes the conditions of teaching, often regulated in laws or plans. The last step of the process is 'learned knowledge', where learners understand the knowledge. However, sometimes the transposition process puts limitations to the knowledge, which can be taught in the class-room, and the original rationale of the knowledge is more or less lost (Bosch & Gascón, 2006).

Developing a set of attached concepts: didactic system, didactic and adidactic situations, didactic engineering etc. this was named the *Theory of Didactic Transposition,* and within some years it spread from France to other countries – especially Spanish speaking countries (Bosch & Gascón, 2006). It also spread from didactics of mathematics to other fields, for instance biology education (Clément, 2007), computer science education (Hazzan, Dubinsky, & Meerbaum-Salant, 2010), and teaching of languages (e.g. Banegas, 2014).

The Didactic Transposition of scholarly knowledge to learned knowledge has been studied by other scientists, for instance Clément (2006), who views knowledge as interactions between

knowledge, values and social practices. He also adds more steps to the process, for instance 'school textbooks and other tools' between the 'knowledge to be taught' and the 'taught knowledge' (Clément, 2006).

Though the idea of Didactic Transposition arose in science education research in school contexts, it can also be used to explain the transformation of knowledge in other contexts, for instance to study how museums create educational environments on the basis of certain objects of scientific knowledge, which they wish to mediate to their visitors. This is called *museographic transposition*. It is for instance described by Simonneaux and Jacobi (1997), who studied choices made in the transformation of scientific knowledge into the knowledge to be presented in posters in a museum exhibition. Another example is Mortensen (2010 b), who used museographic transposition in a retrospective study of the development of an immersive exhibit on animal adaptations to darkness.

Comparison of Didactic Transposition in a school-context and the context of the Grant PGR

In the present thesis Didactic Transposition is used as a backbone to overview the transformation and transposition of knowledge on PGR as it is presented by scientists and practitioners (step 1), to knowledge to be disseminated by the Danish Ministry of Food in the Grant PGR (step 2), by the grant-receivers in the demonstration projects (step 3), and finally how it is learned by the public (step 4). Knowledge is broadly defined as knowledge, values and practices (Clément, 2006). I will explain all 4 steps in the framework by comparing Didactic Transposition of knowledge in a school context to the Didactic Transposition of knowledge of PGR in the Grant PGR and the demonstration projects.

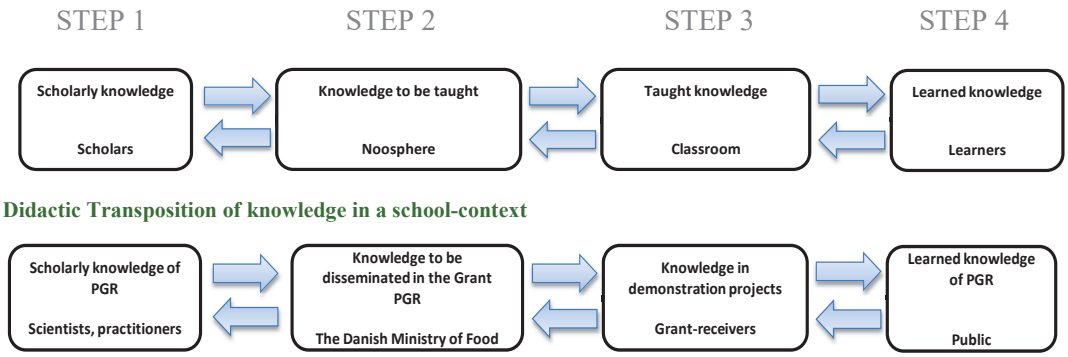


Figure 6: Comparison of the process of Didactic Transposition of knowledge in a school-context and the Grant PGR (after Chevallard & Bosch, 2014).

Step 1: Scholarly knowledge

School-context: The Didactic Transposition process has its point of reference in the *scholarly knowledge* among *scholars*. The scholars are those that are considered as the most legitimate and specialists of the considered field. This is primarily scientists, but also others can be regarded as scholars producing scholarly knowledge, though it is not academically tailored (Chevallard & Bosch, 2014). This knowledge defines and develops the field in question. Its focus is not on teaching or dissemination to people outside the group (Bosch & Gascón, 2006). It is important to notice that there is not an absolute value of scholarly knowledge: what is considered as such varies depending on the period of time and institution. For the analysis or observer, scholarly knowledge is defined as what is considered as such by the disseminating institution, which at the same time legitimates the process of dissemination: it is not the same to spread a person's or lobby's opinion than a well-established scientific result or traditional know-how.

Grant PGR: In the study of the Grant PGR the scholars are *scientists and practitioners*: agriculturists, plant breeders, geneticists, gardeners, farmers, and chefs. Their knowledge of how PGR can be conserved, grown, and used is contributes to the *scholarly knowledge of PGR*.

Step 2: Knowledge to be taught/disseminated

School-context: *Knowledge to be taught* is the 'contract with society'. Chevallard's definition of the *noosphere* concerning teaching is "the 'sphere' of those who 'think' (*noos*) about teaching"

(Chevallard, 2013, p.216). An important empirical indicator here is the curriculum, because it frames the knowledge that can be taught in schools, and an important player in the noosphere is accordingly the Ministry of Education, creating the curriculum (Chevallard, 1988).

Grant PGR: An important player in the *knowledge to be disseminated in the Grant PGR* is *the Danish Ministry of Food*, since it has formulated and set up the conditions of the Grant PGR through the Rural Development Programme, the law, and the executive order which execute it (The Danish Ministry of Food, 2007a, 2011b, 2012). This can be seen similar to the curriculum in schools, because it has influenced the knowledge that was later disseminated in the demonstration-projects. Together with the Ministry, the noosphere also includes experts, scientists, journalists, politicians, lobbyists and other stakeholders who are also involved in the knowledge-dissemination process from the outside, giving advice, producing resources, assessing the results etc.

Step 3: Taught/disseminated knowledge

School-context: The knowledge proceeds to *taught knowledge* in the *classroom.*

Grant PGR: In the Grant PGR this is *the knowledge in the demonstration projects*, which could be experienced by the public, when they got in contact with the *grant-receivers*: research institutions, producers and private companies, museums, local groups with public access, municipalities, pometa, and NGOs. The knowledge of PGR was disseminated as for instance posters, guided tours, tastings of produce and products, items in radio or television, and cooking-events.

Step 4: Learned knowledge

School-context: Finally, if the knowledge is understood, it will be *learned knowledge* in the *learners' communities.*

Grant PGR: The objective of the Grant PGR is equivalent to the *knowledge learned* in school: knowledge of PGR should be acquired by the *public* targeted by the knowledge-dissemination process: the world-wide opinion, a whole society, a group of stakeholders, etc.

Characteristics of Informal Learning Environments

An essential question in my PhD-project has been how the grant-receivers' educational potential can be assessed. Looking at them as Informal Learning Environments, which offer different activities and materials to educate the public, has been one of the main methods to understand and explain this.

In the following I start by defining Informal Learning Environments and describe their educational perspectives. Then I explain why the grant-receivers in the demonstration-projects can be considered to be Informal Learning Environments, and I explore characteristics of the education offered by Informal Learning Environments in two ways:

1) In relation to the setting or situation

2) In relation to the activities and information materials

The framework of Informal Learning Environments is used in chapter 5 (findings) to explore the grant-receivers' educational potential and diversity. The findings are used in Study 2.

The definitions and characteristics of Informal Learning Environments and the activities and materials they offer build mainly on an American report written by The Committee on Learning Science in Informal Environments. The committee was established to look at the potential of non-school settings for science learning and included 14 experts in science, education, psychology, media, and informal education. The report is a broad review of the literatures that inform learning science in informal environments and includes more than 200 sources of literature. It assesses the evidence of science learning across settings, learner age groups, and over varied spans of time and aims, for instance at identifying the qualities of learning experiences that are special to informal environments (National Research Council, 2009). The later Handbook of Research on Science Education mentions this report as a "valuable addition to the field" (Rennie, 2014, p. 121). The report is referred to as "the report" and supplemented by other relevant literature.

The report's findings regarding the science educational potential of Informal Learning Environments match the evaluations and recommendations from Danish museums (e.g. Boritz, 2012; The Danish Ministry of Culture, Agency for Culture and Places, 2009 a and b).

Definition of Informal Learning Environments

The report states that though it is a subject of debate, what makes a learning environment informal, a general definition will include:

> *Learner choice, low consequence assessment, and structures that build on the learners' motivations, culture, and competence. Furthermore, it is generally accepted that informal environments provide a safe, nonthreatening, open-ended environment for engaging with science* (National Research Council, 2009, p. 47).

My point of view is looking at the dissemination of scientific knowledge, which makes my focus the *educational potential* and not the actually *learned knowledge.* Rennie, 2014, defines *informal science education* as a "term for science-related activities that are not part of a formal, assessable curriculum offered by an educational institution" (Rennie, 2014, p. 121). Rennie, 2014, argues that *informal* can be used to distinguish the *learning setting* but not the *learning*, since this is "an ongoing, cumulative process that occurs from experience in a range of settings" (Rennie, 2007, in Rennie 2014, p.121), which makes it meaningless to try to distinguish *formal learning* from *informal.* Thus the name of the settings I am dealing with should be named *informal science education settings.* However, *Informal Learning Environments* is used here, because it is the term used in the report.

The name *Informal Learning Environment* is opposed to the formal setting of schools (e.g. Falk and Needham, 2011). Other names are *out-of-school settings*, as opposed to in-school, which underpins that the learning is not taking place at school, or *free-choice settings,* underlining the ability for the learner to choose freely as opposed to the curriculum-knowledge in a formal school (Falk and Dierking, 2010; Falk and Needham, 2013).

Informal Learning Environments include museums, science centres, zoos, and aquariums or other designed settings as well as settings or situations for family science-discussions or for experiences with hobbies such as gardening and birdwatching, or recreational activities like hiking and fishing. Also clubs as e.g. 4H, girl-guides or scouts can be Informal Learning Environments. Learning can also be reached through media such as television programmes, radio, websites, magazine articles, and newspapers (e.g. National Research Council, 2009; Falk and Dierking, 2010; Nature Editorial, 2010; Rennie, 2014). These are not settings or situations but can be reached independently of time and space.

The educational perspective of Informal Learning Environments

Research during the last years indicates that the general public acquires a considerable part of its knowledge about scientific subjects from Informal Learning Environments (Hein, 1998; Falk and Dierking, 2010; Falk and Needham, 2011; Falk and Needham, 2013; Nature Editorial, 2010; National Research Council, 2009; Rennie, 2014). For many adults this is the only opportunity they have to familiarize themselves with topics and ideas that did not exist in their own school days, such as genetically modified crops, internet privacy, or climate change (Nature Editorial, 2010). The free-choice nature of the knowledge that is offered in these settings for instance enables the public to make decisions on an informed basis, when taking part in elections as citizens in a democratic society. At the same time it requires a certain moment of motivation from the learner, and the outcome can be patchy, situated, strongly learner-driven and depending on individual interest (National Research Council, 2009; Nature Editorial, 2010).

Informal Learning Environments are of fundamental importance for supporting science learning outside of school, primarily because they are available for the segment of the public that is not in contact with the educational system. Informal Learning Environments are of course also available for the part of the population that is enrolled in a formal school. Thus, young and old can explore and learn about science in everyday settings e.g. with their families, by visiting designed settings like museums and science centres, participating in after-school programs, and using media as television, internet or social media to focus on their interests. The report finds abundant evidence of learning in all these types of settings (National Research Council, 2009).

The importance of Informal Learning Environments for public education is well known in education policies (e.g. European Association for the Education of Adults, n.d.), while in some scientific fields with a need to disseminate knowledge to the public, this is still traditionally seen as connected to the formal school system. Thus looking at Informal Learning Environments as settings with a possibility to educate the public opens up new perspectives of communication, especially of topics, which are not – or not yet – part of the curriculum in schools.

In FAO and NordGen (the Nordic Gene Bank) ‘training’ is a keyword to enhance understanding of the importance of PGR. Training is traditionally understood as education in the school-system, and raising public awareness of PGR is often mentioned together with training (e.g. FAO, 2010). However, NordGen has recently started to regard dissemination of knowledge on PGR taking

place in museums or comparable places as training as well. This means that they see these sites as a possibility to reach an audience that has not had the opportunity to learn about PGR in school, because it is not usually a part of the curriculum (Personal communication, Senior Advisor in NordGen, 21.10.2014). This means that seeds and plants will be free of charge to potential users for this purpose, as material is freely available for research, breeding and training (FAO, 2009).

The grant-receivers as Informal Learning Environments

As shown in chapter 2, table 1 all receivers of the Grant PGR have been categorised into 8 different types of institutions. Based on the above I consider each of these – research institutions, companies, local groups with public access, municipalities, open farms, pometa, NGOs and museums – to be an Informal Learning Environment with respect to the dissemination of PGR to the public. The rationale of this is that the institutions are required to disseminate knowledge of PGR to the public, when they are being awarded the Grant PGR. Thus I consider them places with an opportunity of learning for the public outside of school, building on learner choice, no consequence assessment, and structures that build on the learners' motivations, culture, and competence (National Research Council, 2009).

Figure 7 Leader of the demonstration project in Company Ai shows the information board about plant genetic resources in the field.

The Danish Government (in practice: the Ministry of Food) is responsible for engaging the public in PGR (The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004), and as this task is partially fulfilled by the institutions through the Grant PGR, I consider them as acting on behalf of the Government. The Ministry has formulated the purpose and approved the content of the communication activities in the applications from the institutions. Furthermore the Ministry controls that the work is carried out, before it decides, whether the grant can be paid out to the institution (The Danish Ministry of Food, 2007a).

So, though the research institution's overall purpose is working with science, and the vegetable company's is selling vegetables, all institutions have taken on – and are paid for – the same communication responsibility for the Government. Thus the company (see fig. 7) and the research institution carry out their dissemination of knowledge similar to the involved museums, which have communication in the service of society as one of their overall purposes (ICOM, n.d.).

The settings or situations

Having defined the grant-receivers as Informal Learning Environments I now turn to explore the education they offer.

The report organizes its analysis of Informal Learning Environments by looking at the settings/situations, where science learning outside of school occurs. These include *everyday experiences*, *designed settings*, and *programs*. Apart from these, science learning outside of school can also occur on *media-platforms* such as in television, radio, newspapers and on social media (National Research Council, 2009).

Everyday experiences

Almost all people of all ages and backgrounds engage in activities in their daily life that can support science learning. This can be feeding the ducks in the nearby park, watching a sunrise or engaging in hobbies such as hunting, skiing or biking. Everyday learning will most likely be the first experience with science learning for a child, and may as well start an early interest in scientific issues as give opportunities to pursue special interests (National Research Council, 2009; Rennie, 2014).

Designed settings

Like everyday experiences, learning in designed settings is highly structured by the participants, but when people enter a designed setting, such as a zoo, botanical garden, or planetarium, there is an intention behind the phenomena they experience. This reflects the intended communicative and pedagogical goals of designers and educators (National Research Council, 2009).

Some designed settings house live collections, for example aquariums (fish) and botanical gardens (plants), while traditional natural or cultural museums and science-centres often organize non-living collections (taxidermied animals, mineral specimens, scientific equipment like binoculars, or pedagogical models) (National Research Council, 2009).
Interesting examples of designed settings are dioramas and immersive exhibits, since they are designed exclusively to disseminate knowledge to the visitor. Marandino, Achiam, & Oliveira (2014) studied these and define dioramas as "three-dimensional, life-sized, simulated environments in which models or taxidermied animals are placed in an ecological context (...) as a means for the audience to appreciate the relationships between the flora and fauna of an environment …" (p. 253). In immersive exhibits the visitor is included as an actor within a staged environment, e.g. a natural scene like a forest. This makes it possible to gain a more extended experience of animal and plant behaviour or other biological phenomena (Marandino et al., 2014).

Programs

The report defines a program as a subscribed group that recurs over time. After-school science or environmental monitoring through a local organization are mentioned and underpins that science learning programs are typically experienced continuously. This means that they can have a prolonged conversation with their audience, in contrast to learning in designed spaces, which are experienced more episodically and sporadic. Ideally programs are informal in design, learner driven, and building on the interests and motivations of the participant. Research shows that hobbyists, such as e.g. amateur astronomists, though having only little formal training, often exhibit high levels of knowledge and depth of understanding. They might also have collegial relationships with experts in the field and some even contribute to scientific discoveries (National Research Council, 2009).
The report explains that there is some evidence that participation in informal programs, for instance when involving volunteers in data collection (like for instance citizen science programs or environmental monitoring), can improve public engagement in science. This could be local environmental concerns or policies (National Research Council, 2009).

Science media

Science media in the form of radio, television, the internet, or handheld devices, provide a rich and varied set of resources for learning science, and make information increasingly available to people on many platforms. The report states (in 2009) that evidence is strong for the impact of educational television on science learning, but that substantially less evidence exists on the impact of other media such as digital media, gaming and radio (National Research Council, 2009). The report further explains that "for most people, television is the single most widely referenced source of scientific information, though it may be losing ground to the Internet" (p. 299). National Science board (as cited in Rennie, 2014) reports in 2010 that primary sources of information about science for 18-24 year-olds is internet (65%) and television (24%).

Science media also give the opportunity to prepare and process experiences in Informal Learning Environments, because they can be reached independently of the physical environment. The report only mentions examples from in-school, which supposedly use schoolbooks, so this reference is only used here to explain that preparation and processing of experiences can increase the learning-outcome: Preparation activities before a field trip can give students a framework, which can be used to interpret what they will see and guide the things they should pay attention to during the visit. The report, citing observational studies and pre-post survey-based studies by Griffin (1994); Griffin and Symington (1997); Anderson, Lucas, Ginns, and Dierking (2000); and Orion and Hofstein (1994) conclude that appropriate advance preparation makes students concentrate and learn more from their visits (National Research Council, 2009). The report also refers Anderson et al. (2000) and Griffin (1994) for concluding that well-designed examples of classroom follow-up are associated with positive educational impacts (National Research Council, 2009). Rennie (2014) also mentions examples of pre- and positivist activities supporting classroom-teaching.

The activities and information materials

I have distinguished settings and situations, where science education in Informal Learning Environments can occur, all known to support science-learning. I now turn to the activities and information materials offered here to see what is usually needed for them to promote science

education. The report summarizes four main characteristics of activities and materials, which have been connected to science learning, when offered by Informal Learning Environments:

1. engage participants in multiple ways, including physically, emotionally, and cognitively
2. encourage participants' direct interactions with phenomena of the natural and designed physical world, largely in learner-directed ways
3. provide multifaceted and dynamic portrayals of science
4. build on learners' prior knowledge and interests

(National Research Council, 2009, p. 297)

1. Informal science learning environments engage participants in multiple ways, including physically, emotionally, and cognitively

The report states that experiences in designed spaces are often "designed to elicit participants' emotions or sensory responses to scientific and natural phenomena" (National Research Council, 2009, p. 128). Emotional and interactive sensory experiences are prioritized in the design, and are "typically accompanied by particular informational or cognitive goals as well" (ibid. 128). This means that engaging the visitor through emotions and multiple senses is usually not a goal in itself but is followed by a learning goal. Linking plant, animal, and human well-being to conservation themes is mentioned as an example. The use of larger-than-life models and multimedia are also means "to engage multiple senses in the visitor, to make phenomena visible and to inspire participants' awe" (p. 128). In the work of Myers, Saunders, and Birjulin (2004) "emotion is a central component of meaning making" (as cited by Rennie (2014) p. 125). Marandino et al. (2014) studied immersive exhibits. These promote "a sensorial interaction (Harvey et al. 1998) requiring the use of a larger number of senses (visual, olfactory, auditory and tactile) than is usually the case in interactive science centre exhibits" (p. 254). This makes it possible to gain a more extended experience of animal and plant behaviour or other biological phenomena. It is emphasised that the educational value depends on the Museographic Transposition (see 'Didactic Transposition as a conceptual framework' in this chapter for a definition) in their making. This means that content from the domain specific research must be transformed, adapted and embodied in the immersive exhibit (Mortensen, 2010c) in order to bring forth the narrative to express "aspects of the life and behaviour of the organisms, their relation with other organisms, and their relationship with the environment" (Marandino et al.,

2014). Mortensen (2010c) further underlines that the success of an immersion exhibit relies - among other things - on the integration of the visitor in the exhibit. This is explained as ‘hooks’ or ‘bridges’ (See section 4 in this chapter: ‘Informal science learning environments build on learners’ prior knowledge and interests’.)

The report argues that linking emotional and sensory responses with science-specific phenomena to obtain science learning is a central educational challenge for designed spaces and can create important personal connections for the visitor.

Learners often self-report a deeper understanding of a concept by having a direct sensory or immersive experience, e.g. by illustrating how much water the human body contains, instead of just writing it on a board in the exhibit. The report citing Korn (2006) argues that the visitor can touch it and see it, which makes abstract contents more concrete (National Research Council, 2009). Rennie (2014) also explains that exhibit designs, which are “easily related to everyday situations were more educationally successful than those that were not” (p. 125), because visitors could recognize the underpinning concepts or analogies. There is evidence that visitors’ ability to remember facts is consolidated by linking abstractions to sensory experiences, and this can lead to learning of the science content. But the report underlines that “it is unclear how learners draw from these experiences to assemble broader conceptual knowledge” (National Research Council, 2009, p.161).

The report cites Allen (1997); Borun and Miller (1980) and Peart (1984) for arguing that besides the important role of direct experiences, interpretive materials (e.g. labels, signs, audio-guides) are proved to contribute substantively to science learning (National Research Council, 2009). In the report visitors are mostly described as being on their own in designed settings. Having a dialogue with well-informed staff in Informal Learning Environments is primarily associated with programs, as referred in the report from the works of Gelman et al. (1991); Gleason and Schauble (1999) and Schauble and Bartlett (1997): “the skill and background of the leader and the participants, and situational demands are likely to determine the depth of contact and talk, rather than the design of the space or materials alone” (National Research Council, 2009, p.152).

Rennie (2014) mentions that talking to zoo rangers helped interpretation of what visitors experienced by giving background information, and refers the work of Ash, Lombana, and

Alcala (2012), where museum educators were encouraged to transform their role from delivering content to scaffolding learning.

Multiple senses

The report refers to a number of results indicating that integration of multiple senses improves as well learning as the number of potential learners: Jacobson (2006), for instance, suggests that to raise or back up a range of different emotional responses and a variety of processing modes increases the likelihood to get in touch with a greater variety of people and encouraging them as learners. Crowley and Jacobs (2002) refer to the repeated exposure to a single topic across multiple media as an 'island of expertise', which can develop into deep, rich knowledge on a particular domain (National Research Council, 2009). The report gives no conclusive findings about how environments should be integrated but states, however, that the "positive outcomes for learners of integration is important to note" (National Research Council, 2009, p. 183) and concludes that "at the very least, these results support the assertion that helping learners extend their experiences across settings through multiple representations of concepts, practices, and phenomena is a promising design" (National Research Council, 2009, p. 183).

This is borne out by a result cited by Rennie (2014) from Lindemann-Matthies and Kramer (2006) who mentions that zoo visitors using touch tables and having access to signs and boards learned more of the scientific content than those who had not.

2. Informal science learning environments encourage participants' direct interactions with phenomena of the natural and designed physical world, largely in learner-directed ways

Direct access to phenomena of the natural and designed physical world is fundamental to Informal Learning Environments. The report mentions examples from daily life, which can be associated with scientific ideas, e.g. physical mechanics: swinging on a rope or setting off the chain reaction of dominos falling. Thus interactivity (defined by McLean (1993) in terms of reciprocity: "The visitor acts upon the exhibit, and the exhibit does something that acts upon the visitor" (National Research Council, 2009, p. 92)) is one of the key experiences, learners can get with Informal Learning Environments.

The phenomena might be from daily-life, but designed spaces might also give access to experiences that are difficult or impossible for learners to access in other ways, e.g., views of earth from space or nanotechnology (National Research Council, 2009). Marandino et al. (2014) have studied immersion exhibits, where visitors are "converted into actors, who contemplate a recreated nature in order to conserve it". Thus the immersion exhibit is a "means to include the visitor as an actor within a displayed scene and by inference, as an agent in nature" (p. 259). Building on the work of Allen (2007); Brooks and Vernon (1956); Borun (2003); Korn (1997); Rosenfeld and Terkel (1982) and Serrell (2001) the report states that it is "well established that interactive exhibits tend to attract more visitors and engage them for longer times than static exhibits" (National Research Council, 2009, p. 140). The report, citing studies carried out by Falk et al. (2004), argues that visitors tell that they have many different outcomes from interactives, for instance that they learn knowledge and skills, gain new perspectives, and generate enthusiasm and interest (National Research Council, 2009). Blud (1990) is cited in the report for concluding that particularly parents like interactivity or "hands-on" exhibitions, which supports interaction with the physical world in which additional learning can transpire, but also might stimulate constructive exchanges between parents and children more frequently than static exhibits (National Research Council, 2009).

The work of Lucas (1983) is referred in the report for arguing that the specific impact of interactivity tends to be difficult to determine because authentic interactive exhibits usually differ in multiple design properties from non-interactive ones, and also because it is difficult to separate the effect of longer time spent from intellectual stimulation (National Research Council, 2009). Furthermore the work of Koran, Koran, and Longino (1986) is cited for findings showing that when they took away the Plexiglas cover from an exhibit case of seashells, the number of visitors who stopped there increased, and they spent more time, even though only 38 % of those who stopped actually picked up a shell (National Research Council, 2009). Rennie (2014) mentions opportunities to touch organisms in zoos can lead to higher-level thinking.

The report also mentions the work of Allen and Gutwill (2004), who have found negative experiences with interactivity in exhibitions. Sometimes visitors can feel overwhelmed, and some interactions might even lead to misunderstandings, when for instance the user experiences

multiple undifferentiated options or when many users can interfere or disturb the phenomenon being displayed (National Research Council, 2009).

3. Informal science learning environments provide multifaceted and dynamic portrayals of science

The report emphasizes that "the knowledge and processes for building knowledge vary across fields" (p. 298). Examples may be experimental science as physics or fields, which draw on observations and reconstruction of history like for instance anthropology or evolutionary biology. Different fields also have different values and practices of science, which reflect the diverse cultural values of the people engaged in it, and change over time.

These many facets are often portrayed by informal science learning environments (National Research Council, 2009). When they do so, they allow visitors to get in touch with different scientific fields and their diverse cultures giving different perspectives of the world around us and how to get knowledge from it. This is beneficial both to science and to the understanding of learning, and it must be seen as a potential resource for the design of informal environments for science learning.

4. Informal science learning environments build on learners' prior knowledge and interests

Museum staff has for years been aware that visitors want to link their sensory experiences in designed settings to their prior knowledge and experiences. Building on the works of National Research Council (1999), (2007) and Lehrer and Schauble (2000) the report states that it takes time to form this conceptual understanding and mental models of phenomena, which knowledge is built upon (National Research Council, 2009). The report furthermore cites Inagaki and Hatano (2002) and Carey (1985) for concluding that the outcome seems to depend on a person's existing knowledge base (National Research Council, 2009). This is confirmed by Rennie (2014). Memories are often reported in the evaluation literature as a link to learners' prior knowledge: learners self-report that certain experiences in Informal Learning Environments remind them of learning experiences they have had earlier in their lives (National Research Council, 2009).

Museum professionals call it ‘creating hooks’ from science content to everyday life and familiar activities, and the report comments that this is commonly referred in evaluations (National Research Council, 2009). Mortensen (2010a) explains this with other connotations:

> *A way of managing the transition into the micro-culture of the exhibit is therefore to build bridges from the visitors’ life-world to that of the exhibit content, using concepts from these visitors’ daily lives as anchors or founder notions (Mortensen (2010 a), p. 329).*

For example, in the case studied by Mortensen (2010c), an immersion exhibit showing a scaled-up version of a cave insect habitat was understood by some visitors as being a to-scale version of a cave from a human perspective. Mortensen (2010c) concludes that to make the visitors understand this, the nature of the exhibit as an animal habitat should be made clearer, and the scaling should be obvious in a way that links to the visitors’ prior knowledge. Mortensen (2010a) mentions another example, where visitors are given a cue to the scaling by including an every-day object, supposed to be known by all visitors: a bottle cap in a scaled-up version (Mortensen, 2010a).

To view learning as an active, constructive process has led to increased focus on learners’ interests (National Research Council, 2009). Deci and Ryan (2002) are cited in the report for arguing that intrinsic motivation is central to learning during a life-time, because much of what we learn comes from our spontaneous interests, curiosity, and our wish to master the problems we meet and influence our surroundings (National Research Council, 2009).

Rennie (2014) and Marandino et al. (2014) both emphasize that it is essential to build bridges to the visitor’s prior knowledge, and that coherence between the elements are essential to give successful learning for the visitor. Rennie (2014) further underlines that emotion is a central component of meaning making and that experiences in a sociocultural context will often enhance the learning.

Summary of Informal Learning Environments

I have now defined how the grant-receivers in the Grant PGR can be seen as Informal Learning Environments when disseminating knowledge of PGR. Then I have explored the settings or situations, which can support science learning, and the characteristics of activities and

information materials supporting education when offered by Informal Learning Environments. The framework of Informal Learning Environments is used in chapter 5 (findings) to explore the grant-receivers' educational potential and diversity, and the findings are used in Study 2.

The thesis and the use of concepts and frameworks

The overall aim of the thesis is to study the communication potential of the Grant PGR and the conditions which made it. To do this the study must look into the conditions for the formulation of the Grant PGR as these are expected to have an effect on the knowledge that can later be disseminated in the demonstration-projects. Furthermore the grant-receivers and their demonstration-projects must be analysed to evaluate the communicational and educational potential of as well the individual grant-receiver as the grant-receivers as a whole. Also the cooperation between the grant-receivers must be analysed in order to see, how this influences their work.

To manage this, three studies were made resulting in three papers. Figure 8 shows the overview of the studies through Didactic Transposition, and following the frameworks used in the three studies are summarized.

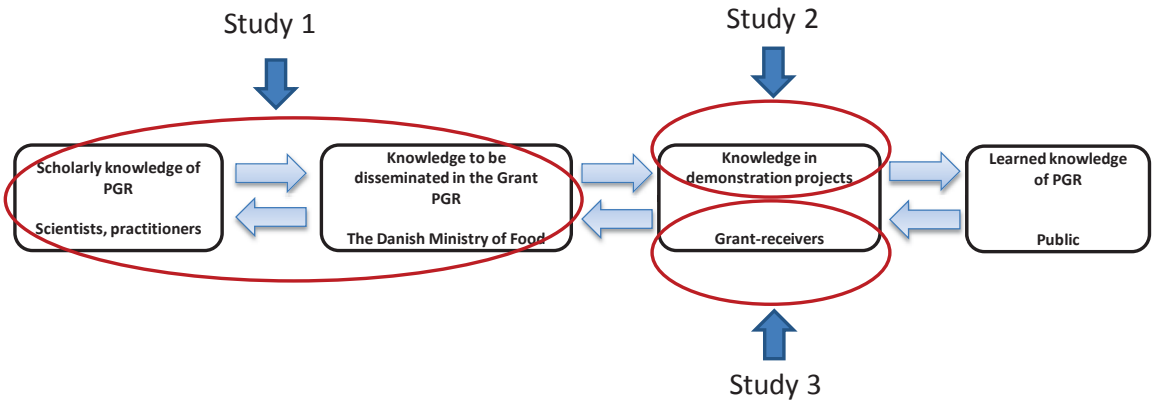


Figure 8: The thesis seen through the framework of Didactic Transposition.

Study 1 (Paper 1) analyses the primary conditions for the Grant PGR. The framework *Didactic Transposition* is used to understand the transformation of 'Scholarly knowledge of PGR' into 'knowledge to be disseminated in the Grant PGR' through the Rural Development Programme

and the law, which executes it. This process changes the knowledge, values and practices originating in 'The scholarly knowledge of PGR', and this influences, what can later be 'Knowledge in demonstration projects'.

Study 2 (Paper 2) focuses on the potential of the grant-receivers to communicate PGR to the public in the demonstration projects. This is the 'Knowledge in demonstration projects'. *Communication theory* is used to assess the coherence of the communication, and the framework *Informal Learning Environments* is used to analyse their educational potential.

Study 3 (Paper 3) takes a closer look at the 'Grant-receivers' and the ways they work together, as this is an objective of the Grant PGR, and it is expected to influence the efficiency of the communication. A combination of *network-theories* is used to study this.

4. Background and methods

To study the dissemination of knowledge in the Grant PGR and the conditions which made it I needed to collect data from the Grant PGR, the grant-receivers and their demonstration-projects. This chapter therefore starts with an overview of the policy history of PGR to understand the background and thus be able to select the most important data and make relevant analyses in the three studies. This is followed by a description of the work with grant-proposals for the Grant PGR in order to select a relevant group of grant-receivers for the three studies. Then I elaborate how grant-receivers were selected for interviews, how the interviews were conducted, their validity, and finally I outline how the selected data were analysed using different theoretical frameworks in the three studies.

Plant Genetic Resources and policy

I have reviewed the history of PGR-policy to understand the circumstances, which influenced the making of the Grant PGR. The most important milestones are summarized in figure 9 and are elaborated in the following.

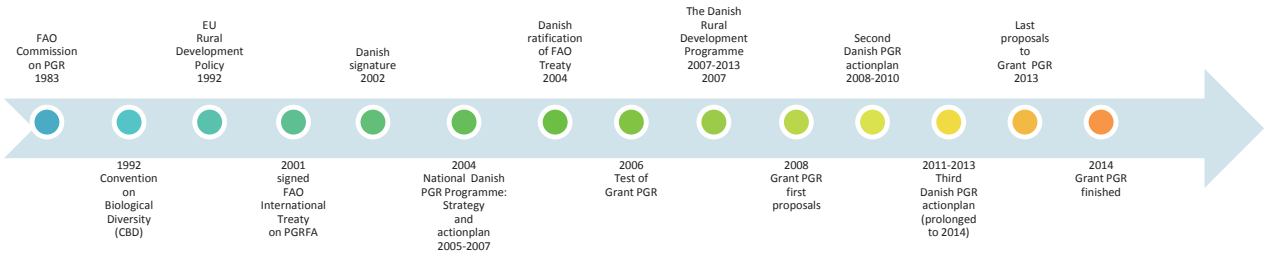


Figure 9 Milestones in the political history of the Grant PGR on a national Danish and international level

FAO's International Treaty on Plant Genetic Resources for Food and Agriculture

The Food and Agriculture Organization of the United Nations' (FAO) Commission on Genetic Resources for Food and Agriculture was established in 1983. It adopted the International Undertaking on Plant Genetic Resources as the first United Nations intergovernmental forum dealing with biodiversity and genetic resources to "ensure that plant genetic resources of

economic and/or social interest, particularly for agriculture, will be explored, preserved, evaluated and made available for plant breeding and scientific purposes" (FAO, 1983, res. 8/83 art. 1).

In 1989 the FAO Conference adopted an agreed interpretation recognizing that “plant genetic resources are a common heritage of mankind to be preserved and to be freely available for use, for the benefit of present and future generations” (Resolution 4/89). An additional resolution (Res. 5/89) endorses the concept of Farmers' Rights because of their “past, present and future contributions in conserving, improving, and making plant genetic resources available.” The emphasis is on farmers “in the areas of origin/diversity of plant genetic resources” (Res. 5/89, b) and their “protection and conservation of their plant genetic resources, and of the natural biosphere” (Res. 5/89, b). Therefore “especially those in developing countries should benefit fully from the improved and increased use of the natural resources they have preserved (…) through plant breeding and other scientific methods.” (Res. 5/89, c) The need to “continue the conservation (in situ and ex situ), development and use of the plant genetic resources in all countries” (Res. 5/89, d) was recognized. This resolution also wants to “ensure that the need for conservation is globally recognized and that sufficient funds for these purposes will be available” (Res. 5/89, a) (FAO, 1989, Res. 5/89, preamble and a, b, c, d).

In 1991 the FAO Conference recognized the sovereign rights of nations over their plant genetic resources (Res. 3/91), so in adopting the agreed text of the Convention on Biological Diversity (CBD) in 1992 there was a need to seek solutions to outstanding matters concerning plant genetic resources in harmony with the CBD (Frison, López, & Esquinas-Alcazar, 2011). Therefore in 1993 the preparation of a rolling Global Plan of Action on Plant Genetic Resources *for Food and Agriculture* (PGRFA) begins in order to provide a forum for the negotiation among governments to identify the technical and financial needs for ensuring conservation and promoting sustainable use of plant genetic resources. In 1995 the FAO Conference renamed the Commission “the Commission on Genetic Resources for Food and Agriculture” and broadened its mandate to cover all components of biodiversity of relevance to food and agriculture (Res. 3/95) In 1997 the Commission established two ‘sectoral working groups’ – one for ‘Animal Genetic Resources for Food and Agriculture’ and one for ‘Plant Genetic Resources for Food and Agriculture’ (Frison, López, & Esquinas-Alcazar, 2011).

After numerous negotiating sessions and meetings the International Treaty on Plant Genetic Resources for Food and Agriculture was signed in 2001 with some brackets remaining (Resolution 3/2001) (Frison, López, & Esquinas-Alcazar, 2011). PGRFA are defined as "any genetic material of plant origin of actual or potential value for food and agriculture" (FAO, 2009, Article 2). This legally binding treaty covers all PGRFA. The Treaty recognizes Farmers' Rights and establishes a multilateral system to facilitate access to PGRFA, and to share the benefits derived from their use. In 2002 The Interim Committee initiates negotiations of the standard material transfer agreement (SMTA), the Treaty's funding strategy, financial rules, rules of procedure and procedures, and mechanisms to promote compliance. The Treaty entered into force in 2004, and the SMTA of the Treaty was adopted in 2006 (Frison, López, & Esquinas-Alcazar, 2011).

In 2007 the Commission adopted a rolling ten-year work plan covering the totality of biodiversity for food and agriculture, and the Multilateral System became operational thanks to the adoption of the SMTA in 2006 (Frison, López, & Esquinas-Alcazar, 2011). The Multilateral System is the Treaty's solution to access and benefit sharing. It puts 64 of our most important crops (e.g. rice, wheat, potatoes and apples) – crops that together account for 80 percent of the food we derive from plants – into an easily accessible global pool of genetic resources that is freely available to potential users in the Treaty's ratifying nations for research, breeding and training for food and agriculture (FAO, n.d. b)

140 of 193 independent nations in the world have signed the International Treaty on Plant Genetic Resources for Food and Agriculture (FAO, n.d. a). Denmark signed the Treaty in 2002 and ratified it in 2004 after initiating the first Danish PGR programme, consisting of a strategy and an action-plan 2005-2007 (The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004).

The countries which have signed the Treaty are responsible to conserve and use their PGRFA in a sustainable way, and FAO requires the political backing of these countries to be firmly based on public awareness and support, stating:

> *In spite of the enormous contribution by PGR to global food security and sustainable agriculture, its role is not widely recognized or understood. Greater efforts are needed to estimate the full value of PGR, to assess the impact of its use and to bring this information to the attention of policy-makers and the general*

public so as to help generate the resources needed to strengthen programs for its conservation and use" (FAO, 2010, p. 198).

Plant Genetic Resources in EU's Rural Development Programme

Since the introduction of the Rural Development Programme in 1992, protection of genetic diversity has been one of the focus areas. The background for this was a concern that varieties of useful plants were threatened with genetic erosion because they were not competitive against the modern high-producing varieties (European Commission, 1998). Continued in the Rural Development Programme 2007-2013 conservation of genetic resources should be given specific attention to combat genetic erosion and through this enhance biodiversity in agriculture. This was part of the focus on encouraging farmers and other land managers to introduce or continue "to apply agricultural production methods compatible with the protection and improvement of the environment , the landscapes and its features, natural resources and the soil" (European Commission, 2005: 35).

National programmes for Plant Genetic Resources

National programmes are the foundation of regional and global efforts for conservation and sustainable utilization of PGR and are highly prioritized by FAO (Commission on Genetic Resources for Food and Agriculture, 2012). The programmes from Sweden and Norway will here be described briefly as references to the Danish work with PGR. This is used in the discussion.

PGR-programmes in Sweden and Norway

In Norway and Sweden the work with PGR is organized as networks in a programme, coordinated by a secretariat. In the following structures and principles from these will be described.

The ***Swedish national programme*** is called the Programme for Diversity of Cultivated Plants (Programmet för Odlad Mångfald (POM)) and was initiated in 2000 by the Ministry of Agriculture "to be an adaptive tool for creating an intelligent and sustainable way to conserve and utilise the plant riches of Sweden" (Swedish Board of Agriculture, 2009, p.3). The

programme is built as a network of activities among actors involved in the field of PGR in different ways. The actors (partners) in the network include e.g. national authorities, the Swedish University of Agricultural Sciences (SLU), NordGen, the plant breeding sector, some NGOs, botanical gardens, grower's associations, and open-air museums. The responsible authority for POM is the Board of Agriculture (Jordbruksverket), and the programme is being coordinated by the Swedish Biodiversity Centre (CBM) to which the associated 'Programme Council' assists in guidance and strategic planning. The biggest actors are represented in the council, which has two meetings per year and some information-flow in between (Swedish Board of Agriculture, 2008). The POM secretariat is financed by the Board of Agriculture, SLU, and CBM. The activities are mainly financed by the actors, for instance research is paid by SLU, and demonstrations in open-air museums is paid by the museums, but some of the planned joint activities are financed directly to the programme by the government, e.g. a nation-wide survey to find, collect and conserve unique plants, which can be of value for Sweden in the future or building a national gene bank (Swedish Board of Agriculture, 2008 and 2009).

There is a high attention to the synergies coming from joint forces and the importance of coordinating activities (Swedish Board of Agriculture, 2008). The work from 2010 to 2015 had 'Conservation of PGR for future utilization' as an overall goal and four milestones to fulfil this. The programme had five fields of activity, involving different actors: conservation, utilization, research, development, training and information, international efforts. Each of the fields had a concrete goal with a time frame, which made it easier to measure the success. For 'Conservation', for instance, the goal was to establish a National Gene-bank that would consist of one central collection and several local clonal archives (Swedish Board of Agriculture, 2008). This is still in a construction-phase and will be opened in June 2016. The new goal for 2016-2020 is organisation and consolidation of the gene-bank (Swedish Board of Agriculture, 2015).

The ***Norwegian national programme*** is called "National Programme for Conservation and Use of PGRFA" (Nasjonalt program for bevaring og bruk av plantegenetiske ressurser for mat og landbruk) and started in 2001. The Norwegian Genetic Resource Centre was established in 2006 as secretariat for the three genetic resource committees (farm animals, crops and forest trees) (Norwegian Genetic Resource Centre, 2013). The centre is part of the Norwegian Institute of Norwegian Bioeconomy Research (NIBIO), which is owned by the Ministry of Agriculture and

Food as an administrative agency with special authorization (NIBIO.no, n.d.). It organises the program for PGR, which consists of a strategy and four-year action-plans, made in collaboration with the genetic resource committee for crops, and is responsible for the annual budget- and work-plans (Norwegian Genetic Resource Centre, 2013).
The action-plans follow the goals for the global action-plan for PGR with four prioritized action areas: A. In situ conservation, B. Ex situ conservation, C. Utilization of PGR, and D. Institution- and capacity building. These are divided into more specific activity-fields with a concrete goal and a time frame, which makes it easier to measure the success.
The Genetic Resource Centre sees itself as a hub, coordinating activities in a network that consists of e.g. agricultural authorities, research institutions, private breeders, Universities, local clone-archives, farmers' organizations, museums, schools, NGOs and international organisations. The centre is very aware that most of the Norwegian agricultural production is based on national genetic resources, which makes their work central to breeding and production of food (Norwegian Genetic Resource Centre, 2011 and 2013).

The Danish national PGR-programme

Denmark started the work on a national programme for PGR in 2002. The strategy and the first Danish action-plan for 2005-2007 formed the national Danish programme for PGR in 2004 (The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004).
A status report on Danish PGR published in 2007 further described the Danish organization of the work as a programme (The Danish Ministry of Food, 2007b). The next action-plan for 2008-10 designates the joint Danish work a programme as well (the Danish Ministry of Food, 2008), while the action-plan from 2011-13 only mentions a programme once – and only when describing the collaboration with the other Nordic Countries' programmes (the Danish Ministry of Food, 2011a). The action-plan 2011-13 was prolonged till end of 2014 (The Danish Ministry of Food, 2014). For the time being (autumn 2016) Denmark does not have a programme, an up-to-date status-report, a strategy or an action-plan in function, but a new strategy is being planned (pers. comm. the AgriFish Agency in the Danish Ministry of Food, 5. and 6. Apr. 2016). A seminar in December 2014 between the Ministry, NordGen, and stakeholders from the Plant Genetic Environment in Denmark was to create ideas for the new strategy, which will be made

by the secretariat in the Danish Ministry of Food, Agriculture and Fisheries' AgriFish Agency. The Danish Committee for PGR will be consultants in the process (The Danish Ministry of Food, 2014).

The coordination

The Danish Committee on PGR was set up in 1999 to take care of the coordination of the work with PGR (e.g. the Nordic Gene-bank). The committee consists of representatives from research, breeding, universities, ministries, organisations, museums, and NGOs (The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004). The committee's secretariat was at the Danish Plant Directorate from 2002.

The Grant PGR was set up as part of the Danish programme in 2006 by the Danish Plant Directorate, the Department, and the Directorate for Food, Fisheries and AgriBusiness (pers. comm. 8. Oct 2014). An analysis of the organization in the field of activities concerning genetic resources in the Ministry of Food was made in 2007 and after this both the work with plant- and farm-animal- genetic resources were coordinated in the Plant Directorate (the Danish Ministry of Food, 2007c).

The action-plan from 2011-13 recommended that the Danish Committee on PGR got a more coordinative role of the Danish work with PGR (the Danish Ministry of Food, 2011a). When the Danish Plant Directorate was merged with the Fishery Directorate and the Directorate for Food, Fisheries and AgriBusiness in 2012 to the new Danish AgriFish Agency, the secretariat for the Committee on PGR was placed in Centre for Agriculture, Plants (The Danish AgriFish Agency, 2012).

The administration of the Grant PGR was also moved to the Danish AgriFish Agency, where administrative staff took over the work from specialists (The Danish AgriFish Agency, 2012). This also meant that the Grant PGR was no longer administered by people who knew about the FAO obligation or the national Danish programme for PGR, which the Grant PGR was part of. From that time the Danish AgriFish Agency has been responsible for the work with PGR in Denmark, housing the secretariat for the committee - now in the Centre for Agriculture, unit for Environment and Biodiversity, team Biodiversity and Climate (The Danish Ministry of Food, 2014).

In 2015 the Minister of Food decided to make a new, nationally funded grant, covering the work with both plant- and farm animal genetic resources (Grant GR). A secretariat in the Danish unit for Environment and Biodiversity in the Ministry of Food's AgriFish Agency is Denmark's national point of contact for the FAO-treaty, serves the Danish Committee on PGR and administrates the new 'Grant for the work with conservation of old Danish farm-animal- and plant genetic resources' (Grant GR) together with the secretariat for the Conservation Committee for Farm-Animal Resources. The committee is now recommending plant projects for the grant. The area is financed by the Financial Act until 2018 (pers. comm. the AgriFish Agency in the Ministry of Food, 5. and 6. Apr. 2016).

The actors

The national Danish programme was made by the Ministry with few other stakeholders (The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004; the Danish Ministry of Food, 2004). But already in the strategy from 2004 there was awareness of the many different actors, which were relevant for the Danish conservation and sustainable use of PGR. Universities, plant-breeders, and local clone-collections, for instance, were well-known to be interested in the field. But also the work of museums, garden-owners, and NGOs was to be encouraged to play a bigger role, e.g. by including the museum-collections of PGR as back-ups to the clone-collections and seeing them as an important 'window' to the public. Also NordGen (the Nordic Gene-bank) was positive to cooperate with museums and NGOs, for instance in a registration of the back-up collections in NordGen's database. The strategy also recommended establishing a partnership between all stakeholders, for instance through involvement in a professional reference forum (The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004).

The status report from 2007 also mentions teamwork between the stakeholders in national working groups, for instance for institutions with clone-collections (the Danish Ministry of Food, 2007b).

Here is also mentioned "a forum for discussion of methods and experiences to help make it easier to get started in the new clone archives and contribute to communication coming out to

anyone interested. There could, for example, be an annual meeting, supplemented with an email list, where problems could be dealt with" (the Danish Ministry of Food, 2007b, p.79).
In 2011 the Danish Ministry of Food defined the Plant Genetic Environment in Denmark as a broad group of stakeholders: researchers, farmers, local "enthusiasts", chefs, museum staff, plant breeders, officials, etc. These very different users were committed, and because there was a good teamwork between this environment and the Ministry they developed the Danish action-plan for PGR from 2011-13 in a dialogue (the Danish Ministry of Food, 2011a).
The Ministry is here further advised to support the environment by for instance letting them meet to exchange experiences and develop their cooperation, and by the formation of working groups as also recommended in the status report from 2007 (the Danish Ministry of Food, 2007b and 2011a).

Demonstration of PGR in Denmark

In 2006 the Ministry of Food initiated tests for demonstration-projects on a series of older Danish agricultural crops and fruit types worthy of conservation (the Danish Ministry of Food, 2012, p. 377). In 2008 the projects were embedded in the Danish Rural Development Programme 2007-13 as the 'Grant for demonstration projects about conservation and sustainable use of plant genetic resources' (Grant PGR) (the Danish Ministry of Food, 2012). This was part of the EU Rural Development Policy 2007-13, described above.
A representative from the Ministry of Food, which was taking part in the design and implementation of the Danish Grant PGR said about the Danish implementation:

> *We could see that PGR were mentioned in the Rural Development Programme, but subsidies were meant for those, who still cultivated them, in for instance Austria and Italy. They could be compensated. But we were not in that situation in Denmark. At best we had PGR in gene banks (Personal communication, 8. Oct, 2014).*

Hence, PGR were included as a grant-scheme for demonstration projects "involving older Danish plant varieties, which are currently stored in the NordGen (Nordic Genetic Resource Centre) or in Danish, national collections" (The Danish Ministry of Food, 2012, p. 234). The aim was to cultivate and demonstrate plant species worthy of conservation, test suitability for

environment friendly farming and food products and disseminate information to the public about the importance of PGR within agriculture and food production. (The Danish Ministry of Food, 2012). This would at the same time help Denmark to fulfil its obligations according to the FAO Treaty and UN's Biodiversity Convention. Many diverse institutions were invited to participate: museums, private companies, public companies, funds, local projects, organizations, public institutions, and municipalities (the Danish Ministry of Food, 2011b). This decision built on good experiences from the tests in the previous Rural Development Programme (The Danish Ministry of Food, 2012).

The Danish Rural Development Programme was executed as *The Danish Law on Development of Rural Areas* with the purpose of "contributing to the sustainable development, where growth is based on sustainable use of resources, and where local participation at the same time contributes to creating attractive living conditions and local jobs" (the Danish Ministry of Food, 2007a, § 1). The protection of genetic plant resources through demonstration projects was included in the law as part of § 2:

> *The Minister of Food, Agriculture and Fisheries can provide grants for the following schemes…4) schemes for sustainable use of farmland, which includes c) environmentally friendly agriculture, including organic farming (ibid. § 2).*

The conditions for the grant were then described in The Executive Order for Grants for Demonstration Projects about Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture (the Danish Ministry of Food, 2009 and 2011b). The demonstration projects were carried out by very diverse institutions. These included museums, research institutions, pometa, private companies, municipalities, local groups and NGOs.

Teamwork between these grant-receivers was one of the purposes of the grant, and grant-receivers working together were preferred (The Danish Ministry of Food, n.d. a). It is quite unusual for the Danish Ministry of Food to make teamwork between grant-receivers a purpose of a grant-scheme. In 2016 only two out of approximately 110 grant-schemes were found to favour teamwork between grant-receivers (Restoration of Streams: teamwork between municipalities; Promotion of Organic Farming: teamwork between stakeholders) (Ministry of Environment and Food of Denmark, the AgriFish Agency, n.d.).

The first grants were given out in 2008, and the last demonstration-projects closed in 2014. A new set-up was made in 2015 as 'Grant for the work with conservation of old Danish farm-animal- and plant genetic resources' (Grant GR). Communication to the public is still one of its purposes, and many diverse institutions are encouraged to apply for the grant, but teamwork between the grant-receivers is not a purpose of the Grant GR (Ministry of Environment and Food of Denmark, the AgriFish Agency, n.d.).

Methods

In the following I will describe my work with grant-proposals for the Grant PGR in order to select a relevant group of grant-receivers for the three studies. Then I elaborate how I selected grant-receivers for interviews, how the interviews were conducted, their validity, and finally I outline how the selected data were analysed using different theoretical frameworks in the three studies.

The grant-proposals and the interviews

In May 2013 I received the proposals from all institutions which were given the Grant PGR from 2008-12 from the Danish Ministry of Food (the AgriFish Agency). These involved museums, NGOs, pometa, open farms, municipalities, local groups with public access, companies and producers, and research institutions - all in all 46 project-applications. To find out, which of the grant-receivers fulfilled the museum-definition and could be assessed, the applications were analysed according to types of organisations involved, purpose, communication methods, target-groups and time-frame (see Appendix A).

Two projects were taken out, because they were not physically accessible (disseminating knowledge of PGR in a book and an app). Now 44 projects were left. All were physically accessible and had an obligation to disseminate knowledge in the service of society and its development, and thus they fulfilled the museum-definition (see chapter 2).

I placed the 44 projects on two axes: In upper right were the ones I expected to be the most communicating and accessible for the public, while in lower left the less accessible and less communicating. My assumption was that the demonstration-projects in museums would be the

most accessible and most communicating compared to demonstration-projects in the other institutions, since they have opening-hours, and communication to the public is one of their key-functions (ICOM, n.d.). To carry out visitor studies the projects had to be active. 17 projects were finished (the orange circles on the board), which made 27 (the blue circles) available for visit and assessment (see fig. 10).

Many of the grant-receivers had more than one demonstration-project, and activities and materials were often shared between the projects in the institution, e.g. activity-days, home-page, and guided tours. This made it more obvious to focus on the grant-receivers instead of on single demonstration-projects. Furthermore many of the projects involved more than one grant-receiver. Thus my focus shifted from the design of single-projects to the diversity of grant-receivers and their cooperation in the Grant PGR. I decided to study how the Grant PGR as a whole communicated knowledge on PGR to the public in order to improve it. This also involved an analysis of the conditions that made the Grant PGR as they were expected to have an impact on the knowledge that could later be disseminated by the grant-receivers.

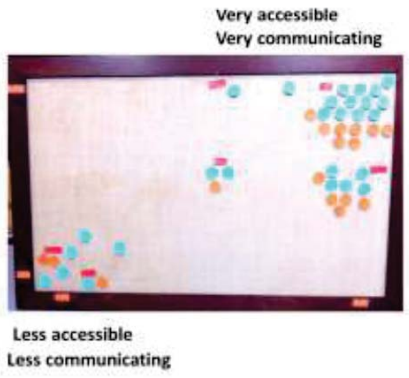


Figure 10: The demonstration-projects placed according to my assumption of their being more or less accessible and communicating.

My focus was now on the institutions. To get a total of the institutions which had received the Grant PGR, I later examined the grant receivers from 2013. Six institutions received the grant, but only one of them was new. This was classified and added to the list of receivers, which was now complete: 28 institutions. The institutions were grouped as belonging to: research institutions, companies, local groups with public access, municipalities, open farms, pometa, NGOs, and museums, and each institution got a letter to differentiate them in an anonymized form:

- Research Institution A, B
- Company A, B, C, D, E, F, G, H, I, J
- Local Group with Public Access A, B, C, D
- Municipality A, B
- Open farm A

- Pometum A, B
- NGO A, B
- Museum A, B, C, D, E

The institutions are summarized in Appendix B.

The assumption was that they were gradually more communicating and accessible down this list, as the research institutions were expected to focus on research, while museums were expected to have communication and accessibility as primary objectives.

Selecting grant-receivers and conducting interviews

I selected institutions representing all eight categories for pre-interviews. Receivers using different media and having many collaboration-partners were preferred, if possible, to establish the broadest potential effect of the communication and teamwork. Also the broadest geographical spread was chosen. Telephone-interviews were conducted with 11 grant-receivers. Themes for the interviews were: communication-methods, target-groups, work-plans, and collaboration-partners. 10 institutions were selected for interviews: one from six of the categories 'Research Institutions', 'Local groups with public access', 'Municipalities', 'Open Farms', 'Pometa', and 'NGOs', and two institutions from each of the biggest categories, as they consisted of very diverse institutions: 'Companies' (farmers, small-scale producers, nurseries, restaurants, and big companies) and 'Museums' (cultural history museums, open-air museums, zoo, manor house). Table 2 summarizes the characteristics of the ten selected institutions and gives short descriptions of all receivers selected for qualitative interviews (named with "i").

Category	**Characteristics**	**Grant Receivers**	**Selected for interview**
Research Institutions	science, knowledge, development	2	Ai: Horticultural research inst., communicates PGR in different media.
Companies	propagation, production, marketing	9	Ai: Big vegetable company, sells vegetables on-line, communicates PGR in many different media, many visitors. Many collaboration-partners.

			Bi: Small gastronomic gourmet restaurant, communicates PGR in different media.
Local Groups with Public Access	conservation, local display	4	Ai: Local group with different ideas of communicating PGR to members/non-members in different media.
Municipalities	conservation, local identity and display	2	Ai: Provincial town with display of PGR in public areas, teamwork with local museum
Open Farms	testing, display for visitors	1	A: Demonstration-farm, communicates PGR in different media. Only one stakeholder in this group [1]
Pometa	gene conservation, public display	2	Ai: Private pometum and nursery, communicates PGR in different media. Many collaboration-partners.
NGOs	gene conservation, public display	2	Ai: Seed savers, communicates PGR by members and at markets.
Museums	demonstration, public display	5	Ai: Zoo, combines communication of PGR in the rainforest and in Denmark Bi: Cultural history museum, communicates PGR in many different media. Many collaboration-partners.

Table 2: Categories of receivers, characteristics and a brief description of the 10 selected for interviews. List of all grant-receivers is in Appendix B.

Qualitative interviews (Kvale, 1997) were conducted with 9 grant-receivers (with the leader of the institution or the leader of the demonstration project in the institution). Seven of the interviews were conducted at the institutions or place for the demonstration of PGR. As NGO Ai has no physical institution, the interview was conducted in the leader's garden. The leader of the demonstration project at Research Institution Ai was interviewed at a university.

[1] No interview was made in this category, as it contained only one receiver, which moved their activities to Company J due to illness.

The interviews were semi-structured and always began with co-producing concept maps of the grant-receivers' definition of and associations to PGR (Novak and Cañas, 2008). I took up a 65x75 cm 'Post-it' and a speed-marker, turned on the recorder and asked: "How do you define PGR?" With this beginning of the interview, I first of all wanted to make sure that the grant-receiver's definition of PGR was consistent with FAO's before I started talking about the subject, accidentally giving some clues to which answer I wanted. In the first interview (Company Ai), I started out asking the grant-receiver to write on the board (blue script), but this stopped his thinking and talking, so I took over the writing half-way (red script). In the following eight interviews I was writing while asking the grant-receiver to associate and explain his or her associations (all concept-maps are in Appendix D). The concept-maps have the most important words and connections between them, so they show how the grant-receiver associated to the subject, while the conversation was recorded at the same time.
All concept maps were made sitting together with the informant, as well as seven of the following interviews, while two were made by telephone due to technical problems (Municipality Ai, Museum Ai). Themes for the interviews were: objectives for the demonstration projects and characteristics of the institution, used media, target groups and their response to the communication, and collaboration-partners. My intention at that time was to return later for visitor-studies, so I ended up asking, if there was a certain occasion they would recommend for this. (The interview-guide is Appendix C). The conditions analyzed in Study 1 influenced the knowledge that could later be disseminated in the demonstration-projects, and thus it could have been interesting to know, how the grant-receivers coped with these conditions. But as Study 1 was finished after Study 2 and 3, the conditions were not considered in these studies.

Some of the information materials produced by the 9 receivers were collected and the use was outlined by the grant-receivers in the interviews (see Paper 2, table 2 for an overview). The interviews were held in Danish, lasted between 2 and 3 hours and were subsequently transcribed. At the policy level qualitative interviews were made with a representative from the Ministry of Food, who was taking part in the design and implementation of the Grant PGR, and with a representative from NordGen. Focus in these qualitative interviews was to unfold the history and present status of both the specific Grant PGR and the political background concerning the

communication of PGR. Both interviews lasted 1-2 hours, and were subsequently transcribed. A follow-up interview was made by e-mail in April 2016 with a leader in the Danish AgriFish Agency to get the latest history and future plans for the National Danish PGR-programme. The interviews were held in Danish, lasted between 2 and 3 hours and were subsequently transcribed.

Validity

Producing valid and reliable knowledge in qualitative studies includes being aware of one's own role as a researcher and the degree to which the produced knowledge in the study can be generalized, as for instance discussed by e.g. Flyvbjerg (2006) and Kvale & Brinkmann (2009). By being explicit about my role as a researcher in the following, I have tried to be less biased, though it is of course not possible to be objective when working with qualitative interviews (Kvale & Brinkmann, 2009).

Insider research – being a double insider

According to Adriansen & Madsen (2009) being a double insider means being inside in relation to the *research matter* as well as to one's *interviewees.* When we as researchers study research fields we are ourselves part of, it might make it "difficult to contest hegemonic discourses and tacit values and ideas" (p. 145). Thus answers might become presupposed and the study might end up being of little use to a wider audience. Being part of the same group, community, or workplace as the interviewees gives – on one hand – "the advantage of having a shared history and a close knowledge of the context" (p. 145), while on the other hand it might make it difficult to handle the relation in the interview-situation. Thus being a double insider when considering interviews affects both the interview situation and how interviews are planned, located, and analyzed (Adriansen & Madsen, 2009).

The research matter: Working with PGR

In my study of the Grant PGR I was in the heart of my own profession: horticulture - and PGR is furthermore a very narrow field. I had been the leader of the six demonstration projects at Museum D before writing my thesis, and therefore I deselected this grant-receiver.

Researching my own professional field meant asking questions that the interviewee knew, I could answer myself: "What is PGR?" At the same time I had been working as a science-writer for ten years, which meant interviewing professionals in my own field. Thus as a journalist I had no troubles asking 'stupid questions', and I could often frame them by for instance asking: "What is PGR *to you*?" From the very rich answers coming from especially this question, including denotations as well as many connotations, I consider the interviews successful concerning the research matter, though I was conducting interviews as an insider. On the other hand, looking back at the analytical phase, I can see that my focus in the study has not been on the content: PGR, but more on how it was communicated, the conditions, the different media, target-groups etc. As soon as I could see that the disseminated knowledge (from interviews and materials) was not contradicting the scholarly reference knowledge, I did not go deeper into this analysis. It might to people outside the Plant Genetic Environment look like this part of the study has been implicit, because I do not write very much about it in the studies.

The interviewees: Being part of the Plant Genetic Environment

I knew two of the interviewees well (study- and work-relations), three of the others quite well (work-relations), while I met four of the interviewees for the first time when conducting the interview. The interviews were mostly conducted in the grant-receiver's institution. I did not feel any difficulties handling the personal relations in the interview-situation, and I just felt it easier interviewing people I knew in the introduction-phase.

But there was a problem concerning power-relations, as for instance described by Kvale & Brinkmann (2009), with the ones who did not know me. Interviewing the grant-receivers to analyze their communication of PGR it was obvious that they thought I represented the Ministry of Food, and thus the authority giving out the grant. Thus I had to explain that my role was the researcher's, and that the aim of the study was evaluating the grant as a whole. When overcoming this, I felt comfortable interviewing, and listening to the interviews, I hear

enthusiastic interviewees telling about PGR, why and how they worked with the communication of them, what they thought of their target-groups etc.
I knew that many of the grant-receivers were critical to the way the Ministry of Food had administered the grants, especially from 2012 to 2014. This was not a subject in the interview, and I handled the grant-receivers' talking about it 'the journalist-way': I listened, but I put down my pencil to indicate that this was not transcribed. When doing the study about networks (Study 3) I had to dive into the conflict to explain, why the grant-receivers as well as representatives from the Ministry were talking about a network between them that I could not report to exist. To document this I used minutes of three official meetings and emails. I had myself reported one of the meetings (the Danish Ministry of Food, 2014), but as the professional contributions had been proof-read by the presenters, and the Ministry of Food had subsequently uploaded the report on their webpage, I found it most correct to write 'the Danish Ministry of Food' as the source. Later, when talking to the leader of the relevant office in the Ministry of Food, he said that he considered this report to be the most correct preliminary evaluation of the Grant PGR. 'Preliminary' because an EU-evaluation of the Rural Development Programme 2007 to 2013 has not been made yet, and when made it will not go deeply into the Grant PGR. It has been a very difficult and time-consuming work to uncoil the Grant PGR-history, as very little has been documented.

Generalization

Flyvbjerg (2006) discusses generalization in the selection of interviewees. As my objective was analyzing the communication potential in the Grant PGR, I wanted to get as much information as possible (Flyvbjerg, 2006). When selecting institutions for interviews I was thus looking for a broad representation of grant-receivers and their communication-activities. From the analysis of applications I selected grant-receivers preferably communicating on many platforms and having many collaboration-partners. So though I selected a broad sample for interviews, my focus was still on the communication potential of the Grant PGR. Thus I selected resilient grant-receivers: which had many different ways to communicate, which (often) had more than one demonstration-project, which worked together with others, which were interested in and related to the Plant Genetic Environment. I deselected 'single-projects' with no relations to

collaboration-partners or other demonstration-projects. I wanted all categories to be represented, so I selected one grant-receiver from each category. In the two biggest categories (companies and museums), I chose two, expected to be very different. This made 10 interviewees (see Table 2). The category 'Open Farm' only contained one grant-receiver, and he fell ill before the interview was conducted. As the demonstration-projects were moved to Company J, the category 'Open Farm' dropped out.

Finally I made 9 interviews - approximately 1/3 of the total of 28 grant-receivers - representing all categories except one. This made my sample broad and quite big, and with the most central grant-receivers to get as much information as possible, and to be able to generalize analytically from case to theory, as described by (Neergaard, 2007).

An expected highest focus on communication in the museums was not found. Study 2 showed a diverse and intense communication from all grant-receivers (see Paper 2, fig. 2), and for instance Research Institution Ai was writing press-releases with 5-6000 subscribers, newsletters and articles for national newspapers, and they were present at two food-fairs, though they state that their emphasis is on production. Company Ai had a very intense communication in more than 15 different media all year round. Museum Bi is open 11 months per year with communication on six different platforms.

Analyses of data

The thesis' three studies unfold different aspects of the Grant PGR. In the following I outline how the interviews described above were analyzed in Study 2 and 3. Finally the methods used in study 1 are described.

Study 2

The aim of the study was to evaluate the grant-receivers' potential to promote public education about PGR in the demonstration projects. This was done by analyzing the concept maps and the interviews in the following ways:

Each concept map including the recorded conversation was first analyzed to see if each grant-receiver's definition of PGR covered FAO's definition "any genetic material of plant origin of actual or potential value for food and agriculture" (FAO, 2009: Article 2). Secondly I analyzed

whether the grant-receiver elaborated on "helping to preserve the great diversity of genetic resources in food and agricultural plants and secure them for posterity through sustainable use", which was the purpose of the Grant PGR (The Danish Ministry of Food, Agriculture and Fisheries, n.d. a). These analyses explored the consistence of the PGR-concept. Thirdly their associations to the subject were used to describe the grant-receivers' diverse identities and different ways of working with PGR. Paper 2 shows an example of, how I have been working with this analysis (NGO Ai), and all concept maps are shown in Appendix D.

The interviews with the grant-receivers were analyzed using the eight elements of the communication-model New Circle Model (Ingemann, 2003): content, target-group (audience), sender, communication-environment, media and design/shaping of the communication, which are interrelated to fulfil the objective/premise and give effect (Ingemann, 2003). This framework is mostly used in the planning phase of communication, and focuses on the relations that need to be clarified and fit together to develop a message in a certain media (Ingemann 2003). As noted by Smedegaard (2003) the circle model has its origin in the work on public communication campaigns by Atkin and Rice (1981). I used the model to evaluate the coherence in the communication of PGR of each grant-receiver, since communication must be coherent to reach its objective. Paper 2 shows an example of the analysis using the New Circle Model (Municipality Ai), and all analyses are shown in Appendix E.

Secondly the grant-receivers were analyzed as being Informal Learning Environments, since the objective of the communication was dissemination of knowledge of PGR to educate the public. An analysis was first made by looking at the demonstration-projects' settings or situations (everyday experiences, designed settings, programmes) and media-platforms, which can be reached independently. Secondly their activities and information materials were analysed for four main characteristics of quality-learning experiences (they engage participants in multiple ways; they encourage participants' direct interactions; they provide multifaceted and dynamic portrayals of science; they build on learners' prior knowledge and interests). The analyses of the grant-receivers were thus compared to findings in other Informal Learning Environments to assess their educational potential (see chapter 3 (description of the framework) and chapter 5 (all findings)).

Study 3

The aim of the study was to take a closer look at the grant-receivers and the ways they worked together, as this was one of the objectives of the Grant PGR, and it was expected to influence the quality and efficiency of the communication.

The interviews were analyzed to outline with whom and how the grant-receivers collaborated. I used a combination of three different frameworks to be able to analyze different aspects of networking: The *cooperative, coordinative and collaborative networks* (Mandell, Keast and Brown, 2009) were used to distinguish between three intensities of networking. The *governance network* (Sørensen & Torfing, 2005) was used to understand relations between the state and a number of diverse partners in private as well as public institutions and civil society. Finally the framework of *Collective Impact* (Kania & Kramer, 2011) was used to unfold how to make networking operational. This combination of frameworks offered opportunities to distinguish between different ways of working together and how to improve the results.

The three frameworks for managing of networks were used to identify patterns, and find similarities and differences in the ways the institutions worked together.

Study 1

This study did not build on the grant-receivers' applications and the interviews I made with them. The aim of the study was to analyse the primary conditions influencing the making of the Grant PGR. To do this I examined the differences and similarities between the knowledge in the Grant PGR and scholarly reference-knowledge, using the framework of *Didactic Transposition* (Chevallard, 1985). In the following I describe the methods used in the analysis. For a full description of the framework, see chapter 3.

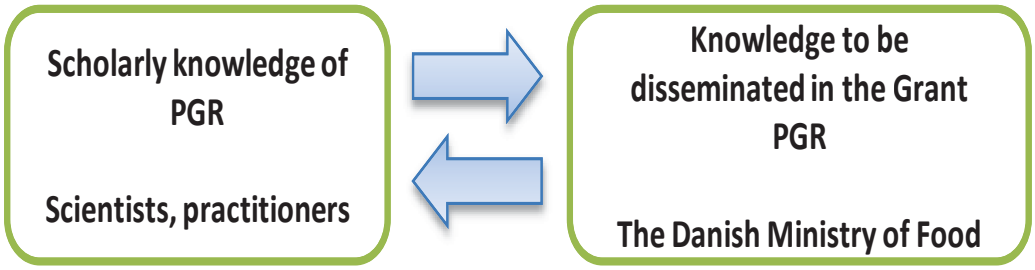


Figure 11: Diagram of the making of the Grant PGR, using Didactic Transposition: 'Scholarly knowledge of PGR' is transposed into 'knowledge to be disseminated in the Grant PGR' (after Chevallard & Bosch, 2014).

To carry out the Didactic Transposition, data needed to describe 'Scholarly knowledge of PGR', 'Scientists, practitioners', 'Knowledge to be disseminated in the Grant PGR' and 'The Danish Ministry of Food' were collected.

Scholarly knowledge of PGR

Our analysis of the first two steps of the Didactic Transposition process relied on different empirical materials. In the case of the scholarly knowledge, a broad literature review was made to find out who the scholars are, and how they define and elaborate the body of scholarly knowledge. We searched the Danish Royal Library's online search engine 'REX', using the words plant genetic resources food agriculture public awareness (see chapter 3). In order to obtain a more structured body of knowledge, we organized the themes they were addressing into 4 categories: genes, resources, agriculture, and policy. The topics concerning *genes* were focused on heredity and diversity. *Resources* were centred on collecting, documenting, conserving, and using PGR as a resource for food and agriculture. *Policy* connected PGR to society through economy, international law, sustainable development and the basic connections between PGR and food production. Finally, the *agricultural* topics put emphasis on the concrete plants, their cultivation, and the products that can evolve from them. These 4 categories have only a methodological purpose and have appeared to be useful for our analyses.

Four scientific papers mentioning all four categories of topics in the abstract were chosen to make the scientific knowledge in the analysis as broad and general as possible, and the abstracts were used to access the scholarly knowledge. These were supplemented by literature of practical knowledge for farmers, gardeners and chefs. Thus the collection of literature represents knowledge from as well scientists, farmers, gardeners and gastronomists, working with PGR. The topics dealt with in the abstracts and the literature of practical knowledge were used to create the subdivisions of the categories.

Type of literature	**Literature in scholarly knowledge**
Scientific papers/books	• Fowler, C., Hodgkin, T., 2004: Plant Genetic Resources For Food And Agriculture: Assessing Global Availability. In: Annual Review of Environment and Resources (abstract) • Hoisington, D., Khairallah, M., Reeves, T., Ribaut, J.-M.,

	Skovmand, B., Taba, S., Warburton, M., 1999: Plant genetic resources: What can they contribute toward increased crop productivity? In: PNAS (abstract) • Rao, V.R., Hodgkin, T., 2002: Genetic diversity and conservation and utilization of plant genetic resources. In: Plant Cell, Tissue and Organ Culture (abstract) • Virchow, D., 1999: Conservation of Genetic Resources: Costs and Implications for a Sustainable Utilization of Plant Genetic Resources for Food and Agriculture. In: Springer Science & Business Media (introduction to book)
Articles in journals for gardeners	• Wood-Pedersen, P., 2015a: De lollandske rosiner får nyt liv. In: Gartnertidende. • Wood-Pedersen, 2015b: Pigeon fra Maribo er anderledes. In: Gartnertidende.
Articles on a homepage from the Danish organization of organic farmers	• Hansen, Per Henrik, n.d.: Dyrkning af spelt, emmer og enkorn. In: Økologi.dk • Hansen, Åse, n.d.: Oplagt med samarbejde landmand-møller-bager. In: Økologi.dk • Larsson, Hans, n.d.: Forsker: Høj kvalitet i gamle sorter. In: Økologi.dk
Homepage from a German company working with cultivation of old varieties of fruit trees	• Bade, Jan, n.d.: Obstmanufaktur, Erhaltung und Pflege historischer und bewährter Obstsorten. In: Sortenerhalt.
Blog on the homepage from a gastronomic NGO	• Nordic Foodlab, 2011: Potato Evaluation. In: nordicfoodlab.org (blog).

Scientists and practitioners (the scholars)

A sample of the body of scholars contains the authors of the previous works. Scientists were agriculturists (Fowler, Reeves), plant breeders (Rao, Taba), botanist and plant biologist (Hosington), geneticists (Ribaut, Warbuton), plant physiologist and plant pathologist (Skovmand), and agricultural economist (Virchow).

In order to access the scholarly knowledge of the practitioners, we include consultants: Jan Bade (pomologist) and Peder Wood-Pedersen (horticulturist) who collected and re-formulated the farmers' and gardeners' experiences, e.g.: "Knuthenlund Manor has established a collection of all apple varieties from Lolland-Falster and reviewed which of the local native varieties could be interesting as new foods" (Wood-Pedersen, 2015b). Other articles are formulated by journalists (e.g. Per Henrik Hansen) interviewing scientists (e.g. Åse Hansen, Hans Larsson) who must be seen as the source (therefore also cited in the literature). The gastronomic knowledge is found in

a blog on the homepage from a gastronomic NGO, written by both chefs and scientists (sensory scientists, organic chemists).

Knowledge to be disseminated in the Grant PGR

To describe the knowledge to be disseminated in the noosphere, we have used three main sources:

- The Danish Rural Development Programme 2007-2013. By: The Danish Ministry of Food, Agriculture and Fisheries, 2012 (the Programme).
- Law for Development of Rural Areas. By: The Danish Ministry of Food, Agriculture and Fisheries, 2007a (the Law).
- Executive order about grant for demonstration projects about conservation and sustainable use of plant genetic resources for agriculture and food. By: The Danish Ministry of Food, Agriculture and Fisheries, 2011b (the Order).

The Danish Ministry of Food

The noosphere examined in this paper is primarily the Danish Ministry of Food, because this is where the conditions for the Programme, the Law and the Order are set up, and thus the most important factor to determine which knowledge can later be disseminated in the demonstration projects. The Danish Ministry of Food decides which plants can be grown and frames the knowledge that can be disseminated in the Grant PGR. This is for instance seen in the Order: "(…) demonstration projects, which may help to increase interest for the plant genetic resources and increase the prevalence of older plant varieties, which according to the assessment of the Directorate for Food, Fisheries and AgriBusiness[2] have been used before 1960 in Danish agriculture or (…) assimilated thereto, suited for environmental friendly farming and for food" (The Danish Ministry of Food, 2011b, § 1). The ministry decides who can get the grants. It decides the overall group that can possibly apply: (museums, private companies, public

[2] The directorate in the ministry working e.g. with subsidies for production and sale of food (primarily EU-subsidies)

companies, funds, communities, organizations, public institutions, and municipalities) and between these the ministry can choose: "The Ministry of Food, Agriculture and Fisheries can set the rules for prioritization and selection of applications" (ibid. § 6). This means that they decide who the grant-receivers and thus the institutions disseminating knowledge of PGR will be.
As mentioned in chapter 3 (Comparison of Didactic Transposition in a school-context and the context of the Grant PGR), other stakeholders in the noosphere also influenced the formulation of the Grant PGR: Danish politicians and lobbyists, but also EU politicians, since the Grant PGR was embedded in the EU Rural Development Policy, and politicians from FAO, because fulfilling the FAO-Treaty and the Biodiversity Convention was one of the goals of the Grant PGR.

Categorization and drawing of concept maps

The topics of the ***scholarly knowledge*** and the ***knowledge to be disseminated*** were categorized into the four categories: genes, resources, policy, and agriculture. These were drawn into two concept maps (Novak and Cañas, 2008) which were 'mirrored' and put together in one concept map to be able to analyze the similarities and differences. Here is shown the core of the 'mirrored' concept map:

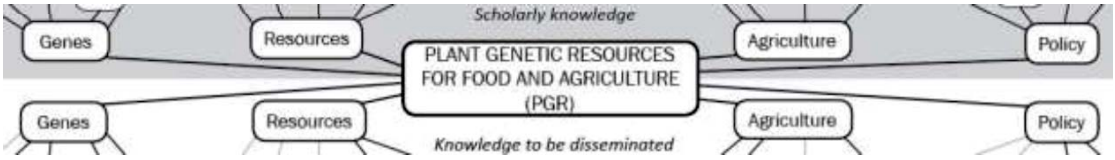


Figure 12: The four categories of knowledge (Genes, Resources, Agriculture, Policy) of PGR drawn into two 'mirrored' concept maps with PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE (PGR) in the middle. S*cholarly knowledge* is placed upwards (grey), and *knowledge to be disseminated* is placed downwards (white).

The subjects in the knowledge to be disseminated were given different colours, which were used in the categorization in the concept maps: As the Programme was at first agreed on this has the highest level (level 1). The Programme was executed in the Law (level 2), and the Law was then described in the Order (level 3).

The 3 levels were given different colours:

- level 1 (the Programme): red
- level 2 (the Law): blue
- level 3 (the Order): green

The whole 'mirrored' concept map is Appendix F, and the four categories can be studied in Paper 1, fig. 5, 6, 7, 8.

To examine which parts of the knowledge to be disseminated are influenced by the scholarly knowledge – and which are not – the mind maps of the two stages of the Didactic Transposition process were compared.

Analysis

Five research questions have guided the analysis:

Q 1: Which knowledge of PGR is present among scholars?

Q 2: How is knowledge of PGR defined in the Grant PGR?

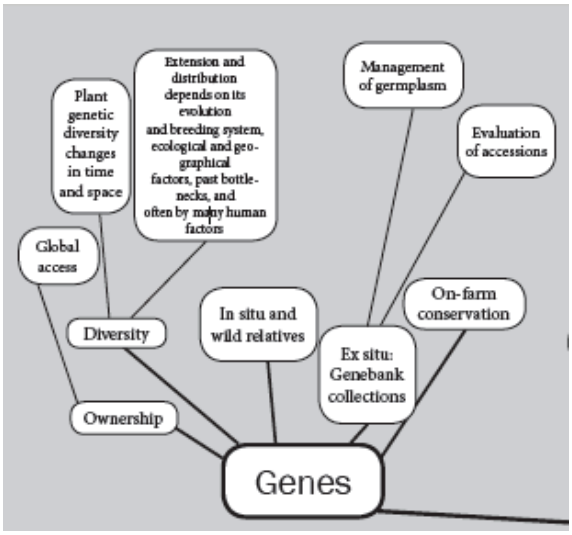
Finally the ***knowledge to be disseminated*** and the ***scholarly knowledge*** were compared to answer

Q 3: Which parts of the ***knowledge to be disseminated*** in the Grant PGR comes from the ***scholarly knowledge***?

Q 4: Which parts of the ***scholarly knowledge*** is not present in ***knowledge to be disseminated*** in the Grant PGR?

Q 5: Which parts of the ***knowledge to be disseminated*** in the Grant PGR comes from other sources than the ***scholarly knowledge***?

To answer research Q1 each group of topics in ***scholarly knowledge*** was at first described and analyzed. Here is shown an example of the group 'genes':



Concerning *genes* the scholars are concentrated on ownership, diversity, and the places where genetic resources are found: in situ (in locations where they have been developed or evolved (Fowler and Hodgkin, 2004)[3], crop wild relatives (a related natural population found in nature (Fowler and Hodgkin, 2004)), ex situ (outside the plant's natural habitat, e.g. a gene-bank (Fowler and Hodgkin, 2004)) and on farm (where it is traditionally grown (Fowler and Hodgkin, 2004)).

Analysis: This group includes the different ways genes can be preserved (ex situ, in-situ and as crop wild relatives, and on farm). Plant genetic diversity is essential to sustainable development, they change in time and space, and diversity is influenced by many factors, many of them human (Rao and Hodgkin, 2002). Diversity (from *genes*), conservation and utilization (from *resources*) are linked: "A better understanding of genetic diversity and its distribution is essential for its conservation and use. Knowledge of both these topics is essential for collecting and use of any plant species and their crop wild relatives (Rao and Hodgkin, 2002). Ownership to genes is relevant, when somebody wants to use plants originating elsewhere, and this is also a question of global access as all nations depend on crops domesticated in distant countries (Fowler and Hodgkin, 2004). This means that sustainable development world-wide is dependent of PGR and how they are conserved.

[3] The citations from the literature in the concept-map (from abstracts) are supported by further explanations and arguments from the same sources (from full text in paper/book)

To answer research Q2 the same description and analysis was made for the ***knowledge of PGR to be disseminated***. Here is shown the 'mirrored' example of the group 'genes' (the colored boxes show the used literature): *Genes* contains the topic diversity, which will be increased, if genetic variation in agriculture is enhanced through the projects. This will reduce risk of destruction due to disease and help plants to adapt to future needs. Most subjects belong to the ex situ collections, in situ and on-farm conservation reached through the projects. Here the plants that can be grown in the demonstration-projects are defined. All should be from/could be registered in the Nordic Gene bank (NordGen), which is the source of the ex-situ collections together with Faculty of Agricultural Sciences, Aarhus University and Faculty of Life Sciences, University of Copenhagen (the Programme). Conservation in situ is of vegetatively propagated plants, while on-farm conservation concerns Danish PGR that are naturally adapted to local and regional conditions, and growing them should complement the static gene-bank conservation and help to beat genetic erosion. A purpose of the demonstration-projects is also to make duplicates of existing clone-collections of perennial vegetatively reproduced plants.

Analysis: On farm conservation of ex situ collections of PGR (from gene-bank and clone-collections) is one of the main aims of the demonstration-projects. Conservation in situ is of vegetatively propagated plants (e.g. apple and Jerusalem artichoke). Though the number of eligible plants is limited, this can definitely help against genetic erosion and increase biological diversity.

Finally the scholarly knowledge and knowledge to be disseminated were compared to answer:

Q 3: Which parts of the ***knowledge to be disseminated*** in the Grant PGR comes from the ***scholarly knowledge***?

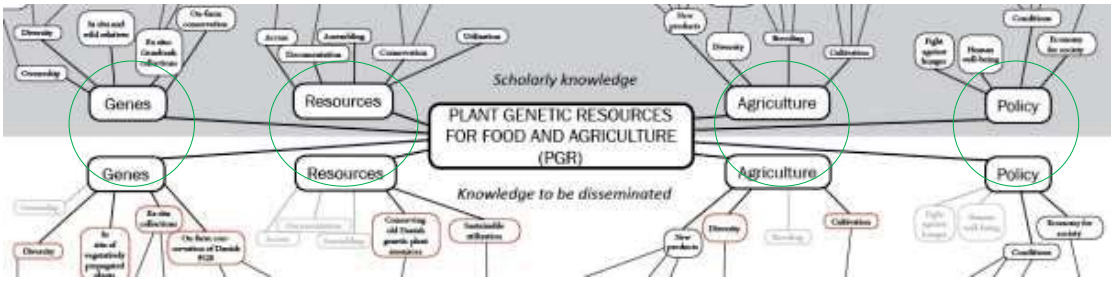
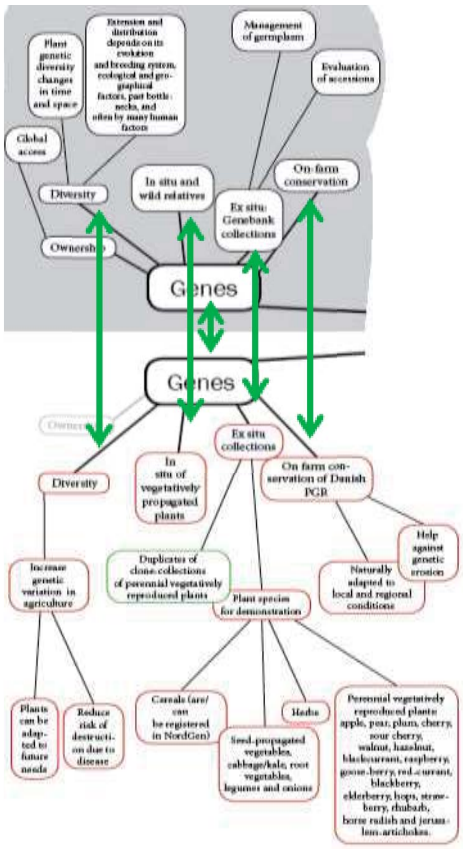


Figure 13: The four categories of knowledge in scholarly knowledge (upwards) and knowledge to be disseminated (downwards) and their subdivisions were compared (green circles) to see which knowledge was the same.

Here is shown the example of the group 'genes':
The ***knowledge to be disseminated*** is clearly influenced by the ***scholarly knowledge***, as the group 'genes' and the subdivisions of the group are represented in both 'mirrored' sides of the concept-map: *diversity*, *in situ*, *ex situ collections*, and *on farm conservation*. This means that the Grant PGR was built on knowledge that originated in the work of scientists and practitioners working with PGR. For instance, the ways genes can be conserved and later retrieved to be used are described in the Grant PGR as *in situ*, *ex situ* and *on farm* like in the scientific papers.



This result is not surprising since, as was said before, the Ministry's project was to disseminate already accepted and assessed knowledge, thus coming from what is considered as socially legitimated.

Q 4: Which parts of the ***scholarly knowledge*** is not present in ***knowledge to be disseminated*** in the Grant PGR?

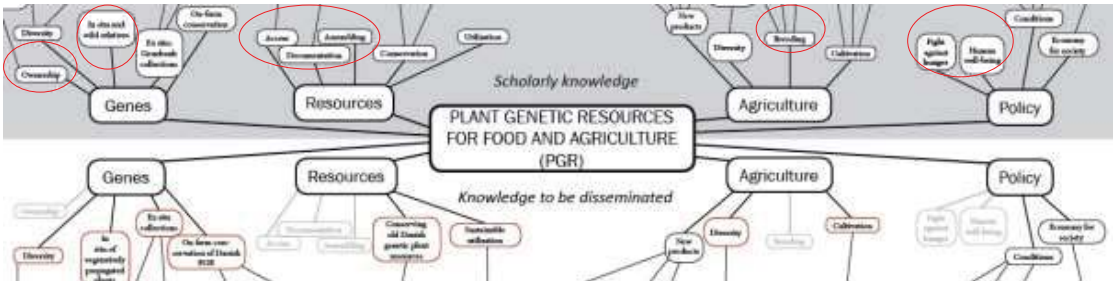
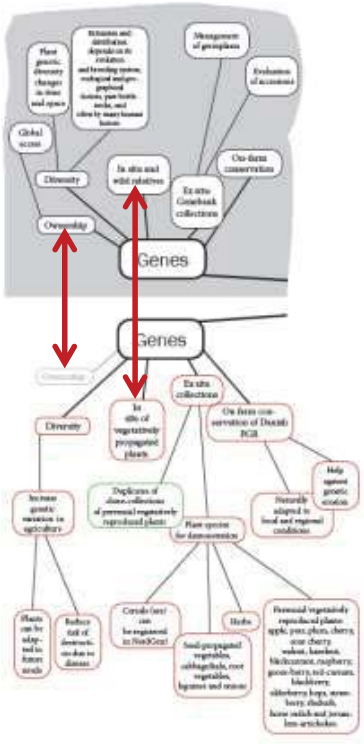


Figure 14: The four groups of knowledge in scholarly knowledge (upwards) and knowledge to be disseminated (downwards) and their subdivisions were compared to see which scholarly knowledge (red circles) was not present in knowledge to be disseminated (shaded).

Here is shown the example of the group 'genes':



Ownership (shaded) and *crop wild relatives* (this is not shaded, because it is only part of the knowledge that is missing) are not mentioned in the ***knowledge to be disseminated***.

Ownership to genes is relevant, when somebody wants to use plants originating elsewhere, and this is also a question of global access as all nations depend on crops domesticated in distant countries (Hoisington et al, 1999; Fowler and Hodgkin, 2004)[4]. As the demonstration projects in the Grant PGR used seeds and plants mainly from ex situ sources (NordGen and clone-collections (the Danish Ministry of Food, 2012)), ownership has not been considered as a relevant topic of the Grant PGR.

Crop wild relatives are crop-related natural populations found in nature (Fowler and Hodgkin, 2004; Rao and Hodgkin, 2002). The seeds and plants in the demonstration-projects should be Old Danish PGR, used before 1960 in agriculture, not in present commercial production – or similar hereto. The grant did not mention the possibility to test crop wild relatives.

[4] The scholarly literature is used in the analysis to argue the significance of the missing knowledge.

Q 5: Which parts of the ***knowledge to be disseminated*** in the Grant PGR comes from other sources than the ***scholarly knowledge***?

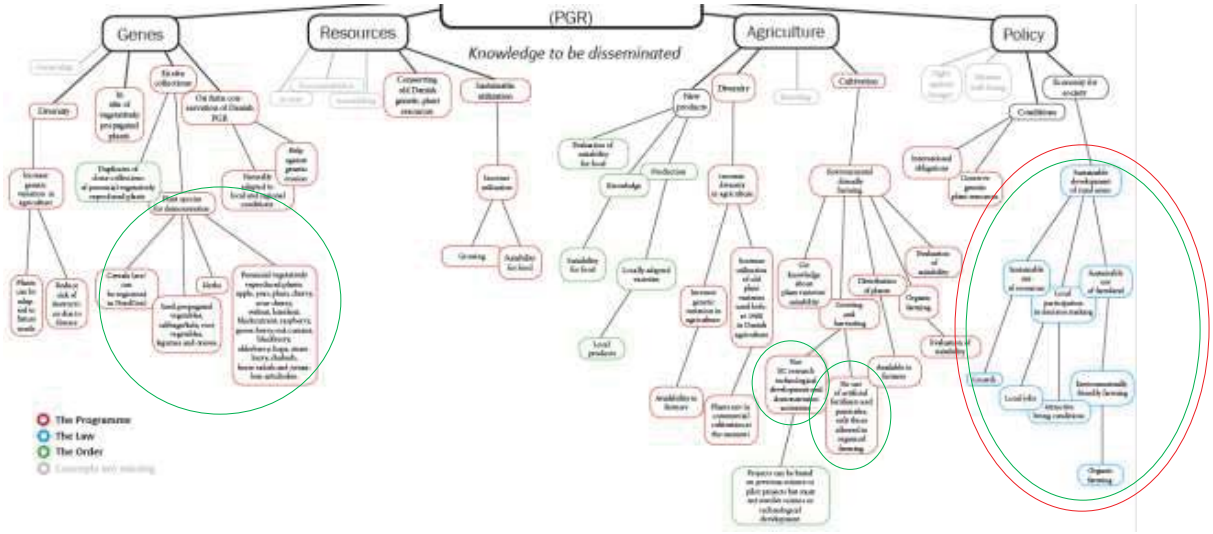
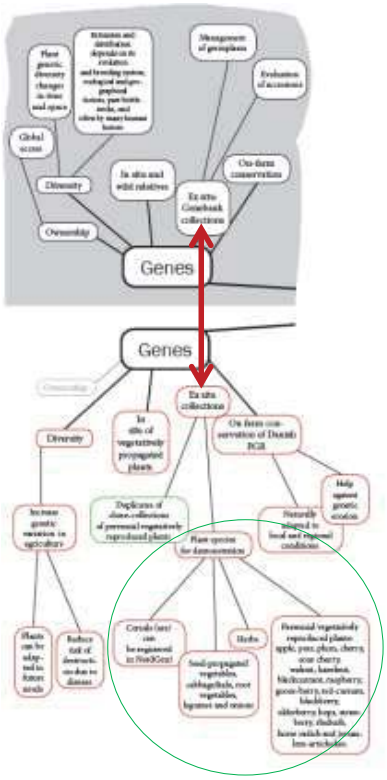


Figure 15: The four groups of knowledge in knowledge to be disseminated and its subdivisions – showing the subjects in knowledge to be disseminated with origin in other sources, referring to fig. 1 in Paper 1 (green ring: EU, red ring: DK)



Here is shown the example of the group 'genes': Whereas ***scholarly knowledge*** of *ex situ collections* is general, e.g. management of germplasm (Rao and Hodgkin, 2002), ***knowledge to be disseminated*** about ex situ collections is specific and contains the exact species of plants that can be grown in the demonstration projects: old Danish PGR, used before 1960 in agriculture (the Danish Ministry of Food, 2012). Of course these species are included in the general PGR in scholarly knowledge, but in knowledge to be disseminated they are limited to less than 50 species. All should be from NordGen or be able to be registered in NordGen because of their genetic value and scarceness. This is stated in the Programme, which has its origin in The EU Rural Development Policy 2007 to 2013. This aimed at protecting genetic diversity due to a concern of genetic erosion of plants which were not competitive against modern high-producing varieties (European Commission, 1998). Thus the Programme should enhance on-farm conservation of PGR naturally adapted to local and regional conditions, which were worthy of conservation and threatened with genetic erosion. In Denmark those PGR are almost solely in gene-

banks, so the Programme was targeted to “supply the static conservation in gene-banks with more dynamic on-farm conservation” (The Danish Ministry of Food, 2012, p. 233). This way the Grant PGR only gave possibilities to conserve and demonstrate a limited number of old varieties of food plants, which were not at first sight competitive to modern high-producing varieties.

The whole analysis of research Q 3, 4, and 5 is unfolded in paper 1.

5. Findings

This chapter first presents an overview of findings concerning the educational potential of the grant-receivers, here defined as Informal Learning Environments. To the end of the chapter is a summary of findings in the three papers.

The educational potential of the grant-receivers in the Grant PGR

Regarding the grant-receivers as Informal Learning Environments has been the main method for me to understand and explain their educational potential (the framework is outlined in chapter 3). In the following I explore characteristics of the education offered by the grant-receivers in two ways:

1) In relation to the setting or situation

2) In relation to the activities and information materials

Finally an example is shown of how these are related to framing and authenticity to evaluate their educational potential and explore their diversity. The findings are used in study 2 (paper 2).

The settings or situations

The report[5] organizes its analysis of Informal Learning Environments by looking at the settings or situations, where science learning outside of school occurs. These include *everyday experiences*, *designed settings*, and *programs*. Apart from these settings, science learning outside of school can also occur on *media-platforms* such as television, radio, newspapers and social media (National Research Council, 2009).

The institutions with demonstration-projects all belong to at least one type of the three settings. Furthermore they all use different media-platforms to disseminate knowledge of PGR, which

[5] National Research Council's report: Learning science in Informal Environments: People, Places, and Pursuits. See Chapter 3: 'Grant receivers as informal learning environments' for details.

gives possibilities for their audience to prepare and process the knowledge. This can be seen in table 3 and is elaborated in the following.

Institution	Everyday experiences	Designed settings	Programs	Media platforms	Prepare and process
Research Institution Ai		2		5	6
Company Ai		3	4	5	6
Company Bi		2		5	6
Local Group w. Public Access Ai		3	4	5	6
Municipality Ai	1	3		5	6
Pometum Ai		3		5	6
NGO Ai		2	4	5	6
Museum Ai		3		5	6
Museum Bi		3		5	6

Table 3: Settings, media and combinations of formats in the institutions with demonstration-projects
1 = pick apples in abolished gardens, 2 = Food-fair, 3 = Fields, plantings, plantations, gardens, 4 = members-activities and subscription, 5 and 6 = webpage, article in newspaper or magazine, social media, handout or leaflet

Everyday experiences

Municipality Ai offers settings with possibilities of everyday experiences with PGR to their citizens. This is done by inviting people to pick fruit in abolished gardens (marked on a map on Municipality Ai's website, see fig. 1) and learn more about apple-varieties. The text on the webpage says: "**Pick an apple**. In 'name of town' several places owned by the municipality offer apples and other fruits, which just wait to be picked."

Figure 16: On Municipality Ai´s web-side citizens can find abolished gardens, where they are allowed to pick fruit from September to November each year.

In the lower left corner a map shows where, and in the lower right corner users are offered recipes for fruit-deserts. They are also encouraged to find the names of the apple-varieties in their garden, using the scientific

“Apple Key” provided by NordGen and University of Copenhagen (NordGen, n.d.). This can enhance learning, because picking apples in abolished gardens is supported by knowledge at the webpage.

Designed settings

Almost all of the institutions in the demonstration-projects can be seen as designed settings or educationally framed real-world phenomena (Company Ai, Municipality Ai, Pometum Ai, Local Group with Public Access Ai, Museum Ai and Bi). People go to the institutions to experience PGR, and there is an intention behind the experiences, because each institution wants their visitors to learn about PGR, e.g. through guided tours, boards, signs, or leaflets. In Municipality Ai, for instance, apple- and walnut trees are planted in parks, squares, and living areas, where people can pick the fruit. The trees are often planted in a systematic manner, explaining the fruit family or how and when to use the fruit. Boards inform about this and tell about PGR by some of the plantings. Three of the institutions (Company Bi, NGO Ai, Research Institution Ai) do not have visitors in the institution but meet them on markets and food-fairs, which are also designed settings: the organizers want people to come there to experience and learn about food.

Among the institutions in the demonstration-projects are museums growing old varieties of grains. As a visitor, you can read the board by the field, telling about this PGR, its history and why it is important to preserve it. In Museum D, you can also walk through a trail in the field to experience the look, smell, and feeling of the grain (see fig. 17). With Company Ai you can have a guided tour in the vegetable-field, and many of the other producers in the demonstration projects (not interviewed) offer guided tours in their fields with the farmer or gardener. It can be debated, whether the grain-field in Museum D is a designed setting or an educationally framed real-world phenomena, since the field is grown only for the visitors, but the guided tours in vegetable- and grain-fields with farmers and producers telling about PGR must be counted to the latter.

Figure 17: Trail through field with an old variety of rye in Museum D as part of a demonstration-project.

The plantings of PGR in museums are arranged by designers and educators to make visitors understand what PGR is. In Pometum Ai and Company Ai (and other producers, farmers and gardeners from the demonstration projects, not interviewed) the plantings are designed and presented by gardeners, farmers and scientists. The intention might be growing grains or vegetables to test - and maybe also sell them - but the demonstration to visitors is a part of the design, because it is a demonstration-project: there are labels on the plants, boards in the field, leaflets and guided tours to inform visitors about PGR. When meeting Company Bi and Research Institution Ai, people get to talk to scientists, while a meeting with NGO Ai or Local Group with Public Access Ai will be guided by amateur-members interested in PGR. Whether the guides are museum-educators, farmers, scientists or amateurs, they are all very aware of their pedagogical intentions, and all take part in the demonstration-projects, because they find it essential to preserve PGR and important to inform the public about it. Company Bi, for instance, wants to "ensure that we pass the cultural and natural heritage of plants on to those, who take over the Earth after us", and Local Group with Public Access Ai wants people to "meet in a cosy, social environment, inspire, teach and learn from each other".

Programs

As two of the institutions in the demonstration projects (NGO Ai and Local Group with Public Access Ai) have members they can also be regarded as programs, when they address their members.

NGO Ai in the demonstration projects has around 900 members. They gather in meetings and

courses, where they change seeds, learn about PGR, and propagation of plants. Some of the members are garden-owners; others are farmers and scientists, while some are considered experts in the field of PGR, though they are amateurs. NGO Ai is for instance member of the governmental Committee for PGR, together with scientists and professional breeders.
The Local Group with Public Access Ai sees itself as a place for local gathering and story-telling. People can attend as members, or they can attend activities as non-members by paying a smaller fee. The group invites experts, when they for instance want to teach grafting, or they arrange excursions to scientific institutions like Pometum B, to tell about PGR. The local focus of the group is for instance seen, when they plant apple-trees of the local variety together in public spaces like in front of the old people's home.
The communication with subscribers to Company Ai also has some characteristics of a program: Subscribers get a weekly newsletter in their vegetable-box, which tells about the produce that is sometimes PGR from the demonstration-projects. This also gives opportunities to have prolonged conversations about PGR.

Science media

All the institutions with demonstration-projects have a webpage telling about PGR. This gives visitors possibilities to prepare their visit and afterwards to process the knowledge they get. As there has been an obligation to write press-releases and articles in local and national media with most of the demonstration-projects, the public has been able to find knowledge about PGR in radio, television, national and local newspapers, Facebook and Twitter. Leaflets and hand-outs can be taken home as well. This is expected to support science learning – when visiting the institutions or at home, before and after the visit.

The activities and information materials

I now turn to the activities and materials to assess their science learning potential. The following four main characteristics reported to support science learning in visitor-studies when offered by Informal Learning Environments (National Research Council, 2009) have been found in the demonstration-projects. These can be seen for each institution in table 4 and are elaborated in the following.

Institution	1. Multiple ways (senses)	2. Direct interaction	*3.* Multifaceted science	4. Building on learners' prior knowledge, memories and interests						
				Guided tours with talk	Activity days with talk	Taste and talk at fairs	Taste and talk at inst.	Visitor memo-ries	Member interest	Local focus
Res. Inst. Ai	b, c		d			x				
Company Ai	a, b, c		d	x			x			x
Company Bi	b, c		e			x				
Loc.Gr.w.P.A.Ai	a, b	x	d, f		x			x	x	x
Municipality Ai	a, b		d, g	x						x
Pometum Ai	a, b		d	x						
NGO Ai	b, c	x	d, f			x			x	
Museum Ai	a, b, c		d, g	x			x			
Museum Bi	a, b, c	x	d, f, h		x		x	x		

Table 4: Four main characteristics of activities and materials in the demonstration-projects reported to support science learning (National Research Council, 2009): a= growing PGR with labels, boards, or leaflet, b= produce and food, c= tastings, d= horticulture, e= sensory science, f= ethnology, g= biology, h= history

All characteristics are present in some of the institutions, and all demonstration-projects had activities with at least 3 of the characteristics.

1. Informal science learning environments engage participants in multiple ways, including physically, emotionally, and cognitively

When visiting six of the demonstration projects (Company Ai, Local Group with public access Ai, Municipality Ai, Pometum Ai, Museum Ai and Bi) the visitor can experience growing PGR, e.g. different varieties of walnut trees, onions, apples or wheat. Like immersive exhibits this can evoke senses: visual, olfactory, auditory and tactile. In all six institutions the visitor can see the growing plants on their own (with boards, labels on plants or a leaflet). Visitors can also attend a guided tour (Company Ai, Municipality Ai, Pometum Ai, and Museum Ai), take part in activity days (Local Group with Public Access Ai, Museum Bi) or taste produce at fairs (Research Institution Ai, Company Bi, NGO Ai). Six of the institutions offer tastings of different varieties of e.g. raw apples, blackberries, rhubarb syrup or bread (Research Institution Ai, Company Ai and Bi, NGO Ai, Museum Ai and Bi). This will always be with a guide, who they can talk to and ask questions, and the visitors are often encouraged to compare taste and texture of different varieties of the same fruit or vegetable. Having a conversation with museum-staff, farmers,

gardeners or scientists is a key mode of disseminating knowledge about PGR in the demonstration-projects and is possible in all institutions. Tasting or working with PGR is also a central way to engage the public with this subject in the demonstration-projects. All produce are considered known, since they are ordinary fruits, vegetables and grain (e.g. walnuts, blackberries, onions, turnips, barley, wheat), though the range of varieties and tastes are sometimes a surprise to the visitor. Company Bi, for instance, experiences amazement from their visitors, when they serve dry apple-cider: "They think that they are going to taste something sweet".

All demonstration projects use more than one format to disseminate knowledge to the public about PGR. Research Institution Ai, which primarily meets its audience on Food-festivals, for instance, brings posters, hand-outs, tastings, and they get into a dialogue "to give a broader and deeper knowledge of what 'Mr. and Mrs. Jensen' taste". Company Ai calls the use of many media 'a scatter gun approach': sending information in all directions. They explain this in another way: "We have experienced that PGR can be disseminated in many ways – from information about the varieties to the wide story of PGR - and preferably with tastings. "Some get excited by the history, the genetical variation - others need concrete vegetables". Museum Bi also uses a combination of media to tell their visitors about PGR. Some are written (signs, boards, and articles), but they often include personal contact: "We have a dialogue with people face to face, when we are disseminating knowledge about PGR."

The institutions disseminate knowledge about the same subject at very diverse institutions, using many different angles and modalities in many different geographical places – within the same time. Because the ways knowledge about PGR is disseminated at the same time is well-integrated with each institution, this is supposed to enhance the opportunity of reaching more people - and for the same person to learn about PGR in more than one way or place – as opposed to one institution communicating about PGR in only the same way. This is further augmented because mass-media having a bigger impact than local media (e.g. radio, TV, national newspapers) are involved.

2. Informal science learning environments encourage participants' direct interactions with phenomena of the natural and designed physical world, largely in learner-directed ways

Figure 18: In Local Group with Public Access Ai members and visitors can learn how to graft old varieties of apple-trees.

Three of the demonstration-projects (Local Group with public access Ai, NGO Ai, and Museum Bi) offer interactivity to the public as part of the experience (see fig. 18). Visitors can for instance engage in practical work in garden and kitchen in Museum Bi. Local Group with public access Ai is based on involving activities with members and visitors: grafting, planting and taking care of apple-trees together, especially the local variety 'Nonnetit from Oustrup'. NGO Ai's members grow PGR in their own gardens, and they offer seeds to non-members at markets and fairs, which they can grow at home.

3. Informal science learning environments provide multifaceted and dynamic portrayals of science

Very diverse institutions were invited to take part in the grant-scheme, representing different scientific fields, for instance horticulture (Research Institution Ai), and sensory science (Company Bi) (The Danish Ministry of Food, Agriculture and Fisheries, 2009). Especially where visitors meet more than one field, they get the opportunity to experience a multifaceted and dynamic portrayal of science. This is seen in at least five of the institutions (Local Group with Public Access Ai, Municipality Ai, NGO Ai, Museum Ai, and Bi). E.g. Museum Bi brings in the fields horticulture, ethnology, and history, when they disseminate knowledge of PGR. This is because their visitors meet people with different educations, and they for instance get knowledge of how the plant is grown, when it was introduced in Denmark, and how it has been used in different periods of time. The way the demonstration-projects are arranged will usually also present more than one scientific field in the three other institutions, e.g. Company Ai also demonstrates historical and ethnological aspects of the plants they work with, though their primary field is horticulture.

This means that the institutions allow their visitors to get in touch with the diverse cultures of scientific fields, which is beneficial to the visitors' understanding of PGR. But this approach will also help giving a less 'nerdy' picture of PGR. An official from the Ministry of Food working with the design and implementation of the Grant PGR was aware that this would benefit the demonstration of PGR to the public (pers.com. 8.10.2014).

4. Informal science learning environments build on learners' prior knowledge and interests

Giving tastings of different varieties of strawberries, having a conversation with a gardener or planting apple-trees together are all ways to give the possibility to create 'hooks' or 'bridges' to the visitor's personal knowledge base. Furthermore the Local Group with public access Ai works with tradition: what they call "within living memory". This is people's personal memories - rooted in the local apple-variety. Museum Bi also states that memories are playing a great role, when people taste:

> *The whole sensory system is used, and flash-backs to something good, confident, and combined with childhood appear. The visitors get to think of their own history and remember grandma's garden, where everything had a special taste: "the strawberries that tasted like my grandmother's"*

Both institutions with members (Local Group with Public Access Ai and NGO Ai) build on personal interest. NGO Ai mentions that members "grow PGR as a hobby for their own benefit – and at the same time save the world". This means that growing PGR in the garden makes sense to members as a hobby, but at the same time many of the members are politically aware and know that growing PGR helps saving them, and saving PGR is important to human survival.
The Local Group with Public Access Ai is based on involving activities with members, building on their interests: "People meet in a cosy, social environment, inspire, teach and learn from each other".
Company Bi meets the public at food-fairs. They tell that the best outcome of their communication would be "to rouse people's curiosity and make them feel like experimenting with fermentation of produce from their own garden and ask for new products in the shops".
The local focus in some the demonstration projects (Company Ai, Local Group with Public Access Ai, Municipality Ai) also connects to the personal interest. This is for instance seen in

Municipality Ai, planting trees in public areas, incorporating fruit trees into the local development plan, and encouraging their citizens to pick apples in abolished gardens.

Framing and authenticity

An important aspect of the demonstration-projects was framing and authenticity. Bain & Ellenbogen (2002) discuss framing and authenticity of objects in museums. Regarding historical objects they elaborate: "Witnessing an object first hand is quite different from seeing it in a book or reading about it. The experience itself generates an air of authenticity and a sense that one is experiencing the past directly" (p.154). This is followed by a discussion of what happens when the objects are taken away from their original frame and displayed in the museum. "Yet, regardless of the object's authenticity, we cannot experience the past directly" (p.154). Museums can't display objects in their historical context, which makes it necessary to mediate the historical experience in the museum setting. It is the museum display that either adds to or detracts from the conclusions the learners draw from the objects, so this is a unique challenge for history museums. This puts emphasis on authenticity of objects and the framing of them when presented for learners. When connected in an adequate way these factors are supposed to enrich the associations in the learner and thus to enhance learning (Bain & Ellenbogen, 2002). Especially Informal Learning Environments showing objects taken away from their original place, communicating time (history), or place (geography) different from their actual time or setting have a challenge to give their visitors enriching associations.

The institutions in the Grant PGR are all characterized by having a frame connected to the food-plants the visitors are going to experience, so the 'objects' are in their authentic frame. Almost all institutions, which can be visited, are associated with plants: Company Ai grows and sells vegetables, Pometum Ai is connected to a nursery and grows, shows and sells fruit trees, Museum Ai is a zoo, showing animals and plants from the rainforest, and wild and cultivated Danish plants and animals, Museum Bi is an agricultural museum with fields and a garden, and the Local Group with Public Access Ai is a collection of fruit trees. People expect to get knowledge and experiences with plants – and most of them food plants - when they go there. Only Municipality Ai is not per se a place, where people go to experience plants, so here citizens are more expected to be surprised, the first time they find out that the municipal planting is

edible and explained. When people visit Company Bi (small gastronomic gourmet restaurant), Research Institution Ai (horticultural research), or NGO Ai (seed savers) on the food-fairs 'Copenhagen Cooking' or 'Food' in the town Århus they are prepared to meet food, which is also an aspect of PGR, and the three institutions will serve tastings and talk to people about PGR. So knowledge of PGR is disseminated in a frame connected to the subject (Bain & Ellenbogen, 2002), and visitors are even tuned in to "plants" or "food", before they reach the institutions, which make them mentally prepared. At the same time showing, tasting, and working with food-plants is a feasible way to introduce people to the important diversity of food-resources. These factors are all supposed to make learning easier, and this is expected to be further enhanced by the authenticity in most of the demonstration projects: Going to a real field or plantation, meeting professionals or enthusiastic amateurs working with PGR. This is of course only the case, if the disseminators are able to transform and adapt knowledge of PGR in the meeting with their visitors. It is to some extent comparable to the domain specific research that must be transformed, adapted and embodied in the immersive exhibit, in order to bring forth the narrative as explained by Mortensen (2010c) and Marandino et al. (2014).

Evaluating the educational potential of the grant-receivers

To evaluate the educational potential of each institution table 3 and 4 are combined. E.g. the Local Group with Public Access Ai is a designed setting (a collection of fruit trees), where visitors can be guided by amateur-members, interested in PGR. At the same time the group acts as a programme to their members: they gather in the group to tell stories of apples, to listen to apple-experts, or to learn grafting. They also plant apple-trees together in the local area. The local group uses different media platforms, e.g. a homepage, which makes it possible for their visitors to prepare and process the visit. The activities and materials are characterized by involving senses in multiple ways (growing PGR with labels, boards, leaflets, and offering produce or food), by giving possibilities of direct interaction (grafting, planting), and the activities and materials show a multifaceted portrayal of science (horticulture (knowledge of plants, botany, ethnobotany) and ethnology (history, science of local traditions)). At the same time they build on the learner's prior knowledge, memory or interest (activity days with the opportunity to talk, visitor memories about the local apple variety, member interest, and a local

focus). These features are all known to enhance science learning when offered by Informal Learning Environments. Furthermore the frame (the collection of fruit trees) is connected to the food-plants that the visitors are going to experience. So the 'objects' are in their authentic frame, and visitors/members meet invited professionals as well as enthusiastic amateurs working with PGR. These factors are all supposed to enrich the associations in the learner and thus to enhance learning. The combination of all these features is furthermore expected to make the abstract notion of 'PGR' concrete to the visitor.

Each of the grant-receivers with demonstration-projects belongs to at least one of the three types of settings or situations (table 3): *everyday experiences*, *designed settings,* or *programs*, all known to support science-learning in different ways. They all use different *media-platforms* to disseminate knowledge of PGR, which give possibilities for their audience to prepare and process the knowledge they get when they are in contact with the grant-receivers. Furthermore their activities and information materials have at least three of the four main characteristics which have been connected to science learning, when offered by Informal Learning Environments (table 4). At the same time the institutions in the Grant PGR are all characterized by having a frame connected to the food-plants the visitors are going to experience, so the 'objects' are in their authentic frame.

The combination of these features gives the grant-receivers (Informal Learning Environments) a high educational potential, and this shows at the same time their high diversity.

Summary of findings in the three papers

Paper 1: Transferring knowledge from a scholarly context to a policy context

- The making of a national grant-scheme for demonstration of Plant Genetic Resources for Food and Agriculture to the public

The paper analyses how knowledge on conserving and growing plant genetic resources in a sustainable way was communicated through a Danish grant-scheme, embedded in the EU Rural Development Policy 2007 to 2013. The aim of the grant-scheme was firstly to protect plant genetic resources for food and agriculture by supporting demonstration-projects; secondly to test

the suitability for environment friendly farming and food products. Finally the grant-scheme should increase public awareness of plant genetic resources and help fulfil national obligations according to FAO and UN.

The analytical framework of *Didactic Transposition* is used to pinpoint the factors having an important impact on the transformation and change of knowledge from a scholarly context to a policy context. In this, we took the "scholarly knowledge" developed by scientists and practitioners working with and investigating plant genetic resources and compared it with the knowledge in the grant-scheme, in order to see how the formulation-process change the body of knowledge and to examine how the changes were influenced by the international level (FAO), the EU level, and the National level (DK).

It was found that the Grant PGR was built on knowledge, values and practices that originated in the work of scientists and practitioners working with PGR, as all basic concepts mentioned by the scholarly literature (genes, resources, agriculture, and policy) were also present in the Grant PGR. However, in the formulation of the grant some of the knowledge was enriched, while some of the knowledge was restrained.

Following factors were limitations in relation to the scholarly knowledge: only Old Danish plant-varieties from gene-bank- and clone-collections could be demonstrated, breeding was not included, no research or technological development were allowed, and only fertilizers and pesticides allowed in organic farming could be used. Knowledge of sustainable development of rural areas was an enriching factor built into the Grant PGR.

The limitations had implications on the demonstration-projects. Limiting PGR to Old Danish plant-varieties from gene-bank- and clone-collections in the demonstration-projects were well suited to dynamic on-farm conservation of Old Danish varieties and therefor to help the conservation of the ex-situ collections of valuable Danish PGR. It also helped Denmark to fulfil its international obligations. But the limited selection of old plant-varieties, not in present production, was less suited for increasing public awareness and interest in conservation of PGR as this should include communicating the importance of sustainable rural development, fight against hunger and adaptation to future needs. Furthermore the demonstration of solely old varieties gave a 'museological' impression of PGR. This was enhanced by breeding not being

included in the knowledge to be disseminated, as only the original old varieties could be grown and demonstrated. This means that one of the aims of the Grant PGR: to increase public awareness and interest in conservation of PGR was limited. Furthermore the restriction to include research in the demonstration-projects was problematic, as one of the aims of the projects was to get knowledge about growing properties of the plant varieties and evaluate their suitability for food. This restriction was contradictory as it is difficult to test and gather knowledge without doing research. Therefor the purposes of the Grant PGR to test suitability for environment friendly farming and food products were not possible to do in a scientific way. The restriction of using artificial fertilizers and pesticides was suitable for testing suitability for environment friendly farming and food products made from old varieties of PGR on the field level. But to conservation of PGR ex situ this decision was problematic as it is sometimes necessary to use pesticides to conserve fragile varieties. This means that the purpose to protect PGR in the Grant PGR was not fully met, and as the grant should at the same time help Denmark to fulfil its obligations according to the FAO-treaty (to conserve PGR), this was not fulfilled either. Knowledge of sustainable development of rural areas was an enriching factor resulting for instance in development of successful high-quality products in the demonstration-projects. These brought out knowledge of PGR to the public and thus the Grant PGR actually fulfilled the purpose of the EU policy by increasing genetic variation in agriculture, and enhancing sustainable development of rural areas through development of new quality products. But the expensive foods made from Old Danish PGR might at the same time have contributed to a view on PGR more connected to luxury products with a Nordic history than to fight against hunger and a necessity for the future.

These factors all influenced the knowledge that could later be disseminated in the demonstration-projects, and the aims of the Grant PGR could not be fully met. All limitations were a result of adaptations of the Grant PGR to EU's Rural Development Policy. This means that though the Danish Ministry of Food formulated the Grant PGR, these decisions were taken on the EU-level, and the Danish Ministry of Food had to incorporate them into the Grant PGR, when they decided to make it part of the Rural Development Programme in EU's Rural Development Policy 2007 to 2013. Also the enriching factor: adding knowledge of sustainable development of rural areas to

the knowledge to be disseminated had its origin in the adaptation to EU's Rural Development Policy. But though it fulfilled its aim to let the agrifood economy, the environment, and the broader rural economy and population go hand-in-hand, it showed at the same time the difficulty to include raising public awareness of PGR in these aims in a way that reflected the scholarly knowledge of PGR.

Finally recommendations for the Grant PGR are given to increase public awareness and interest in conservation of PGR. It is concluded that there is a need for clarity as to what knowledge is selected and deselected in the transposition process as well as awareness of adaptations due to embedding in policies at all levels.

The framework Didactic Transposition is presented as a useful analytical tool, suitable for cases, where objects of knowledge are transposed from scholarly environments into political environments, and built into legislation. Analyses like these can thereby lead to more explicit choices in the development of grant-schemes and other political instruments building on a body of scholarly knowledge.

Paper 2: Communicating plant genetic resources for food and agriculture to the public
- A study of grant-receivers with demonstration-projects in the Danish Rural Development Programme

The paper is a study of the receivers of the Grant PGR to assess their potential to communicate knowledge of PGR to the public through their demonstration-projects. The grant-receivers were museums, research institutions, private companies, municipalities, pometa, local groups, and NGOs, and all had an obligation to communicate PGR to the public. Their individual as well as collective potential to communicate PGR and offer education to the public is evaluated.
It was found that the grant-receivers had the same core-conception of PGR but different angles to the subject reflecting their identities. Their objective was shared: to give information of PGR to the public. Furthermore the wanted effect from all grant-receivers was that their visitors got knowledge of PGR. All were aware of this, and most of them continued by saying: "get interest and engagement". Some of the grant-receivers also wanted their visitors to *do* something: grow

apple-trees, buy high-quality food, teach their children about different apple-varieties, or experiment with fermentation of fruit. Each institution's communication was found to be coherent, which means that the content, target-group, sender, communication-environment, media and design of the communication were interrelated and targeted towards the objective and wanted effect (Ingemann, 2003). Therefor each of the grant-receivers had a high individual potential to communicate PGR to the public. Seven of the institutions furthermore had the same activities as they had before going into the demonstration projects, and they addressed the same target groups, which they usually worked with, using the same media.

All grant-receivers were regarded as Informal Learning Environments, because they gave opportunities of learning science for the public outside of school and belonged to at least one type of setting, where science learning could occur: everyday settings, designed settings or programmes (National Research Council, 2009). They all used different media-platforms to disseminate knowledge of PGR, and gave possibilities for their visitors to prepare and process the knowledge. To assess the grant-receivers' educational potential, four main characteristics reported to support science learning in visitor-studies (National Research Council, 2009) were analysed regarding the demonstration-projects:

1. They engage participants in multiple ways; physically, emotionally, and cognitively.
2. They encourage participants' direct interactions with phenomena of the natural and designed physical world, largely in learner-directed ways.
3. They provide multifaceted and dynamic portrayals of science
4. They build on learners' prior knowledge and interests.

All characteristics were present in some of the institutions, and all had activities with at least 3 characteristics. As each grant-receiver used many of the characteristics known to enhance science learning they were found to have a high educational potential. They used their activities and materials in the demonstration-projects to make the abstract PGR concrete for their visitors.

The many diverse grant-receivers enhanced the potential of science learning and learners, since all facilitated the same core message with the same overall purpose in many different places at the same time. The effect of this was seen to be enhanced by the grant-receivers' diversity, disseminating knowledge of PGR with different perspectives and thus providing multifaceted and dynamic portrayals of science.

Including an obligation to communicate to the public was unique to Denmark's implementation of this grant-scheme, which was part of the Rural Development Programme 2007-13. Six EU countries (England, Ireland, Germany, Austria, Italy and Denmark) implemented the grant-scheme for PGR (European Commission, n.d. a; FAO, n.d. c). Austria, for instance, has implemented the grant-scheme in 1995 as a subsidy for farmers with a high number of varieties in different crops threatened by genetic erosion, and it was also included in the programme 2007-13 without any obligations to inform the public (Bundesministerium für Land und Forstwirtschaft, Umwelt und Wasserwirtschaft, 2007). Other countries as Italy and Germany had communication as part of the implementation but not as an obligation for the grant-receivers (European Commission, n.d.; Regione Umbria, n.d.).
The grant-scheme in the EU-programme was directed at "farmers and other land managers", but the Danish results show that ratification in diverse institutions can reinforce the effect of knowledge-dissemination to the public. Hence, educating the public might enhance the results of the programme, especially when "building bridges between cutting-edge research knowledge and technology and farmers, forest managers, rural communities, businesses, NGOs and advisory services," which is an aim of the current programme (Official Journal of the European Union, 2013, art. 55).

Paper 3: Collaborative networks as institutional support to delivery of environmental services

- *Insights from the Danish grant-scheme for demonstration of plant genetic resources for food and agriculture*

The paper analyses how the grant-receivers worked together as enhancing their collaboration was as one of the purposes of the grant-scheme (The Danish Ministry of Food, n.d. a), and this was expected to affect their efficiency and resilience. Three different kinds of teamwork were found:

- *an overall grant-network of all grant-receivers and the Ministry:* The purpose was networking, inspiration, and connecting the government with the Danish PGR-environment[6].
- *smaller formal teams:* The purpose was helping each other to fulfil the activities described in each application.
- *informal partnerships:* The purpose was sharing of resources (e.g. seeds and produce), information and expertise.

These were analysed using a combination of three different frameworks to be able to analyse different aspects of networking: The *cooperative, coordinative and collaborative networks* (Mandell, Keast and Brown, 2009) is used to distinguish between three intensities of networking. The *governance network* (Sørensen & Torfing, 2005) we use to understand relations between the state and a number of diverse partners in private as well as public institutions and civil society. Finally we use the framework of *Collective Impact* (Kania & Kramer, 2011) to unfold how to make networking operational. It offers opportunities to distinguish between different ways of working together and how to improve the results

It was shown that the formal teams and informal partnerships between the grant-receivers seem to have functioned well. The many informal partnerships fulfilled their purpose of sharing resources in partnerships with some cooperative and some coordinative network characteristics. The formal teams had the purpose to help each other to fulfil the activities described in each application. They were, of course, diverse, but they also seem to have worked quite efficient as teams with mainly the characteristics of coordinative networks. The grant-receivers contributed to the joint projects with their special skills and knowledge, and coordinated their work to heighten the efficiency and quality of the demonstration-projects. The projects sometimes lacked

---

[6] The Danish Plant Genetic Environment is described as "… *remarkable for gathering an unusually broad group of stakeholders: researchers, farmers, local 'enthusiasts', chefs, museum staff, plant breeders, officials, etc. The group is … committed and has a high level of initiative and drive … and there is a good teamwork between these very different users". Its teamwork with the Ministry of food is underpinned as important* (the Danish Ministry of Food, 2011, p. 39-40).

coordination and balancing of expectations, but they developed to become more efficient as they went along, and some of the institutions are now working together in new projects (pers.com. 22.3.2016).

The overall-grant-network which connected the grant-receivers with the Ministry of Food functioned as a governance-network with collaborative characteristics in the test-period from 2006 to 2008, but not from 2008 to 2014. The purpose was networking, inspiration, and connecting the governmental layer with the Plant Genetic Environment in Denmark. The overall-grant-network in the form of a governance network only emerged, because there was a need for cooperation between the Plant Genetic Environment and the Ministry of Food. But communication was almost non-existent present from 2008 to 2014, and the relation was unstable, though meetings had been successful for the grant-receivers as well as for the ministry. Furthermore, in 2012 when the Grant PGR was no longer administered by specialists who knew about the Danish Ministry of Food being responsible for informing the public about PGR, the Ministry lost their intentions to connect to the Plant Genetic Environment.
However, the governance network might make the teamwork at all levels more efficient, and it was requested by the grant-receivers. Furthermore, some of their central qualities in demand belong to a collaborative network: stable relations, tactic information sharing and thick communication flows (Mandell *et al.*, 2009, see table 1 in Paper 3). Collaborative networks are only formed when the participants recognize their interdependence "and their need to make major changes in their operations" (Mandell & Keast, 2009, p. 7). This need might have come, because the communication from the Ministry of Food to the overall-grant-network was almost missing since 2009, making it difficult to work as a Plant Genetic Environment in Denmark.

The paper finally gives recommendations as to how the overall-grant-network could be developed to a collaborative governance-network using the framework *Collective Impact* (Kania & Kramer, 2011).
Some of these recommendations might also be helpful for collaboration in other European environmental services. This could reduce overlap between projects, overcome competition, and help working towards the same goal, and thus increase efficiency and lower costs. Successfully

executed collaborations may also help building up stable, long-term relations and trust between the Plant Genetic Environment and the State.

6. Discussion

This chapter is primarily a discussion of findings from the three studies, and recommendations for future work with the PGR-field in Denmark. This is followed by a discussion of how Didactic Transposition as a model has functioned to understand the process, and how the theoretical frameworks and methods used in the studies have worked in the analyses.

Discussion of findings

Governmental grant-schemes build on scholarly knowledge and are formulated in political environments. The process of formulation changes the knowledge.

Findings from Study 1 show that the Grant PGR built on scholarly knowledge of PGR, which can briefly be summarized: PGR include all plant-varieties of actual or potential value for agriculture (FAO, 2009). Different varieties mean different characteristics – not just in taste and nutrition, but also in growing properties. Thus Plant Genetic Resources for Food and Agriculture are also the "raw material indispensable for crop genetic improvement (…) and are essential in adapting to unpredictable environmental changes and future human needs" and thus to ensure sustainable growing and food for the future (FAO, 2009, Preamble).

The aim of the grant-scheme was to protect plant genetic resources for food and agriculture (PGR) by giving support to projects which conserved and promoted the sustainable use of old Danish PGR worthy of conservation. At the same time suitability for environment friendly farming and food products could be tested. Furthermore the Grant PGR should increase public awareness and interest in conservation of plant genetic resources and enhance the cooperation between stakeholders. The scheme would at the same time help Denmark to fulfil its obligations according to the FAO treaty on PGR and UN's Biodiversity Convention.

Study 1 pinpoints the factors having an important impact on the transformation and change of knowledge from a scholarly context to a policy context, which were influenced by the international level (FAO), the EU level, and the National level (DK).

The grant-receivers who later made the demonstration-projects were working under these conditions. Furthermore the very diverse grant-receivers influenced the dissemination of knowledge to the public (Study 2) as well as the cooperation between them (Study 3). This is

discussed in two parts in the following: *Conditions of the Grant PGR* and *The dissemination of knowledge to the public.*

Conditions of the Grant PGR

Solely old varieties of certain plant-species could be demonstrated

The species of plants that could be grown in the demonstration projects were Old Danish PGR, used before 1960 in agriculture, not in present commercial production. The plants should be under threat of genetic erosion and worthy of conservation. In Denmark this type of varieties is primarily conserved in gene banks, and thus the plants should either currently be stored in NordGen or in Danish, national collections - or be worthy to be so. In this way the Grant PGR would supplement the static ex situ conservation in gene banks with a more dynamic conservation on farm and at the same time help the conservation of the ex-situ collections (The Danish Ministry of Food, 2012). The selection should be based on a concrete evaluation with the purpose of helping maintain the diversity and genetic variation in plant species suited for environment friendly farming, for food, and to increase public awareness of PGR. The scheme would at the same time help Denmark to fulfil its international obligations (The Danish Ministry of Food, 2012).

This finding from Study 1 shows that the decision comes from the Rural Development Programme, and it has its origin in The EU Rural Development Policy 2007 to 2013. It aimed at protecting genetic diversity due to a concern of genetic erosion and was thus targeted at protecting plants which were not competitive against modern high-producing varieties (European Commission, 1998). A representative from the Danish Ministry of Food, who was taking part in the design and implementation of the Danish Grant PGR said about this:

> *We could see that PGR were mentioned in the EU Rural Development Policy, but subsidies were meant for those, who still cultivated them, in for instance Austria and Italy. They could be compensated. But we were not in that situation in Denmark. At best we had PGR in gene banks* (Personal communication, 8. Oct, 2014).

Thus the decision to limit PGR to gene-bank- and clone-collections was an adaptation of the Grant PGR to the EU Rural Development Policy. The specific species allowed to demonstrate in

the Grant PGR were assessed and selected by the Directorate for Food, Fisheries and AgriBusiness in the Ministry of Food (The Danish Ministry of Food, 2011b).

According to the findings in Study 1 the gene-bank- and clone-collections were well suited to dynamic on-farm conservation of Old Danish varieties and therefore to help the conservation of the ex-situ collections of valuable Danish PGR. It also helped Denmark to fulfil its international obligations, as the FAO-treaty states that each country must take care of PGR that are under threat (FAO, 2009). The grant would at the same time contribute to a reversal in biodiversity decline (The Danish Ministry of Food, 2012) and thus help to fulfil the UN-Biodiversity Convention.

But the decision to focus on a limited selection of old varieties of plants was less suited for increasing public awareness and interest in conservation of PGR. PGR include all varieties of actual or potential value (FAO, 2009), and genetic diversity of PGR is critical to food security in the future (e.g. Virchow, 1999), the world's fight against hunger (e.g. Hoisington et al, 1999), and sustainable development on a global level (e.g. Rao and Hodgkin, 2002). But though adaptation to future needs and sustainable rural development was one of the goals of the Rural Development Programme this is apparently not regarded to be on a critical level, as only old varieties, not in present production, could be demonstrated. Thus it was found in Study 1 that the limited selection of PGR in the demonstration-projects did not help public understanding of why it is important to conserve PGR, which means that one of the aims of the Grant PGR: to increase public awareness and interest in conservation of PGR was limited.

Furthermore the demonstration of solely old varieties gave a 'museological' impression of PGR. This was enhanced, because the Grant PGR included an obligation to disseminate knowledge to the public and was one of the few possibilities to get subsidies for demonstrating PGR in Denmark from 2008 to 2013 (The Danish Ministry of Food, 2008 and 2011a). The 'museological' impression was for instance indicated by many grant-receivers writing articles in newspapers and magazines or other mass-media using expressions as "old varieties" and "living cultural heritage" (e.g. Wood-Pedersen, 2015a and b).

To increase public awareness and interest in conservation of PGR I conclude in Study 1 that it would have been better to demonstrate a broader variation, including modern varieties. This would show the development of varieties and the connection between former, present, and future

agriculture. This would also make it easier to disseminate knowledge of why it is essential to preserve the broadest possible variation, and the 'museological' impression could have been avoided.

Breeding, research, and technological development was not part of the Grant PGR

Breeding was not mentioned in the Grant PGR, although this is the basis of plant improvement and development of agriculture to meet future challenges as stated by e.g. Hoisington et al (1999) and Rao and Hodgkin (2002). This finding from Study 1 shows that it is because research and technological development was not possible in the Grant PGR, since these were part of another EU framework-programme. This programme aimed at developing new knowledge, new technology, and demonstration activities or common resources for research (the Danish Ministry of Food, 2012).

The decision that research and technological development, including breeding, could not be used and demonstrated in the Grant PGR was taken at EU-level, and the Danish Ministry of Food had to integrate it into the Grant PGR, when they decided to make it part of the Rural Development Programme in EU's Rural Development Policy 2007 to 2013. The findings from Study 1 shows that it led to a limited demonstration of PGR, even giving the impression that PGR are stable and not dynamic (Rao and Hodgkin, 2002), as only the original old varieties could be grown. It further enhanced the museological impression. This means that one of the aims of the Grant PGR: to increase public awareness and interest in conservation of PGR was limited.

Furthermore to exclude research from the demonstration-projects was problematic, as one of the aims of the projects was to get knowledge on growing properties of the plant varieties and evaluate their suitability for food (the Danish Ministry of Food, 2012). This restriction is contradictory as it is difficult to test and gather knowledge without doing research. Therefore the purposes of the Grant PGR to test suitability for environment friendly farming and food products were not possible to do in a scientific way.

Study 1 concludes that including breeding in the Grant PGR would have been appropriate to give the public knowledge on this important function of PGR and thus to understand the importance of conservation. The restrictions to include research and technological development in the Grant

PGR should either have been taken out, or the intention to test suitability for environment friendly farming and food products should have been subsidized in another way.

No use of pesticides in the demonstration-projects

Cultivation in the Grant PGR only included environment friendly farming, and "no use of mineral fertilizers is allowed for cultivation as in organic farming. Only plant protection products approved for organic farming may be used" (the Danish Ministry of Food, 2012). Study 1 shows that the aim of this was adapted from the first implementation of EU's Common Rural Development Policy in 1992 one of the focus areas and was to protect the environment against pollution (Commission of the European Communities, 1992). Thus no mineral fertilizers or pesticides were allowed in the demonstration projects. The environment was one of the three key areas in the EU Rural Development Policy 2007 to 2013 (The Council of the European Union, 2006), and thus conservation of genetic resources in agriculture was made part of the context, where farmers and other land managers should:"apply agricultural production methods compatible with the protection and improvement of the environment" (European Commission, 2005: 35).

So it was found that the decision on the ways PGR could be grown was taken at EU-level, and the Danish Ministry of Food had to integrate it into the Grant PGR, when they decided to make it part of the Rural Development Programme in EU's Rural Development Policy 2007 to 2013. One of the purposes of this was to test suitability for environment friendly farming and food products.

Many old varieties of PGR are well-suited for organic farming as they were originally grown before modern pesticides and mineral fertilizers were commonly used and have thus been adapted to low-input agriculture (Borgen & Grupe, 2012). This makes organic growing of old varieties of PGR on the field level a good choice, and the demonstration-projects could help to test suitability for environment friendly farming and food products. But a requirement that cultivation of plants in the Grant PGR could only be with organic methods is problematic to conservation. When preserving plants and establishing collections and duplicates it might sometimes be necessary to use pesticides to conserve all varieties, including the fragile ones. Senior lecturer from the Pometum at University of Copenhagen, emphasized this problem:

”Gene conservation must be separated from the demands for organic cultivation, since the pesticide treatment may be necessary to avoid losing the material” (The Ministry of Food, 2014, p. 7). This means that the purpose to protect PGR in the Grant PGR was not fully met, and as the grant should at the same time help Denmark to fulfil its obligations according to the FAO-treaty (to conserve PGR), this was not fulfilled either. Therefore it would have been better to either be less dogmatic (allow pesticides to conserve fragile varieties) or to subsidize conservation of PGR in gene-banks and clone-collections in a different way.

Sustainable development of rural areas was part of the Grant PGR

The Grant PGR should help the sustainable development of rural areas that would bring economic growth to society through e.g. sustainable use of resources and farmland in environmental as well as organic farming. In this process also local jobs, local participation in decision-making, and attractive living conditions for people in rural areas were mentioned.

Study 1 shows that this decision was taken in the Law for Development of Rural Areas (The Danish Ministry of Food, 2007a), and it originates in EU-level, as it was one of the objectives of the Rural Development Programme 2007 to 2013: the agrifood economy, the environment, and the broader rural economy and population must go hand in hand.

So this decision was also taken at EU-level, and the Danish Ministry of Food had to integrate it into the Grant PGR, when it decided to make it part of the Rural Development Programme in EU’s Rural Development Policy 2007 to 2013. But it has also been actively built into the Danish action-plan, for instance in the plan from 2011 to 2013, named: “From Gene bank to Dinner table” (The Danish Ministry of Food, 2011a).

Figure 19: High quality food products developed from the demonstration-projects: Flour of Ølands-wheat and marmalade of blackberries.

Thus encouraging the production of healthy, high-quality products, environmentally sustainable production methods (…) and the protection of biodiversity was central to the Rural Development Programme. It was seen as a win-win, if this could at the same time create

local jobs and attractive living conditions for people in rural areas (The Council of the European Union, 2006).

The plants which were actually grown and demonstrated in the projects included several varieties of all the species proposed in the Grant PGR. This resulted in new products on the basis of Nordic plant varieties from before 1960, developed from the demonstration-projects (see fig. 19). They were marketed as expensive specialities, and some of them turned out to be a great success (Borgen & Grupe, 2012; Hansen, Å, n.d. 2015; Larsson, n.d.). These successful products brought out the knowledge of PGR to the public as a result of the knowledge-dissemination in the demonstration-projects, as they were sold in supermarkets, often communicating on the product about the specific variety and the importance of conserving PGR. Thus the Grant PGR actually fulfilled this purpose of the Rural Development Programme by increasing genetic variation in agriculture, enhancing sustainable development of rural areas through development of new quality products, and communicating this to the public. But though the successful products brought out knowledge of PGR to the public, the expensive foods made from Old Danish PGR might at the same time have contributed to a view on PGR more connected to luxury products with a Nordic history than to fight against hunger and a necessity for the future.

To increase public awareness about PGR's role in fight against hunger and development of food for the future worldwide it would have been helpful to include an obligatory historical and global perspective (e.g. the Irish Potato Famine in 1845 or the rescue of the Syrian gene-bank by the outbreak of the civil war) in the knowledge-dissemination of the Grant PGR.

The dissemination of knowledge to the public

The obligation for grant-receivers to communicate to the public

Increasing public knowledge and interest in PGR by including an obligation to communicate was not part of EU's Rural Development Policy 2007 to 2013 but appeared in the Danish implementation as one of the aims of the Grant PGR. It is shown in Study 2 that this was unique to Denmark's implementation of the grant-scheme in the Rural Development Programme 2007 to 2013 (European Commission, n.d. a; FAO, n.d. c). Six EU countries (England, Ireland, Germany, Austria, Italy and Denmark) have implemented the grant-scheme for PGR (European Commission, n.d. a; FAO, n.d. c). Austria, for instance, has implemented the grant-scheme in

1995 as a subsidy for farmers with a high number of varieties in different crops threatened by genetic erosion, and it was also included in the programme 2007 to 2013 without any obligations to inform the public (Bundesministerium für Land und Forstwirtschaft, Umwelt und Wasserwirtschaft, 2007). Other countries as Italy and Germany had communication as part of the implementation but not as an obligation for the grant-receivers (European Commission, n.d. b; Regione Umbria, n.d.)

The wish to broaden public knowledge and interest in PGR was convergent with the communication objectives for as well Denmark's as FAO's strategies (Commission on Genetic Resources for Food and Agriculture, 2012; The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004). Objectives of raising public awareness of PGR is according to FAO to bring information "to the attention of policy-makers and the general public so as to help generate the resources needed to strengthen programs for its conservation and use" (FAO, 2010, p. 198).

The diverse grant-receivers

Grant receivers and thus disseminators of knowledge in the demonstration-projects were defined in The Rural Development Programme as farmers and other land managers (European Commission, 2005; The Danish Ministry of Food, 2012), but in the Danish implementation this was a much more diverse group: museums, private companies, public companies, funds, local projects, organizations, public institutions, and municipalities (The Danish Ministry of Food, 2009 and 2011b). As found in Study 1 and 2 this decision to extend the group of grant receivers was taken in the Danish Ministry of Food and was unique to Denmark's implementation of the Rural Development Programme. It built on good experiences from the previous Rural Development Programme (2000 to 2006), where tests were carried out in 2006 "with grants being given for demonstration projects with the participation of both farmers and several public institutions" (the Danish Ministry of Food, 2012, p. 377). The diverse group of stakeholders also had its roots in the Danish PGR strategy (The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004).

As demonstrated in Study 2 the actual grant-receivers were museums, private companies, research institutions, pometa, local projects with public access, NGOs and municipalities. So it was to a high degree the expected stakeholders which actually asked for the grant. It is not strange, since the Grant PGR built on good experiences from test-projects with some of these institutions (The Danish Ministry of Food, Agriculture and Fisheries, 2012).

Furthermore Study 1 and 2 show that there were many matches between the scholars (scientists and practitioners) who formulated the scholarly reference-knowledge and the grant-receivers who disseminated knowledge of PGR. The scientists formulating the reference-knowledge were for instance agriculturists, plant breeders, geneticists, and a biologist, while the scientists among the grant-receivers included agriculturists, horticulturists, plant breeders, ethnologists, and biologists. The scholars as well as the grant-receivers belonging to practitioners were farmers, gardeners and chefs, and some of these grant-receivers' projects were even referred to in the scholarly knowledge (e.g. Wood-Pedersen, 2015a and b refers to Company J). The grant-receivers made the pamphlets, signs, information boards, and did the guided tours, and some of the scientists have also written academic publications from the demonstration projects (e.g. Jensen, 2013). This shows that dissemination of knowledge in the demonstration-projects was closely related to the work of scientists and practitioners.

My findings from study 2 show that each grant-receiver defined PGR in accordance with the FAO-definition and the objective of the grant-scheme. The communication was well integrated in each institution, since the elements of the communication model was found to be coherent. Furthermore each grant-receiver can be characterized as an Informal Learning Environment with a high educational potential, because they used many of the characteristics known from other Informal Learning Environments to enhance science learning to make the abstract PGR concrete for their visitors. The finding that scholars and grant-receivers were closely related is furthermore expected to enhance their learning-potential.

The many diverse grant-receivers enhanced the potential of science learning and learners, since all facilitated the same core message with the same overall purpose in many different places at the same time.

The teamwork between the grant-receivers

One of the aims of the Grant PGR was to strengthen cooperation between stakeholders in the field. Thus demonstration-projects with teamwork between the grant-receivers were prioritized by the Ministry (The Danish Ministry of Food, n.d. a). Cooperation between stakeholders in the field is only mentioned in the Executive order about grant for demonstration projects (the Danish Ministry of Food, 2011b), because the many grant-receivers from different fields were not originally part of The Rural Development Programme, as described above. This decision to strengthen cooperation was taken in the Danish Ministry of Food and was unique to Denmark's implementation of the Rural Development Programme. This built on good experiences from 2006 as described above. The Danish strategy also recommended establishing a partnership between all stakeholders in 2004, e.g. through involvement in a professional reference forum (The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004).
Findings from Study 3 demonstrate that the grant-receivers worked together in three different ways: an *overall grant-network* of all grant-receivers and the Ministry, *smaller formal teams*, and *informal partnerships*. The formal teams had the closest links, characteristic of coordinative networks, which fitted their purpose: to help each other to reach the goals of their shared grant application. The informal partnerships were found to be both cooperative and coordinative, which also suited their purpose: sharing various resources. The overall-grant-network had the most unstable connections, and can hardly be termed a cooperative network, since it did not fulfil its intentions: networking, inspiring, and connecting the Danish government with the Danish Plant Genetic Environment.

Findings from Study 3 show that the teamwork between the grant-receivers increased their communication potential and resilience, because the grant-receivers helped each other to fulfil the activities and contributed to the joint projects with their special skills and knowledge. Furthermore they coordinated their work, which heightened the efficiency and quality of the joint demonstration-projects. Therefore the communication by many diverse grant-receivers (Study 2) and the networking (Study 3), initiated by the Grant PGR, were seen to enrich the knowledge in the demonstration projects to a multifaceted image of PGR. Teamwork between

the grant-receivers further contributed to the formation of a Plant Genetic Environment in Denmark.
It is quite unusual for the Danish Ministry of Food to make teamwork between grantees a purpose of a grant-scheme. In 2016 only two out of approximately 110 grant-schemes were found to favor teamwork between grant-receivers (Ministry of Environment and Food of Denmark, the AgriFish Agency, n.d.). But though teamwork has been a key-word for the Grant PGR, it has not been included in the new 'Grant for the work with conservation of old Danish farm-animal- and plant genetic resources' (Grant GR), set up in 2015 (The Danish Ministry of Food, n.d. b).

Summing up the conditions and the communication of the Grant PGR
The aim of the grant-scheme was to protect plant genetic resources for food and agriculture (PGR) by giving support to projects which conserved and promoted the sustainable use of old Danish PGR worthy of conservation. At the same time suitability for environment friendly farming and food products could be tested. Furthermore the Grant PGR should increase public awareness of and interest in conservation of PGR and enhance the cooperation between stakeholders. At the same time the scheme should help Denmark to fulfil its obligations according to the FAO treaty on PGR and UN's Biodiversity Convention.

Limiting PGR to plant-varieties from gene-bank- and clone-collections in the demonstration-projects was well suited to conserve Old Danish PGR. It also helped Denmark to fulfil its international obligations. But the limited selection of old plant-varieties was less appropriate for increasing public awareness of PGR as this should include communicating the importance of sustainable rural development, fight against hunger and adaptation to future needs. Furthermore the demonstration of solely old varieties gave a 'museological' impression of PGR. This was enhanced by breeding not being included in the grant, and thus only the original old varieties could be demonstrated. Furthermore the exclusion of research in the demonstration-projects was contradicting the aim of testing PGR for environment friendly farming and food products. The exclusion of artificial fertilizers and pesticides was suitable for testing suitability for environment friendly farming and food products on the field level. But to conserve PGR ex situ

this decision was problematic as it is sometimes necessary to use pesticides to conserve fragile varieties. The quality products made from Old Danish PGR brought out knowledge to the public. Thus the Grant PGR actually fulfilled the purpose of the EU policy by increasing genetic variation in agriculture, and enhancing sustainable development of rural areas through development of food products. But the expensive foods contributed at the same time to a view on PGR as more connected to luxury products with a Nordic history, than to fight against hunger and a necessity for the future. This means that some of the aims of the Grant PGR were fulfilled, but most of them interfered with each other, hindering a proper implementation. This influenced the knowledge that could later be disseminated in the demonstration-projects.
Within these limits the grant-receivers were successful communicators as their communication was coherent and well integrated in the institution. The grant-receivers were closely related to scholars, and they used many of the characteristics known to enhance science learning to make the abstract PGR concrete for their visitors. The many diverse grant-receivers enhanced the potential of science learning and learners, since all facilitated the same core message with the same overall purpose in many different places at the same time. The effect of this was seen to be enhanced by the grant-receivers' diversity and by working together in teams and network. Thus Informal Learning Environments were successful in creating potentials to educate the public and raise awareness of PGR, and cooperation between grant-receivers enhanced this.

All in all my findings show that the potential to disseminate knowledge of PGR to the public through the Grant PGR was high, but limited in scope, due to its preconditions. All limitations were a result of the adaptations of the Grant PGR to EU's Rural Development Policy. This means that though the Danish Ministry of Food formulated the Grant PGR, the decisions were taken on the EU-level, and the Danish Ministry of Food had to integrate them into the Grant PGR, when they decided to make it part of the Rural Development Programme in EU's Rural Development Policy 2007 to 2013. Also the enriching factor: adding knowledge of sustainable development of rural areas to the grant had its origin in the adaptation to EU's Rural Development Policy. But though this fulfilled the EU aim to let the agrifood economy, the environment, and the broader rural economy and population go hand-in-hand, it showed at the same time the difficulty to include raising public awareness of PGR in these aims, in a way that

reflected the most important core of the scholarly knowledge. The decisions to invite many diverse grant-receivers, to include an obligation for all grant-receivers to communicate, and to enhance cooperation between them were all successful and unique to the Danish implementation of this grant-scheme in the Rural Development Programme. Thus my findings stress the need for clarity as to what knowledge is selected and deselected in the formulation of the grant as well as awareness of adaptations due to embedding in policies at all levels.

Recommendations

Based on the three studies I give recommendations in two steps. At first I shall give recommendations for demonstration-projects on PGR through a grant-scheme. On the basis of these I turn to a broader perspective to give recommendations for the new Danish PGR-programme. These also relate to experiences from Norway and Sweden (see chapter 4).

Recommendations for PGR demonstration-projects in a national grant-scheme
The Danish experiences from the Grant PGR show that plant genetic resources can be demonstrated for the public through a grant-scheme.

Demonstration-projects on PGR through grant-schemes are well suited for cooperation and interdisciplinary initiatives developing new opportunities between different institutions. By being aware of adaptations due to embedding in policies at all levels it will be easier working towards the same international goal: conserving PGR to ensure sustainable development of agriculture and world-wide food-security.

The grant-scheme should build on the work of scholars, and clarity is needed as to what knowledge is selected and deselected in the formulation. To increase public awareness and interest in conservation of PGR the demonstration-projects should comprise a broad diversity of plants, including modern varieties. This would show the development of food plants and the connection between former, present, and future agriculture. It would also make it easier to disseminate knowledge of why it is essential to preserve the broadest possible variation, and the ‘museological’ impression might be avoided. Including breeding in the demonstration-projects

could emphasize these focus-points as it would give the public knowledge of how PGR are used to improve plants and develop agriculture. This would further disseminate knowledge about the importance of conservation. If environment friendly farming is chosen as cultivation-form, conservation of PGR in gene-banks and clone-collections must be subsidized in other ways, as it is sometimes necessary to use pesticides to conserve fragile varieties. Scientific research and technological development should be included in the Grant PGR to make it possible to test the suitability for environment friendly farming and food products of PGR in a scientific way. Development of new quality products on the basis of PGR is positive and helps to raise public awareness of how PGR are used in the development of new quality food-products. To avoid connecting PGR only to luxury products with a Nordic history this could be supplemented by increasing public awareness of PGR's role in fight against hunger worldwide and development of food for the future.

Involving institutions from different fields (museums, private companies, research institutions, pometa, and local projects with public access, NGOs and municipalities) in the demonstration-projects gives the public an opportunity to get in contact with a broad scientific and practical knowledge of PGR. Including an obligation for all grant-receivers to communicate gives a possibility to reach a broad public in many different ways with the same core-message of the importance of preserving PGR. The institutions can communicate in different places at the same time, and their diversity gives different perspectives on PGR, building on scientific and practical knowledge of scientists, practitioners and amateurs, who are working with and have an interest in PGR. This also gives a multifaceted and dynamic portrayal of PGR-science.

Teamwork between the grant-receivers could enhance the quality and efficiency of the demonstration, as knowledge, seeds and practical work can be shared, and different institutions can contribute with different skills. Furthermore an overall network of the grant-receivers and representatives from the government will enhance the resilience of the work.
The short-term recommendation for an overall-grant-network will be the formation of a central secretariat to secure a coordinated effort. The secretariat can manage communication throughout

the network and e.g. arrange seminars/meetings between the government and grant-receivers. Overlap and competition can be avoided, and forces can be joined towards a common goal. The long-term objective will be stable relations with high trust between grant-receivers and the government, which might also help the birth of new teamwork and joint projects with wider timeframes, all leading to better results. This can also build bridges between scientific and practical knowledge, and the government, farmers, private and public institutions, communities, NGOs, policy-makers and the general public.

Recommendations for a new national Danish PGR-programme

It is important that international strategies and national PGR-programmes together govern the conservation, growing, and development of PGR. National programmes are the foundation of regional and global efforts for conservation and sustainable utilization of PGR and are highly prioritized by FAO (Commission on Genetic Resources for Food and Agriculture, 2012).

The national programme should outline long-term goals in a strategy and be followed by action-plans

A strategy outlines long-term goals, while an action-plan defines a series of short-term goals to reach these, preferably including actors, time-frames and a specific budget as for instance seen in the Norwegian National Programme for Conservation and Use of PGRFA (Norwegian Genetic Resource Centre, 2013).

In December 2014 a seminar was held with the purpose of creating ideas for the new Danish strategy. The participants comprised members from the Ministry of Food, NordGen, and grant-receivers from the Plant Genetic Environment in Denmark. The representative from NordGen recommended that Denmark gets a programme like Norway and Sweden, because it will give better long-term-results (The Danish Ministry of Food, 2014).

The Norwegian action-plans follow the goals of the global action-plan for PGR with four prioritized action areas, which are divided into more specific activity-fields, each with a concrete goal and a time frame, which makes it easier to measure the success (Norwegian Genetic Resource Centre, 2013). The Swedish National Program for Diversity of Cultivated Plants had ‘Conservation of PGR for future utilization’ as an overall goal and four milestones to fulfil this

from 2010-15. Each of the fields also had a concrete goal with a time frame, which made it easier to measure the success (Swedish Board of Agriculture, 2008).
Working on longer terms can build up stable relations and high trust and has been requested by the grant-receivers in order to be able to plan their work with PGR. Also this was recommended at the seminar in December 2014. For instance, a representative from University of Copenhagen was wondering why conservation of genetic diversity in Denmark was made in three-year projects without any durable subsidy from the State. The representative from Pometum B underlined the importance of making long-term planning (more than five years), when establishing PGR-plantings and argued: “The plantings and activities made through the Grant PGR have contributed with a lot of good things, but as genetical back-up collections this is not the best model” (The Danish Ministry of Food, Agriculture and Fisheries, 2014).
Like the Swedish and Norwegian programs a Danish program must have a common agenda with central goals and shared measurement of the results, to ensure that efforts remain aligned. This can be ensured, if the action-plan outlines precise targets from the strategy’s agenda, which will make the work operational. Furthermore it will make it possible to document the progress of the field as a whole.

A programme should build on an overall network of the Ministry of Food and the Plant Genetic Environment in Denmark

Networking has been important in the Grant PGR and in the development of a Plant Genetic Environment in Denmark, consisting of a broad group of stakeholders: researchers, farmers, local "enthusiasts", chefs, museum staff, plant breeders, officials, etc. Meeting equally and face to face is important to build up high trust and it enhances as well resilience of the network, as efficiency of the work.
The institutions should undertake different tasks according to their expertise and objectives. If well-coordinated, this will support the overall network and the programme with its common agenda.
The Norwegian and Swedish programs are both built on a network of activities between central stakeholders involved in the field of PGR in different ways. In Sweden the stakeholders include, among others, national authorities, the Swedish University of Agricultural Sciences (SLU),

NordGen, the plant breeding sector, some NGOs, botanical gardens, grower's associations, and open-air museums. And here there is a high attention to the synergies coming from joint forces and the importance of coordinating activities (Swedish Board of Agriculture, 2008).
It is recommendable to include the Plant Genetic Environment in the formulation of the new Danish National Programme.

A secretariat can support the overall network

Coordination of activities and continuous communication are central to a programme based on a network, and a secretariat with these functions would be the heart of this. The secretariat-staff can plan, manage, and support the work with PGR and the Plant Genetic Environment. This means being support to the network, the place where the institutions would meet to exchange experiences and develop their cooperation. It could arrange seminars and meetings, and take care of internal communication, e.g. in form of a common web page. This will help to align goals, measure results, build trust, and create common motivation.
Information can be gathered and centrally distributed – both internally and externally to the public - by an electronic information portal. This will join efforts and reduce overlap.
The plant- and farm-animal secretariats could join to form a centre like in Norway. The Genetic Resource Centre in Norway sees itself as a hub, coordinating activities in a network that consists of for instance agricultural authorities, research institutions, private breeders, Universities, local clone-archives, farmers' organizations, museums, schools, NGOs, and international organisations (Norwegian Genetic Resource Centre, 2011 and 2013).

Discussion of frameworks, concepts, and methods

My aim was to study the communication potential of the Grant PGR and the conditions, which made it. But though it is acknowledged in the reviewed literature that it is important to raise public awareness of PGR through appropriate communication, no investigation or evaluation of how knowledge of PGR could be disseminated was found. Thus, there was no established research field with a defined theoretical framework for analysing dissemination of knowledge of PGR. As the objective of my studies was to look at the potential of raising public awareness through dissemination of knowledge, I turned to frameworks from educational research (*Didactic Transposition* and *Informal Learning Environments*) which were supplemented by frameworks from *communication theory* and *network theory*. The framework of Didactic Transposition was furthermore used as a backbone binding the thesis together.

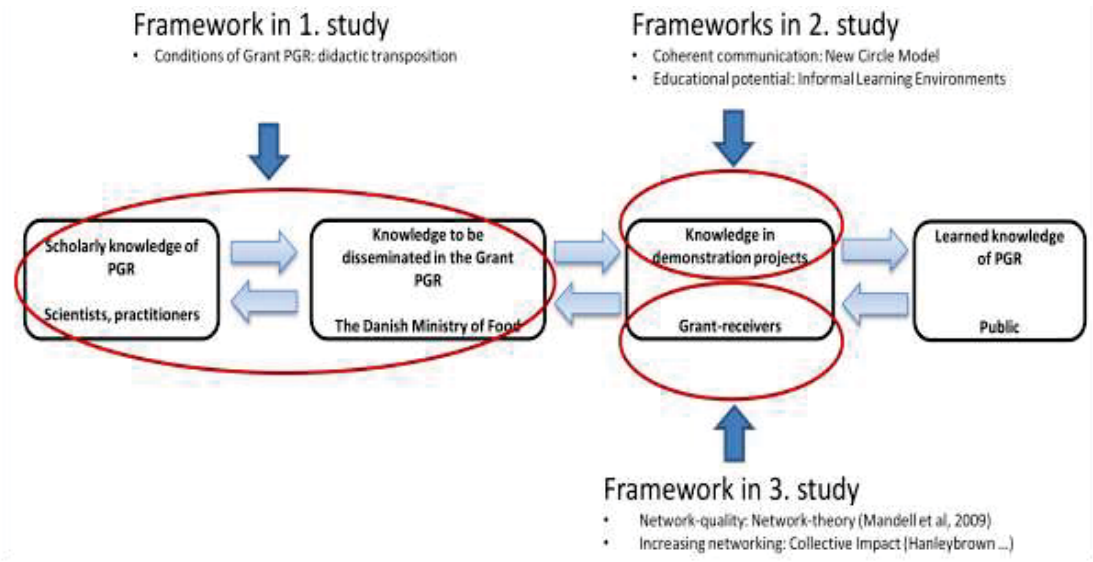


Figure 20: Didactic Transposition used as a backbone to show the process in the thesis. Furthermore all frameworks used in the three studies to analyze different aspects of the Grant PGR can be seen.

Didactic Transposition as a conceptual framework and an analytic tool

Didactic Transposition has been a qualified network to overview the process of scientific knowledge-dissemination and its conditions. The framework views the process building on a

social need for education and diffusion of the scholarly knowledge and emphasizes four steps, which need to be considered, when analysing the process. It begins with the scholarly reference-knowledge generated outside the environment and moved – 'transposed' – through the formation of the grant-scheme to the demonstration-projects and further to the last step, where the public hopefully understands the knowledge.
The framework called my attention to the importance of looking 'behind' the Grant-scheme at the knowledge, values and practices changing in the transformation-process, but also to the learned knowledge in the public though this was not a part of the studies.
Didactic Transposition has also proved to be well suited for analysing the conditions of a successful formation of a grant-scheme. This was done by comparing how knowledge was implemented in relation to scholarly reference knowledge as well as to other important factors. Thus, using the framework gave access to many different aspects without losing the overall view/track of things.

The frameworks used in the three studies

In the ***first study*** *Didactic Transposition* was used to understand the transformation of 'Scholarly knowledge of PGR' into 'knowledge to be disseminated in the Grant PGR'. Although the framework of Didactic Transposition was originally developed in science education research in school contexts, the similarities to the process of analysing dissemination of knowledge of PGR through a grant-scheme, made the adaptation quite relevant: both processes are transforming objects of knowledge, and in the first step of the process analysed in this study, the grant-scheme made conditions for the later dissemination of knowledge in a manner similar to that of the curriculum in schools.

Using Didactic Transposition as an analytical tool, made it possible to analyse a difficult process of knowledge transformation with many factors influencing the process. The decisions taken in the Ministry while formulating the Grant PGR could be compared to the scholarly knowledge of PGR as a reference. Thus the framework made it possible to analyse which knowledge came, and which did not come, from the reference knowledge. Following this, I could compare it to the FAO-level, the EU-level, and the national level. The Didactic Transposition process made it

possible to understand at which level the decisions to change the knowledge were taken, and how it influenced the knowledge that could later be disseminated in the demonstration-projects. Finally it was possible to evaluate whether the decisions taken in the formulation of the grant-scheme were appropriate, and how dissemination of knowledge on PGR through the grant-scheme could be optimized if they were not. Using Didactic Transposition as a framework is suitable to unfold how knowledge is changed in a dissemination-process.

In the ***second study*** I made analyses of the grant-receivers' potential to communicate knowledge about PGR using *communication theory (New Circle Model)* and comparison with other *Informal Learning Environments.*

Concept-maps were first used to evaluate the consistence of the PGR-concept with each of the grant-receivers by asking to their definition of PGR and the associations they had to the concept. As I started each interview by doing so, I find it reliable that all definitions were the grant-receivers' own words. This was further underpinned, as the words they used were very different and did not repeat the FAO-definition or the objective of the Grant PGR – but they still covered these definitions.

Next step was an analysis of the coherence of the communication using the *New Circle Model* and the *comparison with other Informal Learning Environments* to evaluate the educational potential**.** I shall here try to discuss the value of all analyses by looking at each element in the New Circle Model.

The objective/premise: My knowledge of why the grant-receivers wanted to communicate PGR to the public was first of all covered by the concept-maps and the conversation about them, since dissemination of knowledge to the public was part of the objective of the Grant PGR. This was shared by all grant-receivers, and they furthermore they added different perspectives to this.

Sender: My knowledge of the grant-receivers comes from their applications, the concept maps and the interviews. Especially their different perspectives on and angles to PGR gave me information of the grant-receivers' identities. I focused on this, instead of going deeply into an analysis of each material and activity, as for instance 'guided tours', and 'tastings with dialogue', would be different each time. Thus asking to the sender's knowledge and values concerning PGR

gave me a better over-all picture of their communication of PGR, than analyzing single materials and activities.

Content, media, and design/shaping: My knowledge of these comes from the concept maps, from the interviews, and from gathering leaflets, from photographing boards, from looking at home-pages, from listening to audio-guides, and from taking part in activities and guided tours. These were analyzed concerning consistence, coherence as well as educational potential (the settings/situations and activities/materials). So, though I made a broad study, I still find that I got a thorough impression of, how PGR (the content) was designed and communicated through different media in each institution.

Communication-environment: My knowledge came from the applications and the interviews, and the communication-environments were further examined as 'settings/situations' and media in Informal Learning Environments in the analysis of educational potential.

Target-groups (audience): My knowledge of the target-groups comes from the applications and the interviews. My analysis was focused on the communication in the institutions as a whole, which means that I did not analyze how single activities or materials were targeted single target-groups. There was no focus of this in any of the interviewed institutions. This approach would have been optimal, as the most targeted communication usually has the best effect (Ingemann, 2003). This would have required visitor-studies. A thorough analysis of a target group would have included an analysis of their knowledge and interest in PGR, their need to know anything about PGR, their experiences with and attitudes to the importance of protecting PGR, their values and positions on the field of PGR and the sender, and their preferences concerning language and esthetics (Cheesman & Mortensen, 1987; Duit, Gropengießer, Kattmann, Komorek, & Parchmann, 2012). This would have given me a much closer look into, who the visitors were, and how the activities and materials were understood by different target-groups. I find that this would have been valuable, as communication is only successful if it is understood by the target-group.

Instead of making visitor-studies I compared findings from the demonstration-projects with the educational potential of other visitor-studies. The literature came primarily from a report, which was a broad review of international literature concerning learning science in informal environments and includes more than 200 sources of literature (National Research Council,

2009). This made it possible to use the framework coming from the report (the characteristics of settings/situations and activities/materials) as well as to compare my findings with a broad sample of literature. This gave evidence to the results, but at the same time it made the analysis more general: The characteristics of the PGR demonstration-projects were compared to other fields of science-education. What could be said about learning science in general in Informal Learning Environments? Therefore I used the literature on general features enhancing science learning to analyze the demonstration-projects in order to see how these were used to make the abstract 'PGR' concrete for the visitor.

The wanted effect: The elements described above should be interrelated to fulfil the objective (to give information of PGR to the public) and give effect (raise awareness). My knowledge of the wanted effect comes from the interviews. A shared intention from all grant-receivers was that they wanted their visitors to get knowledge. All were aware of this, and most of them continued by saying: "get interest and engagement". Some of the grant-receivers also wanted their visitors to do something: grow apple-trees, buy high-quality food, teach their children about different apple-varieties, or experiment with fermentation of fruit.

These eight elements (objective/premise, sender, content, media, design/shaping, communication-environment, target-groups, wanted effect) should be interrelated to assess the coherence. The fact that seven of the grant-receivers (Company Ai, Local Group with Public Access Ai, Municipality Ai, Pometum Ai, NGO Ai, Museum Ai and Bi) communicated in the same way as before going into the demonstration projects (but with new projects or plant-varieties) indicated that the communication was well integrated in each institution. Furthermore they addressed the same target groups, which they usually worked with, and used the same media. The grant-receivers belonged to the scholars (see **Discussion of findings** above), and I did not find any conflicts with scholarly knowledge of PGR in any of their activities or materials. I found the grant-receivers' explanations of who their visitors were and how they targeted the communication at them reasonable. Furthermore the choice, diversity, and combination of media gave a high educational potential when compared to the framing in each institution and visitor-studies in other Informal Learning Environments. Thus I concluded that the grant-receivers used the media and different designs of communications to make the abstract concept of 'PGR' concrete to their visitors, and that their educational potential was high.

Using the *New Circle Model* made me able to link each institution's scholarly content, target-group (audience), sender, communication-environment, media, and design/shaping of the communication, to the objective/premise and the effect. This broad approach to the communication in each institution gave me a possibility to view the many different media-platforms used to fulfil the obligation and the coherence between the chosen media, the institution's identity, and the aims.
My study with analyses, of as well consistence of the senders' understanding of PGR, the coherence of the communication, and an evaluation of the educational potential compared to visitor-studies have given a broad, overarching approach to understand the communication. A deeper analysis of each element might not have seen the communication as a whole and from different angles, but visitor-studies would indeed have given me knowledge of how successful the communication was.

In the ***third study*** a combination of three different *network-frameworks* was used to be able to analyse different aspects of networking: The *cooperative, coordinative and collaborative networks* (Mandell, Keast and Brown, 2009) was used to distinguish between three intensities of networking. The *governance network* (Sørensen & Torfing, 2005) was used to understand relations between the state and a number of diverse partners in private as well as public institutions and civil society. Finally, the framework of *Collective Impact* (Kania & Kramer, 2011) was used to unfold how to make networking operational.
The analyses built on empirical data from the grant applications (appendix A) and qualitative interviews (see interview-guide, appendix C) with nine of the 28 grant receivers (see chapter 4) and an official from the Danish Ministry of Food, which was the secretariat for the design and implementation of the Grant PGR. E-mails, minutes of meetings, and evaluation reports were included to estimate the number of meetings held in the overall-grant-network, and also to examine the grant-receivers' recommendations for future teamwork.
The three frameworks for managing of networks were used to identify patterns, and find similarities and differences in the ways the institutions worked together.
The findings in Study 3 demonstrate that a call for a favourable institutional environment has been central to the implementation of the collaboration in the Danish Grant PGR. This call is

also found in other environmental cooperatives in Europe (e.g. Renting and van der Ploeg, 2001; Franks and Emery, 2013). Some of the conditions similar to the five conditions of Collective Impact are also mentioned in the literature on collaborations in environmental services (e.g. Renting and van der Ploeg, 2001; Wiskerke et al, 2003; Prager et al., 2012). All agree that more and more farmers commit to collaborative approaches to environmental services, which makes it important to find ways to develop strong institutional support and operationalize the work. The framework Collective Impact offers a tool to get an over-all view of how to make networking operational. This made it possible to make recommendations for networking in the Danish Grant PGR (see Study 3 and above), in the Danish PGR-Programme (see above), as well as in other European environmental services (see Study 3).

Concluding remarks and perspectives for future research

The aim of this thesis was to study dissemination of knowledge of PGR to the public through a grant-scheme, and the conditions that made it. I made three studies using frameworks from educational research, communication theory, and network theory: At first a study of the conditions influencing the formulation of the grant-scheme. Secondly a study of the grant-receivers' communication, and finally a study of cooperation between the grant-receivers.

I found that the grant-scheme was based on scholarly knowledge of conserving and growing food plants in a sustainable way. This knowledge was changed in the process of formulation in a political environment. Limitations to the knowledge were found as a result of the adaptation to EU's Rural Development Policy, making it difficult to fulfil the aims of the grant-scheme as well as international obligations on FAO and UN levels. Furthermore, though central goals of EU's Rural Development Policy were fulfilled with the development of expensive quality food-products it was difficult at the same time to include raising public awareness of PGR in a way that reflected the most important core of the scholarly knowledge. The decisions to invite many diverse grant-receivers, to include an obligation for all grant-receivers to communicate, and to enhance cooperation between them were all successful and unique to the Danish implementation of this grant-scheme in the Rural Development Programme. This means that some of the aims of

the grant-scheme were fulfilled, but most of them interfered with each other, hindering a proper implementation. This influenced the knowledge that could later be disseminated in the demonstration-projects.
All in all the studies show that the potential to disseminate knowledge of PGR to the public through the grant-scheme was high but limited in scope due to the conditions that made it.

With these limits the grant-receivers were successful communicators as their communication was coherent and well integrated in the institution. The grant-receivers were closely related to scholars, and they used many characteristics known to enhance science learning in Informal Learning Environments to make the abstract PGR concrete for their visitors. The many diverse grant-receivers enhanced the potential of learning and learners, since all facilitated the same core message with the same overall purpose in many different places at the same time. The effect of this was seen to be enhanced by the grant-receivers' diversity and by working together in teams and network.

In the thesis I have studied a governmental grant-scheme for demonstration-projects to inform the public. To do so it uses frameworks from educational research, communication theory, and network theory. The thesis thus offers a combination of tools to study governmental initiatives involving dissemination of knowledge and networking.

Using *Didactic Transposition* as an analytical tool makes it possible to analyze complicated processes of knowledge transformation with many factors influencing the process. This framework, thus, could become a useful analytical tool in other cases, where an object of knowledge is transposed from a scholarly environment into a political environment, and built into, for instance, a law. Looking at the decisions made in the transposition process, it will be possible to see, how the scholarly knowledge is enriched or limited by the conditions set by political agendas or other decisions in the process, and whether the conditions are appropriate to the way in which the law can later be carried out. This may lead to more explicit choices in the development of grant-schemes, laws, programmes, and other political instruments, building on a body of scholarly knowledge.

The framework of *Informal Learning Environments* offers a broad sample of literature for analyzing museums and other informal educational settings in order to evaluate their educational potential. This will result in a general analysis, because the actual setting can be compared to many fields of science-education: What can be said about learning science in general in an Informal Learning Environment? This can be further used to analyze how the characteristics of settings/situations and activities/materials are used in the specific case to make the content understandable for the learner.

The *Communication-framework 'New Circle Model'* is mostly used in the planning phase of communication, and focuses on the relations that need to be clarified and fit together to develop a message in a certain media. My findings demonstrate that it can also be used to analyze coherence in dissemination of knowledge by linking scholarly content, target-group (audience), sender, communication-environment, media, and design/shaping of the communication, to the objective/premise and the effect. This broad approach gives a possibility to view many different media-platforms used to fulfil an objective and give effect.

The three *frameworks for managing of networks* can be used to identify patterns and find similarities and differences in the ways institutions work together on projects. This can be used to improve collaboration and develop strong institutional support. The framework Collective Impact offers a tool to overlook networking and make it operational. This could reduce overlap between projects, overcome competition, help working towards the same goal, and thus increase efficiency and lower costs. Successfully executed collaborations may also help building up stable, long-term relations and trust between stakeholders and the State.

References

Adriansen, H. K., & Madsen, L. M. (2009). Studying the making of geographical knowledge: The implications of insider interviews. *Norsk Geografisk Tidsskrift - Norwegian Journal of Geography*, *63*(3), 145–153. http://doi.org/10.1080/00291950903238966

Atkin, & Rice. (1981). Mass media information campaign effectiveness. In *Rice RE, Paisley WJ, ed. Public communication campaigns* (pp. 265–79). Beverly Hills, California: Sage.

Bade, Jan. (n.d.). Obstmanufaktur, Erhaltung und Pflege historischer und bewährter Obstsorten. Sortenerhalt |. Retrieved March 10, 2015, from http://www.obstmanufaktur.com/?page_id=83

Bain, R., & Ellenbogen, K. M. (2002). Placing Objects Within Disciplinary Science. *Perspectives on Object-Centered Learning in Museums*, 140.

Banegas, D. (2014). Democratizing didactic transposition: negotiations between learners and their teacher in a secondary school. *Latin American Journal of Content and Language Integrated Learning*, *7*(2), 1–26. http://doi.org/10.5294/laclil.2014.7.2.1

Boritz, Mette. (2012). *Museumsdidaktik - Et kulturanalytisk studie af undervisningen på danske kulturhistoriske museer* (PhD-disertation). Det humanistiske Fakultet, Københavns Universitet.

Bosch, M., & Gascón, J. (2006). Twenty-five years of the didactic transposition. *ICMI Bulletin*, *58*, 51–63.

Bloch, M. J. (2004). The Non-profit Status of the Museum. ICOM NEWS, 2004(2), 4.

Borgen, A., & Grupe, P. (2012). *Gamle danske kornsorter. En rapport om deres historie og om anvendelsen i økologisk landbrug* (Slutrapport om kornprojekterne på Mørdrupgård 2006-12. 43 sider.). Retrieved from http://www.agrologica.dk/publikationer/slutrapport2011.pdf

Bundesministerium für Land und Forstwirtschaft, Umwelt und Wasserwirtschaft. (2007). Österreichisches Programm für die Entwicklung des Ländlichen Raums 2007 - 2013.

Cheesman, R., & Mortensen, A. T. (1987). *Om målgrupper* (1. udg). Roskilde: Kommunikationsuddannelsen, Roskilde universitetscenter.

Chevallard, Y. (1985). *La transposition didactique: du savoir savant au savoir enseigné*. [Grenoble]: la Pensée sauvage.

Chevallard, Y. (1988). On didactic transposition theory: Some introductory notes. In *International Symposium on Research and Development in Mathematics, Bratislava, Czechoslavakia*. Retrieved from http://yves.chevallard.free.fr/spip/spip/IMG/pdf/On_Didactic_Transposition_Theory.pdf

Chevallard, Y. (2013). A Theoretical Approach to Curricula. *Journal Für Mathematik-Didaktik*, *13*(2-3), 215–230. http://doi.org/10.1007/BF03338779

Chevallard, Y., & Bosch, M. (2014). Didactic Transposition in Mathematics Education. In S. Lerman (Ed.), *Encyclopedia of Mathematics Education* (pp. 170–174). Springer Netherlands. Retrieved from http://link.springer.com/referenceworkentry/10.1007/978-94-007-4978-8_48

Clément, P. (2006). Didactic transposition and the KVP model: conceptions as interactions between scientific knowledge, values and social practices. *Paper Presented at the Proceedings of the ESERA Summer School, Braga, Portugal.*

Clément, P. (2007). Introducing the Cell Concept with both Animal and Plant Cells: A Historical and Didactic Approach. *Science & Education*, *16*(3-5), 423–440. http://doi.org/10.1007/s11191-006-9029-7

Commission of the European Communities (1992). Council Regulation (EEC) No 2078/92/EEC of 30 June 1992. Official Journal of the European Communities 215, pp. 85-90 (1992). Retrieved from http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=013608&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL

Commission on Genetic Resources for Food and Agriculture (Ed.). (2012). *Second global plan of action for plant genetic resources for food and agriculture: adopted by the FAO Council, Rome, Italy, 29 November 2011*. Rome, Italy: Commission on Genetic Resources for Food and Agriculture, Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/docrep/015/i2624e/i2624e00.pdf

De Boef, W. S., Thijssen, M. H., Shrestha, P., Subedi, A., Feyissa, R., Gezu, G., Sthapit, B. R. (2012). Moving Beyond the Dilemma: Practices that Contribute to the On-Farm Management of Agrobiodiversity. *Journal of Sustainable Agriculture*, *36*(7), 788–809. http://doi.org/10.1080/10440046.2012.695329

Donahue, P. F. (2004). Re-evaluating the ICOM Definition of the Museum. ICOM NEWS, 2004(2), 4.

Duit, R., Gropengießer, H., Kattmann, U., Komorek, M., & Parchmann, I. (2012). The Model of Educational Reconstruction – a Framework for Improving Teaching and Learning Science1. In D. Jorde & J. Dillon (Eds.), *Science Education Research and Practice in Europe: Retrosspective and Prospecctive* (pp. 13–37). Rotterdam: SensePublishers. Retrieved from http://dx.doi.org/10.1007/978-94-6091-900-8_2

European Association for the Education of Adults. (n.d.). European Agenda for Adult Learning. Retrieved January 21, 2016, from http://www.eaea.org/en/policy-advocacy/european-agenda-for-adult-learning.

European Commission. (n.d.) a. Rural Development policy 2007-2013 - Country files. Retrieved June 13, 2016, from http://ec.europa.eu/agriculture/rurdev/countries/dk/index_en.htm

European Commission. (n.d.) b. Rural Development policy 2007-2013 - Germany. Retrieved June 13, 2016, from http://ec.europa.eu/agriculture/rurdev/countries/de/index_en.htm

European Commission (1998). *State of application of regulation (EEC) no. 2078/92: Evaluation of agri-environment programmes* (DGVI COMMISSION WORKING DOCUMENT No. VI/7655/98). Brussels.

European Commission (2005). COUNCIL REGULATION (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development Official Journal of the European Union. Brussels. (2005). Retrieved from http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32005R1698&from=DA

Falk, J.H., Dierking, L.D., 2010. The 95 Percent Solution. American Scientist 98, 486. doi:10.1511/2010.87.486

Falk, J.H., Needham, M.D., 2011. Measuring the impact of a science centre on its community. Journal of Research in Science Teaching 48, 1–12.

Falk, J.H., Needham, M.D., 2013. Factors Contributing to Adult Knowledge of Science and Technology: contributions to knowledge of science and technology. Journal of Research in Science Teaching 50, 431–452.

FAO. (n.d. a). List of Countries | The International Treaty. Retrieved October 29, 2015, from http://www.planttreaty.org/list_of_countries.

FAO. (n.d. b). The International Treaty on Plant Genetic Resources for Food and Agriculture. Retrieved March 10, 2014, from http://www.planttreaty.org/content/overview

FAO. (n.d. c). The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture. Country Reports. Retrieved June 13, 2016, from http://www.fao.org/docrep/013/i1500e/i1500e00.htm

FAO. (1983). INTERNATIONAL UNDERTAKING ON PLANT GENETIC RESOURCES. Retrieved from http://www.fao.org/docrep/x5563E/X5563e0a.htm#e.%20plant%20genetic%20resources%20(follow%20up%20of%20conference%20resolution%20681

FAO. (1989). Report of the Conference of FAO Twenty-fifth Session Rome, 11-29 November 1989. FAO Document Repository. Retrieved from http://www.fao.org/docrep/x5588e/x5588e06.htm#e.%20commission%20on%20plant%20genetic%20resources%20and%20the%20international%20undertaking:%20prog

FAO (2009). International Treaty on Plant Genetic Resources for Food and Agriculture. IUCN. Retrieved from http://www.planttreaty.org/content/texts-treaty-official-versions.

FAO. (2010). *The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture.* Rome: Commission on Genetic Resources for Food and Agriculture, Food and Agriculture Organization of the United Nations.

Flyvbjerg, B. (2006). Five Misunderstandings about Case-Study Research. *Qualitative Inquiry*, *12*(2), 219–245. http://doi.org/10.1177/1077800405284363

Fowler, C., & Hodgkin, T. (2004). PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE: Assessing Global Availability. *Annual Review of Environment and Resources*, *29*(1), 143–179. http://doi.org/10.1146/annurev.energy.29.062403.102203

Franks, J. R., & Emery, S. B. (2013). Incentivising collaborative conservation: Lessons from existing environmental Stewardship Scheme options. *Land Use Policy*, *30*(1), 847–862. http://doi.org/10.1016/j.landusepol.2012.06.005

Frison, C., López, F., & Esquinas-Alcazar, J. T. (Eds.). (2011). *Plant genetic resources and food security: stakeholder perspectives on the international treaty on plant genetic resources for food and agriculture*. London ; New York: Earthscan : FAO : Biodiversity International.

Gepts, P. (2006). Plant Genetic Resources Conservation and Utilization. *Crop Science*, *46*(5), 2278. http://doi.org/10.2135/cropsci2006.03.0169gas

Hansen, Per Henrik. (n.d.). Dyrkning af spelt, emmer og enkorn - Økologi.dk. Retrieved March 7, 2015, from http://www.okologi.dk/landmand/fagomraader/oekologisk-planteavl/broedkorn/korn/spelt,-emmer-og-enkorn.aspx

Hansen, Åse. (n.d.). Oplagt med samarbejde landmand-møller-bager - Økologi.dk. Retrieved March 10, 2015, from http://www.okologi.dk/landmand/fagomraader/oekologisk-planteavl/broedkorn/korn/samarbejde-landmand-moeller-bager.aspx

Hazzan, O., Dubinsky, Y., & Meerbaum-Salant, O. (2010). Didactic transposition in computer science education. *ACM Inroads*, *1*(4), 33. http://doi.org/10.1145/1869746.1869759

Hein, G.E., (1998). Learning in the Museum. Routledge, London ; New York.

Hoisington, D., Khairallah, M., Reeves, T., Ribaut, J.-M., Skovmand, B., Taba, S., & Warburton, M. (1999). Plant genetic resources: What can they contribute toward increased crop productivity? Proceedings of the National Academy of Sciences, 96(11), 5937–5943. http://doi.org/10.1073/pnas.96.11.5937.

ICOM (n.d.). Museum Definition- ICOM. Retrieved from http://icom.museum/the-vision/museum-definition/.

Ingemann, B. (2003). Den nye bollemodel - planlagt kommunikation. In L. Fleming & B. Ingemann (Eds.), *Faglig formidling: praksis og konsekvenser*. Frederiksberg: Roskilde Universitetsforlag.

Jensen, Martin. (2013). Genressourcer i vilde danske brombær (Rubus fruticosus). Aarhus University, Institut for Fødevarer, Kirstinebjergvej 10, 5792 Årslev, Danmark.

Kania, J., & Kramer, M. (2011). *Collective impact*. Stanford social innovation review. Retrieved from http://www.lano.org/resource/dynamic/blogs/20131007_093137_25993.pdf

Kosmas, E. N., Dumitru, S., Kougianos, K., Harikiopoulou, M., Theodorakopoulou, E., Dimitropoulos, C., Siafakas, N. (2010). Raising Public Awareness on Chronic Obstructive Pulmonary Disease. *Chest*, *138*(4), 448A. http://doi.org/10.1378/chest.10391

Kvale, S. (1997). *InterView: en introduktion til det kvalitative forskningsinterview*. Kbh.: Hans Reitzel.

Kvale, S., & Brinkmann, S. (2009). *Interview: introduktion til et håndværk*. Kbh.: Hans Reitzel.

Larsson, Hans. (n.d.). Forsker: Høj kvalitet i gamle sorter - Økologi.dk. Retrieved March 7, 2015, from http://www.okologi.dk/landmand/fagomraader/oekologisk-planteavl/broedkorn/korn/kvalitet-i-gamle-sorter.aspx

Layton, D. (Ed.). (1993). *Inarticulate science? Perspectives on the public understanding of science and some implications for science education*. Driffield: Studies in Education.

Lindemann-Matthies, P., & Bose, E. (2008). How Many Species Are There? Public Understanding and Awareness of Biodiversity in Switzerland. *Human Ecology*, *36*(5), 731–742. http://doi.org/10.1007/s10745-008-9194-1

Mandell, M., Keast, R. L., & Brown, K. A. (2009). The importance of a new kind of learning in collaborative networks. Retrieved from http://eprints.qut.edu.au/29884/

Mandell, M. P., & Robyn Keast. (2009). A New Look at Leadership in Collaborative Networks: Process Catalysts. In J. A. Raffel, P. Leisink, & A. E. Middlebrooks (Eds.), *Public sector leadership: international challenges and perspectives*. Cheltenham, UK ; Northampton, MA: Edward Elgar. Retrieved from http://www.ipa.udel.edu/3tad/papers/workshop4/Mandell%26Keast.pdf

Marandino, M., Achiam, M., & Oliveira, A. D. de. (2014). The Diorama as a Means for Biodiversity Education. In S. D. Tunnicliffe & A. Scheersoi (Eds.), *Natural History Dioramas: History, Construction and Educational Role*. Springer.

Mba, C., Guimaraes, E. P., Guei, G. R., Hershey, C., Paganini, M., Pick, B., & Ghosh, K. (2012). Mainstreaming the continuum approach to the management of plant genetic resources for food and agriculture through national strategy. *Plant Genetic Resources*, *10*(01), 24–37. http://doi.org/10.1017/S1479262111000943

Ministry of Environment and Food of Denmark, the AgriFish Agency. (n.d.). Tilskudsguide. Retrieved from http://naturerhverv.dk/tilskudsguide/

Mortensen, M. F. (2010a). Designing immersion exhibits as border-crossing environments. *Museum Management and Curatorship*, *25*(3), 323–336. http://doi.org/10.1080/09647775.2010.498990

Mortensen, M. F. (2010b). Museographic Transposition: The Development of a Museum Exhibit on Animal Adaptations to Darkness. *Éducation et Didactique*, *4*(1), 115–138. http://doi.org/10.4000/educationdidactique.763

Mortensen, M. F. (2010c). Analysis of the Educational Potential of a Science Museum Learning Environment: Visitors' experience with and understanding of an immersion exhibit. *International Journal of Science Education*, *33*(4), 517–545. http://doi.org/10.1080/09500691003754589

National Research Council (Ed.). (2009). *Learning science in informal environments: people, places, and pursuits*. Washington, D.C: National Academies Press. Retrieved from https://languagescience.umd.edu/sites/languagescience.umd.edu/files/lsc/general/doc/belleta l2009.pdf

Nature Editorial. (2010). Learning in the wild. Nature, 464(7290), 813–814. http://doi.org/10.1038/464813b

Neergaard, H. (2007). *Udvælgelse af cases i kvalitative undersøgelser*. Frederiksberg: Samfundslitteratur.

NIBIO. (n.d.). NIBIO.no. Retrieved April 2, 2016, from http://www.nibio.no/en/info/about-nibio

Nilsen, L. B., Subedi, A., Dulloo, M. E., Ghosh, K., Chavez-Tafur, J., Blundo Canto, G. M., & de Boef, W. S. (2015). Practices and networks supporting the on-farm management of plant genetic resources for food and agriculture. *Plant Genetic Resources*, *13*(01), 36–44. http://doi.org/10.1017/S1479262114000616

NordGen. (n.d.). The Pometum apple key (Æblenøglen). Retrieved March 7, 2016, from http://www.nordgen.org/nak/?chglang=ENG

Nordic Foodlab. (2011). Potato Evaluation. Retrieved from http://nordicfoodlab.org/blog/2011/05/potato-evaluation-2

Norwegian Genetic Resource Centre. (2011). Bevaring og bruk av plantegenetiske ressurser, Aktivitetsplan kulturplanter Norsk genressurssenter 2011 – 2014.

Norwegian Genetic Resource Centre. (2013). *strategiplan_for_norsk_genressurssenter.pdf* (No. 19/2013).

Novak, J. D., & Cañas, A. J. (2008). *The theory underlying concept maps and how to construct them* (Technical Report IHMC CmapTools No. 2006-01 Rev 01-2008). Florida Institute for Human and Machine Cognition. Retrieved from http://cmap.ihmc.us/Publications/ResearchPapers/TheoryCmaps/TheoryUnderlyingConceptMaps.bck-11-01-06.htm

Official Journal of the European Union. REGULATION (EU) No 1305/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (2013).

Prager, K., Reed, M., & Scott, A. (2012). Encouraging collaboration for the provision of ecosystem services at a landscape scale—rethinking agri-environmental payments. *Land Use Policy*, *29*(1), 244–249. http://doi.org/10.1016/j.landusepol.2011.06.012

Rao, V. R., & Hodgkin, T. (2002). Genetic diversity and conservation and utilization of plant genetic resources. *Plant Cell, Tissue and Organ Culture*, *68*(1), 1–19. http://doi.org/10.1023/A:1013359015812

Regione Umbria. (n.d.). Progetti attivati - BIODIVERSITA'. Retrieved June 13, 2016, from http://biodiversita.umbria.parco3a.org/pagine/progetti-attivi

Rennie, L. J. (2014). Learning Science Outside of School. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education*. New York: Routledge.

Renting, H., & Van Der Ploeg, J. D. (2001). Reconnecting nature, farming and society: environmental cooperatives in the Netherlands as institutional arrangements for creating

coherence. *Journal of Environmental Policy & Planning*, *3*(2), 85–101. http://doi.org/10.1002/jepp.75

Simonneaux, L., & Jacobi, D. (1997). Language constraints in producing prefiguration posters for a scientific exhibition. *Public Understanding of Science*, (6), 383–408.

Smedegaard, F. (2003). Dynamisk kommunikationsplanlægning. *Syddansk Universitet, Merino*, (30). Retrieved from http://static.sdu.dk/mediafiles/Files/Om_SDU/Institutter/ISK/Forskningspublikationer/Merino/Merino30.pdf

Swedish Board of Agriculture. (2008). *Programmet för odlad mångfald, 2010-2015.pdf* (No. 2008:32).

Swedish Board of Agriculture. (2009). POM English leaflet.pdf.

Swedish Board of Agriculture. (2015). Programmet för odlad mångfald, POM, mål och strategi för perioden 2016-2020.

Sørensen, E., & Torfing, J. (2005). *Netværksstyring: fra government til governance*. Frederiksberg: Roskilde Universitetsforlag.

The Council of the European Union. COUNCIL DECISION of 20 February 2006 on Community strategic guidelines for rural development (programming period 2007 to 2013), 2006/144/EC Official Journal of the European Union (2006). Retrieved from http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32006D0144&from=EN

The Danish AgriFish Agency. (2012). Referat fra mødet i Udvalget for Plantegenetiske Ressourcer 28-6-12.

The Danish Ministry of CultureAgency for Culture and Places. (2009a). *Museernes_laeringspotentialer.pdf*. Kulturarvsstyrelsen, Copenhagen.

The Danish Ministry of Culture, Agency for Culture and Places. (2009b). *God_praksis.pdf*. Kulturarvsstyrelsen, Copenhagen.

The Danish Ministry of Food, Agriculture and Fisheries. (n.d. a). Fakta om tilskud til demonstrationsprojekter om bevaring og bæredygtig udnyttelse af plantegenetiske ressourcer for jordbrug og fødevarer. Retrieved October 30, 2015, from http://naturerhverv.dk/tilskud-selvbetjening/tilskudsguide/plantegenetik/#c8639

The Danish Ministry of Food, Agriculture and Fisheries. (n.d. b). Bekendtgørelse om projekttilskud til bevaringsarbejdet med gamle danske husdyr- og plantegenetiske ressourcer. Retrieved October 29, 2015, from https://www.retsinformation.dk/Forms/R0710.aspx?id=174809

The Danish Ministry of Food, Agriculture and Fisheries. (2004). Handlingsplan for jordbrugets plantegenetiske ressourcer 2005-2007. Retrieved from http://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Landbrug/Genetiske_ressourcer/Planter/Publikationer/Handlingsplan_plantegenetiske_ress.pdf

The Danish Ministry of Food, Agriculture and Fisheries (2007a). Law for Development of Rural Areas, 2007. Lov om udvikling af landdistrikterne (landdistriktsloven), 2007.

The Danish Ministry of Food, Agriculture and Fisheries. (2007b). *Jordbrugets plantegenetiske ressourcer i Danmark Status og bevaring* (No. Udvalget for Fødevarer, Landbrug og Fiskeri (2. samling) FLF alm. del - Bilag 147). Aarhus University.

The Danish Ministry of Food, Agriculture and Fisheries. (2007c). *Analyse af organisering af arbejdsområdet genetiske resurser i Fødevareministeriet*.

The Danish Ministry of Food, Agriculture and Fisheries. (2008). Den Levende Kulturarv Fødevareministeriets handlingsplan 2008-10 for jordbrugets plantegenetiske ressourcer. Retrieved from http://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Tilskud/Projekttilskud/Landdistrikter/LAG/handlingsplan_2008-2010_plantegentik.pdf

The Danish Ministry of Food, Agriculture and Fisheries, 2009. Bekendtgørelse om tilskud til demonstrationsprojekter om bevaring og bæredygtig udnyttelse af plantegenetiske ressourcer for jordbrug og fødevarer - retsinformation.dk [WWW Document]. Retsinformation.dk. URL https://www.retsinformation.dk/Forms/R0710.aspx?id=123370

The Danish Ministry of Food, Agriculture and Fisheries. (2011a). Fra genbank til spisebord Fødevareministeriets handlingsplan 2011-13 for jordbrugets plantegenetiske ressourcer. Retrieved from http://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Landbrug/Genetiske_ressourcer/Planter/Publikationer/Handlingsplan_endelig_version_af_25-5-11.pdf

The Danish Ministry of Food, Agriculture and Fisheries (2011b). Bekendtgørelse om tilskud til demonstrationsprojekter om bevaring og bæredygtig udnyttelse af plantegenetiske ressourcer for jordbrug og fødevarer - retsinformation.dk (2011). Retrieved from https://www.retsinformation.dk/Forms/R0710.aspx?id=138237

The Danish Ministry of Food, Agriculture and Fisheries (2012). The Danish Rural Development Programme 2007-2013. Retrieved from https://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Tilskud/Projekttilskud/Landdistrikter/LDP_Rev_proposal_Consolid_2007-2013f.pdf.

The Danish Ministry of Food, Agriculture and Fisheries (2014). *Referat af Naturerhvervstyrelsens temadag om plantegenetiske ressourcer.docx*. Retrieved from http://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Landbrug/Genetiske_ressourcer/Planter/Publikationer/Referat_fra_temadag_om_plantegenetiske_ressourcer.pdf

The Danish Plant Directorate and the Danish Institute of Agricultural Sciences (2004). Strategi for det danske arbejde med jordbrugets plantegenetiske ressourcer. Retrieved from http://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Landbrug/Genetiske_ressourcer/Planter/Publikationer/Forslag_strategi_270920041.pdf.

University of Copenhagen (n.d.). The Pometum apple key. Retrieved from http://www.nordgen.org/nak/?chglang=ENG

Virchow, D. (1999). Conservation of Genetic Resources: Costs and Implications for a Sustainable Utilization of Plant Genetic Resources for Food and Agriculture. Springer Science & Business Media.

Wiskerke, J. S. C., Bock, B. B., Stuiver, M., & Renting, H. (2003). Environmental co-operatives as a new mode of rural governance. *NJAS - Wageningen Journal of Life Sciences*, *51*(1-2), 9–25. http://doi.org/10.1016/S1573-5214(03)80024-6

Wolfe, C. (2001). Raising public awareness and taking action on the health impacts of air pollution. *Canadian Journal of Public Health, 92*(6), 404. Retrieved from http://search.proquest.com/docview/232000972?accountid=13607

Wood-Pedersen, P. (2015a). De lollandske rosiner får nyt liv. Retrieved March 10, 2015, from http://www.gartnertidende.dk/Gronsager/Nyheder/2015/De_lollandske_rosiner_faar_nyt_liv.aspx#.VP7gVOFhKK8

Wood-Pedersen. (2015b). Pigeon fra Maribo er anderledes. Retrieved March 9, 2015, from http://www.gartnertidende.dk/Frugtbaer/Nyheder/2015/Pigeon_fra_Maribo_er_anderledes.aspx#.VP1xA-FhKK8

Overview of Papers

Paper 1

Transferring knowledge from a scholarly context to a policy context

- The making of a national grant-scheme for demonstration of Plant Genetic Resources for Food and Agriculture to the public

Louise Windfeldt (corresponding author) *Department of Science Education, University of Copenhagen, Copenhagen, Denmark*

Marianna Bosch, *Universitat Ramon Llull, Barcelona, Spain*

Ready for submission, negotiations with journal

Paper 2

Communicating plant genetic resources for food and agriculture to the public

- a study of grant-receivers with demonstration-projects in the Danish Rural Development Programme

L. Windfeldt (corresponding author) and Lene Møller Madsen, *Department of Science Education, University of Copenhagen, Copenhagen, Denmark*

Submitted to Land Use Policy, the International Journal Covering All Aspects of Land Use

http://www.journals.elsevier.com/land-use-policy

Under review

Paper 3

Collaborative Networks as Institutional Support to Delivery of Environmental Services

- Insights from the Danish grant-scheme for demonstration of plant genetic resources for food and agriculture

L. Windfeldt (corresponding author) and L. M. Madsen, *Department of Science Education, University of Copenhagen, Copenhagen, Denmark*

Submitted to Journal of Environmental Policy & Planning

http://www.tandfonline.com/toc/cjoe20/current

Under review

Paper 1: Transferring knowledge from a scholarly context to a policy context

- The making of a national grant-scheme for demonstration of Plant Genetic Resources for Food and Agriculture to the public

ABSTRACT
Governmental grant-schemes build on scholarly knowledge and are formulated in political environments. The process of formulation changes the knowledge. This paper analyses how knowledge of conserving and growing plant genetic resources in a sustainable way was communicated through a Danish grant-scheme, embedded in the EU Rural Development Policy 2007 to 2013. The aim of the grant-scheme was firstly to protect plant genetic resources for food and agriculture by supporting demonstration-projects; secondly to test the suitability for environment friendly farming and food products. Finally the grant-scheme should increase public awareness of plant genetic resources and help fulfil national obligations according to FAO and UN. In order to pinpoint the factors having an important impact on the transformation and change of knowledge from a scholarly context to a policy context, we used the analytical framework of the *Didactic Transposition*. In this, we took the "scholarly knowledge" developed by scientists and practitioners working with and investigating plant genetic resources and compared it with the knowledge in the grant-scheme, in order to see how the formulation process change the body of knowledge and to examine how the changes were influenced by the international level (FAO), the EU level, and the National level (DK). Our analysis shows that, due to the adaptation to EU's Rural Development Policy (the EU-level), change and alteration of the scholarly knowledge were made, thus making it difficult to fulfil the grant-scheme as well as international obligations. This influenced what could later on be disseminated to the public in the demonstration projects. Our findings stress the need for clarity as to what knowledge is selected and deselected in the transposition process as well as awareness of adaptations due to embedding in policies at all levels. The framework Didactic Transposition is presented as a useful analytical tool, suitable for cases, where objects of knowledge are transposed from scholarly environments into political environments, and built into legislation. Analyses like these can thereby lead to more explicit choices in the development of grant-schemes and other political instruments building on a body of scholarly knowledge.

Keywords: Plant Genetic Resources for Food and Agriculture, Rural Development Policy, Didactic Transposition, grant-schemes

Introduction

Governmental grant-schemes build on scholarly knowledge and are formulated in political environments. The process of formulation changes the knowledge. This might enrich as well as constrain how the grant-scheme is implemented and thus the content of the subsequent dissemination of knowledge. This paper presents an example of a national grant-scheme for growing and demonstrating plant genetic resources for food and agriculture and offers a framework: Didactic Transposition to analyze the process.

Plant Genetic Resources for Food and Agriculture (PGR) include all plant-varieties of actual or potential value for agriculture (FAO, 2009). To conserve, grow and develop PGR in a sustainable way requires political and economic backing worldwide. This is why 140 of 193 independent nations in the world have signed the International Treaty on Plant Genetic Resources for Food and Agriculture in FAO (FAO-Treaty), the Food and Agriculture Organization of the United Nations (FAO, n.d.). As stated by FAO, humans need different plants for food, and it is essential to preserve the broadest possible variation. This is to secure human health, to provide a variety of nutrients and flavors, and to enhance our quality of life - for now and in the future. Different varieties mean different characteristics – not just in taste and nutrition, but also in growing properties. Some can survive pests, some are able to grow even in draught, in the cold, in windy, or very wet conditions. Furthermore different varieties make us able to breed new varieties. This makes PGR important for our ability to adapt to unpredictable environmental changes and future human needs, and thus to ensure sustainable growing and food for the future (FAO, 2010). All nations signing the FAO-treaty are responsible for conserving and using their PGR sustainably (FAO, 2009), and FAO requires the political backing to be firmly based on public awareness and support, stating:

> In spite of the enormous contribution by PGR to global food security and sustainable agriculture, its role is not widely recognized or understood. Greater efforts are needed to estimate the full value of PGR, to assess the impact of its use and to bring this information to the attention of policy-makers and the general public so as to help generate the resources needed to strengthen programs for its conservation and use (FAO, 2010, p. 198).

This requirement obligates the participating nations to ensure that suitable public communication initiatives are planned and carried out.

Demonstration of PGR in Denmark

Denmark has signed the FAO-treaty, and the Ministry of Food, Agriculture and Fisheries (the Ministry of Food) coordinated the conservation and use of PGR through a strategy and a series of three-year action plans in the years 2004 to 2014. Raising public awareness was part of the strategy (The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004).

In 2006 the Ministry of Food initiated demonstration projects on a series of Old Danish agricultural crops and fruit types worthy of conservation. Grants were given for testing and demonstrating PGR with the participation of both farmers and several public institutions. Experiences from 2006 to 2007 showed that the scheme was relevant and effective in terms of both testing the sustainable use of existing plant species in an agro-environment and disseminating knowledge to the public about the importance of PGR within agriculture and food production (The Danish Ministry of Food, Agriculture and Fisheries [The Danish Ministry of Food], 2012). In one of the demonstration projects, for instance, more than 200 old varieties of grain from the Nordic Gene Bank (NordGen) were tested for growing- and eating-quality, and some were demonstrated for visitors of the participating farms or in museums (Borgen and Grupe, 2012).

This paper presents a Danish case: The ‘Grant for demonstration projects about conservation and sustainable use of plant genetic resources’ (Grant PGR). It is the aim of the paper to analyze the formulation of the grant using the framework Didactic Transposition. The point of reference is what we will call “scholarly knowledge”, elaborated by scientists and practitioners working with and

investigating PGR. The process by which the scholarly knowledge becomes the knowledge in the grant involves a series of changes. Some of the scholarly knowledge is used, while some is not, and elements not belonging to the scholarly knowledge may be added. This might enrich as well as put limitations to how the grant-scheme can later be implemented. The paper focuses on this transformation, which influences what can later be disseminated to the public in the demonstration projects.
The paper is organized as follows. At first, the theoretical framework and the methods are outlined. Secondly the results are presented and analyzed. In the discussion we consider the decisions taken in the formulation of the grant and present alternatives. However, at first we need to present the object of study – the grant – and how it relates to the international level (FAO), the EU level, and the National level (DK).

The grant for demonstration projects about PGR

The 'Grant for demonstration projects about conservation and sustainable use of plant genetic resources' (Grant PGR) was embedded in the Danish Rural Development Programme 2007 to 2013 (The Danish Ministry of Food, 2012), which was part of the EU Rural Development Policy 2007 to 2013. The policy reflects the multifunctional role farming plays in the European community, and thus the three key areas: the agrifood economy, the environment and the broader rural economy and population were to go hand-in-hand (The Council of the European Union, 2006). Protection of genetic diversity was from the first implementation of the Common Rural Development Policy in 1992 one of the focus areas (Commission of the European Communities, 1992) due to a concern that varieties of useful plants were threatened with genetic erosion, because they were not competitive against the modern high-producing varieties (European Commission, 1998). The focus on PGR should thus enhance biodiversity in agriculture and was part of encouraging farmers and other land managers to introduce or continue "to apply agricultural production methods compatible with the protection and improvement of the environment, the landscapes and its features, natural resources and the soil. In this context the conservation of genetic resources in agriculture should be given specific attention" (European Commission, 2005: 35).

The Danish Rural Development Programme was executed as *The Danish Law on Development of Rural Areas* (the Law) with the purpose of contributing to the sustainable development, where growth is based on sustainable use of resources, and where local participation at the same time contributes to creating attractive living conditions and local jobs (The Danish Ministry of Food, 2007). The protection of genetic plant resources through demonstration projects was included in the law as part of § 2:

> The Minister of Food, Agriculture and Fisheries can provide grants for the following schemes…4) schemes for sustainable use of farmland, which includes c) environment friendly agriculture, including organic farming (ibid. § 2).

The conditions for the grant were then described in The Executive Order for Grants for Demonstration Projects about Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture (the Order) (The Danish Ministry of Food, 2011). The purposes of the Grant PGR were to protect PGR by giving support for projects which enhanced agricultural biodiversity by conserving and promoting the sustainable use of old Danish genetic plant resources worthy of

conservation. At the same time suitability for environment friendly farming and food products could be tested. Furthermore the Grant PGR should increase public awareness and interest in conservation of plant genetic resources and enhance the cooperation between stakeholders. The scheme would at the same time help Denmark to fulfil its obligations according to the FAO treaty and UN's Biodiversity Convention (The Danish Ministry of Food, 2012).

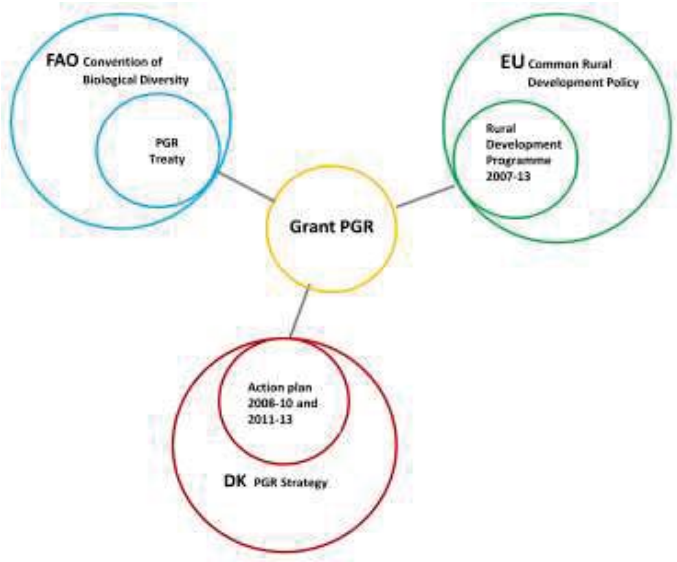


Figure 1: Grant PGR purposes and connections
Grant PGR with the purpose to conserve old varieties, test suitability for environmental friendly farming, food quality, dissemination of knowledge about PGR, increased diversity in agriculture, and cooperation between stakeholders
International level
FAO's PGR Treaty with the purpose to conserve and use PGR in a sustainable way to fulfil the Convention of Biological Diversity.
EU level
EU's Rural Development Programme 2007-2013 with the purpose to combat genetic erosion and through this enhance biodiversity in agriculture to fulfil the Common Rural Development Policy.
National level
DK's Action Plans for Agricultural PGR 2008-10 and 2011-13 with the purpose to conserve and use PGR sustainably for future agriculture to fulfil the Strategy for The Danish Work with Agricultural PGR.

Theoretical framework

In the Grant PGR the knowledge to be disseminated was broadly defined in the Programme, the Law and the Order. This knowledge had its point of reference in scholarly knowledge, described and conceptualized by scientists and practitioners (considered as scholars in relation to the knowledge to be disseminated). It is clear however that this knowledge, including also values and practices (Clément, 2006), was changed in the transformation and translocation from one context to another.

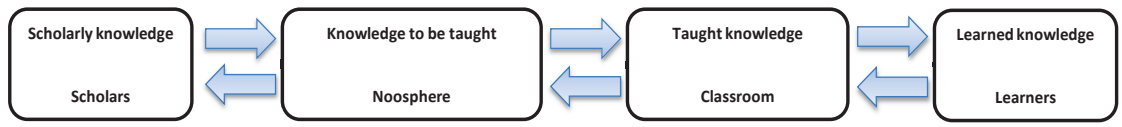
To study this change we use the framework of Didactic Transposition, described by Chevallard (1985) (see also Bosch & Gascón, 2006). The framework was originally developed to examine how scientific knowledge is transformed into school science. Although the idea of Didactic Transposition arose in science education research in school contexts, it can also be used to explain the transformation of knowledge in other contexts, for instance to study how museums create educational environments on the basis of certain objects of scientific knowledge, which they wish to mediate to their visitors. This is called *museographic transposition*. It is described by Simonneaux and Jacobi (1997), who studied choices made in the transformation of scientific knowledge into the knowledge to be presented in posters in a museum exhibition. Another example is Mortensen (2010), who used museographic transposition to analyze knowledge-dissemination projects, for instance in the case of a retrospective study of the development of an immersive exhibit on animal adaptations to darkness.

The demonstration projects in the Grant PGR were made by museums, companies, local projects, organizations, and municipalities. All are considered to be Informal Learning Environments with respect to the dissemination of knowledge on PGR, like museums are. The rationale of this is that the institutions are required to disseminate knowledge of PGR to the public when they are being awarded the grant, and thus are places with an opportunity of learning for the public outside of school (e.g. National Research Council, 2009; Falk and Dierking, 2010). In a sense, the grant transforms them into teaching (or "knowledge-disseminating") institutions. Including an obligation to communicate to the public was one of the aims of the Grant PGR, which was unique to Denmark's implementation of this grant-scheme in the Rural Development Programme 2007 to 2013 (European Commission, n.d. a; FAO, n.d.). It was convergent with the communication objectives for Denmark's as well as FAO's strategies (Commission on Genetic Resources for Food and Agriculture, 2012; The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004).

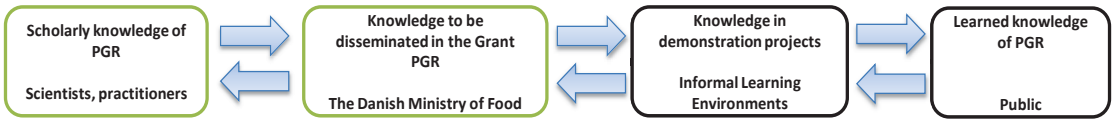
Also the very diverse group of grant-receivers was unique to Denmark's implementation of the Rural Development Programme. The decision was taken in the Danish Ministry of Food and built on good experiences from the previous Rural Development Programme (2000 to 2006) (the Danish Ministry of Food, 2012). The diverse group of stakeholders also had its roots in the Danish PGR strategy and action-plans as they were part of the Danish Plant Genetic Environment (the Danish Ministry of Food, 2011a). Both decisions were important conditions of the Grant PGR.

Didactic Transposition

In the following section we will describe the process of Didactic Transposition in four steps, following Bosch & Gascón (2006). The stepwise analysis allows us to identify the factors that have significant impact on the process. Many of these factors aid the process of knowledge-dissemination, but some of them also represent constraints that might hinder it as well as result in conflicts and misinterpretations.



Didactic Transposition of knowledge



Didactic Transposition of knowledge in the Grant PGR

Figure 2: Diagram of the process of Didactic Transposition (after Chevallard & Bosch, 2014). The green boxes are those analyzed in this paper

Scholarly knowledge and the scholars

The first step of the Didactic Transposition process is the production of knowledge among those that are considered as the most legitimate and specialists of the considered field (*scholars*). This *scholarly knowledge* defines and develops the field in question. Its focus is not on teaching or dissemination to people outside the group (Astolfi et al., 1997). The scholars are primarily scientists, but also others can be regarded as knowledge producers without their knowledge being necessarily academically tailored (Chevallard & Bosch, 2014). In this study the scholars are *scientists* and *practitioners*: agriculturists, plant breeders, geneticists, gardeners, farmers, and chefs, whose knowledge about how plants can be grown and used is essential to the *scholarly knowledge of PGR*. It is important to notice that there is not an absolute value of scholarly knowledge: what is considered as such varies depending on the period of time and institution. For the analysis or observer, scholarly knowledge is defined as what is considered as such by the disseminating institution, which at the same time legitimates the process of dissemination: it is not the same to spread a person's or lobby's opinion than a well-established scientific result or traditional know-how.

Knowledge to be taught and the noosphere

The second step of the process is the production of the *knowledge to be taught* as the main element of the knowledge-dissemination contract with society. This takes place in what Chevallard (1985 and 2013) calls the *noosphere*: the 'sphere' of those who 'think' (*noos*) about teaching or, in our case, about disseminating knowledge. In the Didactic Transposition process in schools, an important component to access the knowledge to be taught is the curriculum, because it frames and organise what should be taught in schools. In this context, an important player in the noosphere is accordingly the Ministry of Education, creating the curriculum (Chevallard, 1988). In our study the *knowledge to be disseminated in the Grant PGR* is mainly described by the Programme, the Law and the Order. The noosphere is organised around *the Danish Ministry of Food*, since it sat up these conditions. This is seen to be similar to the curriculum in schools, because it framed the knowledge that could later be disseminated in the demonstration-projects. Together with the Ministry, the noosphere also includes experts, scientists, journalists, politicians, lobbyists and other stakeholders who are also involved in the knowledge-dissemination process from the outside, giving advice, producing resources, assessing the results etc.

Taught knowledge and the classroom

The Didactic Transposition proceeds to *taught knowledge* in the *classroom.* In the Grant PGR this is *the knowledge in the demonstration projects*, which could be experienced in the *Informal Learning Environments* consisting of research institutions, producers and private companies, museums, local projects, municipalities, pometa, and NGOs. The knowledge of PGR was disseminated as for instance posters, guided tours, tastings of produce and products, items in radio or television, and cooking-events (Windfeldt & Madsen, manuscript in review, 2016).

Learned knowledge and *the learner*

Finally, if the knowledge is used and understood, it will become *learned knowledge* in the *learners' communities*, which in the demonstration-projects will be the *public* focused by the knowledge-dissemination process: the world-wide opinion, a whole society, a group of stakeholders, etc.

The focus in this study is on the first step of the process: transformation of the *scholarly knowledge of PGR* into *knowledge to be disseminated in the Grant PGR* (green boxes in fig. 2). This will allow us to look deeply into the step taken before the knowledge is transformed in the demonstration projects and disseminated to the public. This means understanding the origin of and background for the knowledge that is later disseminated. The last steps transforming *knowledge to be disseminated in the Grant PGR* into *knowledge in the demonstration projects* is part of another study and will be touched briefly in the discussion.

Let us just briefly mention that the order in which we have presented the Didactic Transposition process does not necessarily correspond to its chronology. The double arrows in figure 2 indicate that if the scholarly knowledge is modified to become knowledge to be disseminated, at the same time, the very project of knowledge-dissemination in a given field contributes to a specific kind of development that also affects its production in the scientist sphere. In other words, the production of knowledge is also intimately shaped by the needs of disseminating and teaching it. Kuhn (1994) already noticed it with the role he attributes to textbooks in the establishment of a "normal science".

Methods

Scholarly knowledge and scholars

Our analysis of the first two steps of the Didactic Transposition process relied on different empirical materials. In the case of the scholarly knowledge, a broad literature review was made to find out who the scholars are, and how they define and elaborate the body of scholarly knowledge. We searched the Danish Royal Library's online search engine 'REX', using the words *plant genetic resources food agriculture public awareness*, which resulted in 56 scientific papers in peer-reviewed journals or books. In order to obtain a more structured body of knowledge, we decided to organize the themes they were addressing into 4 relatively independent categories: *genes*, *resources, agriculture,* and *policy.* The topics concerning *genes* were focused on heredity and diversity. *Resources* were centered on describing, documenting and conserving PGR as a resource for food and agriculture. *Policy* connected PGR to society through economy, international law, sustainable development and the basic connections between PGR and food production. Finally, the *agricultural* topics put emphasis on the concrete plants, their cultivation, and the products that can evolve from them. These 4 categories have only a methodological purpose and have appeared to be useful for our analyses.

Four scientific papers mentioning all four categories of topics in the abstract were chosen to make the scientific knowledge in the analysis as broad and general as possible, and the abstracts were used to access the scholarly knowledge (fig. 4). These were supplemented by literature of practical knowledge for farmers, gardeners and chefs. Thus the collection of literature represents knowledge from as well scientists, farmers, gardeners and gastronomists, working with PGR:

Type of literature	Literature

Scientific papers/books	• Fowler, C., Hodgkin, T., 2004: Plant Genetic Resources For Food And Agriculture: Assessing Global Availability. In: Annual Review of Environment and Resources (abstract) • Hoisington, D., Khairallah, M., Reeves, T., Ribaut, J.-M., Skovmand, B., Taba, S., Warburton, M., 1999: Plant genetic resources: What can they contribute toward increased crop productivity? In: PNAS (abstract) • Rao, V.R., Hodgkin, T., 2002: Genetic diversity and conservation and utilization of plant genetic resources. In: Plant Cell, Tissue and Organ Culture (abstract) • Virchow, D., 1999: Conservation of Genetic Resources: Costs and Implications for a Sustainable Utilization of Plant Genetic Resources for Food and Agriculture. In: Springer Science & Business Media (introduction to book)
Articles in journals for gardeners	• Wood-Pedersen, P., 2015a: De lollandske rosiner får nyt liv. In: Gartnertidende. • Wood-Pedersen, 2015b: Pigeon fra Maribo er anderledes. In: Gartnertidende.
Articles on a homepage from the Danish organization of organic farmers	• Hansen, Per Henrik, n.d.: Dyrkning af spelt, emmer og enkorn. In: Økologi.dk • Hansen, Åse, n.d.: Oplagt med samarbejde landmand-møller-bager. In: Økologi.dk • Larsson, Hans, n.d.: Forsker: Høj kvalitet i gamle sorter. In: Økologi.dk
Homepage from a German company working with cultivation of old varieties of fruit trees	• Bade, Jan, n.d.: Obstmanufaktur, Erhaltung und Pflege historischer und bewährter Obstsorten. In: Sortenerhalt.
Blog on the homepage from a gastronomic NGO	• Nordic Foodlab, 2011: Potato Evaluation. In: nordicfoodlab.org (blog).

A sample of the body of scholars contains the authors of the previous works. Scientists were agriculturists (Fowler, Reeves), plant breeders (Rao, Taba), botanist and plant biologist (Hosington), geneticists (Ribaut, Warbuton), plant physiologist and plant pathologist (Skovmand), agricultural economist (Virchow). In order to access the (scholarly) knowledge of the practitioners, we include consultants: Jan Bade (pomologist) and Peder Wood-Pedersen (horticulturist) who collected and re-formulated the farmers' and gardeners' experiences, e.g.: "Knuthenlund Manor has established a collection of all apple varieties from Lolland-Falster and reviewed which of the local native varieties could be interesting as new foods" (Wood-Pedersen, 2015, 2). Other articles are formulated by journalists (e.g. Per Henrik Hansen) interviewing scientists (e.g. Åse Hansen, Hans Larsson) who must be seen as the source (therefore also cited in the literature). The gastronomic knowledge is found in a blog on the homepage from a gastronomic NGO, written by both chefs and scientists (sensory scientists, organic chemists).

Knowledge to be disseminated and the noosphere

To describe the knowledge to be disseminated in the noosphere, we have used three main sources:

- The Danish Rural Development Programme 2007 to 2013. By: The Danish Ministry of Food, 2012 (the Programme).
- Law for Development of Rural Areas. By: The Danish Ministry of Food, 2007 (the Law).
- Executive order about grant for demonstration projects about conservation and sustainable use of plant genetic resources for agriculture and food. By: The Danish Ministry of Food, 2011 (the Order).

The noosphere examined in this paper is primarily the Danish Ministry of Food, because this is where the conditions for the Programme, the Law and the Order are set up, and thus the most important factor to determine which knowledge can later be disseminated in the demonstration projects. The Danish Ministry of Food decides which plants can be grown and frames the knowledge that can be disseminated in the Grant PGR. This is for instance seen in the Order: "…demonstration projects, which may help to increase interest for the plant genetic resources and increase the prevalence of old plant varieties, which according to the assessment of the Directorate for Food, Fisheries and AgriBusiness[7] have been used before 1960 in Danish agriculture or … assimilated thereto, suited for environment friendly farming and for food" (The Danish Ministry of Food, 2011, § 1). The Ministry decides who can get the grants. It decides the overall group that can possibly apply: (museums, private companies, public companies, funds, communities, organizations, public institutions, and municipalities) and between these the Ministry can choose: "The Ministry of Food, Agriculture and Fisheries can set the rules for prioritization and selection of applications" (ibid. § 6). This means that they decide who the knowledge disseminators will be.

As mentioned before, other stakeholders in the noosphere also influenced the formulation of the Grant PGR: Danish politicians and lobbyists, but also EU politicians, since the Grant PGR was embedded in the EU Rural Development Policy, and politicians from FAO, because fulfilling the FAO-Treaty and the Biodiversity Convention was one of the goals of the Grant PGR.

Categorization and drawing of concept maps

To examine which parts of the knowledge to be disseminated are influenced by the scholarly knowledge – and which are not – concept maps of the two stages of the Didactic Transposition were constructed and compared.

The construction of the concept maps followed two main steps. We first identified the main issues, questions or topics that were addressed in a quite independent way, then included the derived questions or issues from each one. This process only shows a static picture of the domain "state of the art" that is obviously subject to variations and evolutions.

The topics of the scholarly knowledge and the knowledge to be disseminated were categorized into the four groups of topics: genes, resources, policy, and agriculture. These were drawn into two concept maps (Novak and Cañas, 2008) which were 'mirrored' and put together in one concept map

[7] The directorate in the Ministry of Food working e.g. with subsidies for production and sale of food (primarily EU-subsidies)

to be able to analyze the similarities and differences. Here is shown the core of the 'mirrored' concept map:

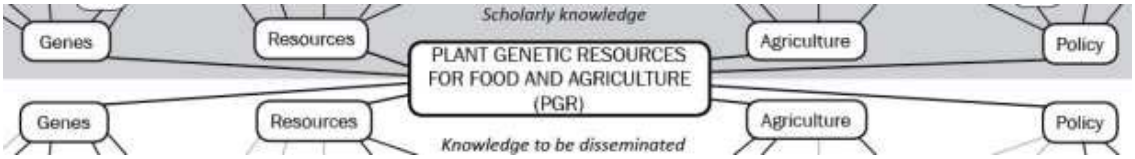


Figure 3: The four groups of knowledge (Genes, Resources, Agriculture, and Policy) of PGR drawn into a 'mirrored' concept map with *scholarly knowledge* placed upwards (grey), and *knowledge to be disseminated* placed downwards (white). Fig. 5 shows the full figure.

The subjects in the knowledge to be disseminated were given different colours, which were used in the categorization in the concept maps: As the Programme was at first agreed on, it has the highest level (level 1, red). The Programme was executed in the Law (level 2, blue), and the law was then described in the Order (level 3, green).

Results

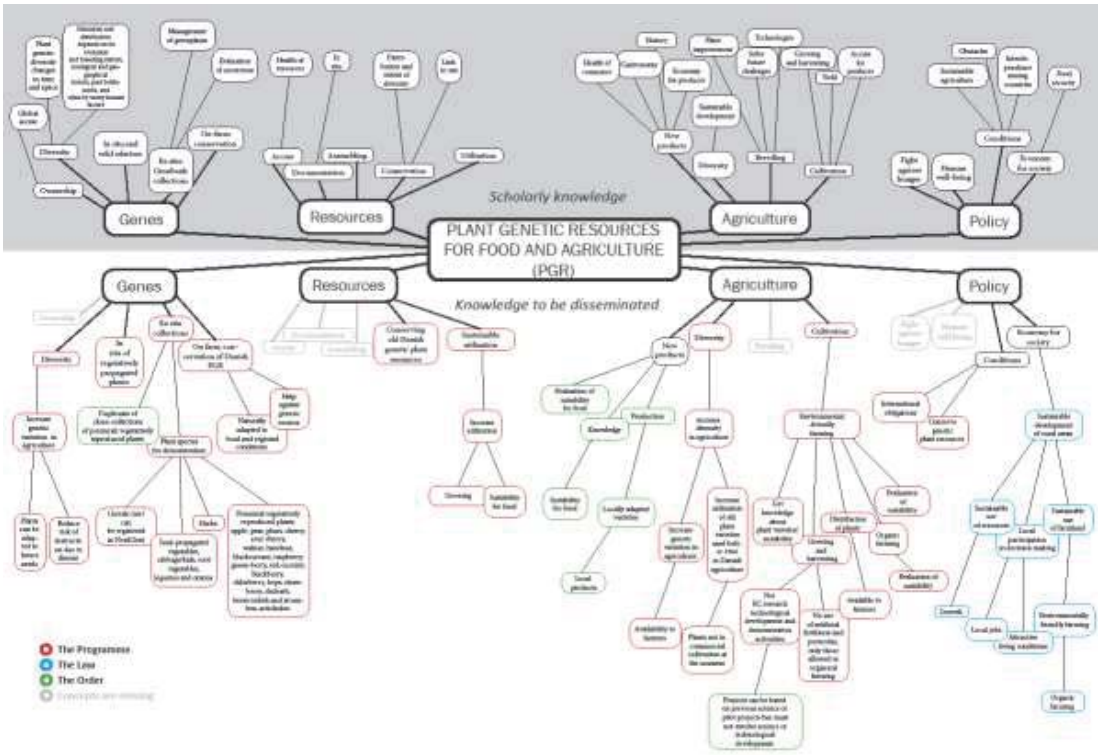
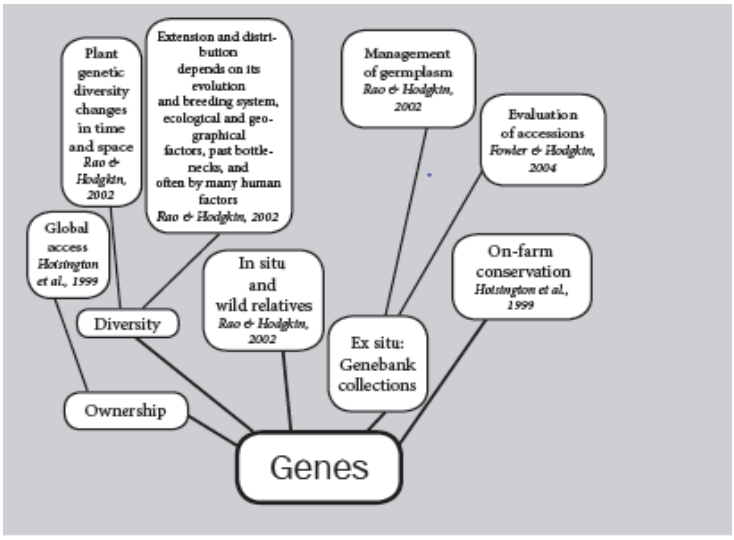


Figure 4: Overview of results: The four categories of knowledge (Genes, Resources, Agriculture, and Policy) of PGR. Scholarly knowledge is placed upwards (dark grey), and knowledge to be disseminated placed downwards (light grey). Shaded subjects are missing. The knowledge to be disseminated has further four levels of importance:
Level 1 (red): The Danish Rural Development Programme 2007-13 (the Programme).
Level 2 (blue): Purpose of The Danish Law on Development of Rural Areas (the Law).
Level 3 (green): The Executive Order for Grants for Demonstration Projects about Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture (the Order)



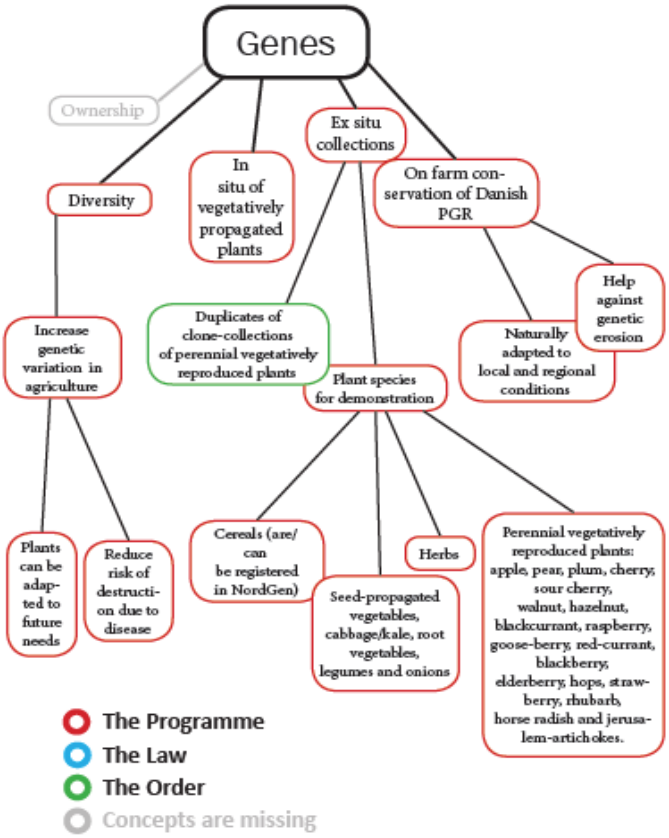


Figure 5: The map of genes
The topic and its subdivisions deal with the heritable variation within and between populations of plants, and with the places, where they can be accessed: in situ, ex situ, and on farm

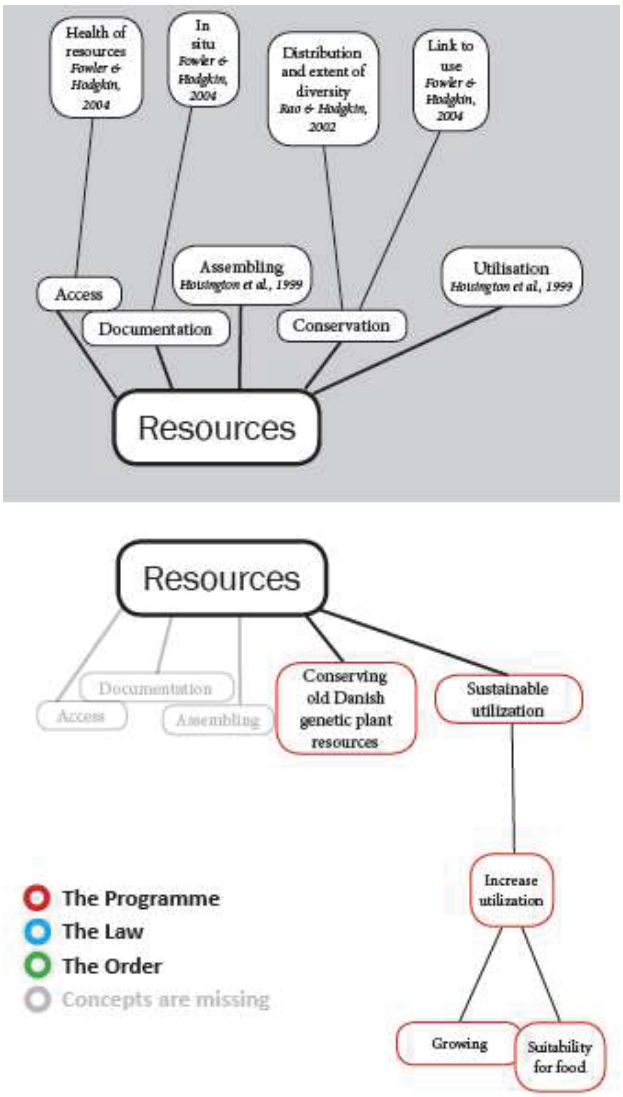


Figure 6: The map of resources
The topic and its subdivisions deal with collecting, documenting, conserving, getting access to, and using PGR.

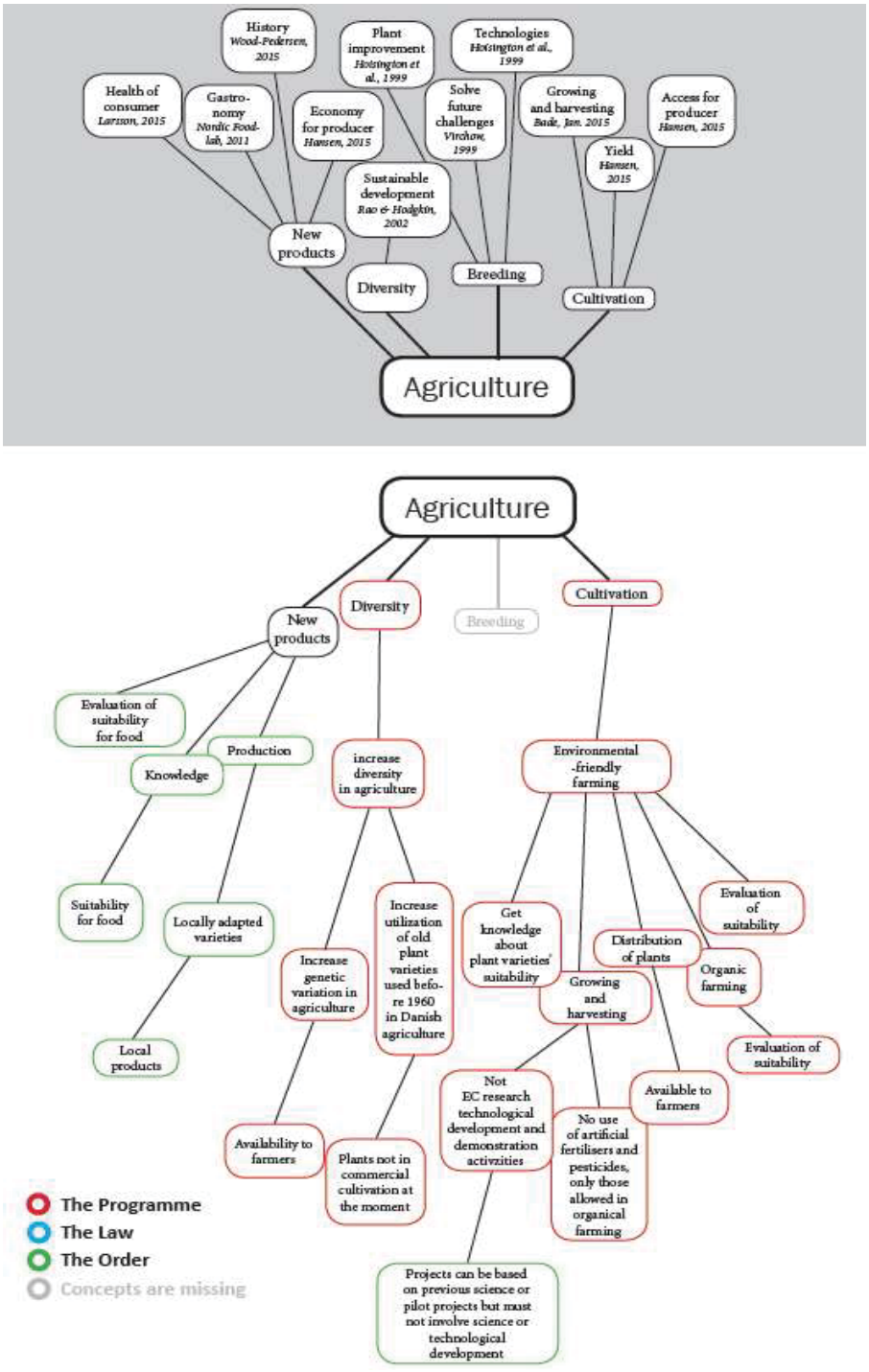
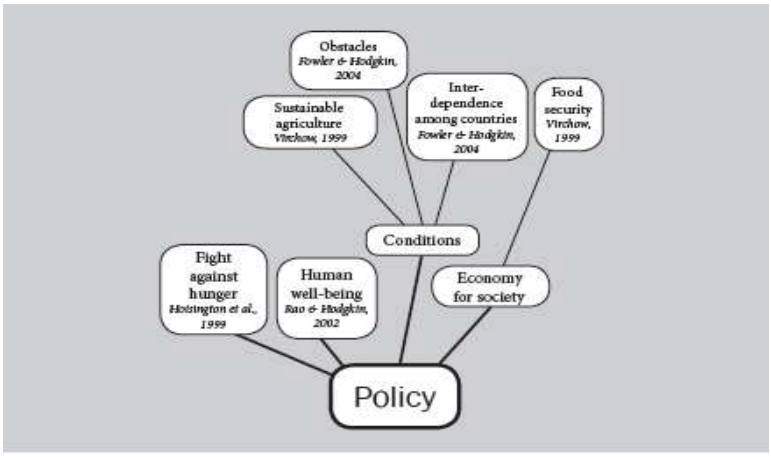


Figure 7: The map of agriculture
The topic and its subdivisions deal with cultivation of plants and products that can evolve from them



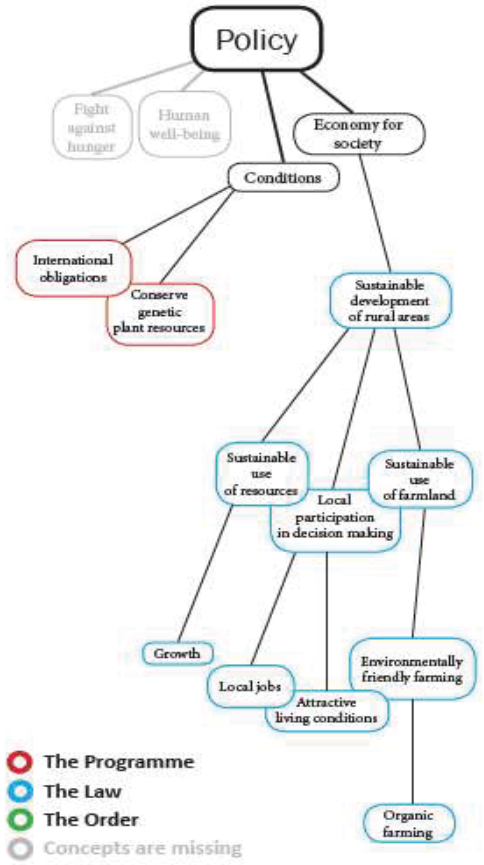


Figure 8: The map of policy
The topic and its subdivisions deal with the connection between PGR and society through e.g. economy, fight against hunger, and sustainable development

Analysis of results

To assess the knowledge, values, and practices in the Grant PGR, the results of the analysis of the concept maps (fig. 5) are analyzed by answering three questions:

1. Which elements of the *knowledge to be disseminated* come from the *scholarly knowledge*?
2. Which elements of the *scholarly knowledge* are not present in the *knowledge to be disseminated*?
3. Which elements of *knowledge to be disseminated* do not come from *scholarly knowledge*?

The findings are then discussed to assess what conditions established by the Grant PGR enrich and what others restrain the dissemination of the knowledge about PGR defined and developed by scientists and practitioners.

1.* Which elements of the *knowledge to be disseminated* come from the *scholarly knowledge?

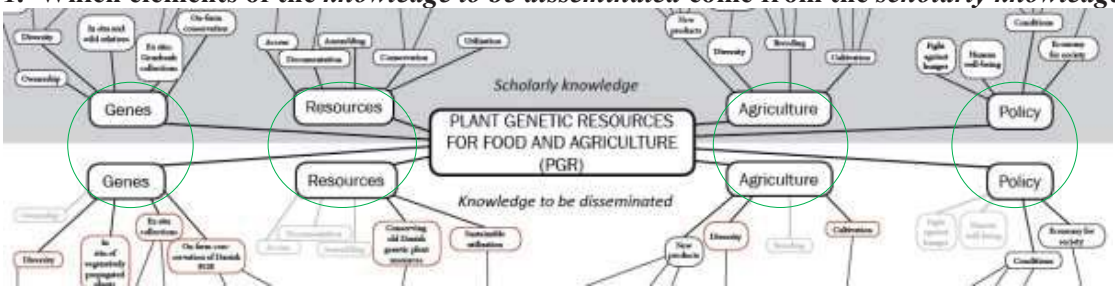


Figure 9: The four groups of knowledge in scholarly knowledge (upwards) and knowledge to be disseminated (downwards) and their subdivisions – clearly showing that knowledge to be disseminated is influenced by scholarly knowledge (green rings).

The knowledge to be disseminated is clearly influenced by the scholarly knowledge, as all four groups (genes, resources, agriculture, policy) and many of the subdivisions of the groups are represented in the concept-map: *Genes*: diversity, in situ, ex situ collections, on farm conservation. *Resources:* conservation and utilization. *Agriculture:* new products, diversity, cultivation. *Policy:* conditions, economy for society.

This means that the Grant PGR was built on knowledge that originated in the work of scientists and practitioners working with PGR. For instance, the ways genes can be conserved and later retrieved to be used are described in the Grant PGR as *in situ*, *ex situ* and *on farm* like in the scientific papers. Also the practical cultivation of PGR mentions *growing and harvesting* in as well the knowledge to be disseminated as the scholarly knowledge. This result is not surprising since, as was said before, the Ministry's project was to disseminate already accepted and assessed knowledge.

2. Which parts of the *scholarly knowledge* are not present in *knowledge to be disseminated?*

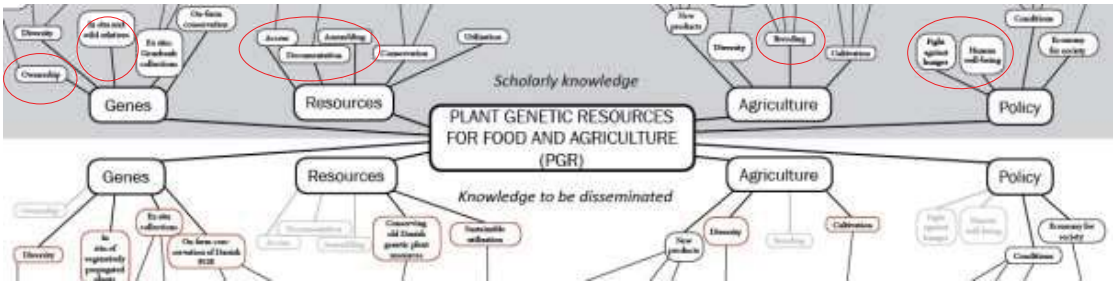


Figure 10: The four groups of knowledge in scholarly knowledge (upwards) and knowledge to be disseminated (downwards) and their subdivisions – showing the subjects from scholarly knowledge (red circles) not present in knowledge to be disseminated (shaded).

Whereas the scholarly knowledge about PGR is general, the knowledge to be disseminated is more specific, showing only the knowledge describing the Grant PGR.

Regarding genes: *Ownership* and *crop wild relatives* are not mentioned in the knowledge to be disseminated.
Ownership to genes is relevant, when somebody wants to use plants originating elsewhere, and this is also a question of global access as all nations depend on crops domesticated in distant lands (Hoisington et al, 1999; Fowler and Hodgkin, 2004). As the demonstration projects in the Grant PGR used seeds and plants mainly from ex situ sources (NordGen and clone-collections) (the Danish Ministry of Food, 2012), ownership has not been considered as a relevant topic of the Grant PGR.
Crop wild relatives are crop related natural populations found in nature (Fowler and Hodgkin, 2004; Rao and Hodgkin, 2002). The seeds and plants in the demonstration-projects should be Old Danish PGR, used before 1960 in agriculture, not in present commercial production – or similar hereto. The grant did not mention the possibility to test crop wild relatives.

***Regarding resources*:** *Documenting, assembling, and accessing* are not mentioned in knowledge to be disseminated.
When taking care of PGR as a resource, *documenting*, *assembling,* and *accessing* the plants is necessary in order to conserve and utilize them (Fowler and Hodgkin, 2004; Hoisington et al, 1999). The plants and seeds in the demonstration projects were coming from ex situ or in situ sources and thus they had already been documented and assembled to be part of the collections. Accessing the collections for the grant-receivers was necessary to utilize them, but this is not specifically mentioned.

Regarding agriculture: *Breeding* is not mentioned as a practice in knowledge to be disseminated.
In the scholarly knowledge *breeding* is the main way to develop new varieties, and the basis of plant improvement (Rao and Hodgkin, 2002, Hoisington et al, 1999), which means solving future challenges (Virchow, 1999). That *breeding* is not a part of the Grant PGR must be because this is research or technological development, which was not allowed in the projects: "no support shall be granted for activities eligible under the framework programme of the European Community for research, technological development or demonstration activities" (the Danish Ministry of Food, 2012, s. 235).

Regarding policy: *Human well-being* and *fight against hunger* are not mentioned in knowledge to be disseminated.
Human well-being is mentioned in scholarly knowledge by Rao and Hodgkin (2002) as a reason why conservation of plant genetic diversity is essential. That this is not part of knowledge to be disseminated is seen as a coincidental error, as e.g. local products from locally adapted varieties and attractive living conditions in rural areas could have been linked to this subject. The work with PGR on a global level is essential to *fight against hunger*. Virchow (1999) argues that agricultural economists have recently begun to direct their research at the importance of conserving and utilizing PGR because of their considerable long run impact on agricultural development and food security. Hoisington et al (1999) argue that genetic diversity in the collections is critical to the world's fight against hunger.

It is stated in the Programme (p. 233) that "retention of the genetic variation is an important prerequisite for maintaining a level of biological diversity which can ensure that plants can be adapted to the needs of the future." But fight against hunger is not mentioned directly.

3. Which knowledge present in *knowledge to be disseminated* did not come from *scholarly knowledge*?

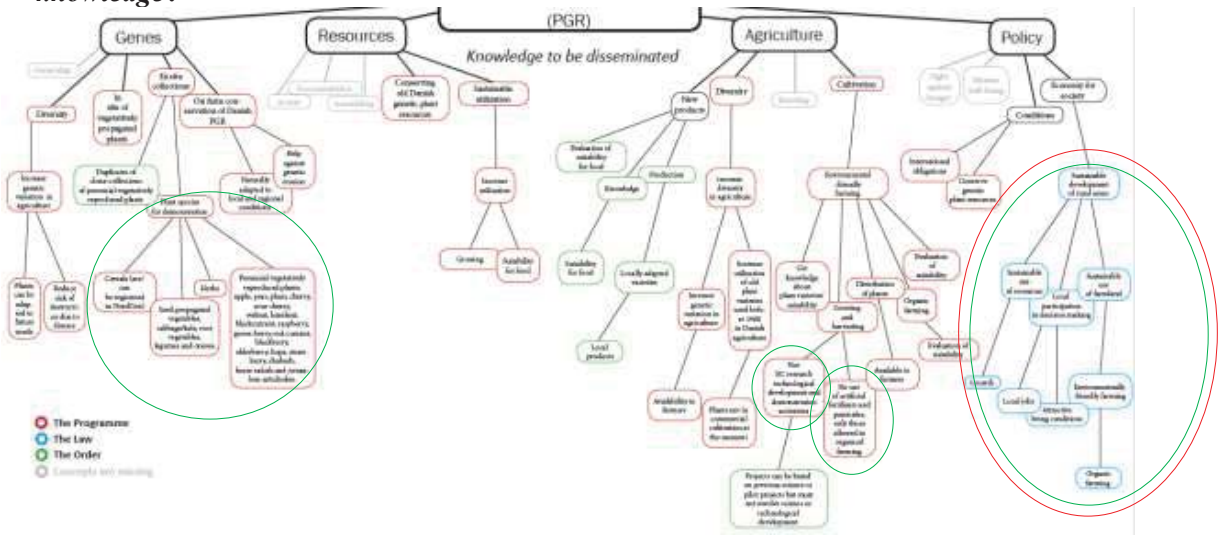


Figure 11: The four groups of knowledge in knowledge to be disseminated) and its subdivisions – showing the subjects in knowledge to be disseminated with origin in other sources, referring to fig. 1 (green ring: EU, red ring: DK)

Some of the knowledge to be disseminated cannot be found in the scholarly knowledge. This must have its origin in other sources.

Regarding genes: Whereas scholarly knowledge of *ex situ collections* is general, e.g. management of germplasm (Rao and Hodgkin, 2002), knowledge to be disseminated about ex situ collections is specific and contains the exact species of plants that can be grown in the demonstration projects: old Danish PGR, used before 1960 in agriculture (the Danish Ministry of Food, 2012). Of course these

species are included in the general PGR in scholarly knowledge, but in knowledge to be disseminated they are limited to less than 50 species. All should be from NordGen or be able to be registered in NordGen because of their genetic value and scarceness. This is stated in the Programme, which has its origin in The EU Rural Development Policy 2007-13. This aimed at protecting genetic diversity due to a concern of genetic erosion of plants which were not competitive against modern high-producing varieties (The Council of the European Union, 1998). Thus the Programme should enhance on-farm conservation of PGR naturally adapted to local and regional conditions, which were worthy of conservation and threatened with genetic erosion. In Denmark those PGR are almost solely in gene-banks, so the Programme was targeted to "supply the static conservation in gene-banks with more dynamic on-farm conservation" (the Danish Ministry of Food, 2012, p. 233). This way the Grant PGR only gave possibilities to conserve and demonstrate a limited number of old varieties of food plants, which were not at first sight competitive to modern high-producing varieties.

Regarding resources: *Conservation* in scholarly knowledge is general, e.g. distribution and extent of diversity (Rao and Hodgkin, 2002), while knowledge to be disseminated is specific and limits conservation to Old Danish genetic plant resources as described above (the Danish Ministry of Food, 2012).

Regarding agriculture: *Diversity* in scholarly knowledge is general and connected to e.g. sustainable development (Rao and Hodgkin, 2002), while diversity in knowledge to be disseminated is limited to old plant varieties used before 1960 in Danish agriculture or assimilated thereto as described above (the Danish Ministry of Food, 2012).

Cultivation in scholarly knowledge includes e.g. growing techniques, pests and yield (Hansen, 2015; Wood-Pedersen, 2015), while cultivation in knowledge to be disseminated only includes environment friendly farming, and "no use of mineral fertilizers is allowed for cultivation as in organic farming. Only plant protection products approved for organic farming may be used" (the Danish Ministry of Food, 2012, p. 234). This originates from the EU Rural Development Policy, which aimed at enhancing friendly farm practices.

Regarding policy:
Economy for society in scholarly knowledge is the basic connections between PGR and food production: food security (Virchow, 1999), while knowledge to be disseminated mentions sustainable development of rural areas that will bring economic growth to society through e.g. sustainable use of resources and farmland in environment friendly as well as organic farming. In this process is also mentioned local jobs, local participation in decision-making, and attractive living conditions for people in rural areas. This is part of the Law, and it originates in the EU-level, as this was one of the objectives of the Rural Development Programme 2007 to 2013. But it has also been actively built into the Danish action-plan, for instance in the plan from 2011 to 2013, named: "From Gene bank to Dinner table" (The Danish Ministry of Food, 2011).

Discussion

The transposition-process in the formulation of the Grant PGR changed the knowledge. Some of the scholarly knowledge was used and reconstructed, while some was not used, and elements not belonging to the scholarly knowledge were added. This enriched as well as put limitations to how the grant-scheme could later be implemented. In the following we will discuss the most important changes.

Solely old varieties of plants in knowledge to be disseminated
Whereas the scientific and practical reference-knowledge is general, knowledge in the Grant PGR is specific and contains the exact species of plants that can be grown in the demonstration projects: old Danish PGR, used before 1960 in agriculture, not in present commercial production. The plants should be under threat of genetic erosion and worthy of conservation. In Denmark, this type of varieties is primarily conserved in gene banks, and thus the plant varieties should either currently be stored in NordGen or in Danish, national collections or be worthy to be so. Thus the Grant PGR would supplement the static ex situ conservation in gene banks with a more dynamic conservation on farm and at the same time help the conservation of the ex-situ collections (The Danish Ministry of Food, 2012). The selection should be based on a concrete evaluation with the purpose to help maintain the diversity and genetic variation in plant species suited for environment friendly farming, for food, and to increase public awareness of PGR. The scheme would at the same time help Denmark to fulfil its international obligations (The Danish Ministry of Food, 2012).

As seen in fig. 4 and 5 this decision comes from the Rural Development Programme. In fig. 11 it is furthermore seen that it has its origin in The EU Rural Development Policy 2007 to 2013. This aimed at protecting genetic diversity due to a concern of genetic erosion and was thus targeted at protecting plants which were not competitive against modern high-producing varieties (The Council of the European Union, 1998). A representative from the Danish Ministry of Food, which was taking part in the design and implementation of the Danish Grant PGR said about this:

> We could see that PGR were mentioned in the EU Rural Development Policy, but subsidies were meant for those, who still cultivated them, in for instance Austria and Italy. They could be compensated. But we were not in that situation in Denmark. At best we had PGR in gene banks (Personal communication, 8. Oct, 2014).

Thus the decision to limit PGR to gene-bank- and clone-collections was an adaptation of the Grant PGR to the EU Rural Development Policy. The specific species allowed to demonstrate in the Grant PGR were assessed and selected by the Directorate for Food, Fisheries and AgriBusiness in the Ministry of Food (The Danish Ministry of Food, 2011). The gene-bank- and clone-collections were well suited to dynamic on-farm conservation of Old Danish varieties and therefor to help the conservation of the ex-situ collections of valuable Danish PGR. It also helped Denmark to fulfil its international obligations, as the FAO-treaty states that each country must take care of PGR that are under threat (FAO, 2009). The grant would at the same time contribute to a reversal in biodiversity decline (The Danish Ministry of Food, 2012) and thus to help to fulfil the UN-Biodiversity Convention.

We would argue, however, that the decision to focus on a limited selection of old varieties of plants was less suited for increasing public awareness and interest in conservation of PGR. PGR include all varieties of actual or potential value (FAO, 2009), and genetic diversity of PGR is critical to

food security in the future (e.g. Virchow, 1999), the world's fight against hunger (e.g. Hoisington et al, 1999), and sustainable development on a global level (e.g. Rao and Hodgkin, 2002). But though adaptation to future needs and sustainable rural development was the goal of the Rural Development Programme this is apparently not regarded to be on a critical level, as only old varieties, not in present production, could be demonstrated. That fight against hunger is not directly mentioned in knowledge to be disseminated (fig. 8) is also seen as a sign of this. Thus the limited selection of PGR in the demonstration-projects did not help public understanding of why it is important to conserve PGR, and this was further enhanced by the non-mentioning of fight against hunger. This means that one of the aims of the Grant PGR: to increase public awareness and interest in conservation of PGR was limited.

We furthermore think that the demonstration of solely old varieties gave a 'museological' impression of PGR. This was enhanced, because the Grant PGR included an obligation to disseminate knowledge to the public and was one of the few possibilities to get subsidies for demonstrating PGR in Denmark from 2008 to 2013 (The Danish Ministry of Food, 2008 and 2011a). The 'museological' impression was for instance indicated by many grant-receivers writing articles in newspapers and magazines or other mass-media using expressions as "old varieties" and "living cultural heritage" (e.g. Wood-Pedersen, 2015a and b).
To increase public awareness and interest in conservation of PGR it would to our opinion have been better to demonstrate a broader variation, including modern varieties. This would show the development of varieties and the connection between former, present, and future agriculture. This would also make it easier to disseminate knowledge of why it is essential to preserve the broadest possible variation, and the 'museological' impression could have been avoided.

Breeding was not mentioned in knowledge to be disseminated, and research and technological development could not be part of the Grant PGR
Breeding was not mentioned in the Grant PGR (see fig. 7) although this is the basis of plant improvement and development of agriculture to meet future challenges as stated in the scholarly knowledge (Hoisington et al, 1999; Rao and Hodgkin, 2002). This is because research and technological development was not possible in the Grant PGR (see fig. 7), since this was part of another EU framework-programme, which aimed at developing new knowledge, new technology, and demonstration activities or common resources for research (the Danish Ministry of Food, 2012).

The decision that research and technological development, including breeding, could not be used and demonstrated in the Grant PGR was taken at the EU-level (see fig. 11), and the Danish Ministry of Food had to integrate it into the Grant PGR, when they decided to make it part of the Rural Development Programme in EU's Rural Development Policy 2007 to 2013. We would argue that this led to a limited demonstration of PGR, even giving the impression that PGR are stable and not dynamic, as only the original old varieties could be grown. It further enhanced the museological impression. This means that one of the aims of the Grant PGR: to increase public awareness and interest in conservation of PGR was limited.

Furthermore, we think, the restrictions to include research in the demonstration-projects was problematic, as one of the aims of the projects was to get knowledge about growing properties of the plant varieties and evaluate their suitability for food (the Danish Ministry of Food, 2012). This restriction is contradictory as it is difficult to test and gather knowledge without doing research. Therefor the purposes of the Grant PGR to test suitability for environment friendly farming and food products were not possible to do in a scientific way.

Thus, to our opinion, including breeding in the Grant PGR would have been appropriate to give the public knowledge about this important function of PGR and thus to understand the importance of conservation. The restrictions to include research and technological development in the Grant PGR should either have been taken out, or the intention to test suitability for environment friendly farming and food products should have been subsidized in another way. Another solution could be adding a statement to the grant that it is not intended to fund research itself, but that collaboration to research is allowed and will be encouraged.

Sustainable development of rural areas was added to knowledge to be disseminated

Knowledge to be disseminated includes sustainable development of rural areas that will bring economic growth to society through e.g. sustainable use of resources and farmland in environment friendly as well as organic farming. In this process is also mentioned local jobs, local participation in decision-making, and attractive living conditions for people in rural areas (see fig. 8). This is not part of the scholarly knowledge. It is in the Law (The Danish Ministry of Food, 2007), and it originates in the EU-level (see fig. 11), as it was one of the objectives of the Rural Development Programme 2007 to 2013: the agrifood economy, the environment, and the broader rural economy and population must go hand in hand in hand.

Figure 12: High quality food products developed from the demonstration-projects: flour of Ølands-wheat and marmalade of blackberries

So this decision was also taken at the EU-level, and the Danish Ministry of Food had to integrate it into the Grant PGR, when they decided to make it part of the Rural Development Programme in EU's Rural Development Policy 2007 to 2013. But it has also been actively built into the Danish action-plan, for instance in the plan from 2011 to 2013, named: "From Gene bank to Dinner table" (The Danish Ministry of Food, 2011a).

Thus encouraging the production of healthy, high-quality products, environmentally sustainable production methods (…) and the protection of biodiversity was central to the Rural Development Programme. It was seen as a win-win situation, if this could at the same time create local jobs and attractive living conditions for people in rural areas (The Council of the European Union, 2006).

The plants which were actually grown and demonstrated in the projects included several varieties of

all the species proposed in the Programme (see appendix A). This resulted in new products on the basis of Nordic plant varieties from before 1960, developed from the demonstration-projects. They were marketed as expensive specialities, and some of them turned out to be a great success (Borgen & Grupe, 2012; Hansen, 2015; Larsson, 2015). These successful products brought out the knowledge of PGR to the public as a result of the knowledge-dissemination in the demonstration-projects, as they were sold in supermarkets, often communicating on the product about the specific variety and the importance of conserving PGR (see fig. 12). Thus the Grant PGR actually fulfilled the purpose of the Programme by increasing genetic variation in agriculture, enhancing sustainable development of rural areas through development of new quality products, and communicating this to the public. We would argue, however, that though the successful products brought out knowledge of PGR to the public, the expensive foods made from old Danish PGR might at the same time have contributed to a view on PGR more connected to luxury products with a Nordic history than to fight against hunger and a necessity for the future.

To increase public awareness about PGR's role in fight against hunger and development of food for the future worldwide it would, we think, have been helpful to include an obligatory historical and global perspective (e.g. the Irish Potato Famine in 1845 or the rescue of the Syrian gene-bank by the outbreak of the civil war) in the knowledge-dissemination of the Grant PGR.

No use of pesticides allowed in knowledge to be disseminated
Cultivation in the Grant PGR only included environment friendly farming, and "no use of mineral fertilizers is allowed for cultivation as in organic farming. Only plant protection products approved for organic farming may be used" (see fig. 7) (the Danish Ministry of Food, 2012). The aim of this was adapted from the first implementation of the Common Rural Development Policy in 1992 one of the focus areas and was to protect the environment against pollution (Commission of the European Communities, 1992). Thus no mineral fertilizers or pesticides were allowed in the demonstration projects. The environment was one of the three key areas in the EU Rural Development Policy 2007 to 2013 (The Council of the European Union, 2006), and thus conservation of genetic resources in agriculture was made a part of the context, where farmers and other land managers should: "apply agricultural production methods compatible with the protection and improvement of the environment" (European Commission, 2005: 35). So the decision of how PGR could be grown was taken at the EU-level (see fig. 11), and the Danish Ministry of Food had to integrate it into the Grant PGR, when they decided to make it part of the Rural Development Programme in EU's Rural Development Policy 2007 to 2013. Here one of the purposes was to test suitability for environment friendly farming and food products.

Many old varieties of PGR are well-suited for organic farming as they were originally grown before modern pesticides and mineral fertilizers were commonly used and have thus been adapted to low-input agriculture (Borgen & Grupe, 2012). In our view this makes organic growing of old varieties of PGR on the field level a good choice, and the demonstration-projects could help to test suitability for environment friendly farming and food products. We think, however, that a requirement that cultivation of plants in the Grant PGR could only be with organic methods is problematic to conservation. When preserving plants and establishing collections and duplicates it might sometimes be necessary to use pesticides to conserve all varieties, including the fragile ones. Senior

lecturer from the Pometum at University of Copenhagen, emphasized this problem: ”Gene conservation must be separated from the demands for organic cultivation, since the pesticide treatment may be necessary to avoid losing the material” (The Ministry of Food, 2014, p. 7). This means, to us, that the purpose to protect PGR in the Grant PGR was not fully met, and as the grant should at the same time help Denmark to fulfil its obligations according to the FAO-treaty (to conserve PGR), this was not fulfilled either. We therefore suggest that it would have been better either to allow pesticides to conserve fragile varieties or to subsidize conservation of PGR in gene-banks and clone-collections in a different way.

Conclusion

This paper has analyzed how knowledge about conserving, growing, and using food plants in a sustainable way was built into a national grant-scheme to disseminate this knowledge to the public through demonstration-projects. The aim of the grant-scheme was to protect plant genetic resources for food and agriculture (PGR) by giving support for projects which conserved and promoted the sustainable use of old Danish PGR worthy of conservation. At the same time suitability for environment friendly farming and food products could be tested. Furthermore the Grant PGR should increase public awareness and interest in conservation of plant genetic resources. The scheme would at the same time help Denmark to fulfil its obligations according to the FAO treaty on PGR and UN’s Biodiversity Convention.

The knowledge was changed in the process by which the grant-scheme was formulated, and the framework Didactic Transposition was used to analyze the factors that had an important impact on the changes. Many of these factors aid the process of knowledge-dissemination, but some of them also limit the process and might result in conflicts and misinterpretations.
The point of reference is called ‘scholarly knowledge’, and the knowledge in the grant-scheme is called ‘knowledge to be disseminated’. The scholarly knowledge is described and conceptualized by scholars, here scientists and practitioners investigating or working with plant genetic resources for food and agriculture (PGR), defined as “any genetic material of plant origin of actual or potential value for food and agriculture” (FAO, 2009, p. 3). This made the knowledge general, and e.g. specific species of PGR, and specific ways to cultivate them were of course part of it, but the knowledge was not limited hereto.
Furthermore, sustainable development of rural areas was not a part of the scholarly knowledge either.

The knowledge was rebuilt to formulate the Grant PGR (knowledge to be disseminated) by the noosphere, which was here primarily the Danish Ministry of Food, Agriculture and Fisheries. In the rebuilding of the knowledge the following factors were limitations in relation to the scholarly knowledge: only Old Danish plant-varieties from gene-bank- and clone-collections could be demonstrated, breeding was not included, no research or technological development were allowed, and only fertilizers and pesticides allowed in organic farming could be used.
Knowledge of sustainable development of rural areas was an enriching factor built into the knowledge to be taught.

The limitations had implications on the demonstration-projects. Limiting PGR to plant-varieties from gene-bank- and clone-collections in the demonstration-projects were well suited to supporting dynamic on-farm conservation of Old Danish varieties and therefor to help the conservation of the ex-situ collections of valuable Danish PGR. It also helped Denmark to fulfil its international obligations. But the limited selection of old plant-varieties, not in present production, was less suited for increasing public awareness and interest in conservation of PGR as this should include communicating the importance of sustainable rural development, fight against hunger and adaptation to future needs. Furthermore the demonstration of solely old varieties gave a 'museological' impression of PGR. This was enhanced by breeding not being included in the knowledge to be disseminated, as only the original old varieties could be grown and demonstrated. This means that one of the aims of the Grant PGR: to increase public awareness and interest in conservation of PGR was limited. Furthermore the restriction to include research in the demonstration-projects was problematic, as one of the aims of the projects was to get knowledge about growing properties of the plant varieties and evaluate their suitability for food. This restriction was contradictory as it is difficult to test and gather knowledge without doing research. Therefor the purposes of the Grant PGR to test suitability for environment friendly farming and food products were not possible to do in a scientific way. The exclusion of using artificial fertilizers and pesticides was suitable for testing suitability for environment friendly farming and food products made from old varieties of PGR on the field level. But to conservation of PGR ex situ this decision was problematic as it is sometimes necessary to use pesticides to conserve fragile varieties. This means that the purpose to protect PGR in the Grant PGR was not fully met, and as the grant should at the same time help Denmark to fulfil its obligations according to the FAO-treaty (to conserve PGR), this was not fulfilled either.

Knowledge of sustainable development of rural areas was an enriching factor resulting for instance in development of successful high-quality products in the demonstration-projects. These brought out knowledge of PGR to the public and thus the Grant PGR actually fulfilled the purpose of the EU policy by increasing genetic variation in agriculture, and enhancing sustainable development of rural areas through development of new quality products. But the expensive foods made from Old Danish PGR might at the same time have contributed to a view on PGR more connected to luxury products with a Nordic history than to fight against hunger and a necessity for the future.

These factors all influenced the knowledge that could later be disseminated in the demonstration-projects, and the aims of the Grant PGR could not be fully met. All limitations were a result of adaptations of the Grant PGR to EU's Rural Development Policy. This means that though the Danish Ministry of Food formulated the Grant PGR, these decisions were taken on the EU-level, and the Danish Ministry of Food had to integrate them into the Grant PGR, when they decided to make it part of the Rural Development Programme in EU's Rural Development Policy 2007 to 2013. Also the enriching factor: adding knowledge of sustainable development of rural areas to the knowledge to be disseminated had its origin in the adaptation to EU's Rural Development Policy. But though it fulfilled its aim to let the agrifood economy, the environment, and the broader rural economy and population go hand-in-hand, it showed at the same time the difficulty to include raising public awareness of PGR in these aims in a way that reflected the most important core of the scholarly knowledge of PGR.

We argue that to increase public awareness and interest in conservation of PGR it would have been better to demonstrate a broader diversity of plants, including modern varieties. This would show the development of food plants and the connection between former, present, and future agriculture. This would also make it easier to disseminate knowledge of why it is essential to preserve the broadest possible variation, and the 'museological' impression could have been avoided. Including breeding in the demonstration-projects could emphasize these focus-points as it would give the public knowledge about how PGR are used to improve plants and develop agriculture. This would further disseminate knowledge of the importance of conservation. If environment friendly farming is chosen as cultivation-form, conservation of PGR in gene-banks and clone-collections must be subsidized in other ways, as it is sometimes necessary to use pesticides to conserve fragile varieties. The restrictions to include research and technological development in the Grant PGR should be taken out of the Grant PGR to make it possible to test the suitability for environment friendly farming and food products of PGR in a scientific way. Development of new quality products on the basis of PGR is positive and helps to raise public awareness on how PGR are used in the development of new quality food-products. To avoid connecting PGR only to luxury products with a Nordic history this could be supplemented by increasing public awareness about PGR's role in fight against hunger and development of food for the future worldwide.

This analysis shows how scholarly knowledge about conserving and growing food plants in a sustainable way was changed when being rebuilt into the grant-scheme. Severe limitations to the knowledge were found as a result of the adaptation to EU's Rural Development Policy, making it difficult to fulfill the National Rural Development Programme as well as international obligations: the FAO treaty on PGR and UN's Biodiversity Convention. And though central goals of EU's Rural Development Policy were fulfilled with the development of expensive quality food-products it was difficult at the same time to include raising public awareness of PGR in a way that reflected the scholarly knowledge of PGR properly. This influenced what could later be disseminated to the public in the demonstration projects.
Therefore it is important that the noosphere is explicit about the knowledge it selects and deselects in the transposition process and that they are aware of adaptations due to embedding in policies on all levels.

Adaptation of the Didactic Transposition process to the analysis of PGR
Although the framework of Didactic Transposition was originally developed in science education research in school contexts, the similarities to the process of analyzing dissemination of knowledge of PGR through a grant-scheme made the adaptation quite relevant: both processes were transforming objects of knowledge, and in the first step of the process analyzed in this paper, the grant-scheme sets conditions for the later dissemination of knowledge in a manner similar to that of the curriculum in schools.

Using Didactic Transposition as an analytical tool has made it possible to analyze a difficult process of knowledge transformation with many factors influencing the process. The decisions taken in the Ministry while formulating the Grant PGR could be compared to the scholarly knowledge of PGR as a reference. The framework made it possible to analyse which knowledge came and which did

not come from the reference knowledge, and thus we could compare it to the FAO-level, the EU-level, or the national level. The didactic transposition process further made it possible to understand at which level the decisions to change the knowledge were taken and how it influenced the knowledge that could later be disseminated in the demonstration-projects. Finally it was possible to evaluate whether the decisions taken in the formulation of the grant-scheme were appropriate in relation to the scholarly knowledge and how dissemination of knowledge about PGR through the grant-scheme could be optimized if they were not.

Next step could be analyzing the knowledge disseminated in the demonstration projects. How did the conditions set in the Grant PGR influence the knowledge that was disseminated? How did the Informal Learning Environments handle the limitations? How did they enrich the knowledge? After this it would be interesting to look at the last step: How is the knowledge learned by the public? Through all steps of Didactic Transposition it will be interesting to see, whether the steps taken in the processes can influence the step before: the double arrows in Didactic Transposition (see fig. 2). This could be misinterpretations of the knowledge learned by the public in the last step of Didactic Transposition that could change the knowledge disseminated in the demonstration-projects or in the Grant PGR (knowledge to be disseminated) in order to make interpretation easier.

Didactic Transposition could become a useful analytical tool in other cases, where an object of knowledge is transposed from a scholarly environment to a political environment, and built into for instance a law. Looking at the decisions made in the transformation process it will be possible to see, how the scholarly knowledge is enriched or limited by the conditions set by political agendas or other decisions in the process and whether the conditions are appropriate for the way the law can later be carried out. This can lead to more explicit choices in the development of grant-schemes, laws, programs, and other political instruments building on a body of scholarly knowledge.

References:

Astolfi, J.-P., Darot, É., Ginsburger-Vogel, Y., & Toussaint, J. (1997). Transposition didactique [Didactic Transposition]. In J.-P. Astolfi, É. G.-V. Y. Darot & J. Toussaint (Eds.), Mots-clés de la didactique des sciences. Repères, définitions, bibliographies (pp. 177-187). Paris: De Boeck & Larcier.

Bade, J. (2015). Obstmanufaktur, Erhaltung und Pflege historischer und bewährter Obstsorten. Sortenerhalt | [WWW Document]. URL http://www.obstmanufaktur.com/?page_id=83 (accessed 3.10.15).

Bosch, M., Gascón, J. (2006). Twenty-five years of the Didactic Transposition. ICMI Bulletin 58, 51–63.

Borgen, A., Grupe, P. (2012). Gamle danske kornsorter. En rapport om deres historie og om anvendelsen i økologisk landbrug (Slutrapport om kornprojekterne på Mørdrupgård 2006-12. 43 sider.).

Bundesministerium für Land und Forstwirtschaft, Umwelt und Wasserwirtschaft (2007). Österreichisches Programm für die Entwicklung des Ländlichen Raums 2007 - 2013.

Chevallard, Y. (1985). *La transposition didactique: du savoir savant au savoir enseigné*. [Grenoble]: la Pensée sauvage.

Chevallard, Y. (2013). A Theoretical Approach to Curricula. JMD 13, 215–230. doi:10.1007/BF03338779.
Chevallard, Y., Bosch, M., (2014). Didactic Transposition in Mathematics Education, in: Lerman, S. (Ed.), Encyclopedia of Mathematics Education. Springer Netherlands, pp. 170–174.
Clément, P. (2006). Didactic Transposition and the KVP model: conceptions as interactions between scientific knowledge, values and social practices. *Paper Presented at the Proceedings of the ESERA Summer School, Braga, Portugal.*
Commission on Genetic Resources for Food and Agriculture (Ed.). (2012). *Second global plan of action for plant genetic resources for food and agriculture: adopted by the FAO Council, Rome, Italy, 29 November 2011*. Rome, Italy: Commission on Genetic Resources for Food and Agriculture, Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/docrep/015/i2624e/i2624e00.pdf
Commission of the European Communities (1992). Council Regulation (EEC) No 2078/92/EEC of 30 June 1992. Official Journal of the European Communities 215, pp. 85-90 (1992). Retrieved from http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=013608&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL
European Commission. (n.d.) Rural Development policy 2007-2013 - Country files. Retrieved June 13, 2016, from http://ec.europa.eu/agriculture/rurdev/countries/dk/index_en.htm
European Commission (1998). *State of application of regulation (EEC) no. 2078/92: Evaluation of agri-environment programmes* (DGVI COMMISSION WORKING DOCUMENT No. VI/7655/98). Brussels.
European Commission. Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), Official Journal of the European Union. Brussels. (2005). Retrieved fromhttp://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32005R1698&
Falk, J.H., Dierking, L.D., (2010). The 95 Percent Solution. American Scientist 98, 486. doi:10.1511/2010.87.486
FAO. (2009). *International Treaty on Plant Genetic Resources for Food and Agriculture*. IUCN. Retrieved from http://www.planttreaty.org/content/texts-treaty-official-versions.
FAO. (2010). *The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture.* Rome: Commission on Genetic Resources for Food and Agriculture, Food and Agriculture Organization of the United Nations.
FAO. (n.d.). List of Countries | The International Treaty. Retrieved October 29, 2015, from http://www.planttreaty.org/list_of_countries.
FAO. (n.d.) b. The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture. Country Reports. Retrieved June 13, 2016, from http://www.fao.org/docrep/013/i1500e/i1500e00.htm
Fowler, C., Hodgkin, T. (2004). Plant genetic Resources for Food and Agriculture: Assessing Global Availability. Annual Review of Environment and Resources 29, 143–179. doi:10.1146/annurev.energy.29.062403.102203.
Hansen, Per Henrik (2015). Dyrkning af spelt, emmer og enkorn - Økologi.dk [WWW Document]. URL http://www.okologi.dk/landmand/fagomraader/oekologisk-planteavl/broedkorn/korn/spelt,-emmer-og-enkorn.aspx (accessed 3.7.15).

Hansen, Åse (2015). Oplagt med samarbejde landmand-møller-bager - Økologi.dk [WWW Document]. URL http://www.okologi.dk/landmand/fagomraader/oekologisk-planteavl/broedkorn/korn/samarbejde-landmand-moeller-bager.aspx (accessed 3.10.15).
Hoisington, D., Khairallah, M., Reeves, T., Ribaut, J.-M., Skovmand, B., Taba, S., Warburton, M. (1999). Plant genetic resources: What can they contribute toward increased crop productivity? PNAS 96, 5937–5943. doi:10.1073/pnas.96.11.5937.
Kuhn, T. S (1994). *The Structure of scientific revolutions* (2nd ed., enlarged). Chicago, Ill: Chicago Univ. Press.
Larsson, H. (2015). Forsker: Høj kvalitet i gamle sorter - Økologi.dk [WWW Document]. URL http://www.okologi.dk/landmand/fagomraader/oekologisk-planteavl/broedkorn/korn/kvalitet-i-gamle-sorter.aspx (accessed 3.7.15).
Mortensen, M. F. (2010). Museographic Transposition: The Development of a Museum Exhibit on Animal Adaptations to Darkness. *Éducation et Didactique*, *4*(1), 115–138. http://doi.org/10.4000/educationdidactique.763
National Research Council (2009). *Learning Science in Informal Environments: People, Places, and Pursuits.* Committee on Learning Science in Informal Environments. Philip Bell, Bruce Lewenstein, Andrew W. Shouse, and Michael A. Feder, Editors. Board on Science Education, Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.
Nordic Foodlab, (2011). Potato Evaluation. Blog: http://nordicfoodlab.org/blog/2011/05/potato-evaluation-2. Nordic Food Lab.
Novak, J.D., Cañas, A.J. (2008). The theory underlying concept maps and how to construct them (Technical Report IHMC CmapTools No. 2006-01 Rev 01-2008). Florida Institute for Human and Machine Cognition.
Rao, V.R., Hodgkin, T. (2002). Genetic diversity and conservation and utilization of plant genetic resources. Plant Cell, Tissue and Organ Culture 68, 1–19. doi:10.1023/A:1013359015812.
Simonneaux, L., & Jacobi, D. (1997). Language constraints in producing prefiguration posters for a scientific exhibition. *Public Understanding of Science*, (6), 383–408.
The Council of the European Union, 2006. Council Decision of 20 February 2006 on Community Strategic Guidelines for Rural Development (programming period 2007 to 2013), Official Journal of the European Union.
The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004. Strategi for det danske arbejde med jordbrugets plantegenetiske ressourcer.
The Danish Ministry of Food, Agriculture and Fisheries. (n.d.). Fakta om tilskud til demonstrationsprojekter om bevaring og bæredygtig udnyttelse af plantegenetiske ressourcer for jordbrug og fødevarer. Retrieved October 30, 2015, from http://naturerhverv.dk/tilskud-selvbetjening/tilskudsguide/plantegenetik/#c8639
The Danish Ministry of Food, Agriculture and Fisheries, 2007. Law for Development of Rural Areas, 2007. Lov om udvikling af landdistrikterne (landdistriktsloven), 2007.
The Danish Ministry of Food, Agriculture and Fisheries, 2009. Bekendtgørelse om tilskud til demonstrationsprojekter om bevaring og bæredygtig udnyttelse af plantegenetiske ressourcer for jordbrug og fødevarer - retsinformation.dk [WWW Document]. Retsinformation.dk. URL https://www.retsinformation.dk/Forms/R0710.aspx?id=123370

The Danish Ministry of Food, Agriculture and Fisheries. (2008). Den Levende Kulturarv Fødevareministeriets handlingsplan 2008-10 for jordbrugets plantegenetiske ressourcer. Retrieved fromhttp://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Tilskud/Projekttilskud/Landdistrikter/LAG/handlingsplan_2008-2010_plantegentik.pdf

The Danish Ministry of Food, Agriculture and Fisheries, 2011. Bekendtgørelse om tilskud til demonstrationsprojekter om bevaring og bæredygtig udnyttelse af plantegenetiske ressourcer for jordbrug og fødevarer - retsinformation.dk. Retsinformation.dk. https://www.retsinformation.dk/Forms/R0710.aspx?id=123370.

The Danish Ministry of Food, Agriculture and Fisheries. (2011) a. Fra genbank til spisebord Fødevareministeriets handlingsplan 2011-13 for jordbrugets plantegenetiske ressourcer. Retrieved fromhttp://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Landbrug/Genetiske_ressourcer/Planter/Publikationer/Handlingsplan_endelig_version_af_25-5-11.pdf

The Danish Ministry of Food, Agriculture and Fisheries (2012). The Danish Rural Development Programme 2007-2013. Retrieved from https://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Tilskud/Projekttilskud/Landdistrikter/LDP_Rev_proposal_Consolid_2007-2013f.pdf

The Danish Ministry of Food, Agriculture and Fisheries (2014). *Referat af Naturerhvervstyrelsens temadag om plantegenetiske ressourcer.docx*. Retrieved from http://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Landbrug/Genetiske_ressourcer/Planter/Publikationer/Referat_fra_temadag_om_plantegenetiske_ressourcer.pdf

Virchow, D. (1999). Conservation of Genetic Resources: Costs and Implications for a Sustainable Utilization of Plant Genetic Resources for Food and Agriculture. Springer Science & Business Media.

Windfeldt, L & Madsen, L (2016). Communicating plant genetic resources for food and agriculture to the public, a study of grant-receivers with demonstration-projects in the Danish Rural Development Programme. *Manuscript in review.*

Wood-Pedersen, P. (2015) a. De lollandske rosiner får nyt liv [WWW Document]. URL http://www.gartnertidende.dk/Gronsager/Nyheder/2015/De_lollandske_rosiner_faar_nyt_liv.aspx#.VP7gVOFhKK8 (accessed 3.10.15).

Wood-Pedersen, P (2015)b. Pigeon fra Maribo er anderledes [WWW Document]. URL http://www.gartnertidende.dk/Frugtbaer/Nyheder/2015/Pigeon_fra_Maribo_er_anderledes.aspx#.VP1xA-FhKK8 (accessed 3.9.15).

Paper 2: Communicating plant genetic resources for food and agriculture to the public

- A study of grant-receivers with demonstration-projects in the Danish Rural Development Programme

L. Windfeldt (corresponding author) and L. M. Madsen
Department of Science Education, University of Copenhagen, Copenhagen, Denmark

Highlights

- Grant-receivers belonging to as well museums, research institutions, private companies, municipalities, pometa, local groups, and NGOs communicated plant genetic resources for food and agriculture (PGR) to the public in a grant-scheme, which was part of the Danish Rural Development Programme 2007-13.
- The grant-receivers had a potential to disseminate knowledge and raise public awareness of PGR because their communication was coherent and well integrated in the institution. Furthermore they used activities known from Informal Learning Environments to enhance learning to make the abstract PGR concrete for their visitors.
- The collective of grant-receivers increased this potential, since all facilitated the same core message with the same overall purpose and many different angles in many different places at the same time.
- The obligation to communicate to the public as part of an agricultural and environmental subsidy could improve the results of the same grant-scheme in other countries.

ABSTRACT

The Danish Ministry of Food, Agriculture and Fisheries has supported demonstration of plant genetic resources for food and agriculture through an EU grant-scheme in the years 2008-2013. This paper evaluates the individual as well as the collective potential of the grant receivers to promote public education about plant genetic resources. All grant-receivers are regarded as Informal Learning Environments, though the institutions are very diverse and include research institutions, museums, private companies, municipalities, pometa, local groups, and NGOs. The results show that the institutions had a high individual potential to promote education of plant genetic resources to the public. The potential was increased by many institutions with the same purpose disseminating the same core message with many different angles in different geographical places at the same time. This gives a possibility to reach more target groups in different ways with knowledge of plant genetic resources.

The results are discussed and compared to the implementation of the Rural Development Programme in other countries.

Key words: Plant Genetic Resources for Food and Agriculture; Rural Development Programme; raise public awareness; grant-scheme; Informal Learning Environments; Denmark

Introduction

The landscapes in Europe have over the decades been the object of a range of agricultural and environmental policy reforms and planning initiatives from both the European Union and the individual member states (Primdahl, 2014). The Rural Development Programme was introduced in 1992 and formally emphasized an environmental move of European agriculture policy and practice. With a range of voluntary environmentally subsidy schemes and the organic farming support measures the programme was put in place to enhance environmental friendly farm practices and focus on biodiversity and quality of the products within the agricultural sector (Primdahl, 2014), for example management agreements (Kleijn et al., 2001) and afforestation programmes (Duesberg et al., 2014; Marey-Perez and Rodriguez-Vicente, 2009; Madsen, 2001).

Research has studied effects and consequences of these subsidy programmes both in relation to the barriers for uptake (e.g. Burton et al., 2008; Wilson and Hart, 2000), their environmental impact (Davey et al., 2010; Hodge and Reader, 2010; Klein et al., 2003) and the used implementation models (Primdahl et al., 2010). A number of the subsidies have what could be termed communication obligations to act as e.g. 'stewards of knowledge' of old agricultural practices (e.g. haymaking, grassland management), as public good (e.g. urban afforestation) and some have either implicit or explicit dissemination of knowledge to the public as part of their requirements. Research of these communication obligations has to our knowledge been very sparse, and we are still left with uncertainties of how knowledge is communicated to the broader public as a result of the agricultural and environmental subsidies under the Rural Development Programme.

To address the research gap concerning the subsidy programmes' communication obligations this paper analyses the communication potential of the 'Grant for demonstration projects about conservation and sustainable use of plant genetic resources' (Grant PGR) implemented in Denmark as part of the Danish Rural Development Programme 2007-13 (The Danish Ministry of Food, Agriculture and Fisheries [The Danish Ministry of Food], 2012). The grant subsidizes demonstration of food plants and aims to broaden public knowledge about plant genetic resources for food and agriculture (PGR). The paper evaluates both the quality of knowledge-dissemination on the individual grant-receiver level as well as the collective dissemination potential of the receivers of the Grant PGR.

The paper is organized as follows. First, the materials and methods are outlined. Secondly, the theoretical framework is presented. Thirdly, the results are unfolded in three parts:

Part I Consistence of the PGR-concept

Part II Coherence of the communication
Part III the Grant PGR's educational potential
The results are summarized on as well the individual as collective level, and compared to the implementation in other EU-countries. However, first we need to establish why communication of PGR is important and how it relates to the Rural Development Programme.

Why raising public awareness of plant genetic resources?

As stated by The Food and Agriculture Organization of the United Nations (FAO) mankind depends on having access to suitable plants for food by preserving the broadest possible variation. This will ensure a varied food supply now and in the future and thus promote health, provide a variety of nutrients and flavors, and enhance our quality of life (FAO, 2009). As the diversity and variation in these food plant resources is mainly based on different genetic combinations, preserving the broadest possible variation means that we need to conserve: "any genetic material of plant origin of actual or potential value for food and agriculture" (FAO, 2009: Article 2).
The worldwide work of developing effective and sustained conservation and utilization practices of PGR is organized through FAO and stated in the International Treaty on Plant Genetic Resources for Food and Agriculture (FAO, 2009). Importantly, the treaty is an exception from the Convention of Biological Diversity with the aim to establish a global system to provide users with access to plant genetic materials from a number of specific crops (e.g. rice, wheat, potatoes and apples) through the Multilateral System. The Multilateral System is the Treaty's solution to access and benefit sharing. It puts 64 of our most important crops – crops that together account for 80 percent of the food we derive from plants – into an easily accessible global pool of genetic resources that is freely available for research, breeding and training to potential users in the Treaty's ratifying nations (FAO, n.d. a). All countries which have signed or ratified the treaty are responsible to conserve and use their PGR in a sustainable way (FAO, 2009) as well as to raise public awareness. This has been stressed by FAO in a number of ways including:

> Raising public awareness of local crops and varieties can help build a broader base of support. This can be achieved in many ways, for example, through personal contacts, group exchanges, diversity fairs, poetry, music and drama festivals and the use of local and international media (Commission on Genetic Resources for Food and Agriculture, 2010, p. 42).

Raising public awareness of PGR is often mentioned together with 'training', which is traditionally understood as education in the school system to enhance the understanding of PGR (e.g. Commission on Genetic Resources for Food and Agriculture, 2010; FAO, n.d. b) However, NordGen (the Nordic Gene Bank) has recently started to regard dissemination of knowledge about PGR taking place in museums or comparable places as training as well. This means that they see dissemination of knowledge about PGR on these sites as a possibility to reach an audience, which has not had the opportunity to get this knowledge in school, because it has not been part of the curriculum (Personal communication with a representative from NordGen, 21.10.2014).

Hence, an important part of preserving PGR is to disseminate knowledge in order to secure public interest and understanding of their importance.

Raising public awareness of PGR in Denmark

In Denmark, this has been addressed at the political and planning level through a strategy and a series of three-year action plans in the Ministry of Food, Agriculture and Fisheries (the Ministry of Food) (The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004). The Grant PGR has been part of the action plans, and disseminating knowledge to the public was an obligation in the grant's demonstration-projects.

Since the introduction of the EU-programme in 1992, protection of genetic diversity has been one of the focus areas. The background for this was a concern that varieties of useful plants were threatened with genetic erosion because they were not competitive against the modern high-producing varieties (The Council of the European Union, 1998). Continued in the Rural Development Programme 2007-2013 conservation of genetic resources should be given specific attention to combat genetic erosion and through this enhance biodiversity in agriculture. This was part of the focus on encouraging farmers and other land managers to introduce or continue "to apply agricultural production methods compatible with the protection and improvement of the environment , the landscapes and its features, natural resources and the soil" (The Council of the European Union, 2005: 35). There were no obligations to communicate PGR to the public.

A representative from the Ministry of Food, which was taking part in the design and implementation of the Danish Grant PGR said about this:

> We could see that PGR were mentioned in the Rural Development Programme, but subsidies were meant for those, who still cultivated them, in for instance Austria and Italy. They could be compensated. But we were not in that situation in Denmark. At best we had PGR in gene banks (Personal communication, 8. Oct, 2014).

Hence, PGR were included as a grant-scheme for demonstration projects: "with the participation of both farmers and several public institutions" (The Danish Ministry of Food, 2012, p. 377). The projects should test: "the use of existing plant species in an agro-environment and disseminate knowledge about the importance of genetic plant resources within agriculture and food production" (ibid: 377), and at the same time help Denmark to fulfil its obligations according to the FAO treaty (The Danish Ministry of Food, 2012).

The programme was executed as The Danish Law on Development of Rural Areas with the purpose of contributing to the sustainable development, where growth is based on sustainable use of resources, and where local participation at the same time contributes to create attractive living conditions and local jobs (The Danish Ministry of Food, 2007, § 1). The protection of genetic plant resources through demonstration projects was included in the law as part of § 2:

> The Minister of Food, Agriculture and Fisheries can provide grants for the following schemes…4) schemes for sustainable use of farmland, which includes c) environment friendly agriculture, including organic farming (ibid. § 2).

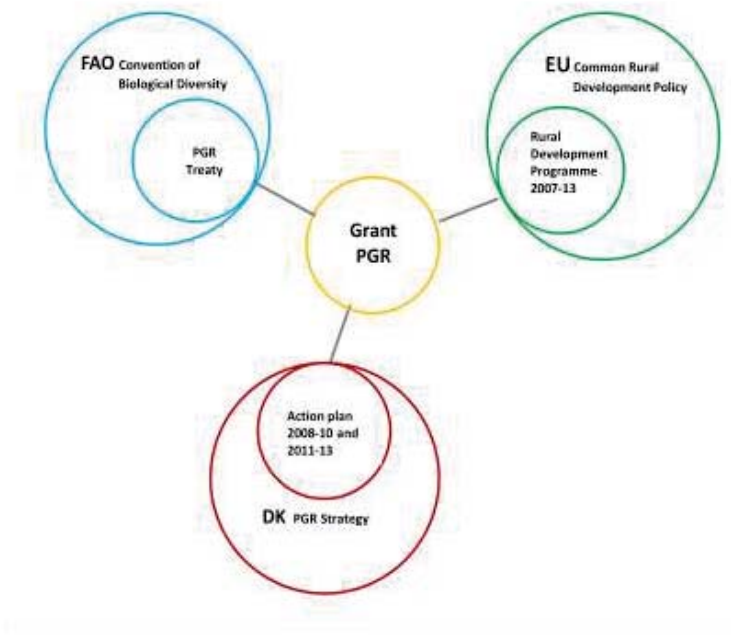


Figure 1: Grant PGR was part of

- **FAO**'s PGR Treaty with the purpose to conserve and use PGR in a sustainable way to fulfil the Convention of Biological Diversity. **Communication objectives:** Disseminate knowledge to secure public interest and understanding of importance.
- **EU**'s Rural Development Programme 2007-2013 with the purpose to combat genetic erosion and through this enhance biodiversity in agriculture to fulfil the Common Rural Development Policy. **Communication objectives:** None. Danish implementation: Disseminate knowledge about the importance of genetic plant resources within agriculture and food production.
- **DK**'s Action Plans for Agricultural PGR 2008-10 and 2011-13 with the purpose to conserve and use PGR sustainably for future agriculture to fulfil the Strategy for The Danish Work with Agricultural PGR. **Communication objectives:** Broaden

Materials and methods

The empirical data consist of applications from all the receivers of the Grant PGR in the period 2008-2013. The grant was launched in 2008, and in total 28 receivers have been awarded through the six applications rounds from 2008-13. The grant has not been awarded in 2014, and in 2015 a new setup was made.
Selection of informants for qualitative interviews has been done in the following steps: first all 28 grant receivers were divided into eight categories, based on document analysis of their original grant proposals. The document analysis outlined the characteristics of the receivers' different focus, including focus on communication and audience. Secondly, ten receivers representing all eight categories were selected for qualitative interviews. Two institutions were chosen from each of the categories 'Companies and producers' and 'Museums' as they were expected to be very different. In the selection, receivers using different media were preferred, if possible, to establish the broadest potential effect of the communication and teamwork. Also the broadest geographical spread was chosen (see fig. 4). Table 1 summarizes the characteristics of the eight categories and gives short descriptions of all receivers selected for qualitative interviews (named with "i").

Category	Characteristics	Grant Receivers	Selected for interview
Research institutions	science, knowledge, development	2	Ai: Horticultural research inst., communicates PGR in different media
Companies and producers	propagation, production, marketing	9	Ai: Big vegetable company, sells vegetables on-line, communicates PGR in many different media, many visitors Bi: Small gastronomic gourmet restaurant, communicates PGR in different media
Local groups with public access	conservation, local display	4	Ai: Community with different ideas of communicating PGR to members/non-members in different media
Municipalities	conservation, local identity and display	2	Ai: Provincial town with display of PGR in public areas, teamwork with local museum
Open farms	testing, display for visitors	1	A: Demonstration-farm, communicates PGR in different media. Only one stakeholder in this group [8]
Pometa	gene conservation, public display	2	Ai: Private pometum and nursery, communicates PGR in different media.
NGOs	gene conservation, public display	2	Ai: Seed savers, communicates PGR by members and at markets.
Museums	demonstration, public display	5	Ai: Zoo, combines communication of PGR in the rainforest and in Denmark Bi: Cultural history museum, communicates PGR in many different media

Table 1: Categories of receivers, characteristics and a brief description of the 10 selected for interviews. List of all grant-receivers is in appendix A.

[8] No interview was made in this category, as it contained only one receiver, which moved their activities to a producer due to illness.

Qualitative interviews (Kvale, 1997) have been made with 9 receivers of the grant (with the leader of the institution or the leader of the demonstration project in the institution). Seven of the interviews were conducted at the institutions or place for the demonstration of PGR. As NGO Ai has no physical institution, the interview was conducted in the leader's garden. The leader of the demonstration project at Research Institution Ai was interviewed at a university. Interviews included co-producing concept maps of the receivers' definition of and associations to PGR (Novak and Cañas, 2008). Themes for the interviews were: objectives for the demonstration projects and characteristics of the institution, used media, target groups and their response to the communication. All concept maps were made sitting together with the informant, but two of the interviews were made by telephone (Municipality Ai, Museum Ai). Additionally some of the communicative material produced by the 9 receivers was collected and its use was outlined by the receivers in the interviews. The interviews were held in Danish, lasted between 2 and 3 hours and were subsequently transcribed.
At the policy level qualitative interviews were made with a representative from the Ministry of Food, who was taking part in the design and implementation of the Grant PGR, and with a representative from NordGen under the Nordic Council of Ministers dedicated to the safeguarding and sustainable use of plants, farm animals and forests in the Nordic countries. Focus in these qualitative interviews was to unfold the history and present status of both the specific Grant PGR and the political background concerning the communication of PGR. Both interviews lasted 1-2 hours, and were subsequently transcribed. All quotes made in the text are translated choosing verbatim translations rather than linguistically correct ones.

Theory

Research of the communicative aspects in the different subsidy programmes under the Rural Development Programme has been sparse and mostly dealing with communication related to the uptake of subsidy programmes (e.g. Christen et al., 2015). To address the communicative obligations to the public in the Grant PGR we therefore turn to communication theory. As debated within the research field (Van Gorp, 2007; Craig 2015) communication theory continues to be 'productive fragmented', a term introduced by Craig (1999). Theories of communication provide normative models for understanding the practice of communication; however they do not form a coherent whole rather they contribute to an understanding from different perspectives (Craig, 1993). As such the diversity and lack of an overarching theory of communication is seen as good for the sake of productivity (Craig, 2015). However, wanting to apply communication theory it challenges the selection of communication model and demands transparency in the application process.
As mentioned earlier the goal in *part II* is to evaluate the coherence of the grant-receivers' communication. This we do by using the communication theory New Circle Model. The goal in *part III* was to evaluate the dissemination potential. Since the purpose of the communication is

dissemination of knowledge, we take a new and innovative approach by considering the receivers as Informal Learning Environments. Both approaches are outlined in the following.

Communication model: the New Circle Model

The New Circle Model is mostly used in the planning phase of communication, and focuses on the relations that need to be clarified and fit together to develop a message in a certain media (Ingemann 2003). As noted by Smedegaard (2003) the circle model has its origin in the work on public communication campaigns by Atkin and Rice (1981) and – as illustrated in Figure 2 – divides the communication in the following six elements: content, target-group (audience), sender, communication-environment, media and design/shaping of the communication, which are interrelated to fulfil the objective/premise and give effect (Ingemann, 2003). We use the model to evaluate the coherence in the communication of PGR of the individual grant-receivers, since communication must be coherent to reach its objective.

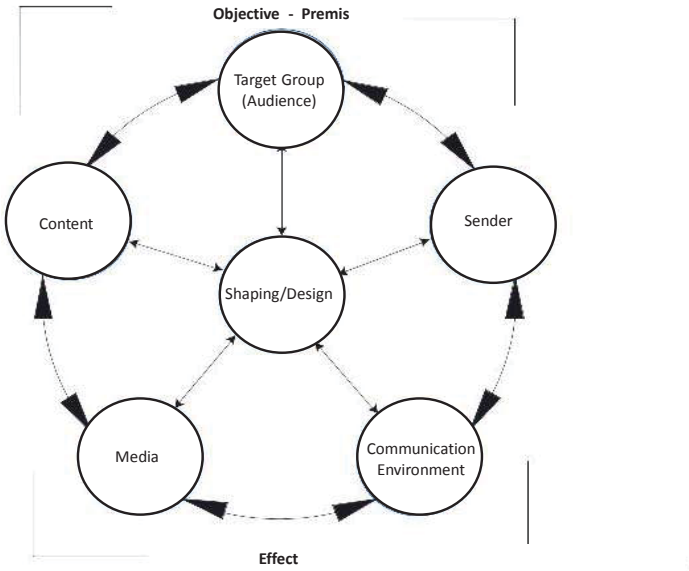


Figure 2: The New Circle Model - the model for planned communication (Ingemann, 2003).

Grant receivers as Informal Learning Environments

Research during the last years indicates that the general public acquires a considerable part of its knowledge about scientific subjects from Informal Learning Environments such as museums, radio or newspapers (Hein, 1998; Falk and Dierking, 2010; Falk and Needham, 2011; Falk and Needham, 2013; Nature Editorial, 2010; National Research Council, 2009; Rennie, 2014). Informal Learning Environments are places with an opportunity of learning for the public outside of school, building

on learner choice, no consequence assessment, and structures that build on the learners' motivations, culture, and competence (National Research Council, 2009). For many adults this is the only opportunity they have to familiarize themselves with topics and ideas that did not exist in their own school days, such as genetically modified crops, internet privacy or climate change (Nature Editorial, 2010).

All grant-receivers have been categorized into 8 different categories of institutions (see table 1). We consider each of these to be an informal learning environment with respect to the dissemination of PGR to the public. The rationale of this is that the institutions are required to disseminate knowledge of PGR to the public, when they are being awarded the Grant PGR. The Danish Government (in practice: the Ministry of Food) is responsible for engaging the public in PGR, and as this task is partially fulfilled by the institutions through the Grant PGR, we consider them as acting on behalf of the Government. Thus the companies and research institutions carry out dissemination of knowledge similar to the involved museums, which have communication in the service of society as one of their overall purposes (ICOM, n.d.). Considering the different grant-receivers as Informal Learning Environments opens up for analyzing the educational potential established at these diverse institutions.

The definitions and characteristics of the used framework to analyze the educational potential build on an American report by The Committee on Learning Science in Informal Environments from 2009. The committee was established to look at the potential of Informal Learning Environments for science learning and included 14 experts in science, education, psychology, media, and informal education. The report is a broad review of international literatures that inform learning science in informal environments and includes more than 200 sources of literature (National Research Council, 2009).

The types of settings, where science learning outside of school occurs are very diverse and can be classified as *everyday experiences,* being activities in daily life, such as skiing or biking, that can support science learning; *designed settings,* being settings with an intention behind the phenomena that can be experienced, such as a museum or a zoo; *programmes,* being subscribed groups, which recurs over time so that educators can have a prolonged conversation with their audience, e.g. hobbyists; *media-platforms,* being television, newspapers or social media, which also give the opportunity to prepare and process experiences, when they can be reached independently of the physical environment (National Research Council, 2009)

According to National Research Council (2009) four main characteristics of quality learning experiences can be distinguished, when offered by Informal Learning Environments:

1. *They engage participants in multiple ways; physically, emotionally, and cognitively:* Experiences designed to elicit participants' emotions or sensory responses to scientific and natural phenomena, followed by a learning goal. Besides direct experiences, interpretive materials (e.g. labels, signs, audio-guides, dialogue with staff) are proved to contribute substantively to science learning. Integration of multiple senses improves as well learning as the number of potential learners.

2. *They encourage participants' direct interactions with phenomena of the natural and designed physical world, largely in learner-directed ways:* Direct access to phenomena of the natural and designed physical world and interactivity.
3. *They provide multifaceted and dynamic portrayals of science:* Visitors get in touch with different scientific fields and their diverse cultures giving different perspectives of the world around us and how to get knowledge from it. Different fields also have different values and practices of science, which reflect the diverse cultural values of the people engaged in it.
4. *They build on learners' prior knowledge and interests:* Visitors can link their sensory experiences to their prior knowledge and experiences. The outcome seems to depend on a person's existing knowledge base. Museum professionals call it 'creating hooks' from science content to everyday life and familiar activities, often also building on visitors' memories and personal interests.

These four characteristics are used to assess the educational potential of the activities and materials from the demonstration-projects (see also 'media and design' in Table 2).

Results

To evaluate the dissemination potential of the grant-receivers, results are presented in three parts: *In part I* grant-receivers' definition of PGR is analyzed in relation to the FAO-definition and the purpose of the Grant PGR to evaluate the consistence. *In part II* the coherence of their communication is analyzed using the communication-model New Circle Model. *In part III* the educational potential is analyzed using the framework of Informal Learning Environments.

Part I: Consistence of the PGR-concept

It was found that the institutions' concepts of PGR covered FAO's definition: "any genetic material of plant origin of actual or potential value for food and agriculture" (FAO, 2009: Article 2) and the purpose of the Grant PGR as well, which is to help preserving the great diversity of genetic resources in food and agricultural plants and secure them for posterity through sustainable use (The Danish Ministry of Food, Agriculture and Fisheries, n.d.).

Figure 3:

The concept map drawn by NGO Ai showing their associations to the subject 'plant genetic resources'. The FAO definition and the purpose of the grant scheme is basically covered by the green circles:

Plants:

all parts of plants, cultivated, wild, that can be eaten, crop wild relatives

Genes:

Raw material, continuation, breeding. The gene bank idea is that genes can be kept and used in other ways.

Resources:

Something that we've got or might get in need for. Many types of use by ('people', breeders, museums). Old and good – not bad. Conservation.

A special angle to the subject reflecting the identity and way of working with PGR by NGO Ai is seen in the red circle:

Political:

Independency of transnational companies and authorities

While explaining their understanding of PGR the institutions demonstrated several angles to the subject, and their statements reflected their diverse identities and different ways of working with these resources. This is illustrated by the results for NGO Ai in the following (see fig. 3)

NGO Ai supplemented the concepts of PGR in the following way: "Thinking of *plants* we refer in particular to the cultivated and wild plants that can be eaten and become resources. *Genes* refers to the approach from the gene bank: "We save the genes". They can be taken out and used in other ways for breeding. Scientists don't think that we need more than one of the same varieties – but this does not cover the cultural history or cultural botanical approach: "How have the plants been used, eaten and conserved?" *Resources* are "something that we've got or might get in need for. Museums need other resources than breeders and restaurants."

Other institutions had different angles to PGR; Company Bi associated "cultural heritage or things that grow wild: natural heritage. We must make sure that we pass it on to those who take over the Earth after us." Pometum Ai said: "Old varieties. The best way to conserve them is to make people grow them" and Museum Bi stated that: "We must take care of the living cultural heritage, so that we conserve it - as a museum specimen. But also disseminate knowledge about it to make the general public understand that it is important".

Though the institutions had different associations to the subject, we did not find that any of them had a different or fragmented definition. As seen in the above citations the institutions showed different angles to PGR, reflecting their identity and way of working: The museum regards PGR as

'living cultural heritage' and 'museum specimens', while Pometum Ai regards PGR as something people should grow. NGO Ai regards PGR as something political: "We can grow and save our own seeds and thus be independent of companies and governmental rules". These approaches can be further examined in table 2: 'Sender, objective and content'.

Part II: Coherence of the communication

Knowing that the institutions have the same core-conception of PGR but different angles to the subject reflecting their identities, the next step is to see if their communication of PGR is coherent (Ingemann, 2003) and how they approach it. Besides the elements of *sender, objective, and content* (treated above), also *wanted effect*, *target-groups*, and *media and design* are elements in the New Circle Model needed to evaluate the coherence of the grant-receivers' communication (see table 2).
Regarding *wanted effect* some features are shared by all the institutions interviewed. Most important is that all of them want their target groups to get knowledge of PGR as a wanted effect. Municipality Ai, for instance, wants their citizens to use the possibilities (of having access to PGR) and get knowledge about PGR, while Museum Ai wants that "people realize that Danish PGR can be threatened and want to take care of them". As seen here interest and engagement from the target groups is also a wanted effect for most of the institutions.
Looking at *target groups* they are mainly adults and families. Apart from this they are quite diverse, covering from the average public: 'Mr. and Mrs. Jensen' (Research Institution Ai, Company Bi) to nerds (Company Bi, Pometum Ai). Two of the institutions also have members (Local Group with Public Access Ai, NGO Ai), and Company Ai has subscription customers, which all give the opportunity to communicate during a longer period of time. Members have a special status. In the Local Group with Public Access Ai members can adopt an apple tree, which they take care of, and the members of NGO Ai grow PGR in their own gardens and exchange them. Some of the institutions address a narrow group of people in a limited time of the year, but most of them communicate with a broad target group many times a year, especially when they communicate on web, social media, in newspapers, television or radio (especially: Research Institution Ai, Company Ai, Municipality Ai, Pometum Ai, NGO Ai, Museum Ai, and Museum Bi).
Concerning *media* and *design* all institutions have a webpage, while most of them write articles in local or national newspapers or magazines, television or radio. All institutions have a dialogue with their target groups. This can be through guided tours (Company Ai, Municipality Ai, Pometum Ai, Museum Ai), activity days (Local Group with Public Access Ai, Museum Bi) or at fairs (Research Institution Ai, Company Bi, NGO Ai). The dialogue is combined with tastings in six of the institutions (Research Institution Ai, Company Ai and Bi, NGO Ai, Museum Ai and Bi). This is seen by the institutions as a good way to get in touch with people. Research Institution Ai says: "We typically bring general information on food-festivals. They get the whole story, but then they get tastings as well. This is far the strongest way to disseminate, because we get to talk to people."
Six of the nine institutions grow PGR, which you can watch as a visitor (Company Ai, Local Group

with Public Access Ai, Municipality Ai, Pometum Ai, Museum Ai and Bi), and Museum Bi takes their visitors to the garden to harvest produce, which they afterwards prepare together in the kitchen.

Concerning the *communication environment* the diversity is reflected in the geographical diversification of the institutions (fig. 4) and the places, where they meet their target groups.

Figure 4: Geographical spreading of the 28 institutions. The red circles mark interviewed institutions. A list of all grant-receivers is in Appendix A.

The 28 grant-receivers are geographically spread out from North to South. There are no grant-receivers from Western and Southern Jutland, and none from Mid- and Western Sealand.

The nine interviewed gran-receivers meet their visitors either at the institution in rural areas (Company Ai, Local Group with Public Access Ai, Pometum Ai, Museum Bi), in the city or smaller towns, where some are located (Municipality Ai, Museum Ai), or at markets and fairs (Research Institution Ai, Company Bi, NGO Ai). The communication environment can also be at home by the target group with all media that can be reached independently of the physical environment (National Research Council, 2009).

Grant receiver	Sender, objective and content	Wanted effect	Target groups	Media and design
Research Institution Ai	Emphasis in projects is on production. - Developing a broader assortment of food-products with PGR. - Gene-conservation and innovation through growing of wild fruit and berries in orchards - Finding niches for smaller products to higher prices	Testing: Knowledge of PGR goes from science to consumer, and from consumer back to science. At best: - old varieties are produced and available – the public has many products to choose from and gets aware of protecting nature at the same time	- The private consumer: 'Mr and Mrs Jensen Many segments: children, grown-ups, elderly people, - producers, - industry, - retail sale.	- tastings, - dialogue, - poster and a hand-out - articles in hobby- and professional garden-magazines, - webpage, - press-releases (5-6000) - newsletters - newspapers (national/local) - Radio, - Television. - Direct contact to producers

Grant receiver	Sender, objective and content	Wanted effect	Target groups	Media and design
Company Ai	Grows and sells a variation of organic vegetables in boxes on-line, brought out to the customers. You order a box with undefined vegetables, so the company has the opportunity to put PGR in the box and tell the customer about them. - Test and selection of varieties of PGR to evaluate the commercial potential.	Effect: Get excitement and demand of the good produce back in market. Target groups get information and knowledge about and interest in pgr.	- private customers (primary) and - company-customers order a box with undefined vegetables, also PGR - on-site visitors to the farms, where they experiment with growing and selection of PGR (local, national, internat., professionals (farmers, gardeners).	- Boxes with PGR and a newsletter with recipes telling why and how to use them - plants and board in field - guided tours (arranged, some with tastings or a meal), - fairs (historical cooking, boards, guided tours) - 'country-side kitchen' - local newspaper, - homepage with blogs - Twitter, Facebook, Instagram. - Connection between platforms
Company Bi	Small gastronomic restaurant, also serving less known produce and using microbiology in the kitchen (fermentation makes the taste available). Want to enrich gastronomy and the way we conserve and use resources.	- We must ensure that we pass the cultural and natural heritage of plants on to those, who take over the Earth after us - make people conscious and curious, get them to experiment with fruit from their own garden, making them demand fermented prod. from pgr. -apple-aficionados want to work with fermentation	- Nerds - professionals (chefs, gardeners, cook apprentices), - the public, who will be the ultimate user.	- Fairs with tastings, introductions, dialogue, - Master Class for professional chefs - Flyer for fairs, - homepage with blogs.
Local Group with Public Access Ai	Members: Practical skills are the fundamental basis: learn to graft an apple-tree, get knowledge about genetical diversity, get excited. We collect memories about apples – especially the local 'Nonnetit from Oustrup'	People meet in a cozy, social environment, inspire, teach and learn from each other. We are all newcomers!	Members: the neighbors, many have summer cottages here. Non-members: also neighbors and summer-cottage-people, tourists. Non-members can join all activities by paying.	- Juicing own apples - drafting courses - planting public apple gardens by local art museum and in public spaces - apple-trees are taken into the museum experience. - members 'adopt' a tree - talk, - telling local stories - excursions to hear about PGR - information-boards - web
Muni-cipality Ai	Projects should create visibility about the municipality and the	- Citizens use the possibilities and get knowledge about PGR	- Citizens	Fruit-trees with signs in public space - board explain the project

Grant receiver	Sender, objective and content	Wanted effect	Target groups	Media and design
	green things they do, the recreational possibilities. - utilization, experience and recreational use of PGR. - All PGR are in public space, so everything is fully accessible.	- People plant more apple-trees of old varieties in their gardens, remember the taste of old varieties, pass it on to their children and grand-children.		- audio-guide - guided tours - fruit incorporated into the local development plan - the Municipality homepage - News in local newspapers
Pometum Ai	Big collection of fruit-trees together with nursery. -Visitors can see many varieties of fruit-trees. -PGR have proven their value by being able to grow in the Danish climate. - want people to rediscover old varieties and use them - want to increase demand for good, Danish produce - Knowledge about PGR is not only for sciolists! It must be accessible so that people can use it	We must make people interested in PGR, so they want to plant exactly THIS variety of apple in their own garden. The best way to conserve PGR is to make people grow them.	- garden owners - young families with children, who want to be sure of the things they eat - people +60 years are normally more aware of the value of old var., have time to be interested in growing them. - emphasizes the non-academic target-groups - fruit tree-collectors	- visit the Pometum (visitors may pick fruit that has fallen from trees) - signs and boards - folders - web -guided tours - public campaign for gathering of PGR from private gardens - fruit-festival
NGO	Countrywide non-profit organization for seed saving. - Members can grow PGR as a hobby for their own benefit – and at the same time save the world. -Political and monetary independence: We can grow and save our own seeds and thus be independent of companies and governmental rules	People become members or buy seeds so that the NGO can use money on other activities. - You get interesting old food-plants - You help interesting old stuff back on the dinner-table - we want to inform about PGR - People understand that plants can also become extinct, but that they can help to save them.	Members are variated: men, women, young, old, ethnically, geographically, increasing numbers. Especially urban people are interested in conservation and heritage. Non-members: Mostly garden owners.	- members grow PGR in their own gardens - Web (2 homepages) - meetings (exchange of seeds and knowledge) - Facebook - Markets (seeds, leaflets and books, tastings, dialogue) - Articles
Museum Ai	Our living cultural heritage is threatened like the tropical animals, which are also in the museum.	- People realize that Danish PGR can be threatened and want to take care of them, e.g. by using them.	Visitors to the museum: Children and grown-ups of all ages. Housewives often react on food-	- grow PGR (Museum Ai and Municipality Ai) - signs and boards - web (also from QR) - audio-guide

Grant receiver	Sender, objective and content	Wanted effect	Target groups	Media and design
	This is the reason why we are into this project: people can see that we have plants in DK which are threatened, and we are the only ones to take care of them.	- I hope that people go out and buy PGR after visiting the museum – but for a start: inspiration.	plants, men on plants for beer and mead. This is nice, because it attracts both genders	- food of PGR served for guests 'eat and save' - guided tours with tastings - events
Museum Bi	Museum for food and cultural history of the meal in Denmark: - conserve and demonstrate living cultural heritage - animals and plants - 'muse-um specimens' - disseminate knowledge of PGR on the plate in past, present and the future.	- PGR contribute to tell the story of the meal. - People understand variation in use and taste of the varieties. And the importance: human survival. - demand on PGR from visitors.	Visitors to the museum, especially families Especially activities in holidays incl. summer-holiday: harvest, cooking - articles are for a broader audience	- PGR in the museum-garden - signs and boards - Activity-days (working in garden, cooking with PGR from garden, compare varieties) - food-events (harvest) - Articles - web

Table 2: How the institutions approach their communication of PGR: sender and objective, wanted effect, target groups and media.

Coherence of the elements in the communication of PGR

Communication is found to be coherent in all the assessed institutions (see the example of Municipality Ai in Figure 5). This means that for each of the analyzed grant receivers the elements in the New Circle model are aligned and targeted towards fulfilling the objective and wanted effect of the communication (Ingemann, 2003). Seven of the institutions do what they already did before going into the demonstration projects, and they address the same target groups, which they usually work with, using the same media (Company Ai, Local Group with Public Access Ai, Municipality Ai, Pometum Ai, NGO Ai, Museum Ai and Bi).

Example: Municipality Ai

There is coherence between category of *sender* (conservation, local identity and display), and the *objective* to create visibility about the green initiatives Municipality Ai takes and the recreational possibilities they give to their citizens. To reach the objective they plant PGR in public spaces and give possibilities for locals to use the fruit – also from apple-trees in abolished gardens (the Municipality web-page has a map of these gardens). Everything is fully accessible, and signs, boards and leaflets tell the citizens about the project. Fruit-trees, web-page, leaflets, signs and boards are all seen as *media*, and the *communication environment* is primarily outside in Municipality Ai, where the citizens pass. There is also a new neighborhood, where fruit-trees are incorporated in the local development plan: with a noise zone towards a highway, recreational area with a fruit gene bank, there are apples and drupes (e.g. walnut). The new roads will be named after apple-varieties, and the dissemination concept is: what can be used for juice, stewed apples etc. (building on an instruction from Pometum B). Municipality Ai is aware that this is a possibility to reach their *target group:* "We must justify the money we use on this in our restricted budget: What is in it for us and our citizens?" The project is also communicated in local media: "Local media like these nice local stories." The *wanted effect* is to give knowledge about different varieties of fruit-trees and PGR to their citizens (*content*). They also wish that people plant more apple-trees of old varieties in their gardens at home "and maybe remembered that their parents or grand-parents had a 'Signe Tillisch' or a 'Skovfoged' (varieties) in their garden and want to pass them on to children and grandchildren. The fruit-trees are growing on municipal areas – this is also a way of disseminating for the common good: "Here everybody can go for recreation. You can just go for a 30 minutes' walk and pick a bag of apples, which you can bring home to the kitchen."

All in all the coherence between the elements is seen to be high. Municipality Ai is aware to reach their citizens, where they pass, and they meet them with possibilities and accessible knowledge about PGR.

Figure 5: Coherence of the elements in the New Circle Model (Ingemann, 2003)

Part III: The Grant PGR's educational potential

As shown in Table 3 the grant-receivers meet the criteria for Informal Learning Environments, since each of them give opportunities of learning science for the public outside of school and belong to at least one type of setting, where science learning can occur: everyday settings, designed settings or programmes (National Research Council, 2009). They all use different media-platforms to disseminate knowledge of PGR, and give possibilities for their audience to prepare and process the knowledge.

Institution	Everyday Settings	Designed settings	Programmes	Media platforms	Prepare and process
Research Institution Ai		**2**		**5**	**6**
Company Ai		**3**	**4**	**5**	**6**

Company Bi		**2**		**5**	**6**
Local Gr. w. Public Access Ai		**3**	**4**	**5**	**6**
Municipality Ai	**1**	**3**		**5**	**6**
Pometum Ai		**3**		**5**	**6**
NGO Ai		**2**	**4**	**5**	**6**
Museum Ai		**3**		**5**	**6**
Museum Bi		**3**		**5**	**6**

Table 3: Settings, media and combinations of formats in the institutions with demonstration-projects
1 = pick apples in abolished gardens, 2 = Food-fair, 3 = Fields, plantings, plantations, gardens, 4 = members-activities and subscription, 5 and 6 = webpage, article in newspaper or magazine, social media, handout or leaflet

Everyday-settings: Municipality Ai has a map of abolished gardens on their website: "Pick an apple. In 'name of town' several places owned by the municipality offer apples and other fruits, which just wait to be picked." Users are given recipes for the fruit and are encouraged to find names of the apple-varieties in their garden, using the scientific "Apple Key" (University of Copenhagen, n.d.)

Designed settings: The plantings of PGR in Museum Ai and Bi are arranged by scientists and educators. In Municipality Ai the plantings are designed by a scientist. In Pometum Ai and Company Ai the plantings are designed and presented by gardeners, farmers and scientists. Demonstration to visitors is part of the design: there are labels on the plants, boards in the field, leaflets and guided tours to inform visitors about PGR in the temporary designed settings. When meeting Company Bi and Research Institution Ai, people get to talk to scientists, while a meeting with NGO Ai or the Local Group with Public Access Ai will be guided by amateur-members interested in PGR. All found it essential to preserve PGR, important to inform the public about it and very aware of their pedagogical intentions (see part II, 'sender, objective and content').

Programmes: NGO Ai has around 900 members, which gather in meetings and courses, where they change seeds, learn about PGR and propagation of plants. Some members are considered experts in the field of PGR, though they are amateurs. NGO Ai is for instance member of the governmental Committee for PGR, together with scientists and breeders. The Local Group with Public Access Ai sees itself as a place for local gathering and story-telling. They invite experts to teach grafting, or they arrange excursions to institutions like Pometum B[9]. Communication with subscribers to Company Ai also has some characteristics of a programme: Subscribers get a weekly newsletter in their vegetable-box telling about the produce, sometimes PGR from the demonstration-projects. This also gives opportunities to have prolonged conversations.

[9] List of all demonstration institutions in Appendix A.

Media-platforms and *prepare and process:* All grant-receivers have signs, boards or guided tours, which can only be reached on-site, while webpages (all) give a possibility to find knowledge about PGR independently of the site as well as radio, television, national and local newspapers, and social media. Leaflets and hand-outs can be taken home as well to process knowledge.

Characteristics of learning experiences in Informal Learning Environments
To assess the grant-receivers' educational potential, the four main characteristics reported to support science learning in visitor-studies have been analysed regarding the demonstration-projects. These can be seen for each institution in table 4.

Institution	**1. Multiple ways (senses)**	**2. Direct interaction**	***3.* Multifaceted science**	**4. Building on learners' prior knowledge, memories and interests**						
				Guided tours with talk	Activity days with talk	Taste and talk at fairs	Taste and talk at inst.	Visitor memo-ries	Member interest	Local focus
Res. Inst. Ai	b, c		d			x				
Company Ai	a, b, c		d	x			x			x
Company Bi	b, c		e			x				
Loc.Gr.w.P.A.Ai	a, b	x	d, f		x			x	x	x
Municipality Ai	a, b		d, g	x						x
Pometum Ai	a, b		d	x						
NGO Ai	b, c	x	d, f			x			x	
Museum Ai	a, b, c		d, g	x			x			
Museum Bi	a, b, c	x	d, f, h		x		x	x		

Table 4: Four main characteristics of activities and materials in the demonstration-projects reported to support science learning (National Research Council, 2009): a= growing PGR with labels, boards, or leaflet, b= produce and food, c= tastings, d= horticulture, e= sensory science, f= ethnology, g= biology, h= history

All characteristics are present in some of the institutions, and all had activities with at least 3 characteristics.

1. Engage participants in multiple ways (senses): Growing PGR (e.g. varieties of walnut trees, onions, or wheat) can evoke senses: visual, olfactory, auditory and tactile. This is followed by interpretive materials, guided tours, activity days or tastings (e.g. raw apples, blackberries, rhubarb syrup, bread) with possibility to talk to a skilled guide. All institutions have a learning goal (see 'objective' and 'wanted effect' in table 2) and all use more than one format to disseminate knowledge to the public about PGR. Research Institution Ai, which meets its audience on Food-festivals, brings posters, hand-outs, tastings, and they get into a dialogue "to give a broader and deeper knowledge of what 'Mr. and Mrs. Jensen' taste". Company Ai calls the use of many media 'a scatter gun approach': "We have experienced that PGR can be disseminated in many ways – from information about the varieties to the wide story of PGR - and preferably with tastings. "Some get excited by the history, the genetical variation - others need concrete vegetables" (See part II, 'media and design').
2. Encourage participants' direct interactions: Visitors can engage in practical work in garden and

kitchen (Museum Bi), while the Local Group with Public Access Ai is based on involving activities with members and visitors: grafting, planting and taking care of apple-trees together, especially the local variety. NGO Ai's members grow PGR in their own gardens, and they offer seeds to non-members at markets and fairs, which they can grow at home.
3. Provide multifaceted portrayals of science: Very diverse institutions were invited by the Ministry of Food to take part in the grant-scheme, representing different scientific fields (The Danish Ministry of Food, 2009). The Ministry, which gave out the grant, was aware that this would benefit the demonstration of PGR to the public, because the institutions were very diverse and expected to be interested in different aspects of PGR (pers.com. 8.10.2014).
4. Build on learners' prior knowledge and interests: Giving tastings of different varieties of strawberries, having a conversation with a gardener, cooking food or planting apple-trees together are all ways to create 'hooks' to the visitor's personal knowledge base. At the same time they are obvious ways to introduce people to the important diversity of food-resources.
Museum Bi argues that memories are playing a great role, when people taste:

> The whole sensory system is used, and flash-backs to something good, confident, and combined with childhood appear. The visitors get to think of their own history and remember grandma's garden, where everything had a special taste: "the strawberries that tasted like my grandmother's"

The Local Group with Public Access Ai works with tradition: what they call "within living memory". This is people's personal memories - rooted in the local apple-variety. Both institutions with members build on personal interest: The Local Group with Public Access Ai is based on involving activities with members: "People meet in a cozy, social environment, inspire, teach and learn from each other". The local focus also connects to the personal interest. This is seen in Municipality Ai, planting trees in public areas and in the Local Group with Public Access Ai planting apple-trees of the local variety in public spaces like in front of the old people's home.

Discussion

Including an obligation to communicate to the public was unique to Denmark's implementation of this grant-scheme in the Rural Development Programme 2007-13. Six EU countries (England, Ireland, Germany, Austria, Italy and Denmark) have implemented the grant-scheme for PGR (European Commission, n.d. a; FAO, n.d. c) Austria, for instance, has implemented the grant-scheme in 1995 as a subsidy for farmers with a high number of varieties in different crops threatened by genetic erosion, and it was also included in the programme 2007-13 without any obligations to inform the public (Bundesministerium für Land und Forstwirtschaft, Umwelt und Wasserwirtschaft, 2007). Other countries as Italy and Germany had communication as part of the implementation but not as an obligation for the grant-receivers (European Commission, n.d. b; Regione Umbria, n.d.)

The grant-scheme in the EU-programme was directed at "farmers and other land managers", but the Danish results show that ratification in diverse institutions can reinforce the effect of knowledge-dissemination to the public. Hence, educating the public might enhance the results of the programme, especially when "building bridges between cutting-edge research knowledge and technology and farmers, forest managers, rural communities, businesses, NGOs and advisory services," which is an aim of the current programme (Official Journal of the European Union, 2013, art. 55).

Conclusion

The results show that each grant-receiver defined PGR in accordance with the FAO-definition and the objective of the grant-scheme. The communication was well integrated in each institution, since the elements of the communication model was found to be coherent. Furthermore each grant-receiver can be characterized as an informal learning environment with a high educational potential, because they used many of the characteristics known to enhance science learning to make the abstract PGR concrete for their visitors.
The many diverse grant-receivers enhanced the potential of science learning and learners, since all facilitated the same core message with the same overall purpose in many different places at the same time. The effect of this was seen to be enhanced by the grant-receivers' diversity and by working together in teams and network. These findings show that Informal Learning Environments can be used to educate the public and raise awareness about PGR. Both are important to FAO and the world-wide work with PGR.

References:

Atkin, & Rice. (1981). Mass media information campaign effectiveness. In *Rice RE, Paisley WJ, ed. Public communication campaigns* (pp. 265–79). Beverly Hills, California: Sage.

Bundesministerium für Land und Forstwirtschaft, Umwelt und Wasserwirtschaft. (2007). Österreichisches Programm für die Entwicklung des Ländlichen Raums 2007 - 2013.

Burton, R., Kuczera, C., Schwarz, G., & others. (2008). Exploring Farmers' Cultural Resistance to Voluntary Agri-environmental Schemes. *Sociologia Ruralis*, *48*(1), 16–37.

Christen, B., Kjeldsen, C., Dalgaard, T., & Martin-Ortega, J. (2015). Can fuzzy cognitive mapping help in agricultural policy design and communication? *Land Use Policy*, *45*, 64–75. http://doi.org/10.1016/j.landusepol.2015.01.001

Commission on Genetic Resources for Food and Agriculture, 2010. The second report on the state of the world's plant genetic resources for food and agriculture. Commission on Genetic Resources for Food and Agriculture, Food and Agriculture Organization of the United Nations, Rome.

Craig, R. T. (1993). Why are there *so* many communication theories? *Journal of Communication*, *43*(3), 26-33.

Craig, R. T. (1999). Communication theory as a field. *Communication theory*,*9* (2), 119-161.

Craig, R. T. (2015). The Constitutive Metamodel: A 16-Year Review. *Communication Theory*, *25*(4), 356-374.

Da Davey, C., Vickery, J., Boatman, N., Chamberlain, D., Parry, H., & Siriwardena, G. (2010). Regional variation in the efficacy of Entry Level Stewardship in England. *Agriculture, Ecosystems & Environment*, *139*(1-2), 121–128. http://doi.org/10.1016/j.agee.2010.07.008

Duesberg, S., Dhubháin, Á. N., & O'Connor, D. (2014). Assessing policy tools for encouraging farm afforestation in Ireland. *Land Use Policy*, *38*, 194–203. http://doi.org/10.1016/j.landusepol.2013.11.001

European Commission (1998). *State of application of regulation (EEC) no. 2078/92: Evaluation of agri-environment programmes* (DGVI COMMISSION WORKING DOCUMENT No. VI/7655/98). Brussels.

European Commission. COUNCIL REGULATION (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development Official Journal of the European Union. Brussels. (2005). Retrieved from http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32005R1698&from=DA

European Commission. (n.d.) a. Rural Development policy 2007-2013 - Country files. Retrieved June 13, 2016, from http://ec.europa.eu/agriculture/rurdev/countries/dk/index_en.htm

European Commission. (n.d.) b. Rural Development policy 2007-2013 - Germany. Retrieved June 13, 2016, from http://ec.europa.eu/agriculture/rurdev/countries/de/index_en.htm

Falk, J. H., & Needham, M. D. (2011). Measuring the impact of a science centre on its community. *Journal of Research in Science Teaching*, *48*(1), 1–12. http://doi.org/10.1002/tea.20394

Falk, J. H., & Needham, M. D. (2013). Factors Contributing to Adult Knowledge of Science and Technology: CONTRIBUTIONS TO KNOWLEDGE OF SCIENCE AND TECHNOLOGY. *Journal of Research in Science Teaching*, *50*(4), 431–452. http://doi.org/10.1002/tea.21080

FAO. (2009). *International Treaty on Plant Genetic Resources for Food and Agriculture*. IUCN. Retrieved from http://www.planttreaty.org/content/texts-treaty-official-versions

FAO (n.d.) a. Overview | The International Treaty. Retrieved October 3, 2014, from http://www.planttreaty.org/content/overview

FAO (n.d.) b. Training and Capacity Development Programme. Retrieved from The International Treaty on Plant Genetic Resources for Food and Agriculture. http://www.planttreaty.org/content/training-and-capacity-development-programme

FAO. (n.d.) c. The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture. Country Reports. Retrieved June 13, 2016, from http://www.fao.org/docrep/013/i1500e/i1500e00.htm

Falk, J. H., & Dierking, L. D. (2010). The 95 Percent Solution. *American Scientist*, *98*(6), 486. http://doi.org/10.1511/2010.87.486

Hein, G.E., 1998. Learning in the museum, Museum meanings. Routledge, London ; New York.

Hodge, I., & Reader, M. (2010). The introduction of Entry Level Stewardship in England: Extension or dilution in agri-environment policy? *Land Use Policy*, *27*(2), 270–282. http://doi.org/10.1016/j.landusepol.2009.03.005

ICOM. (n.d.). Museum Definition- ICOM. From http://icom.museum/the-vision/museum-definition/

Ingemann, Bruno (2003). Den nye bollemodel - planlagt kommunikation. In Flemming, Leslie & Ingemann, Bruno (eds.): *Faglig formidling - praksis og konsekvenser* (pp. 119-127). Copenhagen: Roskilde Universitetsforlag.

Kleijn D, Berendse F, Smit R, & Gilissen N. (2001). Agri-environment schemes do not effectively protect biodiversity in Dutch agricultural landscapes. *Nature*, *413*, 723–725.

Kleijn, D. (2003). How effective are European agri-environment schemes in conserving and promoting biodiversity? *Journal of Applied Ecology*, *40*(6), 947–969. http://doi.org/10.1111/j.1365-2664.2003.00868.x

Kvale, S. (1997). *InterView: en introduktion til det kvalitative forskningsinterview*. Kbh.: Hans Reitzel.

Madsen, L. M. (2001). Location of woodlands: The Danish afforestation programme for field afforestation. Geographica Hafniensia A10, København.

Marey-Pérez, M. F., & Rodríguez-Vicente, V. (2009). Forest transition in Northern Spain: Local responses on large-scale programmes of field-afforestation. *Land Use Policy*, *26*(1), 139–156. http://doi.org/10.1016/j.landusepol.2008.02.004

National Research Council (Ed.). (2009). *Learning science in informal environments: people, places, and pursuits*. Washington, D.C: National Academies Press. Retrieved from https://languagescience.umd.edu/sites/languagescience.umd.edu/files/lsc/general/doc/belletal2009.pdf

Nature, 2010. Editorial: Learning in the wild. Nature 464, 813–814. doi:10.1038/464813b

Novak, J. D., & Cañas, A. J. (2008). *The theory underlying concept maps and how to construct them* (Technical Report IHMC CmapTools No. 2006-01 Rev 01-2008). Florida Institute for Human and Machine Cognition. Retrieved from http://cmap.ihmc.us/Publications/ResearchPapers/TheoryCmaps/TheoryUnderlyingConceptMaps.bck-11-01-06.htm

Official Journal of the European Union. REGULATION (EU) No 1305/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (2013).

Primdahl, J. (2014). Agricultural Landscape Sustainability under Pressure: Policy Developments and Landscape Change. *Landscape Research*, *39*(2), 123-140.

Primdahl, J., Vesterager, J. P., Finn, J. A., Vlahos, G., Kristensen, L., & Vejre, H. (2010). Current use of impact models for agri-environment schemes and potential for improvements of policy design and assessment. *Journal of Environmental Management*, *91*(6), 1245–1254. http://doi.org/10.1016/j.jenvman.2009.12.012

Regione Umbria. (n.d.). Progetti attivati - BIODIVERSITA'. Retrieved June 13, 2016, from http://biodiversita.umbria.parco3a.org/pagine/progetti-attivi

Rennie, L. J. (2014). Learning Science Outside of School. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education*. New York: Routledge.

Smedegaard, F. (2003). Dynamisk kommunikationsplanlægning. In: *Merino*, (30). 1-33. Syddansk Universitet.

The Danish Plant Directorate and the Danish Institute of Agricultural Sciences. (2004). *Strategi for det danske arbejde med jordbrugets plantegenetiske ressourcer*. Retrieved from http://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Landbrug/Genetiske_ressourcer/Planter/Publikationer/Forslag_strategi_270920041.pdf

The Danish Ministry of Food, Agriculture and Fisheries. Lov om udvikling af landdistrikterne. LOV nr 316 af 31/03/2007. (2007). Retrieved from http://www.sslug.dk/~chlor/www.retsinformation.dk/lov/l8675.html

The Danish Ministry of Food, Agriculture and Fisheries. Bekendtgørelse om tilskud til demonstrationsprojekter om bevaring og bæredygtig udnyttelse af plantegenetiske ressourcer for jordbrug og fødevarer. BEK nr 76 af 03/02/2009. Retsinformation.dk (2009). Retrieved from https://www.retsinformation.dk/Forms/R0710.aspx?id=123370

The Danish Ministry of Food, Agriculture and Fisheries (2012). The Danish Rural Development Programme 2007-2013. Retrieved from https://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Tilskud/Projekttilskud/Landdistrikter/LDP_Rev_proposal_Consolid_2007-2013f.pdf

The Danish Ministry of Food, Agriculture and Fisheries (n.d.). Plantegenetik. Retrieved June 13, 2016, from http://naturerhverv.dk/tilskud-selvbetjening/tilskudsguide/plantegenetik/

University of Copenhagen. (n.d.). The Pometum apple key. Retrieved from http://www.nordgen.org/nak/?chglang=ENG

Van Gorp, B. (2007). The constructionist approach to framing: Bringing culture back in. *Journal of communication*, *57*(1), 60-78.

Wilson, G. A., & Hart, K. (2000). Financial imperative or conservation concern? EU farmers' motivations for participation in voluntary agri-environmental schemes. Environment and planning A, 32(12), 2161-2186.

Institutions with demonstration-projects 2008-2013

'Grant for Demonstration Projects about Conservation and Sustainable Use of PGR'

Institutions	Demonstrating varieties of:
Research Institution Ai (interviewed)[10]	blackberry, walnut, kale/cabbage, celery, carrot, turnip, onion, leek, herbs
Research Institution B	kale, celery, carrot, leek, onion, turnip, herbs
Company Ai (interviewed)	Leek, onion, turnip, herbs
Company Bi (interviewed)	Gooseberry, bullace, apple
Company C	Grain
Company D	Grain
Company E	Strawberry
Company F	Grain
Company G	Blackberry
Company H	Apple
Company I	Mustard
Company J	Grey peas, potato
Local Group with Public Access Ai (interviewed)	Apple
Local Group with Public Access B	Apple
Local Group with Public Access C	Crab apple
Local Group with Public Access D	Grain
Municipality Ai (interviewed)	Apple, walnut
Municipality B	Apple
Open farm [11] A	Grey peas, potato
Pometum Ai (interviewed)	Apple, fig, bullace, cherry
Pometum B	Apple, cherry, strawberry, red currant, gooseberry, bullace
NGO Ai (interviewed)	Peas, beans
NGO B	Cabbage/kale, turnip
Museum Ai (interviewed)	Apple, walnut, hops, grain
Museum Bi (interviewed)	Cabbage/kale, celery, turnip, carrot, leek, onion, herbs, cherry, apple
Museum C	Grain
Museum D	Grain, kale/cabbage, celery, carrot, beans, peas, apple
Museum E	Grain

[10] All interview institutions are named with "i"

[11] No interview was made in this category, as it contained only one receiver, which moved their activities to a producer due to illness

Paper 3: Collaborative Networks as Institutional Support to Delivery of Environmental Services

- Insights from the Danish grant-scheme for demonstration of plant genetic resources for food and agriculture

L. Windfeldt (corresponding author) and L. M. Madsen

Department of Science Education, University of Copenhagen, Copenhagen, Denmark

Abstract

Collaboration between institutions delivering environmental services is growing, which makes it important to find ways to manage the networking. This paper analyses how actors in a grant-scheme from the Danish Ministry of Food, Agriculture and Fisheries worked together. Three different kinds of teamwork were found: an *overall grant-network* of all grant-receivers and the Ministry, *smaller formal teams*, and *informal partnerships*. The formal teams had the closest links, characteristic of coordinative networks, which fits their purpose: to help each other to reach the goals of their shared grant application. The informal partnerships were found to be both cooperative and coordinative, which also suits their purpose: sharing various resources. The overall-grant-network had the most unstable connections, and can hardly be termed a cooperative network, since it did not fulfil its intentions: networking, inspiration and connecting the Danish government with the Danish Plant Genetic Environment. We use the framework of Collective Impact to discuss how this network might be improved to become a collaborative network. The resulting recommendations are argued to be helpful for collaboration in other European environmental services to build up stable, long-term relations and trust between the institutions and the State and potentially improve the delivering of environmental services.

Keywords: environmental services, collaborative networks, implementation of grant-schemes, Rural Development Programme, grant receivers, plant genetic resources for food and agriculture

INTRODUCTION

The Danish landscape is rapidly changing, and different interests from agriculture, outdoor recreation, and nature conservation put the use of areas under pressure as in many other European countries (e.g. Emery & Franks, 2012; Primdahl, 2014; Realdania, n.d.; Renting and van der Ploeg 2001). As an alternative to the present Danish public delivery of environmental benefits 12 parties (representing farming, forestry, municipalities, NGOs and other users of the landscape) have

gathered in an "open country project" to inspire to a national land re-parcelling from a multifunctional perspective: positive development of agriculture, richer nature, cleaner aquatic environments, better recreational possibilities, and attractive rural areas – all at the same time. The initiative is founded by a private philanthropic organization, and development of a new, interdisciplinary paradigm is one of the outcomes, which the parties hope to get out of the process (Grønnegaard, 2016; Grønnegaard & Johansen, 2016).

Similar types of initiatives are known from within agriculture where farmers organise in environmental cooperatives as for example in the Netherlands (Renting and van der Ploeg 2001, Wiskerke *et al.* 2003). Here "Environmental cooperatives are innovative associations of farmers based at local or regional level, which promote and organize activities related to sustainable agriculture and rural development in their locale" (Renting & van de Ploeg 2001: 87). Another example is the movement towards, installing collaborative elements in the Agri-environmental schemes as the "Supplement for group action" found in the English Environmental Stewardship Scheme (Emery & Franks, 2012, Franks & Emery 2013).

Even though different in organisation and relation to landscape planning and politics in the different countries these types of collaboration across ownership boundaries can from an ecosystem perspective be seen as enhancing the provision of ecosystem services at the landscape level (Prager el al. 2012). However, the advantages of these new ways of delivering environmental benefits can also from an institutional perspective be seen as positive. For example, Hanleybrown, Kania & Kramer (2012) discuss isolated versus collective impact of grant-schemes: when funders select individual grant-receivers, they want to choose the ones which offer the most promising solutions. By uniting, the institutions will often be able to maximise the resources and reduce duplication and overlap (Hanleybrown et al, 2012; Mandell & Keast, 2009). Also more complex problems are often solved better through the interaction of many working together. This overcomes competition, unites their efforts, and helps in working towards the same goal (Hanleybrown et al, 2012; Mandell & Keast, 2009).

When we look at the results of these initiatives, however, it seems that they are all in some way or the other grappling for institutional support. In their analysis of the Dutch environmental cooperatives Renting and van der Ploeg (2001) underline that the success of environmental cooperatives "presupposes a *responsive and favourable institutional environment*" (ibid: 97, italics in original). Also, in Franks and Emery's (2013) paper analysing the "supplement for groups action" it is concluded that the supplement for group actions are more likely to be included if negotiations are assisted by an external organisation.

In the present paper we want to contribute to the knowledge and discussions of institutional support to delivery of environmental services. By analysing the Danish "Grant for demonstration-projects about conservation and sustainable use of plant genetic resources (Grant PGR)" under the EU rural development programme we hope to contribute to the discussion of new ways of institutional

relations between the state and partners in the landscape. What is unique in the Grant PGR is that enhancing teamwork between the grant-receivers was as one of the purposes of the grant (The Danish Ministry of Food, Agriculture and Fisheries [the Danish Ministry of Food], n.d.). Furthermore, the ministry and all grant-receivers joined in an overall network. This allows for an analysis of the network and relations between the different partners.

The Grant PGR was given by The Danish Ministry of Food, Agriculture and Fisheries (the Ministry of Food) in 2008 to 2013 to 28 institutions which were geographically spread all over the country. Each grant funded demonstration-projects to conserve and raise public awareness of Nordic agricultural or garden crops and fruit types worthy of conservation (The Danish Ministry of Food, 2012). These are Plant Genetic Resources for Food and Agriculture (PGR). Mankind depends on having access to suitable plants for food, and different varieties mean different characteristics – not just in taste and nutrition, but also in growing properties. Thus, when we preserve the broadest possible variation of PGR, we help to ensure sustainable growing and food for the future (FAO, 2009, Preamble).

In Denmark public information activities about PGR is organized through the Ministry of Food. The Ministry gave out the Grant PGR as part of the national strategy for PGR, and the demonstration-projects were carried out by very diverse institutions. These included museums, research institutions, pometa, private companies, municipalities, local groups and NGOs (Windfeldt and Madsen, 2016, manuscript in review). The grant-receivers were all part of the Plant Genetic Environment in Denmark. The 'Plant Genetic Environment in Denmark' is mentioned for the first time in the Danish action-plan for PGR 2011 to 13, which underpins its important teamwork with the Ministry of food and describes the environment as

> … remarkable for gathering an unusually broad group of stakeholders: researchers, farmers, local 'enthusiasts', chefs, museum staff, plant breeders, officials, etc. The group is … committed and has a high level of initiative and drive … and there is a good teamwork between these very different users. The diverse approach to the field is seen as a force that stimulates the activities and development. (The Danish Ministry of Food, 2011, p. 39-40).

The focus of the present paper is to illustrate the ways of institutional relations that evolved as a result of implementing the Grant PGR with teamwork as a preferred condition. To address this focus the paper firstly outlines the ideas of cooperative, coordinative and collaborative networks as well as the governance network, and the framework of collective impact. Secondly, the type of teamwork established with the Grant PGR and characteristics of the teamwork are analyzed and discussed. Finally, the paper reflects on the call for institutional support put forward within research as well as how to rethink collaborative governance networks not only for the Danish Grant PGR but also in other agri-environmental schemes.

NETWORKS AND THE MANAGING OF DIFFERENT NETWORK TYPES

We use a combination of three different frameworks to be able to analyse different aspects of networking: The *cooperative, coordinative and collaborative networks* (Mandell, Keast and Brown, 2009) is used to distinguish between three intensities of networking. The *governance network* (Sørensen & Torfing, 2005) we use to understand relations between the state and a number of diverse partners in private as well as public institutions and civil society. Finally we use the framework of *Collective Impact* (Kania & Kramer, 2011) to unfold how to make networking operational. It offers opportunities to distinguish between different ways of working together and how to improve the results.

The cooperative, coordinative and collaborative network

In both *cooperative* and *coordinative* network types, participants are independent organizations and/or individuals coming together for a specific purpose. In cooperative networks it is to share information and expertise, while in coordinative networks the purpose is to better coordinate existing services. In both types of networks the status quo is maintained, meaning that working together does not make the institutions change the way they work, resources remain their own, and power remains within the organization (Mandell *et al.*, 2009; Mandell & Keast, 2009).

Network Types		
Cooperative network	Coordinative network	Collaborative network
Low trust – unstable relations	Medium trust – based on prior relations	High trust – stable relations
Infrequent communication flows	Structured communication flows	Thick communication flows
Known information sharing	'Project' related and directed information sharing	Tactic information sharing
Adjusting actions	Joint projects, joint funding, joint policy	Systems change
Independent/autonomous goals	Semi-independent goals	Dense interdependent relations and goals
Power remains with organization	Power remains with organizations	Shared power
Resources – remain own	Shared resources around project	Pooled, collective resources
Commitment and accountability to own agency	Commitment and accountability to own agency and project	Commitment and accountability to the network first
Relational time frame requirement – short term	Relational time frame requirement – medium term, often based on prior projects	Relational time frame requirement – long term, 3-5 years

Table 1: Characteristics of the three network types: Cooperative, coordinative, and collaborative (After Mandell et al, 2009).

According to Mandell *et al.* (2009), a network also exists in which participants are interdependent: a collaborative network. The definition of the collaborative network builds upon the work of Innes & Boher, who state that "the stakeholders must have full diversity of interests and at the same time interdependence, so that they cannot get their interests met independently" (Innes & Booher, 2010, p. 35). "This goes beyond just being dependent of the same resources, data needs, common clients or geographic issues, although these may be part of it." (Mandell & Keast, 2009, p. 6).

Collaborative networks are only formed when there is a need to solve a complex problem. This means that "all participants must first recognize their interdependence on each other and their need to make major changes in their operations" (Mandell & Keast, 2009, p. 7).
In the work of Cordero-Guzman, 2001; Edwards & Stern, 1998; Huxham, 2000; Huxham, & Vangen, 1996; Keast et al, 2004; Walker, 2002 (as cited in Mandell & Keast, 2009), collaborative networks may be a mechanism to facilitate shared information and make use of new knowledge sets and resources. Through increased interactions and synergies, new and innovative outcome that is not possible by working alone may be the result (Mandell & Keast, 2009). Collaborative networks are more resilient than the other two, but they demand more time – and often training of the institutions involved (Mandell *et al.*, 2009). In table 1 the three different network-types and their characteristics can be seen.

Governance Networks

Governance networks described by Sørensen and Torfing (2005) are networks bridging a strong government and a strong civil society. A governance network can be defined as:

> (1) a relatively stable horizontal linking of interdependent but operationally autonomous actors, (2) which interact and try to influence each other through negotiation, (3) that takes place within an institutionalized community, (4) which is self-regulating within frameworks that are often set by the political authorities, and (5) in a broad sense, contributes to management of the public sector (Sørensen & Torfing, 2005, p. 15).

The authors work with public planning, and study institutions which are acting in political or economic contexts. Interestingly, while the work of Mandell & Keast as well as Innes and Booher originate in solving conflicts of e.g. use of land or water (Innes and Boher, 2010), or taking care of fragile citizens (Mandell *et al.*, 2009) Sørensen and Torfing refer to a long tradition of organisation in the Danish society. Back in history the merging of church and state, or the setting-up of a well-functioning tax-paying system made a strong state with will and capacity to govern the economic and social life. At the same time there is a strong tradition for citizens in civil society to organize in unions and associations and to make a difference in governance of society (Sørensen & Torfing (2005).

Collective impact

The concept of "Collective impact" (CI) was introduced at Stanford University in 2011 as a "systemic approach to social impact that focusses on the relationship between organisations and the progress toward shared objectives" (Kania & Kramer, 2011, p. 39). It focuses on the relations in a group of important actors from different sectors united to solve a specific social problem and as such it can extend the notion of a collaborative network and guide ways to make it operational. CI operates with five conditions; common agenda, shared measurement, mutually reinforcing activities, continuous communication and backbone support.

Common Agenda: All institutions in the network must have a shared vision for change, which means that they have the same understanding of the problem they want to solve and the same approach to how to solve it. So the goals must be the same - at least the central goals - which often requires many meetings and discussions (Kania & Kramer, 2011). This is similar to 'dense interdependent relations and goals' (all text marked with 'quotations marks' are quotes from Table 1) and 'commitment and accountability to the network first' in the description of the collaborative network by Mandell *et al.* (2009). The collaborative network must here be seen as the ideal result of a process, where institutions have the same goal and a shared vision for change. Interdependency where "stakeholders must have full diversity of interests and at the same time interdependence, so that they cannot get their interests met independently" (Innes & Booher, 2010, p. 35) is also seen as a result of a process, starting with the definition of shared central goals.

Shared measurement: When agreeing to a common agenda, the institutions must at the same time agree with the way they want to measure and support success. This is a way to ensure that the efforts remain aligned. All institutions can be held responsible for how they fulfil the common goals, and successes and failures can be shared in order to learn from them. Furthermore the progress of the field as a whole can be documented (Kania & Kramer, 2011).

Mutually Reinforcing Activities: As CI involves a group of stakeholders, which are often very diverse, the most efficient way to join forces will be that all participants do the things at which they are best in a way that is aligned with the others and which supports their work. It makes coordination a central concept, and a mutual plan of action must be made in which each stakeholder undertakes different types of activities (Kania & Kramer, 2011). This is what Mandell *et al.* (2009) call 'pooled, collective resources' in the collaborative network.

Continuous Communication: Many meetings are required to build up the trust needed to join forces. Here a common vocabulary can be created among the diverse institutions, and the shared measurement system can be agreed upon. Kania & Kramer (2011) suggests weekly or even biweekly in-person meetings, preferably supported by external facilitators and a structured agenda. Between the meetings web-based tools (e.g. Google Groups) can be used to keep the

communication afloat. Mandell *et al.* (2009) mention 'tactic information sharing' and 'thick communication flows' to build 'high trust' and 'stable relations' in collaborative networks.

Backbone Support: A separate support-organisation is needed to create and manage the common agenda, the shared measurement and the communication required to reinforce mutual activities. The backbone support-organisation is to take care of coordination and internal communication, which requires dedicated staff able to manage, plan and support the institutions equally and to collect data and report (Kania & Kramer, 2011). The Strive Partnership (as cited by Kania & Kramer, 2011) pinpoints three roles of the support-organisation: project manager, data manager, and facilitator. Kania & Kramer (2011) argues that expecting that "collaboration can occur without a supporting infrastructure is one of the most frequent reasons why it fails" (Kania & Kramer, 2011, p. 40).

METHODOLOGY

The empirical data consist of grant applications from all receivers of the Grant PGR in the period 2008 to 2013[12]. To study their teamwork and hence the networking, qualitative interviews (Kvale, 1997) were carried out in 2013 to 2014 with nine receivers of the grants (with the leader of the institution or the leader of the demonstration project in the institution). Selection of the nine informants for qualitative interviews was done in the following steps: At first all 28 grant-receivers were divided into eight categories, based on document analysis of their original grant proposals. Secondly, 10 receivers representing all eight categories were selected for qualitative interviews[13]. In the selection process, recipients using different media and having many collaboration partners were preferred, if possible, to establish the broadest potential effect of their collaboration and dissemination of information. Two institutions were chosen from the categories "Companies" and "Museums", as they were expected to be very different. All 28 grant-receivers are listed in appendix A.

At the policy level, a qualitative interview was conducted with an official from the Danish Ministry of Food, which was the secretariat for the design and implementation of the Grant PGR. Focus in this qualitative interview was on unfolding both the history and present status of the specific Grant PGR and the political background relative to the communication of PGR in Denmark.

All interviews lasted 1to 2 hours, were subsequently transcribed, and quotes made in the text are translated choosing verbatim translations rather than linguistically correct ones. E-mails, notes on meetings, and evaluation reports were included to estimate the number of meetings held in the

[12] The grant was given from 2008 to 13, and all demonstration-projects were completed by the end of 2014.
[13] Due to illness no interview was made in the category 'Open Farm' (only one institution).

overall-grant-network, and also to examine the grant-receivers' recommendations for future teamwork.

The three frameworks for managing of networks were used to identify patterns, and find similarities and differences in the ways the institutions worked together.

RESULTS

The nine interviewed institutions were found to work together with other grant-receivers in three different forms of teamwork, which were all active at the time when the interviews were made. First of all there was ***an overall-grant-network*** consisting of all institutions then working with the demonstration-projects and representatives from the Ministry of Food. But there were also smaller ***formal teams*** as well as ***informal partnerships.***

Three forms of teamwork

The overall-grant-network

The overall-grant-network was governed by the Ministry of Food, which invited those in charge of the demonstration-projects to network meetings together with representatives from the Ministry. They would present their projects, exchange experiences and give their feed-back to the Ministry of Food. The teamwork was set up by the Ministry of food with the purpose to network, inspire, and connect the government with the Plant Genetic Environment. All grant-receivers shared interest in the same subject (Windfeldt and Madsen, 2016, manuscript in review), and they were connected through the demonstration-projects they carried out, all initiated and paid for by the Grant PGR of the Ministry of Food. The Ministry of Food besides formulating the purpose also approved the contents of the communication activities in the applications from the institutions. Furthermore, the Ministry checked that the work had been carried out, before it decided whether the grant could be paid out to the institution (the Danish Ministry of Food, 2009).

The Danish Government (in practice: the Ministry of Food) is responsible for informing the public about PGR (The Danish Plant Directorate and the Danish Institute of Agricultural Sciences, 2004), and this task was partially fulfilled by the institutions participating in the Grant PGR (the Danish Ministry of Food, 2009), which can therefore be seen acting on behalf of the Government. The Government, on the other hand, was dependent on the institutions to carry out a task for which it was responsible. The overall-grant-network therefore acted as a governance network, which connected the government that issued the Grant PGR with researchers, pometa, municipalities, companies, museums, local groups, and NGOs.

Smaller formal teams and informal partnerships

The official from the Danish Ministry of Food explained that the intention of bringing different people together in projects was to benefit the work with PGR. The reason was that the very diverse institutions were expected to be interested in different aspects of PGR. As Denmark is a small country with relatively small professional environments, he argued:

> It would be an advantage, if the projects did not get too nerdy – but that the stakeholders worked together in a crisscross manner. This is also why we (the Ministry) decided to support teamwork in preference to single projects (Pers. com., Oct. 8. 2014).

This "crisscross manner" has led to 9 formal teams and 17 informal partnerships involving the interviewed institutions at the time they were interviewed. These are all seen in table 2.

Institution	Formal teams	Informal partnerships
Research Institution Ai	• Producer G • Company Ai, Research Institution Ai, Research Institution B, Museum Bi • Company Ai, Research Institution B	• Museum Ai • Municipality Ai • Pometum B
Company Ai	• Research Institution Ai, Research Institution B, Museum Bi • Research Institution Ai, Research Institution B	
Company Bi	• NGO Ai	• Pometum B • Museum D
Local Group w. Public Access Ai		• Pometum B
Municipality Ai	• Museum Ai	• Research Institution Ai • Pometum Ai
Pometum Ai	• Local Group with Public Access C • Pometum B, Museum Bi • Local Group with Public Access D	• Museum Bi
NGO Ai	• Museum D • Company Bi	
Museum Ai	• Municipality Ai	• Pometum Ai • Research Institution Ai • Company D • Museum Bi • Pometum B • Company C
Museum Bi	• Research Institution Ai, Research Institution B, Company Ai	• Pometum Ai • Pometum B

Table 5: The institutions working together in formal teams and informal partnerships.

9 Formal teams

Who: two or more of the grant-receivers, connected through one or more demonstration-projects

with shared applications.
Purpose: Helping each other to fulfil the activities described in each application.
Example: The Research Institution Ai worked together with Producer 15 on a shared application concerning wild varieties of blackberries. The producer grew the berries and produced marmalade, while the Research Institution Ai evaluated growing properties. Demonstration and tasting of berries and marmalade for the public was a joint activity, while the Research Institution Ai wrote articles, flyers etc.

17 Informal partnerships
Who: grant-receivers helping each other in an informal way.
Purpose: Sharing of resources (e.g. seeds and produce), information and expertise.
Example: Pometum Ai helped Museum Bi on their 'Apple-day' by identifying apple-varieties for their visitors.

Characteristics of the teamwork

The characteristics of the three identified types of teamwork; *overall-grant-network***,** the *formal teams*, and *informal partnerships* are analyzed according to Mandell *et al.* (2009) and summarized in table 3.

Teamwork	**Cooperative Network Characteristics**	**Coordinative Network Characteristics**	**Collaborative Network Characteristics**
The overall-grant-network	• Low trust – unstable relations • Infrequent communication flows • Power remains with organization • Resources – remain own • Commitment and accountability to own agency	• 'Project' related and directed information sharing • Semi-independent goals	
Formal teams		• Structured communication flows • 'Project' related and directed information sharing • Joint projects, joint funding, joint policy • Semi-independent goals • Power remains with organizations • Shared resources around project • Commitment and accountability to own agency and project	
Informal partnerships	• Infrequent communication flows • Known information sharing • Adjusting actions • Power remains with organization	• Medium trust – based on prior relations • Semi-independent goals	

	• Resources – remain own • Commitment and accountability to own agency		

Table 3: Overview of characteristics of the overall-grant-network, the formal teams and the informal partnerships. Source: Network-types in Table 1 (Mandell et al, 2009)

The analyse shows that characteristics of cooperative and coordinative networks were found in all three types of teamwork, but no characteristics of a collaborative network. This is unfolded in the following.

Characteristics of the overall-grant-network

The overall-grant-network was formed before the Grant PGR was given, when test-demonstration-projects were carried out from 2006 to 2008. This was under the equivalent scheme during the 2000 to 2006 Rural Development Programme (The Danish Ministry of Food, 2012). The overall-grant-network met 5 to 6 times from 2006-2008. The official from the Ministry of Food explained:

> We did one thing which I consider unusual for grant-schemes. We held meetings, where we invited those in charge of the demonstration-projects. They could present their projects and exchange experiences. Gathering everybody also gave them opportunity to talk during lunch. There was, indeed, a good energy at those meetings, and something concrete coming from it was that the grant-scheme was changed. For instance new crops were taken in (Pers. com., Oct. 8. 2014).

A common webpage was established in 2006 to 2007 as part of the test-demonstration-projects. The webpage shared information and activities from the demonstration-projects.

When the present grant was given as part of the Rural Development Programme 2007 to 2013, the communication and number of meetings became sparse: The overall-grant-network only met once between 2008 and 2014 (in 2009). During this period smaller or larger versions of the network have met at least three times (Bavnshøj, 2014; pers. com. Dec. 20, 2010; pers. com. Feb. 25, 2016; The Danish Plant Directorate, 2009; The Danish Ministry of Food, 2014). The webpage which was established in 2006 has not been active since 2008 (Landbrugsarven, n.d.), which indicates that information and activities from the demonstration-projects have not been shared in this form in the overall-grant-network from 2008 to 2014. When the Danish Plant Directorate was merged with the Fishery Directorate and the Directorate for Food, Fisheries and AgriBusiness in 2012 to the new Danish AgriFish Agency, administrative staff took over the administration of the Grant PGR from specialists (The Danish AgriFish Agency, 2012). This meant that the Grant PGR was no longer administered by people who knew about PGR or the Ministry of Food being responsible for informing the public about PGR. Thus the Ministry lost their history of intentions to connect to the Plant Genetic Environment although they still had the responsibility for securing public awareness of PGR.

The overall-grant-network primarily had the characteristics of a ***cooperative network*** from 2008 to 2014. 'Communication-flows were infrequent' (Mandell *et al.*, 2009 – see Table 1): the webpage was inactivated, and the institutions were randomly invited to meetings, except for the first one in 2009 (Bavnshøj, 2014; The Danish Ministry of Food, 2014). During the period the network gradually lost its history of intentions due to a shift from specialist to administrative staff, which resulted in 'low trust' between the institutions and the Ministry. All these are characteristics of an 'unstable relation'). 'Status quo is maintained' in the institutions, 'resources remain their own', and 'power remains with the institutions' (Mandell *et al.*, 2009).

However, there was a request from the institutions to meet and coordinate, which was confirmed in the interviews. The Pometum Ai, for instance, said that meeting every second year "is not enough to learn from each other and know what the others are doing". Museum Bi asked for a collective dissemination of knowledge in the network. "It would have been fine, if the effort had been coordinated", they stated, "if there was a meeting every year, where the projects were presented, and progress and obstacles could be discussed."

Some of the grant-receivers[14] were invited to two meetings in Oct. 2014 to make a "Vision-paper" for future activities communicating PGR. The paper recommends a yearly seminar, where grant-receivers gather to exchange experiences and have the possibility to develop new teamwork and projects. Furthermore the paper recommends an electronic information portal, where information and results from active and finished projects could be gathered. What was learned? What could be required from new projects? And where to get plants, seeds etc.? This led to a suggestion to establish a PGR-secretariat, which would function as a sparring opponent and secure a coordinated effort (Bavnshøj, 2014). The suggestions from this "Vision-paper" will be inspiration for the new Danish strategy for PGR, which is prepared in 2016.

Some characteristics of a ***coordinative network*** were also found. Although all were very diverse independent institutions they shared the same overall goal for the demonstration-projects: They wanted their target groups to acquire knowledge about PGR and the importance of their protection, though all had different perspectives of the subject, reflecting their identities (Windfeldt and Madsen, 2016, manuscript in review). These must be characterized as 'semi-independent goals' (Mandell *et al.*, 2009). Furthermore the institutions met to 'share information and expertise' (Mandell *et al.*, 2009) related to the grant. A network with the same overall goal and 'project-related information sharing' has the characteristics of a coordinative network (Mandell *et al.*, 2009).

[14] Museum Ai and Bi, NGO Ai, Pometum Ai, Company Ai, Local Group with Public Access Ai, Municipality B, Museum D, Museum C, Pometum B, Local Group with Public Access B, Company C

Characteristics of the formal teams

All of the 9 formal teams have the characteristics of ***coordinative networks***.
First of all the 'proposal and the funding were joint', and the 'resources around the project were shared' (Mandell *et al.*, 2009). The 'communication flows were structured', and 'information was shared around the joint project' (Mandell *et al.*, 2009). Goals were still 'semi-independent' as all projects belonged to the overall-grant-network, and 'commitment and accountability would be to own agency' as well as to the joint project.

An example is the formal team of Company Ai, Museum Bi, the Research Institution Ai, and Research Institution B (see table 2) that had four shared applications for projects demonstrating different old Danish varieties of root vegetables, onions, leeks and herbs. Company Ai and the research institutions tested and selected varieties to evaluate their commercial potential, while Museum Bi was working with the history of the varieties. This reflected their different identities and angles to the subject: Company Ai (test and growing of varieties of PGR to evaluate the commercial potential), Museum Bi (conservation and demonstration of living cultural heritage), and Research Institution Ai/Research Institution B (Selecting varieties and developing a broader assortment of food-products with PGR). Research Institution B was not part of the interviews. They all participated in different parts of the scientific work, selecting and describing the varieties, their history and their use. The seeds, produce and knowledge gained were used by all team-partners, and all took part in disseminating knowledge to the public at fairs and activity-days at the others (e.g. historical kitchen, and harvest-days) (Windfeldt and Madsen, 2016, manuscript in review). The leader of the projects at Company Ai said:

> We developed a tradition during the three years, where Museum Bi came here at our harvest-market and explained the history of the varieties, while we came to some of their market-days, where we showed the produce with tastings and told about differences in growing-properties and taste. (pers. com. 22.3.2016)

'Power still remained with the organisations', as no higher organisational level was present, and 'status quo was maintained in the institutions' (Mandell & Keast, 2009).

Characteristics of the informal partnerships

The 17 informal partnerships have some characteristics of ***cooperative*** and some of ***coordinative networks***.
Cooperative network: Institutions did not have a shared project, but they 'shared knowledge' (Mandell & Keast, 2009) and activities, also tangible things such as seeds, plants and information materials were shared. The projects were not joint as in coordinative networks, but 'actions were adjusted' (Mandel *et al.*, 2009). Communication was only needed around the sharing of resources and was thus 'infrequent'. This also means that 'resources and power remained with the institutions' as no higher organisational level was present (Mandell & Keast, 2009). Goals were still

‘semi-independent’ as all projects belonged to the overall-grant-network, and the ‘relations were quite stable’, because they were often ‘based on prior relations’. These are characteristics of ***coordinative networks*** (Mandell & Keast, 2009).

Examples: Pometum B and Research Institution Ai shared their knowledge, because the project-leaders knew each other from university and both worked with cherries. Company Bi had an informal partnership with Pometum B and Museum D, which both grew produce for their fermentation experiments. Company Bi returned the favour by demonstrating their experiments at fairs held by the two other institutions: ‘Open House Day’ at Pometum B and ‘Old Varieties’ Days’ at Museum D.

DISCUSSION

Integrating teamwork in the implementation of the Danish Grant PGR to support the further development and reconciliation of the Plant Genetic Environment has not been straightforward as we have shown in the analysis.

It has been shown that the formal teams and informal partnerships between the grant-receivers seem to have functioned well. The many informal partnerships fulfilled their purpose of sharing resources in partnerships with some cooperative and some coordinative network characteristics. The formal teams had the purpose to help each other to fulfil the activities described in each application. They were, of course, diverse, but they also seem to have worked quite efficient as teams with mainly the characteristics of coordinative networks. The grant-receivers contributed to the joint projects with their special skills and knowledge, and coordinated their work to heighten the efficiency and quality of the demonstration-projects. The projects sometimes lacked coordination and balancing of expectations, but they developed to become more efficient as they went along, and some of the institutions are now working together in new projects (pers.com. 22.3.2016).

The overall-grant-network which connected the grant-receivers with the Ministry of Food functioned as a governance-network with collaborative characteristics in the test-period from 2006 to 2008, but not from 2008 to 2014. The purpose was networking, inspiration, and connecting the governmental layer with the Plant Genetic Environment in Denmark. The overall-grant-network in the form of a governance network only emerged, because there was a need for cooperation between the Plant Genetic Environment and the Ministry of Food. But communication was almost non-existent present from 2008 to 2014, and the relation was unstable, though meetings had been successful for the grant-receivers as well as for the ministry. Furthermore, in 2012 when the Grant PGR was no longer administered by specialists who knew about the Danish Ministry of Food being responsible for informing the public about PGR, the Ministry lost their intentions to connect to the Plant Genetic Environment.

But the governance network might make the teamwork at all levels more efficient, and it was requested by the grant-receivers. Furthermore, some of their central qualities in demand belong to a collaborative network: stable relations, tactic information sharing and thick communication flows (Mandell *et al.*, 2009, see table 1). Collaborative networks are only formed when the participants recognize their interdependence "and their need to make major changes in their operations" (Mandell & Keast, 2009, p. 7). This need might have come, because the communication from the Ministry of Food to the overall-grant-network was almost missing since 2009, making it difficult to work as a Plant Genetic Environment in Denmark.

New ways: developing a collaborative governance network for the Grant PGR

Thus, institutional support has to some degree been available in the implementation of the Danish Grant PGR. However, an unfulfilled potential exists of developing a more resilient collaborative network between the Ministry of Food and the Plant Genetic Environment in Denmark. This could also increase the efficiency of the formal teams and informal partnerships: Overlap between projects might for instance be reduced, and new projects would emerge. In the following we use the framework of Collective Impact (CI) to explore how to fulfil this potential.

Using the five conditions of CI to build a collaborative governance network

The grant-receivers in the Grant PGR had aligned goals concerning their work with PGR which would be the beginning of a shared vision for change - at least on central goals - leading to a *common agenda* (Kania & Kramer, 2011).

All institutions should undertake different tasks as they did in the formal teams, but this might be further developed to support the governance network (*mutually reinforcing activities)*. This makes coordination a central concept (Kania & Kramer, 2011).

A separate support-organisation in the form of a secretariat *(backbone support)* would secure a coordinated effort and was requested by the grant-receivers. Overlap between projects could for instance be reduced. The Pometum Ai explained: "I am working right now with collection of bullace (a small plum with many local varieties) in Denmark. I know that another demonstration-project worked on this in 2006, but I cannot find information about it anywhere." Another example is the Local Group with Public Access Ai, the Pometum Ai, Pometum B, and Museum D, which all made descriptions of some of the same apple-varieties for their homepages. If the secretariat had an electronic information portal, like the one initiated in 2006, joint plant-descriptions could be made and placed here together with other relevant information and results from the demonstration-projects.

Importantly the secretariat would be the centre of the network, and all institutions would meet on equal terms and face to face (Kania & Kramer, 2011) as also described by Innes and Boher (2010). A difficulty might be the role of the Ministry of Food in the collaborative governance network, since they administrated the governmental grant. If the Ministry of Food is an equal part of the

network, their controlling role could be taken over by the network's *shared measurement*, agreed on by all institutions (Kania & Kramer, 2011). The prioritizing of means might require many meetings and discussions (*continuous communication)* but can result in a better disposition of money and resources. Instead of selecting the single grant-receivers, which offer the most promising solutions, interaction of many institutions working together can be chosen. Grants would be distributed with the greatest advantage possible for the network. This would overcome competition and help working towards the same goal (Hanleybrown, Kania, & Kramer, 2012).

It is crucial to agree on a way to measure and support success so that all institutions balance expectations and work in the same direction. All can be held responsible of how they fulfil the common goals, and successes and failures can be shared in order to learn from them *(Shared measurement)*. Furthermore the progress of the field as a whole can be documented (Kania & Kramer, 2011) as also the Danish "open country project" do with a following research-team which analyses and documents the interdisciplinary goals (Grønnegaard & Johansen, 2016).

Building up stable long-term relations

The secretariat-staff must plan, manage, and support the institutions as well as the ministry (Kania & Kramer, 2011). They could arrange seminars and meetings and take care of coordination and internal communication (Kania & Kramer, 2011). This means that for instance knowledge, seeds and plants can be coordinated and exchanged between the institutions, and information can be gathered and centrally distributed – both internally and externally to the public - by the electronic information portal. This will join efforts and reduce overlap.

It will also help building up stable, long-term relations and trust, which is important on the way to success for the collaborative network (Kania & Kramer, 2011; Innes and Boher, 2010; Mandell *et al.*, 2009; Sørensen and Torfing, 2005). Museum Bi expresses its interest in focussing on a continued work with PGR as opposed to projects with a fixed time-frame. Company Ai has a similar conclusion and elaborates: "to be able to implement the demonstration-projects, it is important to keep a deep knowledge of growing plants, and to do this we must engage in a long-term program. This would be enhanced by a strong management making an overall plan of which plants to work with and why." (Pers.com. 22.3.2016). This might also increase interactions and synergies, and new and innovative outcome that is not possible by working alone in short time-frames may be the result (Mandell & Keast, 2009). This will make a more resilient network but it demands more time, and maybe training of the institutions involved will be necessary (Mandell *et al.*, 2009). Thus the collaborative network will typically meet for some years to develop shared performance indicators, discuss their progress, learn from each other, and align their efforts to support the network (Kania & Kramer, 2011; Mandell *et al.*, 2009).

Concluding remarks: developing collaborative networks in other environmental services

As discussed in the introduction collaboration between institutions delivering environmental services is growing, which makes it important to find ways to manage the networking. In our analyses of the Danish PGR grant-scheme we found three different kinds of teamwork: an *overall grant-network* of all grant-receivers and the Ministry, *smaller formal teams*, and *informal partnerships*. The formal teams had the closest links, characteristic of coordinative networks, which fits their purpose: to help each other to reach the goals of their shared grant application. The informal partnerships were found to have some characteristics of cooperative and some from coordinative networks, which also suits their purpose: sharing various resources often based on prior relations. The overall-grant-network had the most unstable connections, and can hardly be termed a cooperative network, since it did not fulfil its intentions: networking, inspiration and connecting the Danish government with the Danish Plant Genetic Environment

A call for a responsive and favourable institutional environment has been central to the implementation of the collaboration in the Danish Grant PGR. This is also found in examples from the Dutch environmental cooperatives (Renting and van der Ploeg, 2001) and the English "supplement for groups action" (Franks and Emery, 2013) By using the ideas of governance networks (Sørensen and Torfing, 2005), cooperative, coordinative and collaborative networks (Mandell *et al.*, 2009) and Collective Impact (Hanleybrown et al, 2012) we have elaborated recommendations as to how such collaboration could be developed and operationalized.

Most importantly we recommend a governance network with collaborative network qualities between the Ministry and all the institutions as this could also increase the efficiency of the formal teams and informal partnerships: Overlap between projects might be reduced, and new projects would emerge. The institutions must have aligned goals, which would be the beginning of a shared vision for change leading to a common agenda. A separate support-organisation in the form of a secretariat would secure a coordinated effort, and all institutions would meet here on equal terms. It is crucial to agree on a way to measure and support success so that all institutions balance expectations and work in the same direction.

Some of these recommendations we argue might also be helpful for collaboration in other European environmental services. The framework Collective Impact was developed in collaborative efforts to meet societal problems as cleaning up rivers or uniting cross sectors for better farming practices (Kania & Kramer, 2011). In the Danish "open country project" the framework is used to facilitate the difficult process of multifunctional land re-parcelling (Grønnegaard & Johansen, 2016). The literature on collaborations in environmental services mentioned in this paper shows that some of the conditions similar to the five conditions of CI are also found: Renting and van der Ploeg (2001) for instance find a *common agenda* and *shared measurement* in well-functioning collaborations and underlines the importance of a strong institutional support. Wiskerke et al (2003), researching the same projects, report a growing problem with getting institutional support, while Prager *et al.*

(2012) focus on the need for *continuous communication* and *backbone support.* All agree that more and more farmers commit to collaborative approaches to environmental services, which makes it important to find ways to develop strong institutional support and operationalize the work. This could reduce overlap between projects, overcome competition, and help working towards the same goal, and thus increase efficiency and lower costs. Successfully executed collaborations may also help building up stable, long-term relations and trust between the institutions and the State.

REFERENCES

Bavnshøj, P. (2014) *Visionspapir i henhold til akt. 20 i "Fra genbank til spisebord", Fødevareministeriets handlingsplan 2011-13 for jordbrugets plantegenetiske ressourcer* (Unpublished report). Dansk Landbrugsmuseum.

Emery, S. B., & Franks, J. R. (2012) The potential for collaborative agri-environment schemes in England: Can a well-designed collaborative approach address farmers' concerns with current schemes? *Journal of Rural Studies*, *28*(3), 218–231. http://doi.org/10.1016/j.jrurstud.2012.02.004

FAO (2009) *International Treaty on Plant Genetic Resources for Food and Agriculture*. IUCN. Available at http://books.google.com/books?hl=en&lr=&id=3j6leJSP2xgC&oi=fnd&pg=PR9&dq=%22by+the+continuing+erosion+of+these%22+%22countries,+in+that+all+countries+depend+very+largely+on+plant+genetic+resources+for%22+%22that+plant+genetic+resources+for+food+and+agriculture+are+a+common+concern%22+&ots=AD5iG81Olo&sig=4MlZNxvfYpnsyf4VUZkNgaiKsQE

Franks, J. R., & Emery, S. B. (2013) Incentivising collaborative conservation: Lessons from existing environmental Stewardship Scheme options. *Land Use Policy*, *30*(1), 847–862. http://doi.org/10.1016/j.landusepol.2012.06.005

Grønnegaard, H. (2016) Evaluering af jordfordelingsprojektets planlægningsfase. Collective Impact.

Grønnegaard, H., & Johansen, P. (2016) Hvordan skal komplekse samfundsforandringer gribes an? In E. B. Rasmussen (Ed.), *Klimaledelse*. Forlaget Andersen.

Hanleybrown, F., Kania, J., & Kramer, M. (2012) Channeling change: Making collective impact work. Palo Alto, CA: *Stanford Social Innovation Review*. Available at http://partnership2012.com/download/Collective%20Impact%20II.pdf

Innes, J.E., Booher, D.E. (2010) *Planning with complexity: an introduction to collaborative rationality for public policy*. New York, NY: Routledge, Milton Park, Abingdon, Oxon.

Kania, J., & Kramer, M. (2011) Collective impact. *Stanford social innovation review.* Available at http://www.lano.org/resource/dynamic/blogs/20131007_093137_25993.pdf

Kvale, S. (1997) *InterView: en introduktion til det kvalitative forskningsinterview.* Copenhagen: Hans Reitzel.

LandbrugsArven. (n.d.) Available at http://www.landbrugsarven.dk/ (accessed 24 April 2015).

Mandell, M., Keast, R. L., & Brown, K. A. (2009) The importance of a new kind of learning in collaborative networks. Available at http://eprints.qut.edu.au/29884/

Mandell, M. P., & Keast, R. (2009) A New Look at Leadership in Collaborative Networks: Process Catalysts. In J. A. Raffel, P. Leisink, & A. E. Middlebrooks (Eds.), *Public sector leadership: international challenges and perspectives.* Cheltenham, UK ; Northampton, MA: Edward Elgar. Available at http://www.ipa.udel.edu/3tad/papers/workshop4/Mandell%26Keast.pdf

Prager, K., Reed, M., & Scott, A. (2012) Encouraging collaboration for the provision of ecosystem services at a landscape scale—Rethinking agri-environmental payments. *Land Use Policy*, *29*(1), 244–249. http://doi.org/10.1016/j.landusepol.2011.06.012

Primdahl, J. (2014) Agricultural Landscape Sustainability under Pressure: Policy Developments and Landscape Change. *Landscape Research*, *39*(2), 123–140. http://doi.org/10.1080/01426397.2014.891726

Realdania (n.d.) Realdania.dk. Available at https://realdania.dk/ (accessed 24 April 2015).

Renting, H., & Van Der Ploeg, J. D. (2001) Reconnecting nature, farming and society: environmental cooperatives in the Netherlands as institutional arrangements for creating coherence. *Journal of Environmental Policy & Planning*, *3*(2), 85–101. http://doi.org/10.1002/jepp.75

Sørensen, E., & Torfing, J. (2005) *Netværksstyring: fra government til governance*. Frederiksberg: Roskilde Universitetsforlag.

The Danish AgriFish Agency (2012) Referat fra mødet i Udvalget for Plantegenetiske Ressourcer 28-6-12.

The Danish Ministry of Food, Agriculture and Fisheries (2009) Bekendtgørelse om tilskud til demonstrationsprojekter om bevaring og bæredygtig udnyttelse af plantegenetiske ressourcer for jordbrug og fødevarer - retsinformation.dk. Available at https://www.retsinformation.dk/Forms/R0710.aspx?id=123370

The Danish Ministry of Food, Agriculture and Fisheries (2011) Fra genbank til spisebord. Fødevareministeriets handlingsplan 2011-13 (14) for jordbrugets plantegenetiske ressourcer. Available at: http://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Landbrug/Genetiske_ressourcer/Planter/Publikationer/Handlingsplan_endelig_version_af_25-5-11.pdf

The Danish Ministry of Food, Agriculture and Fisheries (n.d.) Fakta om tilskud til demonstrationsprojekter om bevaring og bæredygtig udnyttelse af plantegenetiske ressourcer for jordbrug og fødevarer. Available at http://naturerhverv.dk/tilskud-selvbetjening/tilskudsguide/plantegenetik/#c8639 (accessed 24 April 2015).

The Danish Ministry of Food, Agriculture and Fisheries (2012) The Danish Rural Development Programme 2007-2013. Available at https://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Tilskud/Projekttilskud/Landdistrikter/LDP_Rev_proposal_Consolid_2007-2013f.pdf

The Danish Ministry of Food, Agriculture and Fisheries (2014) *Referat af Naturerhvervstyrelsens temadag om plantegenetiske ressourcer.docx*. Available at http://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Landbrug/Genetiske_ressourcer/Planter/Publikationer/Referat_fra_temadag_om_plantegenetiske_ressourcer.pdf

The Danish Plant Directorate and the Danish Institute of Agricultural Sciences (2004) Strategi for det danske arbejde med jordbrugets plantegenetiske ressourcer. Available at http://naturerhverv.dk/fileadmin/user_upload/NaturErhverv/Filer/Landbrug/Genetiske_ressourcer/Planter/Publikationer/Forslag_strategi_270920041.pdf

The Danish Plant Directorate. (2009) Referat_af_moede_16-9-09.doc.

Windfeldt, L & Madsen, L. M. (2016) Communicating plant genetic resources for food and agriculture

to the public, a study of grant-receivers with demonstration-projects in the Danish Rural Development Programme. Manuscript in review.

Wiskerke, J. S. C., Bock, B. B., Stuiver, M., & Renting, H. (2003) Environmental co-operatives as a new mode of rural governance. *NJAS - Wageningen Journal of Life Sciences*, *51*(1-2), 9–25. http://doi.org/10.1016/S1573-5214(03)80024-6

Appendix A

Institutions with demonstration-projects 2008-2013, Grant for Demonstration-projects about Conservation and Sustainable Use of PGR'

Institutions	**Demonstrating varieties of:**
Research Institution Ai (interviewed)[15]	blackberry, walnut, kale/cabbage, celery, carrot, turnip, onion, leek, herbs
Research Institution B	kale, celery, carrot, leek, onion, turnip, herbs
Company Ai (interviewed)	Leek, onion, turnip, herbs
Company Bi (interviewed)	Gooseberry, bullace, apple
Company C	Grain
Company D	Grain
Company E	Strawberry
Company F	Grain
Company G	Blackberry
Company H	Apple
Company I	Mustard
Company J	Grey peas, potato
Local Group with Public Access Ai (interviewed)	Apple
Local Group with Public Access B	Apple
Local Group with Public Access C	Crab apple
Local Group with Public Access D	Grain
Municipality Ai (interviewed)	Apple, walnut
Municipality B	Apple
Open farm [16] A	Grey peas, potato
Pometum Ai (interviewed)	Apple, fig, bullace, cherry
Pometum B	Apple, cherry, strawberry, red currant, gooseberry, bullace
NGO Ai (interviewed)	Peas, beans

[15] All interviewed institutions are named with "i"
[16] Due to illness no interview was made in this category. Activities were moved to Company J

NGO B	Cabbage/kale, turnip
Museum Ai (interviewed)	Apple, walnut, hops, grain
Museum Bi (interviewed)	Cabbage/kale, celery, turnip, carrot, leek, onion, herbs, cherry, apple
Museum C	Grain
Museum D	Grain, kale/cabbage, celery, carrot, beans, peas, apple
Museum E	Grain

Appendix A: Details of grant-receivers' applications

Ansøger	**Tids-periode**	**Organi-sation**	**Projektformål** (opgaver)	**målgrupper**	**Formidlingsmåder**
NGO B	Afsluttet	NGO	Der afprøves 6 sorter af hyld, som kunne vise sig værdifulde til fremstilling af hyldebærsaft og blomsterekstrakt.		
Company C Company D **Samarb.:** Museum Ai Museum Bi	Afsluttet	Compa-nies	Opformering og vurdering af egnethed til miljøvenlig drift og fødevarekvalitet for hundreder af oprindeligt danske sorter af korn.		
Pometum Ai	Afsluttet	Pometa	Bevaring og afprøvning af egnethed som fødevarer.		
Company E	Afsluttet	Companies	Dyrkning og undersøgelse for egnethed til miljøvenlig drift og fødevarer for samtlige 90 Registrerede sorter af jordbær i Norden.		
Research Inst. Ai **Samarb.:** Museum Bi NGO B	Afsluttet	Research Institutions	En undersøgelse af hvilke gamle sorter af danske kål og rodfrugter, som egner sig til økologisk dyrkning, og som samtidigt er velegnet til konsum.		
Company I	Afsluttet	Companies	Der blev dyrket sort og brun sennep på Bornholm indtil 2. Verdenskrig, herefter overtog den gule sennep. Nu skal sorter af brun og sort sennep afprøves for at afprøve dyrkningen af disse sorter med henblik på at fremstille fødevarer.		
Local group B	Afsluttet	Local groups	Bevarelse og fornyelse af historisk frugttræssamling med stor genetisk variation.		

Municipality B	Afsluttet	Municipalities	At skabe en samling af æble-træer, hvor træerne er kende-tegnet ved, at de kan gro og ud-vikle frugt i kystnære egne af Vestjylland. Dyrkningen af disse sorter skal udbredes lokalt.		
Museum E	Afsluttet	Museum	I årene 2009-11 dyrkes udvalgte sorter af hvede, rug, byg og havre. Disse vurderes årligt for deres egenskaber til miljøvenlig dyrkning. Derudover vurderes konsumegenskaber i samarbejde med Bøgedal bryggeri og bageriet Aurion.		
Municipality B	Afsluttet	Municipalities	Etablere en træ- og busksamling med spisenødder indeholdende historiske arter og sorter. Fokus lægges på hassel, valnød og spisekastanje. Samlingen skal både fungere som sikkerhedskopi for Pometet i Taastrup, men også styrke interessen for frugttræer i en af de mest træfattige egne af Danmark.		
Research Inst. Ai **Samarb.:** Museum Bi NGO B Museum D	Afsluttet	Research Inst.	Finde frem til, hvilke sorter, der egner sig til økologisk dyrkning, og som samtidigt er velegnede til konsum. Via demonstration af sorterne ved egne og samarbejdspartneres lokaliteter bliver der rig mulighed for at vise besøgende den store genetiske diversitet, der er i de gamle sor-ter. Samtidig bliver der mulighed for at formidle kulturhistorien. Målet er at interessen bliver så stor, at det bliver relevant at op-formere nogen af sorterne efterfølgende.		
Research Inst. Ai	Afsluttet	Research Inst.	Projektet skal indsamle blåbær over hele landet med vægt på Nord- og Vestjylland. Klonerne opformeres og udplantes på Årslev og i en statsskov i Vestjylland. Dyrkning og egenskaber hos klonerne beskrives og der måles på indhold af sukker, syre osv.		
Pometum Ai **Samarb.:** Pometum B	Afsluttet	Pometa	Indsamling af løvskal-kirsebær		

Pometum Ai **Samarb.:** Pometum B	Afsluttet	Pometa	Finde og indsamle planter af kvæde, mispel og morbær som er tilbage i ældre haveanlæg, offent-lige anlæg og andre steder, hvor de er brugt som nytte- eller pryd-planter til udplantning på Blomstergården og KU's pomet. Der indsamles forskellige kloner, for at se hvilke, der er bedst egnet til fortsat dyrkning, samti-dig med, at der sker en opbyg-ning af en genbank med de for-skellige sorter til bevarelse.		
Company C Company D **Samarb.:** Museum Ai Museum Bi Museum D	Afsluttet	Companies	At opformere gamle danske korn-sorter fra NordGen, som endnu kun findes i små mængder. At vurdere, beskrive og demonstre-re sorternes potentielle værdi, især inden for anvendelsen i det "Ny Nordiske Køkken", deres kva-litet og dyrkningsegenskaber. At opprioritere arbejdet med at undersøge kornets smagsegen-skaber, og udvikle de gastrono-miske muligheder for, at kornets smag bedst muligt udnyttes.		
Pometum B	Afsluttet	Pometa	Formålet er at bevare og sikre en større privat samling, samt nye inventeringer af frugt og bær. Derudover skal sorter vurderes til økologisk produktion, og frugter fra udvalgte gode sorter vil blive forarbejdet til prøveproduktioner af blommehedvin og kirsebær-rødvin.		
Research inst. Ai **Samarb.:** Company Ai Museum Bi	2011-2013	Research inst.	At finde frem til hvilke gamle, frøformerede danske kål og rod-frugter egnede til økologisk dyrk-ning og som samtidig er velegnet til konsum. Via demonstration af sorterne ved ansøger og samar-bejdende inst. bliver der rig mulighed for at vise besøgende den store genetiske diversitet, der er i de gamle sorter. Samtidig bliver der mulighed for at formid-le kulturhistorien. Det bedste vil være, at interessen blev så stor, at det bliver relevant at opforme-re nogle af sorterne efterflg.	Alt i alt skal det gøre forbrugerne, herunder børn og unge, gartnere, landmænd, haveejere og offentligheden interesseret i de gamle sorter.	• Åbent hus v. høst 13, bla. smagsprøver • Temadag Mus Bi 2012 bla smagsprøver • Comp. Ai: inf. ved andre formidl og oplevelsessit. Besøgende kan smage på sorterne. • Skiltning de ¾ steder • Informationsmat ¾ steder Hjemmesider
Company G **Samarb.:** Research	2011-2013	Companies	Projektet vil opformere og dyrke 20 danske brombærkloner, som tidligere er identificeret af Res. inst. Ai. Vi vil lave demonstration og vurdering af yrkningsmetoder og	Landmænd, frugtavlere, haveejere, kokke, fødevareprod. og andre med interesse for emnet.	• Åben-mark arr. Hvor projektets formål og res. formidles og demonstreres. Smagsprøver. • Inf. om de forsk. Brombærkloners forskellighed

Institution Ai			dyrkningsegnethed for de for-skellige kloner. Desuden vil der være en fødevarevurdering af de forskellige sorter, både som friske bær og deres egenskaber i pro-duktion af syltetøj/marmelade. Projektet vil afholde formidlings-arr. Samt informere på internet, i aviser og tidsskrifter.		og vigtigheden af at bevare et bredt spekter af brombærgener ved åben-mark arr. Og på internet. Form. Akt. Skal skabe større opm. omkring PGR og vigtigheden af at bevare en stor diversitet af gener for eftertiden. • Stiklinger med hjem – sikre levesteder
Pometum Ai **Samarb.:** Museum Bi?	2011-2013	Pometum	Etablering af kopisamling fra KUs pomet i Tåstrup og indsamling af kloner af figner fra museer, par-ker og anlæg, private haver som har stået i det fri i mindst 15-20 år og dermed bevist at de kan klare det danske klima og bære fuldmoden frugt i DK. Effekt: At der skabes så store interesser for danske figner, at en eller flere planteskoler sætter i prod. til danske haver. Øge den stigende interesse om plantegenetiske kopisaml. På Pometum Ai og andre steder i DK.	Pometum Ai's park og pomet er åbent alle ugens dage fra 1. maj til udgangen af uge 42 hver år. Rundvisninger: Private, institutioner, prof. Brugere. Årlig frugtfestival 14.-14. sept. 13: Gårdbutikker, hobbyavlere og private	• Rundvisninger • Årlig frugtfestival • Hjemmeside • Stand på Landsskuets havedel • Æbledag Museum Bi • Bestille planter Artikler
Museum D	2011-2013	Museum	At bevare og formidle gamle sorter. Dermed kan det store antal mennesker, der hvert år besøger museet, opleve de gamle sorter og blive opmærksomme på både de konkrete sorters potentiale og den mere overordnede bevaring af genetiske ressourcer inden for fødevare- og jordbrugsplanter.	Familier (rundvisning dog med højt fagligt indhold, hvis gruppen primært er voksne.) Niveau for hjem-mesidetekst: store skole-børn og interesserede voksne. Skriftlig formid-ling primært målrettet voksne. Der skelnes mel-lem den flygtige gæst og gæsten, der gerne vil for-dybe sig i emnet	• Gamle Sorters Dage 27.28.okt 2013 • Levendegørelse (juli) • Skilte, foldere • Hjemmeside • Rundvisning • Mølledag 16. juni høst
Museum C	Afsluttet 31-12-12	Museum	At demonstrere en miljøvenlig og økologisk dyrkning af en række særligt udvalgte korn- og plante-arter for der igennem at under-søge og kortlægge, hvilke egen-skaber der er for disse mht fødevarekvalitet, sundhed og dyrkningssikkerhed. Der forven-tes at kunne opsamle, konkludere og formidle en række nyttig og værdifuld viden om, hvordan sor-ter med stærk fødevarekvalitet og sundhed kan dyrkes under danske forhold i økologiske og miljøvenlige jordbrugsprod.	Jordbrugere, der overvejer korn- og plantearter til økologisk fødevareproduktion, herunder miljøvenlig produktion af disse. Den almindelige fødevareforbruger	• Temadage/aftner • Workshops • Podekurser • Åbent Hus • Høst
Local group B	2011-2013	Local Groups with Public Access	At formidle genbevarelse og fødevarekvalitet og fortælle lokalhistorie med nutidig forankring. Der foregår en aktiv formidling af Wøldikes Æblehave både mht miljø,	Formidling både i lokalområdet og i bredere sammenhæng.	• Rundvisninger • Æblepressedag • Podekurser • Brochurer • Opsøgende foredrag i

			mangforldighed og fødevarekvalitet. Denne formidling vil kunne intensiveres med en udvidelse af det beplantede areal.	Offentligt regi og foreninger. Institutionsarr. Æblepresning for bedsteforældre og børnebørn i børnehaver Haveforeninger og øvrige besøgende	havekredse • Offentlige arr. hvor det er umuligt at undgå emnet plantegenetik og genbeva-relse og fødevarekvalitet. Temaet indgår også i børnehavebesøgene.
Pometum B **Samarb.:** Pometum Ai	2011-2013	Pometum	At bevare den danske sorts-samling af pære for eftertiden ved 1) genetablering af den kom-plette sortssamling på Pometum B, 2) komplettering af den eksi-sterende dubletsamling (Pometum Ai), 3) afprøvning af forebyggelses- og bekæmpelsesmetoder over for tjørnepragtbille, der er forenelige med miljøvenlig dyrkning, 4) analyse og evt. sortsforskelle i modtagelighed.		• Årligt Åbent Hus arr. • Gruppearr. • Hjemmesider
Pometum B **Samarb.:** Museum Bi Pometum Ai	2011-2013	Pometum	Projektet forventer at finde så mange af de gamle kirsebær-sorter som muligt og få dem opformeret. Til dels yderligere undersøgelser for deres dyrk-ningsmæssige og spisemæssige kvaliteter. Museum Bi vil formidle dyrkningen af de indsamlede og udvalgte sorter.	Økologiske avlere men også konventionelle avle-re ville kunne nyde gavn af at dyrke disse sorter, hvis de besidder særlige sundhedsgavnlige stoffer. Desuden vil private have-ejere samt plantesamlere nyde gavn af en fornyet tilgængelighed af disse arter og sorter. Målgrup-pen er en meget sam-mensat blanding af stor-by/Københavnere med interesse for råvarer samt folk med egen have med interesse for privatdyrk-ning af frugt og bær. Formidlingsmaterialet forventes sammen med frugten at udgøre et unikt materiale, som vil kunne appellere til alle alders-grupper fra folkeskole til pensionisterog som vil kunne give inspiration til nye anvendelser af kirse-bærret i det moder-ne/nordiske køkken.	• se og smage kirsebærrene på museets arealer. • formidlingsarrangementer med historisk kontekst på museet i projektperioden. • De Gamle Sorters Dag • Tilberedningen af kirsebær vil blive implementeret i museets arrangementer, hvor måltidets kulturhisto-rie er i fokus. • mundtlige oplæg om dette emne, ligesom gæsterne skal se tilberednings-formerne og have mulig-hed for at vurdere smagen af fortidens køkken. • identificeres, udvælges og præsenteres et sammendrag af tidligere tiders brug af kirsebær. Dette skal danne baggrund for formidlingen. • Opskrifter på hjemmesiden. • Åbent Hus, Pometum B • Sortspræsentation og dyrkningsvejledning. • Ved Company vil markens udvikling blive formidlet til godsets gæster og frugtavlskolleger. • Nystartet udvikling og ny-fortolkning af kirsebærvin. • Pometum Ai har omfattende samlinger af PGR med off. Adgang.
Local Group with public access Ai	01-05-11 til	Local Groups with Public Access	Etablering af en plantage Plantagen/pometet skal anvendes til bevarelse af disse frugttræer og formidling af den viden, man har om	Skolebørn, børnehaver, , lokale, turister og sommerhusgæster. Odsherred rummer DKs største	• Der skal være offentlig adg til plantagen og der vil med tiden kunne opsættes bor-de, bænke, etableres shel-tere, ligesom det vil kunne fungere som

Samarb.: Pometum B	01-05-14		netop disse træer. Desuden eksperimenteres med anvendelse og opbevaring og formidling af den indsamlede viden. Formålet er at få lokalbefolkningen engageret i også at bevare og opdyrke denne plantegenetiske ressource samt øge interessen for dansk kvalitetsfrugt med smag. Der arrangeres besøg i plantagen og i æbleværkstedet Nonnetits lokaler, ligesom der afholdes foredrag om frugtkultur-historiske emner og praktiske dage med bla mostpresning. Generel viden om PGR vil blive formidlet til skoleelever og andre besøgende.	sommerhusbebyggelse. Bevarelse af ældre frugtsorter, udbredelse af kendskabet til disse i lokalbefolkningen, herunder skoleungdommen og blandt besøgende turister og sommerhusgæster.	udflugtsmål samt anvendes til under-visning. • Min. 12 arr. Over 3 år: • off. Foredragsarr. • 3 off. podningsarr., hvor fødevarekvalitet også demonstreres • Off arr. Med fødevare-kvalitet, hvor de besø-gende kan smage frugten. • Informationstavle • Brochure • Rundvisninger • Praktiske aktivitetsdage for lokale, hvor man bla kan fremstille most og andet frugtsjov. • Adoption af træer? • Produktion af træer til private. I informations-materialet sættes sorterne ind i en kulturhistorisk sammenhæng.
Museum E	01.01.2012 - 31.12.2013	Museums	Projektet: At lave total opforme-ring i småskala af alle udvalgte arter og sorter, dyrke alle - arter og sorter i markskala (grøntsager kun i småskala), vurdere alle ud-valgte arters og sorters smag, holdbarhed, udseende, håndter-barhed, kvalitet i forhold til miljø-venlig dyrkning, næringsværdi, egnethed til forskellige typer af madlavning, indhold af protein, fibre og fedt. Bred formidling af al info med relevans til projektets overordnede mål – herunder dyrkning og afprøvning af fø-devarer fra miljøvenlig drift. For-ventet effekt er forøget almen in-teresse og forståelse – også i un-dervisningsregi. At engagere alle typer af målgrupper på deres præmisser.	Det brede, interesserede publikum skoler, interesseorganisationer/grupper andre aktører, interesserede gæster nye dyrkere uden for projektet. Uddannelsessøgende og specialister	• rundvisninger • info-foredrag, • informationsmateriale (hjemmeside, DVD og personlig rådgivning), • (undervisningsmateriale til skoler, interesseorganisationer/grupper,) • Møder og erfaringsudveksling med andre aktører/interes-serede gæster og nye dyr-kere uden for projektet. Indhold tilpasset målgrup-pens interesser. • Udbredelse af og adgang til plantemateriale
Museum Ai **Samarb.:** Municipality Ai	01.02.2012 - 31.12.2013	Museums	Danmarksudstillingen er den første udendørs udstilling i Museum Ais billetterede udstil-ling. Her oplever gæsterne en række holistiske scenarier med dyr, planter og deres omgivelser. Rejsen foregår her i tid, mens lo-kaliteten er fastlagt til vores eget land. Over årene etableres: urtid, istid, skovtid, nutid, fremtid. En bondegård opføres og er udstil-lingsvindue for både dyre- og plantegenetiske ress. *Projektet:* At afprøve plantematerialet i for-hold til oplevelsesværdi, hård-førhed og vækstforhold, og vur-dere egnethed	Der er i projektet lagt vægt på, at formidlingen udbydes til forskellige målgrupper, såvel geografisk som aldersmæssigt. Særligt den gruppe, der ikke kender til PGR. Formålet er, at folk finder ud af, hvad PGR er.	• Gæsterne kan gå på opda-gelse i spiselige planter, • Nutidsscenarium med spi-sested. Mus. Ais kokke vil kunne anvende planterne i restaurantens køkken. • Skilte og QR-koder infor-merer om arbejdet med PGR, såvel i Mus. Ai som hos samarbejdspartn. proj. • PGR vises desuden i kommunens offentlige anlæg (parker, skoler, institutioner) • PGR-event med Meyers om Madhus med fokus på fremtidens mad, herunder produkter og resultater fra de

			til miljøvenlig drift og egnethed til fødevarer. For-midling: "Den spiselige have" formidles til de besøgende som en del af "Danmarksudstillingen". Plantematerialet prøves i forhold til oplevelsesværdi, hårdførhed og vækstforhold. De planlagte formidlingstiltag og events forventes at bidrage positivt til befolkningens viden og efter-spørgsel af PGR. Formålet er at et bredere udsnit af befolkningen får (øget) kendskab til de danske PGR samt de muligheder der lig-ger for at anvende dem i nye gas-tronomiske sammenhænge, der tilgodeser fremtidens madvaner herunder diversitet, sundhed og miljøvenlig drift. At øge fokus på mulighederne i at integrere PGR i forskellige former for oplevelses-økonomi.		øvrige projekter. Her kan gæsterne opleve po-tentialet i PGR. Hvornår? • Informationsstand om NordGens arbejde. • Plancher og skilte 3 formidlingsstrategier: • Formidling til mus. gæster via displays i og omkring. Der lægges vægt på at fremvise et bredt spektrum af de afgrøder, der er om-fattet af bekendtgørelsen. • Ekstramural formidling i forbindelse med Mus Ai guidede ture i genbanken og Gudenådalen. • Formidling via QR-koder og smartphones.
Res. Inst. Ai **Samarb.:** Company Ai	01.02.2012 - 31.01.2014	Res. Inst	Projektet: At etablere dubletter af den eksisterende klonsamling pga. en betydelig risiko for, at de vegetativt formerede grøntsager udsættes for sygdomme og lignende, og dermed kan gå tabt. Formålet er at sikre bevarelse af grøntsagsklonerne og at udbrede forståelsen for værdien af en stor mangfoldighed af fødevareplanter, og vigtigheden af at bevare PGR, der sikrer variation og valgmuligheder for avlere og brugere.	Årligt 40.000 besøgende på Company Ai, der spænder fra skoleelever, direktører, kokkeelever, børnefamilier og haveentusiaster.	• Årlige tema-arrangementer med kok, smagsprøver og vidensformidling på Com-pany Ai skilte og plancher, der beskriver arter og sor-ter ved demonstrations-arealerne. • Deltagelse i andres arran-gementer om genbevaring • "åbent hus" på Res.Inst. Ai. • Hjemmeside "Den danske samling af vegetativt formerede grøntsager" • projektet vil være på face-book og andre medde-lelsesmedier
Museum Bi **Samarb.:** Company Ai Res. Inst B	01.01.2012 - 31.12.2014	Museums	*Projektet:* At finde frem til sorter, der er velegnede til økologisk dyrkning samtidigt med, at de er gode spise arter. Formidle vigtig-heden af at bevare vore gamle danske sorter og vise dem, hvor stor mangfoldighed og genetisk diversitet der er både i udseende og smag. Formidle kulturhistori-en. Relevante oplysninger om de-monstrationsprojektet, om beva-ringen og en bæredygtig udnyt-telse af de plantegenetiske res-sourcer vil komme til at fremgå på samarbejdsparterne hjemme-sider. Formål: at gøre forbruger-ne interesserede i de gamle sor-ter. Det bedste vil være, at inter-essen blev så stor, at det bliver relevant at	Hos Comp Ai kommer en bred gruppe af besøgen-de – lige fra den profes-sionelle gartner/land-mand til den almindelige forbruger. Haver til Maver. Børn og unge, virksomheder, gartnere, landmænd, haveejere, offentligheden. Sociale medier skal særligt nå de unge. På mus Bi bliver informationerne om de gamle sorter formidlet gennem et professionelt museumsmiljø i en hel-hed og i et naturligt sam-menhæng med de øvrige elementer fra landbrugs-historien.	• Company Ai: Besøgende kan se, smage og høre om de gamle sorter. • Kunder smager sorterne • Formidlings- og , smage på sorterne. • Åbent hus hos Comp Ai. • Temadag på Mus. Bi 2013 • Dyrkning i den landbrugs-bot. Have, hvor museums-gæsterne har adgang og hvor de tilbydes smagsop-levelser. Tilgængelig infor-mation. • Skiltning og informations-mat., som de besøgende kan få med sig hjem. • Hjemmesider og facebook mm.

			opformere nogen af sorterne efterfølgende.		
NGO Ai **Samarb.:** Museum D	01.01.2012 - 31.12.2014	NGOs	Projektet: At opformere ærter ved småskaladyrkning, hvor plan-ternes vækst og deres sort vurde-res sensorisk. 2 sorter vil blive opformeret i markskala. Medlem-mer af foreningen er engageret i at vedligeholde en række forskel-lige afgrøder og planter, blandt andet ærter og bønner, i tæt samarbejde med NordGen. For-mål er at se, om der er potentiale til at udnytte disse sorter til føde-varer, evt. kommercielt. Sætte fokus på de sjove, spændende og vigtige arbejde det er at bevare og udnytte PGR og biologisk mangfoldighed.	Rundvisninger tilpasset den enkelte målgruppe. Skilte: den almindelige voksne besøgende, særligt interesserede fra 9. klasse til voksne, folkeskoleklasser. Lokale markeder med den almindelige forbruger som målgruppe	*Formidling:* Det høstede materiale vil indgå i • 3 madevents og • 15 markedsdage med stande. • Fremvisning af småskala dyrkning på udvalgte demonstrationssteder, • forsøgsarealerne vil blive fremvist på markvandr. • to/tre foldere hvor også genbevaring, mangfoldig-hed og PGR berøres. • formidling til skoleklasser via "Haver til maver".
Open Farm A	Afsluttet 01.03.2012 - 01.03.2013	Open Farm	Pomet m. lokale æbler, pærer og blommer. Projektet: At etablere et pomet på Lolland, vurdere og *formidle de lokale sorters egen-skaber og historie*, og indlede en opformering af de sorter, der har tilknytning til Lolland Falster.		• Presse • informationsmateriale i form af tavler, skilte ved de enkelte træer og en oversigt over sorterne og deres anvendelse.
Open Farm A	01.02.2012 - 01.02.2014	Open Farm	Projektet: At opformere, afprøve og vurdere ærtesorterne. For-midling: Der vil blive udarbejdet informationsmateriale med sor-ternes egenskaber, historie og muligheder for anvendelse i sam-menhæng med nutidige opskrif-ter.		• Lokalpressen • Informationsmat med sor-tens egenskaber, historie og muligheder for anvend-else i sammenhæng med nutidige opskrifter • Lokale spisesteder demon-strerer fødevarekvalitet
Municipality B	01.06.2012 - 31.05.2015	Municipalities	*Projektet:* At indsamle leve-dygtige kloner af spisekastanjer rundt om i Danmark og opfor-mere dem i et pomet. *Formidling:* Pometet er åbent for offentlig-heden og de indsamlede kloner vil blive demonstreret offentligt. 1) at få skabt opmærksomhed om indsamlingen af mat – elektronisk og tekst.2) der oprettes en hjem-meside. Formål: at screene DK for spisekastanjer til dansk genbank.		• Dagspresse og tv • Åbent Hus (hvornår?) • Folder • Hjemmeside der løbende informerer om arbejdet i projektet og sluttelig op-remser de oprettede sam-linger rundt omkring i DK • Kloner udplantes også uden for museet • Foredrag og møder om projektet og dets resultater • Spisekastanjer som føde-vare demonstreres ved et af ovenstående arr.
Museum D	01.01.2012 - 31.12.2013	Museums	Projektet: At demonstrere og for-midle de gamle danske sorter af bærbuske og jordbærplanter på Frilandsmuseet, samt etablere en hasselstævningsskov. Formidling: Museets mange gæster kan stifte bekendtskab med de gamle sor-ter	Store skolebørn og interesserede voksne – i øvrigt som forrige projekt på Mus. D. Foreninger og private. Formidlingen til de besøgende skal sikres et højt fagligt niveau og skal	• Levendegørelse i juli måned • Gamle sorters dage m. rundvisninger, smagsprøver, relevante publikationer og salg af frø. Sammenligning af sorter på udseende, duft og smag. • Rundvisninger for betalende grupper

			ved at se, smage, dufte til og læse eller høre om de forskellige sorter. Formål: At bevare og for-midle gamle sorter. Dermed kan det store antal mennesker, der hvert år besøger museet, opleve de gamle sorter og blive opmærk-somme på både de konkrete sor-ters potentiale og den mere over-ordnede bevaring af genetiske ressourcer inden for fødevare- og jordbrugsplanter. Formidling er vigtig for at skabe forståelse for betydningen af genetisk diver-sitet, og her kan museerne spille en vigtig rolle. Eksistensen af ge-netisk diversitet er fundamental for, at vi kan opretholde og udvi-de en mangfoldig fødevareprod.	omsættes gennem konkrete aktiviteter, der er let tilgængelige for alle mennesker. Fra børn til voksne, fra den flygtige besøgende til den mere vidende gæst, der har tid til at fordybe sig.	• Skilte (historie, anvendelse, smag, moderne potentiale) • Hjemmeside • Smagsoplevelser for publikum formidler planternes nytteværdi som fødevare
Pometum Ai	02.01.2012 - 31.12.2014	Pometa	Projektet: At indsamle og afprøve lokale sorter af ovennævnte arter. Formidling: Der vil blive af-holdt åbent hus arrangementer og demonstration af indsamlet frugt. Hovedemnet er bevaring af vore gamle frugtsorter, dyrkning og anvendelse af deres frugt. Ef-fekt: at der sættes mere fokus på værdien og brugen af vore gamle sorter og den kulturhistorie, der er knyttet hertil – både lokalt og nationalt. Synliggøre den offent-lighed, der er omkring Pomet. Ai.	De mange personer der ønsker at være selvforsynende, gårdbutikker, specialbutikker. Økologiske producenter, private haveejere. Havearr. På museer og i havekredse.	• Frugtfestival med blandt andet smagsprøvning og indsamling af kommen-tarer fra gæsterne. • Smagspr ved andre arr. • Plakat, der formidler pro-jektet, opskrifter og an-vendelse • Folder d.o. • Små udstillinger ved events • Hjemmeside: • Havelyst og havenyt Formidling via Mus. Bi. Her møder Pom. Ai også op ved events. Deltager i arbejdet med nordisk mad sammen med Viborgegnens fødevarenetværk.
Pometum Ai	01.01.2012 - 31.12.2014	Pomet Udgår - bog	*Projektet:* At smags afprøve 125 æblesorter i et systematisk for-løb. *Formidling:* Der vil blive ud-arbejdet en bog med projektets resultater.		
Company F	01.10.2011 - 01.10.2013	Companies	*Projektet:* At dyrke kornet kun ved hjælp af grøngødning, hvor antal jordbehandlinger under-søges. *Formidling:* Kornet vil blive vurderet med hensyn til fødeva-rekvalitet ved lokalt måltid for 40 personer, og projektet vil blive formidlet ved hjælp af artikler i lokalpressen og fagblade og ved private rundvisninger og oplæg.		• Artikler • Rundvisninger, hvis interesserede melder sig • Smagsprøver for 40 pers med alm ris som reference – del af vegetarisk aftensmåltid med tilhørende årstidsgrønt og bønner
Museum Bi **Samarb.:**	B 01.01.13-31.12.15	Museums	*Formålet*: er at finde frem til hvil-ke gamle, frøformerede, danske krydderurter af persille, kørvel, kommen, purløg og oregano, som egner sig til økologisk dyrkning, og	Bred gruppe af besøgende – fra den prof. Gartner/landmand til den alm. Forbruger. Haver til maver, som lærer børn,	• Temadag 2014 på Mus. Bi. • Ved andre formidlings- og oplevelsessit. Fortælles om projektet. Smagsprøver. Comp Ai i 2013, 2014 og 15

Company Ai Res. Inst. B			som samtidig er velegnet til konsum og til anvendelse i det nutidige køkken. Via demonstra-tion af sorterne ved Mus. Bi og Company Ai bliver der rig mulig-hed for at vise besøgende den store genetiske diversitet, der er i de gamle sorter, samt at smage på urterne. Samtidig bliver der mulighed for at formidle kultur-historien. Det er også meningen at der vil blive opformeret frø af henholdsvis oregano og kørvel – frøene leveres til NordGen. Samt-lige sorter dyrkes ved Aarstiderne og udvalgte historiske sorter ved Museum Bi. Resultaterne leveres til NordGen i en form, så data-basen med beskrivelser af sorter-ne kan udbygges med dyrknings-mæssige egenskaber. Res. Inst. B indgår med ekspertviden omkring de gamle sorter, og om opforme-ring af kørvel og oregano.	hvordan grønt dyrkes og bruges. De vil også inddrages i projektet	• Company Ai har spisested. • Kunder smager afgrøder • Besøgende ser sorternes forskelligheder • Skiltning, inf. mat. Som den besøgende kan få med hjem. • Hjemmesider: relevante opl om dem.proj., om bevaringen og en bæredygtig udnyttelse af PGR: • You-tube • Comp. Ais blog
Res. Inst. Ai **Samarb.:** Res. inst. B Company Ai	B 03.10.12-15.06.15	Res. Inst	Formålet med projektet er at undersøge gamle danske sorter af spidskål og broccoli for deres eg-nethed til miljøvenlig dyrkning og som råvarer til nutidige fødeva-rer. Det er populært at spise kål, både fordi det er sundt, men især fordi kål er en del af den aktuelle trend omkring det ny nordiske køkken, hvor det handler om at anvende friske lokale råvarer, og bruge dem i nye og originale ret-ter, som bliver lavet med inspira-tion fra fortidens madlavning. In-den for den enkelte grønsagsart er der en enorm diversitet, der ved en nærmere udredning, vil kunne føre til en mere bæredyg-tig udnyttelse, både dyrknings- og kvalitetsmæssigt. Comp. Ai indgår i projektet, hvilket er med til at sikre dyrkningsudbredelse af de gode sorter, samtidigt med at budskabet når ud til forbrugerne. Res. Inst B indgår med ekspert-viden omkring gamle danske sor-ter. Ved at udbyde frø af de gam-le danske sorter af spidskål og broccoli øges diversiteten inden for disse afgrøder. Det er vigtigt at have fokus på genetisk varia-tion, da de eksisterende sorter sandsynligvis ikke har den for-nødne genetiske variation til at i-mødekomme fremtidens mange krav om sygdomsresistens og ændrede		• Blog: • Det forventes, at demonstrationsprojekterne vil få en meget positiv effekt på de mange • gæster, som besøger henholdsvis, Institut for Fødevarer ogComp. Ai. Alle de arrangementer • og tiltag, som er besluttet i projektet, vil øge opmærksomheden om de gamle sorter og vise, • hvor stor betydning det har at bevare og bruge dem. Netop kombinationen af oplysning og • oplevelser, hvor gæsterne ser, dufter og smager afgrøderne, forventes at få dem til at bruge de • nye erfaringer derhjemme.Dagligdagen i projektet kan følges på bloggen http://fortidensfro.blogspot.dk/ • Høstmarked hvor sorterne præsenteres • Dyrkningen vises frem til besøgende på gården. Høstmarkeder hvor sorterne præsenteres • Dyrkningen vises frem til besøgene på gårdene

			klimaforhold.		
Open Farm A (moved activities to Company J due to illness)	04.10.12-15.06.15	Open farm	Projekt vil opformere og afprøve en række gamle kartoffelsorter, formidle viden om variationen i sorter og vurdere om der iblandt de gamle sorte kan være sorter med potentiale for at bevare og dyrke i større skala ved miljø-rigtige dyrkningsmetoder og udvikle til lokale fødevarer.		• Formidling i pressen • Informationsmat med sorternes egenskaber, historie og muligheder for anvendelse • Demonstration ved at lade lokale spisesteder anvende og formidle historien og nye anvendelser for sorten. •
Municipality B **Samarb.:** Pometum B	04.10.12-15.06.15	Municipalities	I samarbejde med Pometum B, Slots- og ejendomsstyrelsen, Borgmuseet på Spøttrup Borg, Museum Salling og lokal lodsejer etableres der i en af de tidligere frugthaver fra udstykningen af jordtillægget fra Spøttrup Borg en blommesamling udvalgt af Pometum B. Særkendet for disse sorter er, at de kan gro og udvikle frugt i kystnære egne af det vest-lige Danmark, og at de er beva-ringsværdige. Podningen af blom-merne sker på grundstammer i X-by af borgergruppen i samar-bejde med og under ledelse af pometmesteren fra Pom. B.	Folkeligt baseret landdistriktsudviklingsprojek t: Borgere i X-by er med i projektet. Samlingen er åben uden entrebetaling	• Fokus på kvalitet, formid-ling, events, anvendelse i moderne kontekst. Kompe-tenceudvikling hos borger-ne. • Ny udstillingsbygning på Spøttrup nær rugthaverne. • Udbygning af spøttrup kulturhal. • Blommer i husholdningen i moderne kontekst • Hjemmeside: med smagning og anvendelse • Distribution af sorter til særligt interesserede • Særlige arrangementer • Årligt foredrag om genetiske ressourcer • nyhedsbreve
Local group D **Samarb.:** Pometum Ai	04.10.12-15.06.15	Local groups	Reparation af allé mellem Skelund og Veddum bestående af kirsebær fra lokalområdet: Skelund-Veddumkirsebær. Træerne laves ud fra bestående kirsebær fra lokalområdet, hvor der har været dyrket kirsebær gennem århundreder.	Allé langs offentlig cykelsti på gammel banestrækning. Lokale, både private og erhvervsdrivende	• Historien om Veddum kirsebær nedskrives og udgives i et hæfte så efter-kommere og tilflyttere kan tilegne sig viden om den del af lokalområdets kul-turhistorie. Hæftet udleve-res til alle interesserede. I hæftet står, hvor træet kan købes • Reception ved afslutning af projektet i aug 2015. • Evt mindre prod af kirse-bærvin til receptionen og evt i fremtiden. • Information på hjemme-siden produktion af træer til salg, l erhverv eller have.
Research Institution Ai	04.10.12-15.06.15	Res. Inst.	Projektet kombinerer genres-sourcer af vilde danske træer med fødevaretrenden New Nor-dic Food og skaber nye innova-tive anvendelser af vilde råvarer til unikke produkter. Målet er dels at etablere vidensgrundlaget for etablering af nye produk-tioner af vilde råvarer med hen-blik på at øge diversitet og nyud-vikling i frugtavlserhvervet, dels at udvikle katalog over produkt-muligheder baseret på vilde egenskaber og derved forankre nye	såvel private brugergrupper som professionelle, primært frugtavlere Inviterede grupper af både private forbrugere og professionelle fra fødevarebranchen smagsevaluerer.	• Nye produktioner demon-streres og smagsevalueres for relevante brugergrup-per ved udvalgte arr. • Inspirationskatalog med opskrifter, forarbejdning og tilberedning • Åbent Husarrangement Food Festival 2013 • Opsøge andre muligheder for at formidle indhold og resultater fra projektet • FVMs arrangements-kalender for genressourcer nævnes. • Hjemmeside, der også linker til

			produkter i fødevare-branchen. Ved åbenthusarr og deltagelse i andre formidlingsakt vil betydningen af PGR og mulig-heden for at anvende dem og ud-vikle nye produkter af dem blive inddraget.		anden viden om genressourcer • Deltagelse i fælles genres-sourceaktiviteter, feks surkirsebær ved Pom. B, vilde brombær Comp. G, Mus. Bi, Mus. Ai.
Pometum B	AZ	Pometa Udgår Virtuel - Ikke tilgængelig	Projektet vil udvikle og publicere en applikation om æblesorter til brug på I-phones og I-pads. For-målet er at udbrede kendskabet til diversiteten inden for æblesor-ters kvaliteter og egenskaber. Applikationen skal beskrive de ca. 90 æblesorter, som forekommer hyppigt hhv. i danske haver og i handel. Applikationen skal også kunne bruges til at søge et æble med særlige egenskaber som ro-busthed, smag, evt. egnethed til most, blomstringstid, sæson m.m. Effekt: kendskabet til gene-tisk diversitet øges, og fremtidige registreringer og kvalitetsunder-søgelser af æblesorter hurtigt kan blive let tilgængelige for alle.	udgår – ikke tilgængelig Projektets målgruppe er alle med interesse for æbler, mad og/eller genetiske ressorcer.	• Applikationen skal kunne bruges både som nøgle og katalog og vil virke som en forenklet, "markudgave" af Pometum Bs æblenøgle. • Samtid skal Pometum Bs æblenøgle justeres, så den også kan bruges i en forenklet udgave. Applikationen skal kunne opdateres på samme måde som Æblenøglen, således at det bliver nemt at ajourføre begge informations-flader samtidig.
Local group with public access C **Samarb.:** Pometum Ai	05.10.12-15.06.15	Local groups	Formidlingsprojekt, der har til formål at beskrive nogle af Local group with public access Cs paradisæbler i og deres anven-delse i husholdningen og til pryd. Paradisæbler er et kendt pryd-træ, men det er de færreste, der er klar over, at mange af dem er velegnede til syltning, gelé, kryd-dersnaps og andre formål i køkkenet. Formål at øge kendskabet til Local group with public access C. og alle paradisæblerne.	Lokale kokke og fødevareprofessionelle, foreningen og borgere i byen. Turister, idet haven anses som turistattraktion	• Smagninger med prof. Kokke og restauratører og ved generalforsamling i foreningen og forårsfest i byen, 2014. Her giver den almindelige forbruger sin mening. • Bog udgives med bla opskrifter • På længere sigt sælge produkter fra havens træer
Company Bi **Samarb.:** Pometum B	05.10.12-15.06.15	Companies	Projektet skal formidle et uudnyt-tet potentiale i PGR og give grundlag for udbredelsen af gam-le sorter samt at give grobund til bedre udnyttelse af disse igen-nem fermentering. Føre til flere egnsrelaterede fødevarer med udg pkt i PGR under miljøvenlig drift. Belyse et eventuelt uud-nyttet potentiale i gamle egns-specifikke frugt- og bærsorter igennem deres egnethed som fødevare efter fermentering, i form af cider, eddiker og som mælkesyregæret. Hovedaktivite-ten er forsøg med fermenteringer med efterfølgende sensoriske profileringer udført af professio-nelle kokke og smagere. Hvis et potentiale opdages, vil det ændre synet på disse arter/sorter Flere	Jordbrugere, hobbyavlere, fødevareprod., samlere, rest.branchen og interesserede privatpersoner	• Resultater formidles gennem flere arrangementer, bla Copenhagen Cooking 2014 • Aften på Company B hvor projektet præsenteres • Publikation udarbejdes

			er i naturen omkring os, som så udnyttes bedre. Bidrage til lokal-miljøet. Øget samarbejde mellem aktører. – synergi. Samling af planter plantes ved gartneri.		

Appendix B: All grant-receivers

Institutions with demonstration-projects 2008-2013

'Grant for Demonstration Projects about Conservation and Sustainable Use of PGR'

Institutions	Demonstrating varieties of:
Research Institution Ai (interviewed)[17]	blackberry, walnut, kale/cabbage, celery, carrot, turnip, onion, leek, herbs
Research Institution B	kale, celery, carrot, leek, onion, turnip, herbs
Company Ai (interviewed)	Leek, onion, turnip, herbs
Company Bi (interviewed)	Gooseberry, bullace, apple
Company C	Grain
Company D	Grain
Company E	Strawberry
Company F	Grain
Company G	Blackberry
Company H	Apple
Company I	Mustard
Company J	Grey peas, potato
Local Group with Public Access Ai (interviewed)	Apple
Local Group with Public Access B	Apple
Local Group with Public Access C	Crab apple
Local Group with Public Access D	Grain
Municipality Ai (interviewed)	Apple, walnut
Municipality B	Apple
Open farm [18] A	Grey peas, potato
Pometum Ai (interviewed)	Apple, fig, bullace, cherry
Pometum B	Apple, cherry, strawberry, red currant, gooseberry, bullace
NGO Ai (interviewed)	Peas, beans
NGO B	Cabbage/kale, turnip
Museum Ai (interviewed)	Apple, walnut, hops, grain
Museum Bi (interviewed)	Cabbage/kale, celery, turnip, carrot, leek, onion, herbs, cherry, apple
Museum C	Grain
Museum D	Grain, kale/cabbage, celery, carrot, beans, peas, apple
Museum E	Grain

[17] All interview institutions are named with "i"

[18] No interview was made in this category, as it contained only one receiver, which moved their activities to a producer due to illness

Appendix C: Interview guide

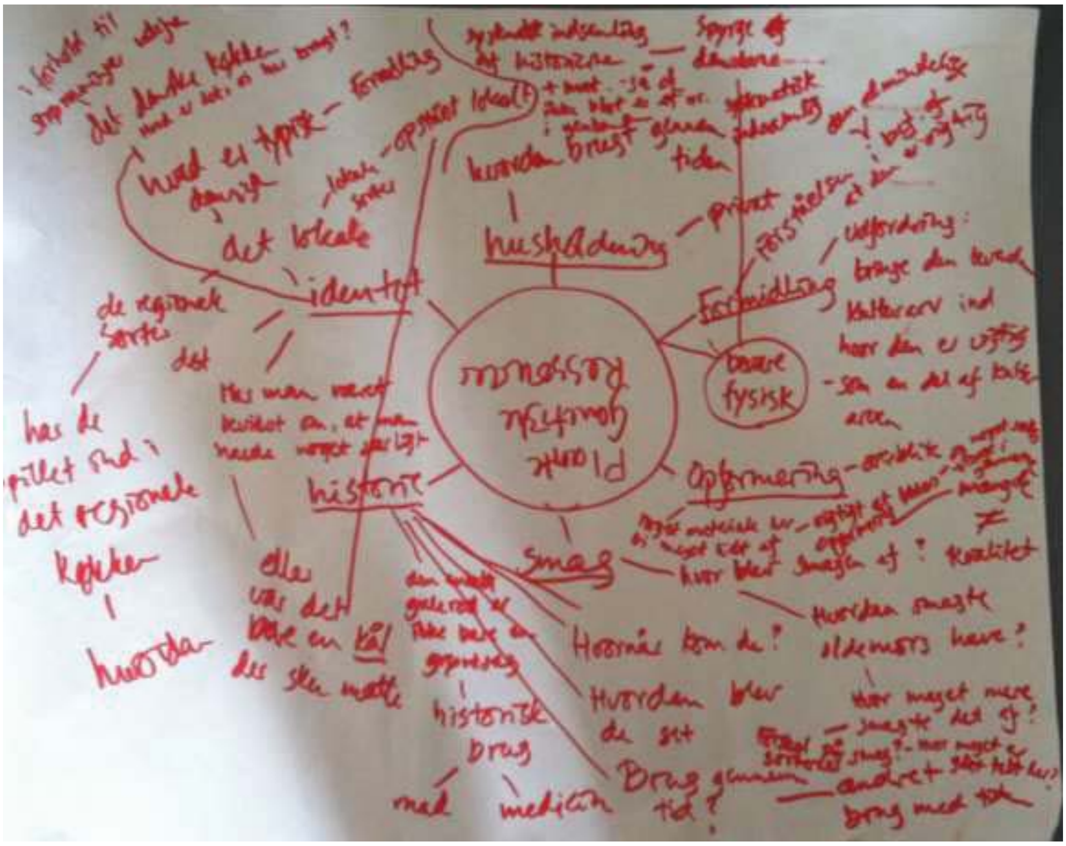
I har et demonstrationsprojekt under Fødevareministeriets tilskudsordning for plantegenetiske ressourcer.

1. Hvordan kan man som besøgende opleve PGR hos jer?
2. Hvornår kan man opleve PGR?
3. Hvilke formidlingsmetoder bruger I?
4. Hvordan tror du, at disse tiltag bidrager til en forståelse af, at PGR er udgangspunkt for nu- og fremtidens fødevarer?
5. Har I fokus på særlige målgrupper?
6. Hvilke andre institutioner i tilskudsordningen arbejder I sammen med?
7. Hvorfor skal de specielt besøge jer for at få noget at vide om PGR?
8. Hvad ville være det bedste, folk kunne få ud af at besøge jer?
9. Hvordan ved du, om folk fik det?
10. Hvilke tilbagemeldinger får I?
11. Tror du, det er anderledes her end på de andre projekter?
12. Er der en særlig lejlighed, du vil anbefale som velegnet til at tale med jeres gæster om PGR?
13. Hvad gør denne lejlighed særlig velegnet?

Appendix D: Concept maps from interviews

Local Group with Public Access Ai

Museum Bi


identitet
det lokale
historie
husholdning
Formidling
bare fysisk
Opformering
smag
historisk brug
mad
medicin
Hvornår kom de?
Hvordan blev de sat
Brug gennem tid?

NGO Ai


Plante Genetiske Ressourcer
Kulturhistorisk
Kulturbotanisk
Ressourcer
gener
Planter
Politisk
Brug
Biodiversitet
Miljø
etno-botanik
arkeo botanik
bygningshistorisk
patriotisk
hytte
vilde
basismateriale
foredling

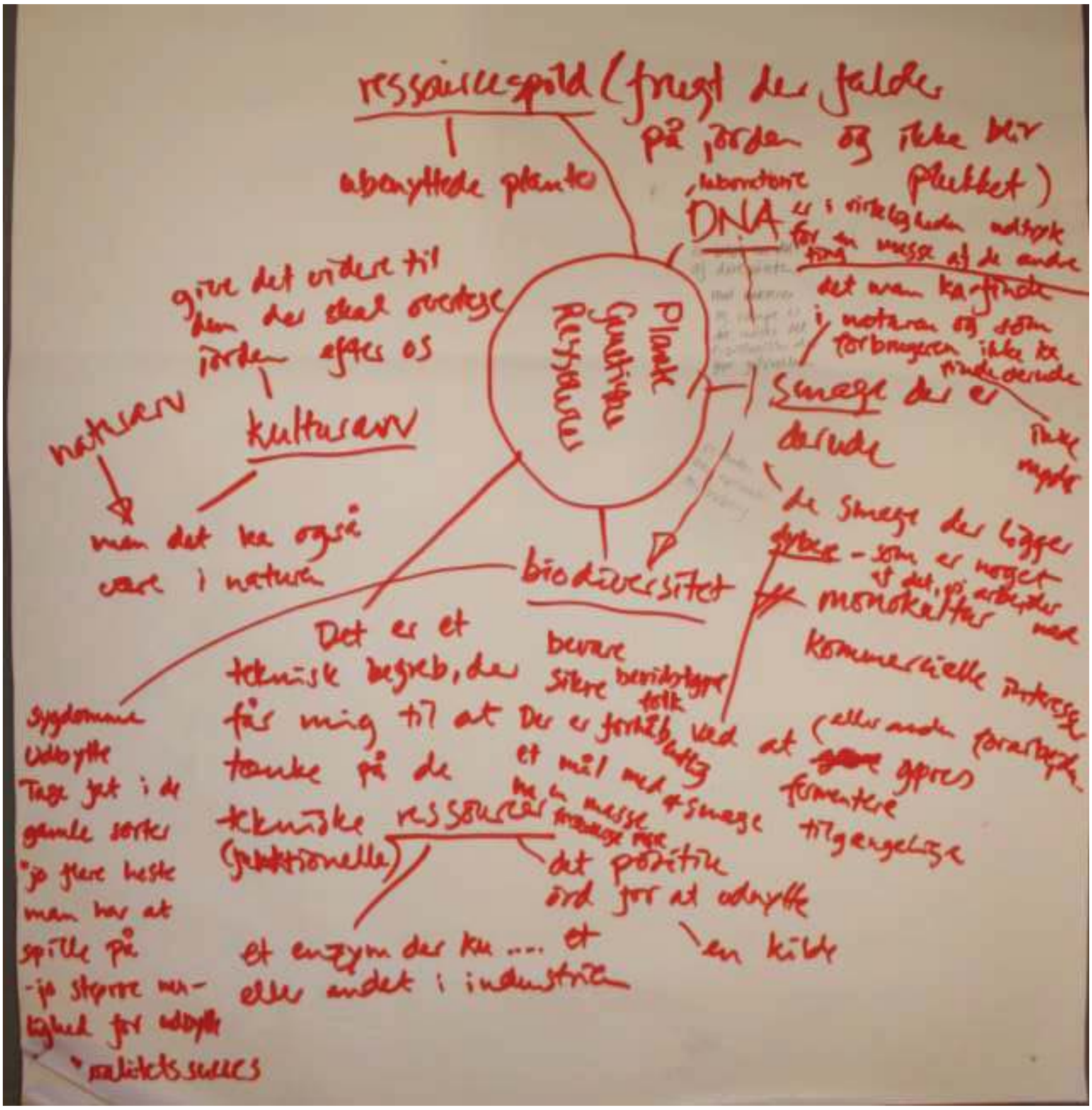
Pometum Ai


Plante
Genetiske
Ressourcer
Merværdi
Oprindelse
ikke masseprod.
tilgængelig
viden

Museuim Ai

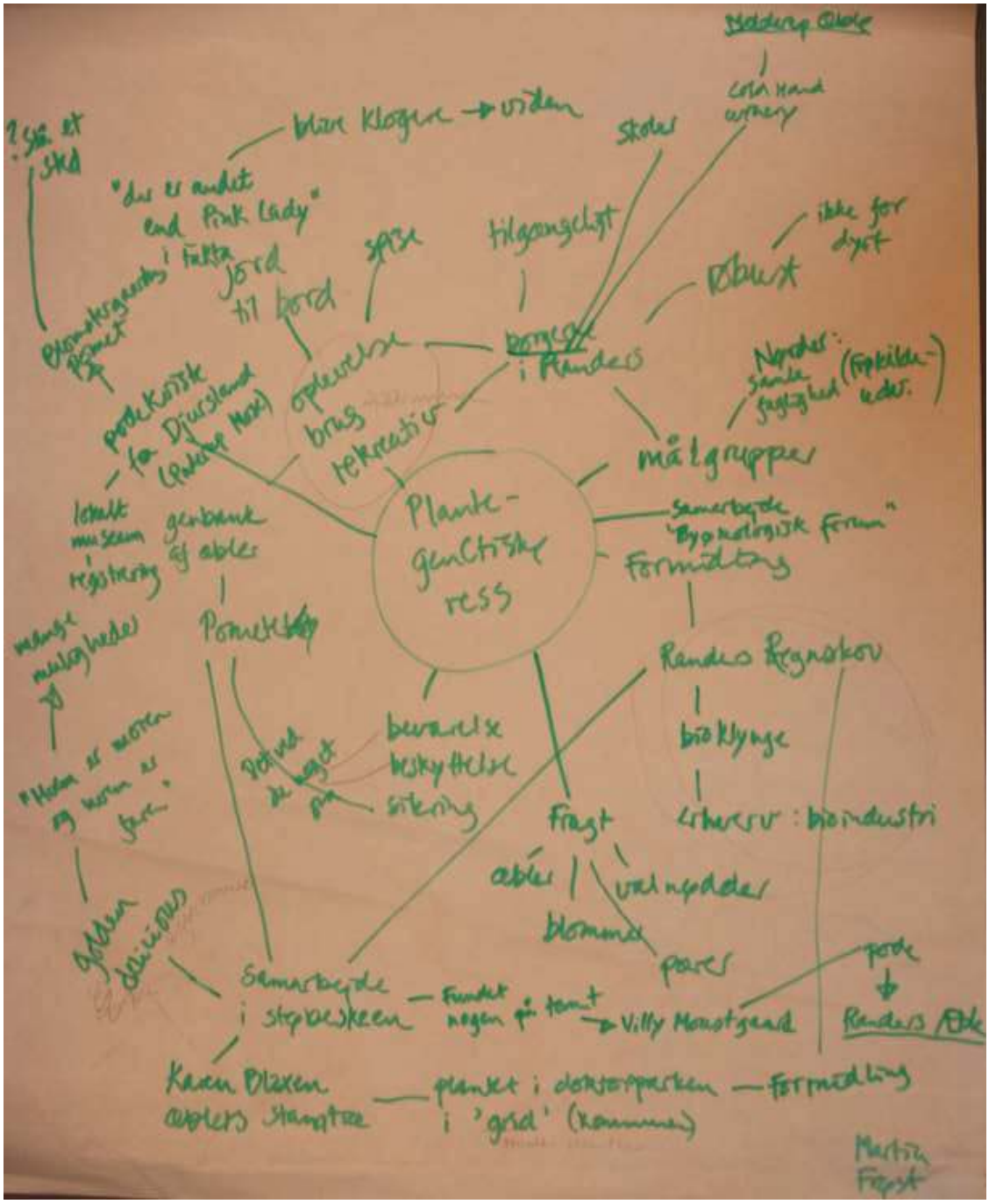

Hvad kan de bruges til ?
Plante Genetiske Ressourcer
Variation på middagsbordet
Miljø
Forædling
projektet
Kulturplanter
Vores kulturarv

Company Bi

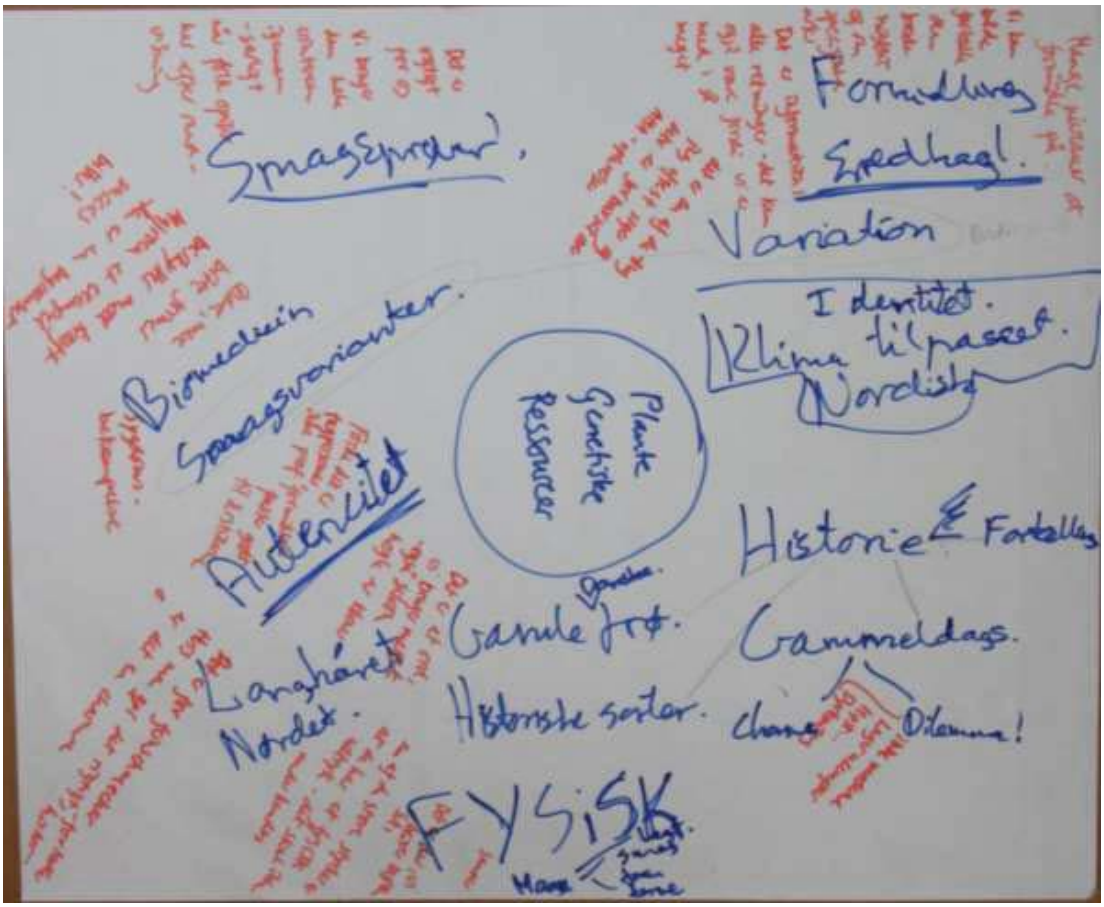

ressourcespild (frugt der falder
på jorden og ikke blir
plukket)
DNA
Plante Genetiske Ressourcer
kulturarv
naturarv
biodiversitet
monokulturer
kommercielle interesser
et enzym der kan .... et
eller andet i industrien

Research Institution Ai

Municipality Ai



Company Ai


Smagsprøver.
Formidling
Spredhagl.
Variation
Identitet.
Klima tilpasset.
Nordisk
Biomedicin
Smagsvarianter.
Plante
Genetiske
Ressourcer
Autenticitet
Historie & Fortælling
Gamle Frø.
Gammeldags.
Langhåret
Nordet.
Historiske sorter.
Dilemma!
FYSISK

Appendix E: Coherence of elements, New Circle Model

- Analysis of coherence between the elements using the New Circle Model

Research institution Ai

There is coherence between category of *sender* (science, knowledge, development of the agricultural sector) and emphasis on developing a broader assortment of food-products with PGR (*objective*). Focus in communicating is with as well potential consumers of new products with PGR as producers, industry, and retail sale. These are targeted through a broad range of media: Food-fairs (*communication-environment*) with tastings, a poster, hand-outs, and dialogue (*media*), where they meet 'Mr. and Mrs. Jensen' (*target group*): "We typically bring general information on food-festivals. They get the whole story, but then they get tastings as well. This is far the strongest way to disseminate, because we get to talk to people." They brought for instance different varieties of wild and cultivated blackberries at the Food Festival. "700 people answered the test: 'How do you range the taste of these varieties on a scale?' Now we bring back the answers from the consumers. In this way we get feedback from meeting the consumer. This is how knowledge of PGR goes from science to consumer and from consumer back to science (*objective*). The other *objective* of meeting the consumer at fairs is information about variation and varieties: "Variation is also opening the customer's eyes to see that blueberries are not just blueberries, apples are not just apples. There is variation, and different varieties can be used for different purposes." To address producers, industry, and retail sale (*target groups*) they write articles in professional journals (e.g. 'Fruit and berries' and 'Gardeners' journal'), press releases (5-6000 subscribers), and newsletters. The press releases also give access to local and national media. "Some stories are easy to communicate, some are more complicated science. Then they give almost no feedback." They are also aware of local newspapers: "Through local papers we reach many private customers, as they are targeted towards them". An in-between professional and private dissemination will be the hobby garden-magazines giving general information of the projects and produce they are working with, for instance "What is a crab apple?" "What is a wild hazelnut?" (*media*).

The research institution uses scientific media such as 'posters' and 'hand-outs', and through the university's homepage you can reach deeper knowledge on your own (*media*).

They contact producers directly: "We communicate with the institutions – we call them or send mails – to tell them that there is this project. Then they can offer to work with it."

The research institution finds this communication important: "I consider it important to get hold of some of the institutions – producers – to bring some of the ideas we are working with in play, to hear, if they are established and will be able to produce." This is also caring for the whole production-chain: "Who will buy his produce? Is there a connecting link which must process it to make the product, we are asking for at the end? And who is the consumer? Is industry going to sell

it? Those chains are important to get hold of, if everything is going to succeed."
The objectives (testing produce/products and offering knowledge of PGR) are addressed directly to the costumer with tastings and dialogue on fairs (*communication-environment*), where the customer will expect that kind of dissemination and via mass-media to reach a broader public. To get knowledge of the projects to producers, industry, and retail sale they are contacted directly or via their subscription to press releases, which also means that they expect to get this information. Whether this will in the end result in new produce, products, seeds or plants (*wanted effect*) is a matter of the success of the whole production-chain.
Consumers on the fairs taste produce/products: "It does not necessarily taste good – but it is an experience", read posters and hand-outs and get into a dialogue with the staff to get a broader and deeper knowledge of what they taste. The consumer is taking active part in tastings, and their feed-back is taken back to the producers. Before or after the experiences at the fair they might read about PGR in the newspaper or magazines or watch news about PGR on television/in radio. If you wish, you can always turn to the webpage for more information.

Company Ai
There is coherence between category of *sender* (selection and selling of PGR), and high focus on communicating with a broad *target-group* – potential customers. "Come and visit us, be our friends – then you buy more boxes," (*wanted effect*) is the rationale behind the country-side kitchen, where they invite new customers buying vegetables in boxes. At the same time they are aware that the local guests are not potential customers: "The neighbours are not customers buying boxes, but they show up for events. For instance on 'Forest's Day' their visitors will be neighbours, who pass by. "They are not customers because they all have a kitchen garden". They regard their neighbours as very serious visitors. "Many of them have knowledge about PGR compared to the hasty people from the capital". They also have many professional or semi-professional on-site visitors, national as well as from abroad. These might be farmers "even conventional pig breeders", garden lovers or housewives' leagues (*target-groups*). Despite of this awareness on different groups of visitors, they tell that they are very aware of NOT thinking in different target-groups. But they are for instance very aware of using as well the web as the local newspaper to advertise their country-side kitchen: "The event was originally only advertised on the web-side, but using the local newspaper opened up a new market, and the event was sold out!" (*media*)
Before they got the grant for demonstration projects they already had communication-activities with customers and visitors and as part of the grant "we use the platforms, we already have: blogs, guided tours etc." The several platforms are described as: "We use a scatter gun approach: information in all directions". They explain this in another way: "We have experienced that this can be disseminated in many ways – from information about the varieties to the wide story of PGR - and preferably with tastings. We use that a lot." "Some get excited by the history, the genetical variation - others need concrete vegetables". Tasting is central – both to vegetable-box customers and on-site visitors, and is regarded as an effective way of getting in touch with people. Around

3000 visitors will for instance show up for Harvest Market with historical kitchen, guided tours and tastings. But also the webpage with blogs and advertisement is straight-forward, since customers order vegetable-boxes on-line (*media*). This gives the opportunity to provide broader and deeper information of PGR in many different formats as well as newsletters with information about PGR and recipes showing how to use them. The board in the field telling about PGR from seed to vegetable as well as the whole demonstration-project gives broader information to on-site visitors as well as dialogue at fairs and markets (*communication-environment*). Social media are also very much used to disseminate knowledge about PGR, and connections are made between platforms and the webpage "to generate traffic." They say that they have no leaflet, because they find this way to communicate boring, but they admit that it could give knowledge to their guests once they are back home (*media*). All in all the coherence between the elements are seen to be high, and the intense dissemination could be regarded as a scatter gun approach, but they are quite aware of their different target-groups and how to reach them.
They are also aware that PGR is seldom the focus from their visitors and customers: "Often people come for other reasons. In the end there will be a meal, which might contain PGR from the project, e.g. an onion. At the same time we present the produce on tables to make our guests have a look at, how different the varieties look and taste. It is important to catch people's attention."
Their objective: To evaluate the commercial potential of old varieties of vegetables is approached by dissemination of tastings, knowledge and excitement to their target groups, and some PGR are already back in the market, because they have shown a commercial potential – others are more difficult to sell, as they have an unwanted taste – often bitter (e.g. turnip). Feedback from their visitors on e.g. the harvest market show an interest in "tasting, hearing, knowing", and the country-side kitchen is "repeated because of demand" from their customers. "Getting heirloom-vegetables into the supermarket" is, however, not a reality yet.
Customers taste produce in their box, use recipes, read newsletters, web, and social media. Visitors watch living plants, read the board in the field, go on guided tours, experience tastings, meals 'country-side kitchen' (inviting new customers and locals for dinner with PGR), and get into a dialogue with the staff. The website, blog or social media give more information and offers the opportunity to prepare the visit or return to the subject, once the visitor is back home.

Company Bi

There is *coherence* between category of sender (selection and selling of products of PGR), and their focus on communicating with as well professionals and nerds as the public, as these represent target-groups developing the field and "the public who will be the ultimate user" as they say in the interview. The *objective*: "to enrich gastronomy and the way we use resources" is addressed on different levels. The small gastronomic restaurant experimenting with fermentation of PGR see themselves as having a quite nerdy primary target-group, which they address in introductions and master classes, as this gives them the opportunity to "give deeper explanations of the whole,

complicated project: gastronomy, PGR, fermentation are all difficult subjects.” Presenting the project for cook apprentices at Copenhagen Hospitality College will ”sow seeds on a higher level. If we can inspire cook apprentices, who will be the future chefs on Danish restaurants, to find resources in nature and work with them in the way, we find interesting, we can possibly move much more than addressing Mr. and Mrs. Jensen at the Open Air Museum.” They describe the latter *target-group* as someone who ”maybe find it a funny project and off course tell about it to people they know.” Addressing the public on fairs with tastings “that make people come to our stand”, dialogue and flyer give them access to this target group. “Some taste our products and say “argh, this is sour”, because they thought they were going to taste apple-juice. People care very much about what they think they are going to taste. This is where we begin our dialogue. Then we can say “that is a particular variety” ”.
The shorter dialogue on fairs (*communication environment*) with “Mr and Mrs Jensen” and the presentations and arranged master class with the nerds and professionals seem to be appropriate communication environments, which will suit the target-groups.
However, they find it challenging to cover the background for their work and make people understand gastronomy, PGR and fermentation, and the *wanted effect* “making people curious, get them to experiment with fruit from their own garden, and making them demand fermented products from PGR “is seen as a dream. More realistic: making people curious. “We want to kick something that others give a further kick” is addressed by e.g. inspiring cook apprentices to make them inspire others.
They get feedback from their target groups, who seem to be spontaneously curious and interested, and some go back and read the blog on their homepage.
Tastings, which often seem to surprise, and dialogue are features activating the visitor. The flyer, homepage and the possibility for the interested to dig deeper into the subject with presentations and master class gives the dissemination of topic several entrances, which can also be reached before and after the visit (*media*).

Local group with public access Ai
There is *coherence* between category of *sender* (conservation, local display), and their focus on members from the neighborhood (many have their summer-cottage here) (*target-group)*, who come to graft and plant apple-trees, especially the local variety ‘Nonnetit from Oustrup’, and collect memories about apples. This local group is working with tradition, what they call “within living memory” (*objective*). Practical work with members is the main focus: grafting, planting, pressing apples. They also go on excursions (e.g. to the Pometum B) and invite for talks and story-telling (*content*). The group wants their members to get excited and get knowledge of PGR (*wanted effect*). People meet in a cosy, social environment (*communication environment*); inspires each other, teach, and learn: how do you make good apple syrup? How do you keep your apples? The public is invited for activities (*target group*), and they can get basic information about PGR and the local apple on boards in the local group and on the homepage (*media*).

They get a lot of positive response from members and the public: “It is amazing how many people, who get interested – also in tasting and identifying apples. There is a good breeding-ground for this among the locals!”
The local group is based on involving activities: grafting, planting, pressing apples and exchanging knowledge and memories. Talks, leaflets, boards and homepage give an opportunity to get more information. The connection with people’s personal memories is an anchor of involvement, and the local focus, e.g. on planting apple-trees on public areas, is also a motivation.

Municipality Ai
There is coherence between category of *sender* (conservation, local identity and display), and the *objective* to create visibility about the green things the municipality does and the recreational possibilities they give to their citizens. To reach the objective they plant PGR in public spaces and give possibilities for locals to use the fruit – also from apple-trees in abolished gardens (the municipality homepage has a map of these gardens). Everything is fully accessible, and signs, boards and leaflets tell the citizens about the project. Fruit-trees, home-page, leaflets, signs and boards are all seen as *media*, and the *communication environment* is primarily outside in the municipality, where the citizens pass. There is also a new neighbourhood, where fruit is incorporated in the local development plan: with a noise zone towards a highway, recreational area with a fruit gene bank, there is apples and drupes (e.g. walnut). The new roads will be named after apples, and the dissemination concept is: what can be used for juice, stewed apples etc. (building on an instruction from Pometum B).
The municipality is aware that this is a possibility to their *target group*: citizens. At the same time the trees are vulnerable: “We must justify the money we use on this in our restricted budget: What is in it for us and our citizens? How can we keep it? We have fighting dogs and drunk idiots passing …so we planted roses around the trees – that works!”
The project is also disseminated as news in local media: ”We made a lot of newspaper-stories on this. Local media like these nice local stories, especially when nothing else is going on.”
The wanted *effect* is to give knowledge about different varieties of fruit-trees and PGR to their citizens (*content*). They also wish that people plant more apple-trees of these old varieties in their gardens at home “and maybe remembered that their parents or grand-parents had a ‘Signe Tillisch’ or a ’Skovfoged’ or ’Flaskeæble’ in their garden – that they remembered the taste of this apple and felt like planting it in their own garden and pass it on to their children and grand-children.”
The municipality gets positive response from their citizens on for instance the possibility to pick apples in abolished gardens: “People find this fantastic! My strategic basis is that this is to create visibility about the municipality and the green things we do, the recreational possibilities. But people think that this is dam good, and the apples are picked! The trees are stripped! People say: ”I didn’t know that I were allowed to pick these apples.” But they are growing on a municipal area – this is also a way of disseminating for the common good: here everybody can go for recreation, you don’t need to pay for going to the fitness center, you can just go for a 30 minutes’ walk and pick a

bag of apples, which you can bring home to the kitchen." There is also a growing interest in guided tours in the nature, mainly from people on post-employment benefit or pensioners.
All in all the coherence between the elements is seen to be high. The municipality is aware to reach their citizens, where they pass, and they meet them with possibilities, they seem to appreciate, and accessible knowledge.
The municipality focuses on utilization, experience, and recreational use for their citizens, who are all encouraged to pick apples for cooking, plant trees, go on guided tours - and get more information on web, signs, boards and in leaflets: "When you as a citizens walk around the town, you will see a sign on an apple-tree telling: "red pigeon-apple". You will also see a board explaining about the project, and there is an audio-guide."

Pometum Ai

There is coherence between category of *sender* (gene conservation, public display) and the pometum's *objective* to show many varieties of fruit-trees to their visitors. They want their visitors to rediscover the old varieties of PGR and use them, and want people to increase demand for the good, Danish produce – not a 'supermarket-variety', produced abroad. "The best way to conserve PGR is to make people grow them. We must make people interested, so they want to plant exactly THIS variety of apple in their own garden - because they know that this variety is good for cooking etc."
They address this to their *target-groups*, mainly by letting them walk around in the huge pometum (*communication environment*), read leaflets, signs and boards – or going on a guided tour (*media*).
The pometum's approach is: "Knowledge about PGR is not only for sciolists! It must be accessible so that people can use it." The owner of the pometum explains that he is good at explaining so that everybody understands it. "When sciolists speak, ordinary people often don't get a word of it. We have many guests, who haven't been reading a lot, and don't understand processes and the chemistry behind (*target-group*). We try to disseminate so that people can work with PGR on their own. So we put a lot of information on the home-page. "Knowledge is for use – not for show." On guided tours they are aware to address the group (*media*).
Many of the people coming have bought a new house or want advice for their garden, so most visitors come to the pometum with an exact purpose. They emphasize 3 groups of visitors, all garden-owners: 1. Young families who get their children at an early age and want to be sure of what they eat. 2: People +60 on their way out of work who have the time to be interested in growing PGR 3: pensioners and people on post-employment benefit. Besides from this they have visitors without a garden, who want to experience the many varieties in the pometum, and fruit tree-collectors. They get response from many of their visitors – especially 60+ - who say: "It is good that you conserve the old varieties of apples" (*target-groups*).
The fact that you can also buy fruit-trees in the pometum gives a hands-on approach to PGR: visitors mainly come to the pometum with a purpose to plant and grow PGR themselves. Many read the home-page before or after coming for instruction and background-knowledge.

NGO Ai

There is coherence between category of *sender* (gene conservation, public display) and their *objective* to grow and conserve PGR to get independency of companies and authorities (to members) and to give knowledge, seeds and tastings on markets and fairs (to non-members). "As a member you can grow PGR as a hobby for your own benefit – and at the same time you can save the world." They are addressing especially members (*target group*) on their web-pages and Facebook (*media*). The number of members has been increasing over the last 15 years, and is now close to 900. The leader of the NGO tells, that this started, when they got a homepage. Members are diverse: males and females, young, old, ethnically, from bank managers to homeless, pensioners, students. Most of them grow a garden. There are members in all parts of Denmark. "People from Copenhagen are not traditionally our target group, but it gives food for thought that when it comes to conservation and heritage, it hits the urban segment – not the village halls." Members have meetings two or more times a year, where they give talks about PGR, how to collect seeds etc. – and, importantly, exchange seeds and knowledge.

The NGO has met most of its non-members (*target group*) on markets and fairs through more than 25 years (*communication environment*). They get tastings, seeds, leaflets and books about PGR They can also talk to members about how to grow or eat the produce (*media*). The markets and fairs can be with other NGOs, garden centres, cattle shows, food fairs – or just a local library. The intension is that people get knowledge about PGR and grow the plants at home in their garden. Maybe they become members later on. Articles are written in garden magazines, women's magazines. As PGR is the raison d'être of this more than 30 years old NGO, they have a solid knowledge of their target-groups – both members, and non-members. Number of members is increasing - one new member per day in 2015. They tell that they were in place before the demonstration project began.

The main activity for this NGO is growing and saving seeds from PGR, which means practical hands-on activities. There are many possibilities for as well members as non-members to read about PGR, and knowledge can also be obtained and exchanged through dialogue at meetings and markets.

Museum Ai

There is coherence between category of *sender* (demonstration, public display) and their *objective* to reach visitors of the museum with the message that "culture-plants, our living cultural heritage, is threatened – like the tropical animals, we also display in the museum (*communication environment*). They are very aware that "this is the reason why we are into this project: people can see that we have plants in DK, which are threatened – and we are the only ones to take care of them."

They are telling people about this using different *media* (living plants in the museum and the municipality, signs (also with audio guide) and boards, web (also from QR), newsletters, guided tours, events, food of PGR served for guests 'eat and save'). Especially on guided tours the guides

in the museum can see that the point about the threatened cultural heritage is often realised by their visitors: “Goodness! I didn´t know”. The guide says: “It is sort of banal, but it has a great impact to tell people something they didn’t know.” The visitors on the guided tours are often couples: “Housewives often react on food-plants, men on plants for beer and mead. This is nice, because it attracts both genders.” As they address the same *target-group* (their visitors) with the same media, they usually use, and the same agenda (PGR are threatened – we must take care of them), there is a high potential that the message reaches the target-group.
They don’t expect their visitors to go directly out and buy PGR after visiting the museum, but they hope to give them inspiration for a start (*wanted effect*).
The museum uses a combination of *media* to tell their visitors about PGR. Some are written (signs and boards, web-side (also from QR-codes on boards), newsletters), but some signs also have a telephone-number with an audio-guide. Other media are addressing more senses (smell, taste) like living plants in the museum and municipality and food of PGR served for guests: ‘eat and save’. Some are involving, especially the guided tours and events with tastings and a possibility for the visitors to ask questions. Visitors to the museum in general are both children and grown-ups, but many of the media used to explain about PGR are primarily suited for a grown-up *target-group*.

Museum Bi

There is coherence between category of *sender* (demonstration, public display) and the *objective* to reach the visitors of the museum with knowledge of PGR and the importance to preserve them. Their identity as the museum for food and cultural history of the meal in Denmark is aligned with the way they tell about PGR: “It is important for us to disseminate knowledge of the PGR that is on the plate in past, present and the future.” This means that they also emphasize human survival: “The living cultural heritage, especially PGR, contribute to the history of the Danish meal. When looking at food-history the self-sufficient period is much longer than the industrial, so the many varieties tell the story of variation of taste and that is has been necessary to grow different varieties in different growing conditions. Then we are down into the elementary things: survival.” Visitors to the museum (*communication environment*) experience PGR in many ways (*media*) (living PGR in the museum-garden, signs and boards, food-events where produce of PGR is harvested in the garden with the public, activity-days where food is made in the kitchen from PGR-produce from the garden (varieties are compared), articles published on all produce they have been working with). Activities are especially in holidays including summer-holiday with many families (*target group*), where they visit the animals and harvest PGR “We can see that this is a success with our visitors.”
They get a lot of response: “most of our visitors don’t know anything about PGR, so basic knowledge is alpha and omega, and then we build upon this: importance, history, protection and cooperation between institutions, including NordGen.” But the interest is growing. People are getting aware that different varieties taste differently. Especially people 60+ are asking for varieties they knew in their childhood, and they are approving that they might be grown again (*target-group*). Old varieties bring memories to people of grandma’s garden, where everything had a

special taste. “So many guests tell about this.” People call the museum to ask for old varieties of vegetables, berries, hops – especially local or rare ones. As they address the same target-group (their visitors) with the same media, they usually use, and the same agenda (food-history), there is a high potential that the message reaches the target-group. There is much response from 60+. In their cooperation with the research institution Ai and company Ai, the museum is responsible to describe the history and cultural history of use of the varieties, they are working with. Publicized articles are meant to reach a broader audience.

The museum uses a combination of *media* to tell their visitors about PGR Some are written (signs, boards, and articles), but most of them are actively involving the audience: “We have a dialogue with people face to face, when we are disseminating knowledge about PGR” Most of the activities include practical work in the garden and kitchen with the visitors, where many senses (feel, smell, taste) are involved. Often taste of different varieties of the same fruit or vegetable is compared. Afterwards many people call them to hear, where they can get more of ”that special rhubarb” or ”that fantastic carrot” or ”the strawberries that tasted like my grandmothers’.” Memories are playing a great role, when people taste: ”The whole sensory system is used, and flash-backs to something good, confident, and combined with childhood appears. People´s own history.”

Appendix F: Concept map, Didactic Transposition